ASSET PRICES AND MONETARY POLICY

Economic Group
Reserve Bank of Australia

Proceedings of a Conference

held at the H.C. Coombs Centre
for Financial Studies, Kirribilli
on 18–19 August 2003

ASSET PRICES AND MONETARY POLICY

Editors:

Anthony Richards
Tim Robinson

Economic Group
Reserve Bank of Australia

Website: http://www.rba.gov.au

ISBN 0 646 42423 8 (Print)

Printed in Australia by J.S. McMillan Printing Group

Table of Contents

Introduction

Anthony Richards

The Bank's annual conference has now been held continuously since 1989 and aims to address topics of reasonably general interest to policy-makers, academics, the financial markets and the general public. However, it is rare that a conference has been as timely as this year's, 'Asset Prices and Monetary Policy'. This introduction provides an overview of some of the main themes that emerge from the papers presented at the conference, and included in this volume.

Presentations on Some Historical Episodes

A number of papers examine various historical episodes of turbulence in asset prices. John Simon's paper provides an overview of three episodes in Australian economic history which he describes as bubbles – the 1890s Melbourne land boom, the Poseidon nickel boom, and the equity and property market episodes of the late 1980s. Simon characterises bubbles as typically being episodes where fundamental factors bring about an initial price increase, which is magnified through subsequent speculative activity into further sharp price increases, and then followed by a dramatic fall that occurs with no obvious changes to fundamentals. He notes that such episodes usually occur in periods of general optimism following long periods of expansion, and are often accompanied by easy availability of credit and substantial use of leverage. While most conference participants thought that any definition of a bubble is highly subjective, most concurred with the designation of the three Australian episodes as bubbles.

In his comments on Simon's paper, David Merrett notes the differences in the causation, frequency and impact of 'bubbles' in Australia over the past 200 years. Nineteenth century Australia was characterised by frequent 'bubbles', but these tended to be local, rather than colonial or national in scope. Several factors may have contributed to the shift to more synchronised (albeit less frequent) misalignments in asset prices over the past 100 years. These include the growing size of financial markets relative to the real economy, and the increased flow of information between regions and agents. In a related vein, several participants speculated that increasing globalisation, including of banking practices, may be leading to greater synchronisation of asset-price bubbles across the world. The simultaneous commercial property market booms of the late 1980s in the US, Europe, Asia and Australia were cited as a possible example of this phenomenon.

The paper presented by Barry Eichengreen (co-authored with Hui Tong) uses data for 12 countries over a century or more to measure volatility in equity prices as a proxy for general asset-price volatility. The authors then examine the relationship between asset market volatility and possible underlying determinants of volatility, such as monetary volatility, capital account openness, and the choice of exchange rate regime. The most promising determinant appears to be monetary volatility, which is estimated to be positively related to asset-price volatility in almost every country studied. This suggests that the unstable monetary policies of the Great Depression and the 1970s and 1980s are likely to have contributed to the observed higher volatility in equity prices in these periods. Hence Eichengreen concludes that shifts to more stable monetary regimes, such as Australia's inflation-targeting regime, should have contributed to reduced volatility in asset prices.

The paper presented by Karl Case (co-authored with John Quigley and Robert Shiller) looks at the recent history of the US housing market. This paper presents data on the size of price cycles in the US, and results from a survey of home-buyers. The price data show that while house price growth in some US cities has been very stable over many decades, other regions have seen extremely volatile price cycles, with prices sometimes falling substantially in downswings. A major factor in this different behaviour appears to be the elasticity of housing supply, with cities with fewer constraints on expansion (either physical or legal) experiencing smaller cycles.

The survey results presented by Case suggest that even after the recent long boom in US house prices, which has taken prices to record-high levels, buyers are still expecting double-digit average annual price growth over the next decade. The survey suggests that price expectations are highly extrapolative (i.e., past increases lead to expectations of future increases), and that this contributes to the observed swings in prices.[1] The paper also suggests that these swings in prices have a substantial effect on the macroeconomy via their impact on household wealth. The implication for the US (and Australia) is that if a substantial fall in housing prices were to occur, growth in private consumption (which accounts for around 60 per cent of aggregate expenditures) could slow sharply.

An additional historical assessment is provided by Adam Posen in his paper on the Japanese experience following the bubble of the late 1980s. Posen first addresses the argument that is often made that excessively easy monetary policy was a major contributor to the bubble. He presents cross-country evidence that periods of sustained ease in monetary policy do not necessarily result in asset-price booms, and also that asset-price booms are frequently not preceded by periods of monetary ease. Accordingly he argues that lax monetary policy is by no means a prerequisite for an asset-price boom, and his assessment of Japanese monetary policy during the boom phase suggests that monetary policy played only a small role in contributing to the bubble, with poor financial sector practices much more to blame. In addition, his cross-country analysis suggests that sharp falls in asset prices have historically not been followed by CPI deflation, and that periods of deflation are typically not preceded by sharp falls in asset prices. This, plus the fact that Japan had positive inflation and only a modest recession in the initial aftermath of the bursting of the

1. Interestingly, the survey results for the housing market are remarkably similar to related survey results for the US equity market. A paper by Fisher and Statman (2002) suggests that around half of respondents to their survey of individual investors thought that the stock market was overvalued in the late 1990s and in early 2000, but that they continued to expect very high stock returns (with these expectations driven largely by recent price movements).

Japanese bubble, prompts Posen to argue that the subsequent 'Great Recession' that Japan suffered was not inevitable, but was the result of subsequent policy mistakes (in the mid 1990s) and structural weaknesses in the financial sector.

Several participants noted that the historical record of booms and busts in asset prices suggests that the impact on the real economy varies markedly between episodes. The episodes that have been most costly in social and economic terms have typically been those which have been accompanied by high leverage and a large build-up in credit. On average, it appears that property market booms and busts are more costly than equity market bubbles, which many conference participants attributed to the greater use of leverage often associated with property. However, as John Plender notes in his comments in the concluding session, equity market bubbles could also be very costly to the extent that they encourage excessive investment in sub-optimal projects. He notes that the fallout from the 2000–2002 fall in global equity prices does not thus far appear to be as large as might have been expected, which he attributes to the healthy capitalisation of banking systems and the fact that there was no boom and bust in commercial property in this episode. In his comments on the papers by Charles Bean and Stephen Cecchetti, Warwick McKibbin also presents simulations from the G-cubed model suggesting that the major effects of asset-price misalignments on the real economy stem from over-investment, and that these effects could be very persistent.

Presentations on Monetary Policy Issues

The discussion at the conference addressed the role of monetary policy both in the upswing of asset-price booms and in the aftermath. There was substantial agreement that monetary policy should respond aggressively to the contractionary effects of sharp falls in asset prices, particularly as the risks of deflation increase. This is one of the messages in Posen's paper, although he also points to the need for fiscal policy to work in tandem with monetary policy, and for policy-makers to be aware of weaknesses in the financial and corporate sectors.

Given this agreement on the role of monetary policy in the aftermath of booms, most of the discussion on monetary policy focused on its role during upswings in asset prices, especially when there are concerns that these swings may not be fully justified by fundamentals. A few years ago, views tended to be polarised on this issue. On the one hand, it was argued by some academics (e.g., Bernanke and Gertler (2001)) that monetary policy should ignore developments in asset markets, except insofar as they affect forecasts of inflation at the horizon at which the central bank targets inflation. On the other hand, some academics and practitioners (e.g., Cecchetti, Genberg and Wadhwani (2003)) argued that monetary policy should instead respond pre-emptively by increasing interest rates to try to head off misalignments in asset prices as they emerge.

It appears, however, that more recently debate has shifted towards the middle ground between these two positions. This would argue that monetary policy should not aggressively attempt to burst perceived asset-price bubbles, but should take account of asset-price fluctuations, to the extent that they provide information about the shocks affecting the economy, or have possible implications for output and inflation in the medium term, beyond the usual inflation-targeting horizon. This position would emphasise the need for some flexibility in an inflation-targeting framework, echoing some of the themes on this score from the Bank's 1997 conference on 'Monetary Policy and Inflation Targeting'.[2]

This shift to the middle is implicit in the paper by Charles Bean, who argues that a forward-looking 'flexible inflation-targeting' framework should indeed bear in mind the longer-run consequences of asset prices and financial imbalances in setting interest rates. Rather than considering if asset prices should enter directly into Taylor-type rules or inflation-targeting rules, Bean's paper considers how asset prices might enter into an optimal monetary policy rule, given an objective function that minimises output gaps and deviations from the inflation target. His framework suggests a role for monetary policy that is a little broader than implied by the narrow view described above – that is, monetary policy should respond to asset prices if they signal changes in expected inflation *or activity*. Furthermore, he suggests that such an approach is consistent with the way that many central banks already act. For example, although their 'first-level' target is the inflation rate, many inflation-targeting central banks (including the Bank of England and Reserve Bank of Australia) have broader mandates which include paying attention to employment and economic growth.

Bean emphasises that an automatic response to any single asset price would not be appropriate, but that the central bank should attempt to extract information from asset prices and other variables about the shocks that are influencing the economy and their implications for future inflation and growth. If this analysis signals that the economy is overheating, increasing the risk of subsequent financial instability, this would have implications for future activity and inflation. Hence, an inflation-targeting regime should pay attention to asset prices and their implications for the medium-term risks facing the economy.

In their paper, David Gruen, Michael Plumb and Andrew Stone provide further evidence to support Bean's notion that there is no single automatic policy response to asset-price developments or misalignments. Gruen *et al* consider the case of an economy where an asset-price bubble is boosting aggregate output and inflation, and where in each future period this bubble will either continue to grow or burst, with known probabilities. A policy-maker who can only affect this economy with a lag faces two countervailing influences: the desire to tighten policy to dampen output and inflationary pressures (and perhaps help burst the bubble), versus the desire to ease policy to prepare for the eventual bursting of the bubble. The optimal policy in their model will depend upon the characteristics of the bubble process and the nature of the costs associated with the bubble bursting. Of course, as emphasised by David Stockton in his comments on the paper, in the real world it is unlikely that the informational requirements for optimal policy will be satisfied – policy-

2. See, for example, the 'Round-up' discussion by Ball (1997).

makers face great uncertainty about the existence of bubbles, let alone their precise stochastic characteristics. The authors conclude that the appropriate policy strategy will be a matter for judgement, with some cases where activist policy is warranted (the central bank should lean against the bubble) and others where such a response would be counterproductive. They note that in practice it may be difficult for the central bank to distinguish between these cases given the information available.

The paper by Stephen Cecchetti argues more strongly for monetary policy to respond, albeit cautiously, to developments in asset markets. He responds to three points made by those who oppose using monetary policy to combat the instability caused by asset-price bubbles. First, although it may be difficult to estimate equilibrium asset values, he argues that this does not mean that policy-makers should not try to identify misalignments in asset prices – other variables, such as potential GDP, are also difficult to estimate, but are routinely estimated by central banks. Nor should policy-makers simply ignore the possibility of asset market bubbles by appealing to the idea that efficient financial markets would eliminate them. Second, he argues that the possibility that excessively activist monetary policy might destabilise the economy does not justify the absence of any action – rather it calls for caution in the extent of the action. Third, he argues that communication problems facing a central bank in justifying a monetary policy response to a potential bubble are no different from the communication issues associated with normal interest rate increases to stabilise prices and growth in the medium term.

Cecchetti's paper then presents some novel empirical evidence on the conduct of monetary policy in the United States. He examines minutes and transcripts of the policy-setting Federal Open Market Committee (FOMC) for references to keywords concerning asset-market valuations. He finds that the frequency of such references is correlated with a measure of the overvaluation of the equity market, and that as equity market valuations boomed in the 1990s, the frequency with which the FOMC discussed the equity market rose dramatically. In addition, Cecchetti estimates a policy reaction function for the US and finds some evidence that the level of interest rates over 1990–2003 was positively correlated with a measure of equity market overvaluation and negatively correlated with a measure of banking system stress. Cecchetti's results imply that Federal Reserve officials were talking more about asset prices as valuations rose in the 1990s, and perhaps also adjusting policy to lean against the bubble. He contrasts these results with recent public statements by Federal Reserve officials that there is little evidence that monetary policy can be used to limit the size of bubbles and their destructive fallout.[3]

3. For example, at the August 2002 Jackson Hole Conference, the Federal Reserve Chairman concluded (see Greenspan (2002, p 5)) that 'It seems reasonable to generalize from our recent experience that no low-risk, low-cost, incremental monetary tightening exists that can reliably deflate a bubble. But is there some policy that can at least limit the size of the bubble and, hence, its destructive fallout? From the evidence to date, the answer appears to be no'.

Conference Discussions

The fact that each asset-price boom has different causes and consequences implies that there is no single appropriate monetary policy response to a boom. This observation prompted some conference participants to note that there might be scope for other arms of policy, including tax and regulatory policies, to respond to asset-price developments.

Jeff Carmichael's comments in the concluding session note that if developments in asset markets imply an increasing level of risk in the financial system, this should be of concern to the financial regulator, which should assess whether the level of capital being held by banks should be increased. However, regulators may be no better at spotting bubbles than others. Furthermore, as Gordon de Brouwer notes in his comments, policy-makers need to be wary that interventions to limit speculative activity in one asset class do not simply push the problem elsewhere. More generally, conference participants noted that there was not yet a consensus among the regulatory authorities that they should be using capital requirements to respond to credit booms or possible asset-price imbalances. It is likely that there will be ongoing discussions on this topic, especially in the lead-up to the introduction of the revised Basel Capital Accord.

Regarding the role of monetary policy itself, there was broad consensus at the conference that policy-makers should not attempt to *target* asset prices, but that they also should not ignore them. Many of the participants seemed to support the view expressed by Philip Lowe, in his comments on the papers by Bean and Cecchetti, that central banks should focus on whether developments in credit and asset markets are materially increasing financial system risk and broader risks to the macroeconomy.

The question is then how an inflation-targeting regime should take these risks into account, given the general goals in terms of inflation and economic activity. The challenge in this regard is that the risks engendered by developments in asset markets are most often low-probability, medium-horizon events that do not lend themselves to easy inclusion in standard short-term forecasts. In particular, the risk of a substantial asset-price correction may be sufficiently low or hard to quantify as to be excluded from any central forecast, particularly at a horizon of only one or two years. But that does not mean that it can be ignored. Rather, these considerations highlight the need for monetary policy to maintain a medium-term perspective and to take into account an assessment of risks to the outlook, not just the central forecast.

References

Ball L (1997), 'Round-up', in P Lowe (ed), *Monetary policy and inflation targeting*, Proceedings of a Conference, Reserve Bank of Australia, pp 320–324.

Bernanke BS and M Gertler (2001), 'Should central banks respond to movements in asset prices?', *American Economic Review*, 91(2), pp 253–257.

Cecchetti SG, H Genberg and S Wadhwani (2003), 'Asset prices in a flexible inflation targeting framework', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 427–444.

Fisher KL and M Statman (2002), 'Blowing bubbles', *The Journal of Psychology and Financial Markets*, 3(1), pp 53–65.

Greenspan A (2002), 'Economic volatility', remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–30 August.

Three Australian Asset-price Bubbles

John Simon[1]

According to modern economic theory—which holds that markets are efficient, i.e., that share prices reflect intrinsic values, and that speculators are simply rational economic agents intent on optimising their wealth—the history of speculation is a dull affair. In the world of efficient markets there are no animal spirits, no crowd instincts, no emotions of greed or fear, no trend-following speculators, and no 'irrational' speculative bubbles. Yet the activities of speculators down the ages appear to me to be richer, more diverse in motivation and extraordinary in result, than anything described by economists.

Chancellor (1999, p xiii)

1. Introduction

Stories of speculative bubbles and the ensuing crashes are fascinating. When reading through, for example, *Extraordinary popular delusions and the madness of crowds* by Charles Mackay (1980) one is left with the overwhelming thought, 'how could rational people behave so?' Cautionary tales based on the Dutch tulip mania are well known, yet bubbles continue to occur. Each generation seems to believe that 'this time it will be different'. Railways, electricity and the Internet are all great technological advances that spawned great speculative excess.

The recurrence of speculative excess in widely differing environments suggests that it is, at base, a product of human nature. As such, Australia has had its fair share of speculative excess. This paper will examine three occasions when Australia has experienced asset-price bubbles: the land bubble in Melbourne in the 1880s; the Poseidon nickel bubble of 1969–1970; and the stock and property market bubbles of the late 1980s. These episodes cover property markets, mining stocks and stocks more generally; as such they provide a diversity of experience that a study of episodes in the stock market alone would miss. Mining stocks, for example, behave very differently to those of stocks more generally because of the inherent riskiness of the activity. The property market is different again.

Nonetheless, the choice of these episodes anticipates an important discussion: What exactly is a bubble and why do these episodes qualify? While we can all point to episodes that look like a bubble, actually tying down a definition, or categorising a given episode is much harder. I turn to that question now to provide a justification for why the particular episodes listed above have been chosen.

1. I would like to thank Simon Guttmann for valuable research assistance. I would also like to acknowledge Michael Cannon and Trevor Sykes, whose books on the Melbourne land boom and Poseidon bubble proved invaluable resources. Tony Richards, Luci Ellis and seminar participants at the RBA provided useful comments.

2. What is a Bubble?

One of the more common things said of bubbles is that 'you know one when you see one'. Unfortunately this means different things to different people. Some economists do not believe that there have been any asset market bubbles – merely examples of unrealised expectations.[2] Others even suggest that periods of 'irrational despondency' are more common than periods of 'irrational exuberance'.[3] There are numerous academic papers discussing whether certain episodes are, or are not, bubbles and there is no consensus in the literature.[4]

To answer the question posed I begin with a brief presentation of four famous bubbles; this serves to outline the data underlying this discussion. Section 2.2 then discusses previous academic writing on bubbles and their classification of various bubble episodes. I argue that most of these papers do not provide a satisfactory definition of bubbles. Instead, I propose a slightly different approach to identifying bubbles and provide a definition of bubbles based on that approach in Section 2.3. This definition forms the basis for calling the episodes selected in this paper 'bubbles'.

2.1 Four famous bubbles

I start my definition using the following events: the South Sea bubble, railway speculation in the 19th century, the US stock market in 1929, and the Internet bubble on the NASDAQ. There have been many more speculative bubbles throughout history. Kindleberger (2000), Mackay (1980) and Chancellor (1999) provide informative reading for those interested in more details and examples. The examples presented here are intended to provide a representative rather than exhaustive sample.

2.1.1 The South Sea bubble[5]

The South Sea bubble primarily involved trading in the shares of the South Sea Company in 1720. This company was formed in 1711 by a group of merchants and given a monopoly on British trade with the South Seas – Spain's South American colonies – in exchange for taking over some British government debt. A problem was that Spain was unwilling to allow much British trade.[6] Thus, the actual trade involved in the company's activities was relatively limited. Rumours of trade agreements with the King of Spain helped fuel some speculation. The bubble was, however, based around a purely financial transaction.

---

2. See Garber (1990).
3. See Siegel (2003).
4. Section 2.2 provides more details about the relevant literature.
5. See Mackay (1980, pp 46–88) and Chancellor (1999, pp 58–95) for further details.
6. The only trade allowed was to provide slaves to the Spanish colonies and one general trade ship per year of a restricted tonnage and cargo value from which the King of Spain, in any case, took a substantial cut of the profits.

In 1719 it was proposed that the entire British government debt would be privatised – holders of government debt would be offered shares in the South Sea Company in exchange for their debt. This arrangement offered a number of potential benefits: the South Sea Company was offering to refinance the debt at a lower interest rate, so the government would lower its interest costs; debt holders were being offered tradable equity securities in exchange for their non-tradable debt; and the South Sea Company was hoping to profit as the middleman. However, the South Sea Company also sought to improve its profit through other means. The South Sea Company inflated the price of its shares in the market and then offered debt holders shares whose market value was higher than the value of their debt holdings but whose nominal value was much lower. The company made easy credit available to shareholders: shares were offered for sale on 20 per cent deposit, effectively lending the remaining 80 per cent, the money gained through this offer was used to offer loans to existing stockholders (secured against their stock) who wished to buy more stock. This served both to increase demand and reduce supply as shares used to collateralise loans were held by the company. These activities look much like a pyramid scheme where money from early investors is used to attract further investors. In addition to offering loans, demand was further stimulated by announcing an increase in the dividend payable.[7]

The South Sea bubble occurred over about 7 months in 1720. Company shares are reported to have risen from £130 on February 1 to around £1 000 on August 1. The rise in South Sea Company shares helped to fuel a more general speculative fever in England. Across the Channel, John Law's Mississippi scheme, whose general principles were copied in the South Sea scheme, had caught the French imagination. Companies were floated in Exchange Alley with dubious business plans. The accounts in Mackay (1980) and Chancellor (1999) suggest that many companies were started merely to raise capital from speculators and then abscond with the cash. The most famous of these is the, possibly apocryphal, 'company for carrying on an undertaking of great advantage, but nobody to know what it is'.[8] The FT Actuaries All-Share Index provides a picture of the price movements at this time (Figure 1).

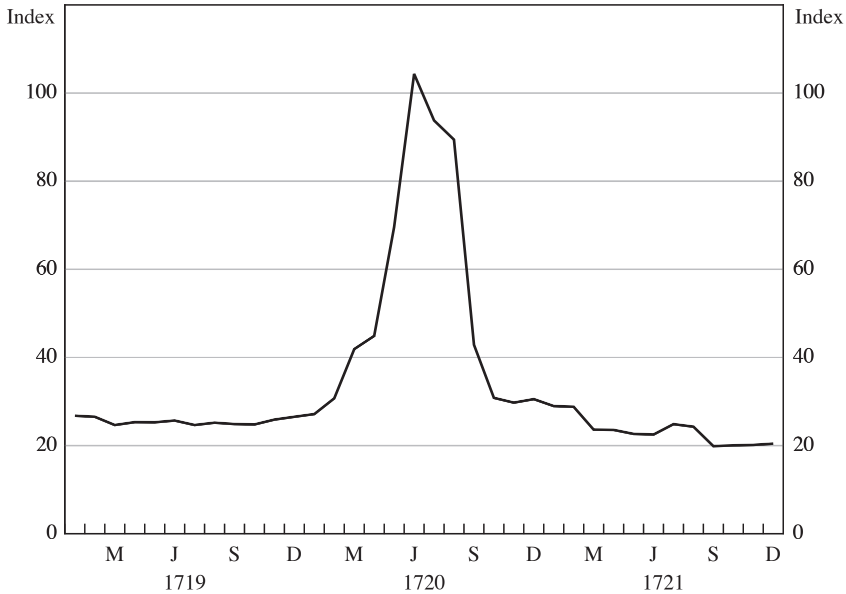
The index shows that overall stock prices rose almost four-fold in as many months. Nonetheless, like all bubbles, the collapse was just as rapid; from a peak of over £1 000 at the beginning of August, shares in the South Sea Company fell to £580 on September 12 and £150 on September 30. The general index mirrors these movements.

The simplest reason for the crash is that the pyramid scheme collapsed when new investors slowed and the principals started selling up. The fraudulent activities of many of the fringe companies also soured investors on stocks in general. Subsequently, parliamentary enquiries were established and many of the directors of the company convicted of various fraudulent activities.

7. The source of the money to fund the higher dividend was not made clear.

8. See Mackay (1980, p 55) and Chancellor (1999, p 72) on this particular South Sea bubble company.

Figure 1: UK Share Prices



Source: Global Financial Data, Inc.

2.1.2 *Railway mania*[9]

Railways represented a revolutionary technological innovation. They allowed large quantities of goods or passengers to be transported quickly and efficiently between previously isolated areas. This advantage meant that there was a great amount of real profit to be made by either companies who used railways or companies who owned them. Initially, at least, it was the railways that captured the profits. Only later, when there was over-capacity, did the profits accrue to railway users.

There was an outbreak of speculation associated with the opening of the first railway, the Stockton and Darlington, in 1825, but the major mania occurred some 20 years later. In the early 1840s railways captured the public imagination. Queen Victoria was persuaded to take her first railway journey in 1842 and, reportedly, found it quite pleasant. But much of the attention was generated by George Hudson, a particularly energetic entrepreneur who, in 1844, controlled over one-third of all the track in operation in the UK.

George Hudson engaged in some dubious and outright illegal practices in the process of promoting his railways: his company accounts were poorly maintained and, on occasion, fictitious; he paid dividends out of capital; and he intertwined his personal and corporate dealings, thereby extracting considerable personal gains.

The railway mania experienced its zenith in 1845. At the beginning of the mania, established companies were doing quite well – the three largest were paying dividends

9. See Chancellor (1999, pp 122–151) for more details.

of 10 per cent, well above the more normal 5 per cent.[10] There was a surge in the number of new railways proposed. There were public solicitations for stock and a profusion of publications on railways, all of which served to feed the public's appetite for railways. In Scotland, banks were formed to provide loans of up to 80 per cent against the security of railway shares. Many people are reported to have signed up for share floats with no intention or ability to pay for the shares – they intended to resell the shares before any money was due. Contemporary commentaries highlighted the speculative rather than fundamental nature of investors: 'There is not a single dabbler in scrip who does not steadfastly believe—first, that a crash sooner or later, is inevitable; and, secondly, that he himself will escape it'.[11] Chancellor reports that some shares rose by around 500 per cent over the course of 1845. The UK railway index suggests that the overall rise was milder – prices doubled in the up-phase (Figure 2).

Figure 2: UK Railway Share Prices

Source: Global Financial Data, Inc.

The bubble burst in October of 1845. In part this was the inevitable collapse of the fraudulent schemes that had survived on, and fuelled, the bubble. In part it was because most shares had been issued on a partly paid basis and further calls on investors were required when railway construction actually began. To come up with the capital some speculators liquidated their assets, which, in turn, placed further downward pressure on share prices. While many railway companies collapsed, others continued and contributed to a large over-capacity that kept railway shares depressed for many years to come.

10. Chancellor (1999, p 130).

11. A letter in *The Times*, 12 July 1845 – quoted in Chancellor (1999, p 136).

2.1.3 The US stock market in 1929[12]

The 1920s was a decade of great optimism. Much was made of the fact that the US was enjoying a new economy based on improved business methods. The founding of the Federal Reserve in 1913 led to predictions of the death of the business cycle. New technology, in the form of the motor car, aircraft and radio, was seen to herald a new era. In sum, these technological innovations, not for the first or last time, contributed to a feeling that the old rules no longer applied.

As with previous bubbles, credit was relatively easy to obtain and, in particular, margin loans were very popular among stock investors. Wigmore (1985) calculates that margin loans amounted to about 18 per cent of market capitalisation in October 1929. On the corporate financial front, there was a trend towards retaining more earnings in companies to expand operations as well as the use of increased debt to finance expansion. In this environment old valuation methods, based on dividends, became increasingly difficult to use and 'warranted' prices relative to dividends rose.

In this environment of general optimism, and on the back of popular enthusiasm and speculation, stock prices rose. The Dow Jones rose by 75 per cent from around 200 to around 350 in a little over a year between July 1928 and August 1929 (Figure 3).

Figure 3: Dow Jones Index

Source: Global Financial Data, Inc.

12. See Chancellor (1999, pp 191–232) and White (1990) for more details.

Eventually, the growth in stock prices stopped and, shortly after reaching its peak (September 3), the stock market crashed on October 28. There was no readily apparent cause for the crash and further weakness took the index back below 200 in around a month. There was a brief rally from there but the index generally trended down for the next couple of years. At the depths of the Depression in 1932 it traded near 40.

2.1.4 The Internet bubble

In the more recent Internet bubble there were many features similar to the railway mania and 1929 bubble. The new economy and the benefits of new technology were touted. As documented by Cooper, Dimitrov and Rau (2001), the simple addition of dot com to a company's name was sufficient for it to become the object of speculation. The unusually long expansion through the 1990s was taken as evidence that the business cycle had been tamed. Indeed, some people claimed that, over the long run, shares were a safer investment than bonds – an idea that had also been in vogue just before the 1929 crash.[13] The rise in tech-stocks was frequently justified by claims that the old rules of business no longer applied to these firms – a surprisingly familiar refrain. In particular, because few of the firms involved had ever paid a dividend, traditional valuation methods could not support the prices being paid for the stocks. Companies with the vaguest business plans were floated on stock exchanges at huge premiums to the underlying capital. Tech stocks generally reached remarkably high prices – Amazon.com was valued at US$26 billion at the end of 1999, approximately 10 times the combined value of their traditional 'bricks and mortar' competitors, Borders and Barnes and Noble.[14]

The clearest measure of the bubble is given by the tech-heavy NASDAQ stock index. Graphing the NASDAQ against the S&P 500 index shows that both grew at around the same rate from 1995 to late 1998. Figure 4 suggests that the bubble may have started around the beginning of 1999 and enjoyed its greatest growth from November 1999 to the middle of March 2000, over which time the NASDAQ index grew by 70 per cent.[15]

The collapse of share prices from March 2000 was fairly rapid and, as with 1929 before, there was no obvious real trigger for the collapse.[16] By March 2001 the NASDAQ was again level with the S&P index and has remained there since.

---

13. Chancellor (1999, p 194), provides a summary of the relevant work (EL Smith (1924), *Common stocks as long term investments*, McMillan, New York) and its effect on investors at the time.

14. At the end of 2001 the difference had fallen to 15 per cent because of the fall in Amazon's market capitalisation to US$4 billion and a rise in the market capitalisation of Borders and Barnes and Noble.

15. Because the S&P 500 included a number of tech stocks it would also have been affected by the bubble. Thus, this figure should not be seen as quantifying the size of the bubble in any way.

16. Ofek and Richardson (2003) suggest that the collapse was triggered by the expiration of lock-up clauses that allowed insiders to finally sell their stock.

Figure 4: US Share Price Indices
3 January 1995 = 100

Source: RBA

2.2 Bubble literature

Starting from basic theory, the value of an asset should equal the discounted flow of future income flows. Thus, for stocks, their ultimate value is determined by the flow of dividends they produce. This principle can be used to determine if asset prices are behaving oddly by looking for periods when the stock price becomes misaligned with the dividend stream that supports it. Unfortunately, a problem with this approach is that what really matters are future dividends and these can not be observed *ex ante*. Instead, assumptions about future dividend growth and interest rates need to be made. If these assumptions turn out to be wrong, 'rational' prices can be very different *ex ante* and *ex post*.

Some initial work in this area was by Shiller (1981) who claimed that there was evidence that stock market values could not be justified on the basis of future dividend flows – implicitly suggesting that bubbles might be present in share prices. Later work has questioned his findings on economic and econometric grounds. In general, evidence of bubbles is difficult to find via this route because various econometric issues muddy the results. Abstracting from econometric issues, small changes to assumptions can justify a wide range of stock prices – finding truly irrational prices is therefore quite difficult. Thus, despite being the avenue of most intensive research, this approach has been unable to give unambiguous conclusions. The case against bubbles is best put by Flood and Hodrick (1990), 'It is our contention that no econometric test has yet demonstrated that bubbles are present in the data. In each case, misspecification of the model or alternative market fundamentals seems the likely explanation of the findings'.

Partly in reaction to this, there is a literature that looks for other testable implications of bubbles. These can be divided into two groups, those that look for a measure of fundamentals and those that examine the statistical properties of returns. However, in order not to raise your hopes about this literature, a reasonable summary of the state of play was given by Miller (1990, p 37) when he said – 'Here, as all too often in economics … we are faced with competing theories that can seemingly account for the same facts and we have no way of conducting decisive experiments that can distinguish between them'.

McGrattan and Prescott (2001a, 2001b) look for departures from a fundamental measure of asset values. They define a bubble by reference to the *q* theory of investment – a set of assets should be worth the sum of the values of the individual assets. They conclude that the 1929 stock market was undervalued. In a similar vein, DeLong and Shleifer (1991) look at the value of closed-end funds (a particular kind of managed fund) relative to their underlying stock holdings and, in contrast, conclude that there was a bubble in 1929. Rappoport and White (1991) identify a bubble by looking at the risk premium embodied in loans to stockbrokers. They find that this risk premium increased markedly in the 1929 stock market and thereby infer the presence of a bubble. A problem with using these approaches is that they rely on particular institutional features of the US stock market, and could not easily be applied to other asset markets.

In contrast to the fundamentals-based approaches, Santoni and Dwyer (1990) identify a bubble as a period when stock market returns do not follow a random walk, i.e., there is a departure from the efficient markets hypothesis. Using this definition they claim that neither 1929 nor 1987 were bubbles. However, Warman (1990) points out that their test is not a useful discriminator because it identifies some non-bubble periods as 'bubbles'. In somewhat of a mix of the two approaches, Siegel (2003) proposes a definition of a bubble as one where the 30 year future returns from holding stock are more than two standard deviations below the average. Using this definition he finds no evidence of bubbles in the past 120 years in the general US stock market. Monte Carlo experiments on Siegel's test suggest that it suffers from low power – it misses most bubble episodes while also identifying non-bubble episodes as bubbles.[17]

Given the conflicting set of results coming from empirical tests it would seem that views about the existence of bubbles come down to personal judgements. At one extreme is Peter Garber. He proposes that: 'Before economists relegate a speculative event to the inexplicable or bubble category, however, we must exhaust all reasonable economic explanations … our methodology should always require that we search intensively for market fundamental explanations before clutching the "bubble" last

17. Details of this exercise are available on request.

resort' (Garber 1990). He then claims that fundamentals could support the prices paid during the tulip mania, the Mississippi scheme and the South Sea bubble.

By contrast, other economists view it as self-evident that bubbles have periodically occurred. For example, Shiller (2003) defines a bubble as 'a period when investors are attracted to an investment irrationally because rising prices encourage them to expect, at some level of consciousness at least, more price increases. A feedback develops — as people become more and more attracted, there are more and more price increases. The bubble comes to an end when people no longer expect the price to increase, and so the demand falls and the market crashes'. Stiglitz (1990) offers that 'It seems plausible to me … to interpret marked price declines which occur without any apparent new information as the breaking of a bubble'. Kindleberger (2000) has a similar definition, 'a bubble is an upward price movement over an extended range that then implodes'. These definitions, while the vaguest, also seem the most robust and suitable to me. They are very similar to the definition I propose.

2.3 A definition

I approach the question of 'what is a bubble?' as one of classification. By considering enough examples it should be possible to identify the common features of all the episodes and thereby arrive at a useful working definition. Given the disagreement as to whether bubbles even exist, I offer one semantic nicety. I intend to classify asset market events that look like the 1929 US stock market and the South Sea 'event'. I will call this category of events 'bubbles'. Those readers that object to this use are free to substitute 'market rises and falls that look like the 1929 US stock market' wherever they see the word 'bubble' in the remainder of this paper.

To start with the obvious, the primary thing that draws our attention to bubbles is how high prices rise and how deeply they fall – it is their quintessence. All bubbles involve a rapid price rise and then fall. However, considering the 'bear trap' rally on the US market in 1929 or the NASDAQ in 2000, it is clear that the 'pop' does not necessarily occur all at once.

Bubbles have their genesis in some fundamental change – they do not spring *ex nihilo*. This is commonly the development of some 'new' thing. For railways it was a new transportation technology, for the tech stocks it was the Internet and computers. This 'new' element is also what frequently allows the bubble to grow to spectacular proportions – the high level of uncertainty about the implications of the new technology mean that very high valuations can be entertained. Nonetheless, new technology is not a necessary requirement for bubbles and speculative attention can be turned on practically anything – Kindelberger (2000, pp 41–43) gives a list that includes metallic coins, tulips, commodities, and foreign exchange among many others. Bubbles occur when the initial reason for investing becomes subsumed in a general demand for assets whose prices have risen in the past, regardless of the initial reason for the rise.

This leads to another essential feature of the bubbles – the presence of speculative rather than fundamental reasons for investing. What draws our eye to many bubbles is that, when viewed from a dispassionate distance, the justifications given for investment seem very weak. The rapid collapse of prices for no convincing reason is a feature of bubbles that is closely tied to their speculative nature. The rapid collapse suggests the presence of people in the market who require the price to go up in order for them to continue to buy or hold the asset – in other words, speculators. Another sign of the speculative excess is the surge in new company formation. Bubbles seem to attract 'entrepreneurs' trying to cash in on the euphoria. While some solid companies may be founded during bubble periods they seem to be vastly outweighed by the fraudulent or deluded.

Bubbles also seem to happen after a period of benign economic conditions – they typically cap a long expansion. The preceding period of benign conditions provides the foundation of optimism on which the bubbles build. Indeed, just 5 to 10 years seems to be enough time for people to forget that prices can fall as well as rise.

One final common element in bubbles is easy access to credit. Margin loans, partly paid shares or low deposit home loans are all ways of increasing the demand for the asset that will serve to raise its price. This leveraging is typically what fuels the upward and downward phases. Highly-leveraged investors would typically be unable to maintain payments when asset prices fell. Many bubbles have been followed by financial crises as the collapse of the speculators brings down the lending institutions. However, the recent Internet bubble does not seem to have been fuelled by credit. While the level of debt in the US was increasing steadily at the time of the bubble, there is no sign of an acceleration associated with the Internet bubble. Similarly, there have been few stories of highly-leveraged investors being caught out by the crash in the NASDAQ – instead people have lost accumulated savings. The Internet bubble seems to have been funded out of wealth rather than debt.

To summarise the foregoing discussion, a bubble is an asset market event where prices rise, potentially with justification, rise further on the back of speculation, and then fall dramatically for no clear reason when the speculation collapses. Furthermore, they typically occur in an environment of general optimism, for example, at the end of a long expansion. Commonly associated with these price changes, but not necessarily, are an easy availability of credit, new technology, and an increase in company formation.

On the basis of this definition a number of Australian events qualify as bubbles. This paper will examine three of them: the land boom in Melbourne in the 1880s; the Poseidon nickel boom; and the 1987 stock market and associated property market boom. In each case, asset prices rose rapidly before crashing spectacularly. More details, highlighting how similar the Australian experience is to the general experience, are provided in the relevant sections.

The land mania of the 1880s took two main forms. The first was based on a plethora of building societies, whose optimistic officials believed that every family in the colony could simultaneously build their own house, keep up the payments through good times and bad, and support an army of investors who were being paid high rates of interest for the use of their money. The second form of mania was the deeply-held belief that it was impossible to lose money by 'investing' in land—a belief which persists to the present day.

(Cannon 1966, p 12)

3. The Melbourne Land Boom

Land, as an investment, is quite unlike shares, which are the usual object of speculation. Land has always been perceived as a safer asset to own than other investments; land is tangible in a way that paper shares are not. Also, because of the generally high transaction costs involved in buying and selling land, it has much lower turnover than shares. This lower turnover corresponds with typically long holding periods for land, which, in turn, can help prevent the faddish speculation that may infect certain share prices from time to time. Nonetheless, there are elements to land as an investment that can facilitate speculation. For a start, the high transaction costs just mentioned could dissuade people from selling in a bubble. Furthermore, land is not homogeneous. While one BHP share is identical to another, one house in Footscray is invariably unlike another house in Footscray. This differentiation makes it much harder to establish a 'market price' for any given property. In this environment it is much harder to establish when the price is 'too high'. Also, because of the size of land transactions relative to people's incomes, borrowing to finance a land purchase has been a ubiquitous practice. In contrast, borrowing for share purchase has always been regarded as a risky endeavour and has regularly been implicated in the formation of stock bubbles. Furthermore, unlike the share market, land is not 'marked to market' every day. This can allow misalignments in prices to persist for extended periods – margin calls on leveraged share investors help to speed the deflation of share market bubbles whereas this process does not occur in property markets.

3.1 Melbourne in the 1880s

The 1880s in Melbourne were a time of great growth. Melbourne developed rapidly through this period supported by the wealth that had been created by the earlier gold rushes. The introduction of cable trams and trains made suburban living much more convenient. New lines were opened to Richmond, Fitzroy, Brunswick and Carlton, to name a few, beginning in 1885.[18] Telephones were gradually being introduced, once again reducing the inconvenience of living in the suburbs, and electricity was beginning to be used for industry. In addition to the introduction of tram and train services, other technological innovations, such as hydraulic lifts, allowed taller buildings to be built, and thereby, increased Melbourne City land

18. These suburbs are located between 2 and 6 kilometres from downtown Melbourne.

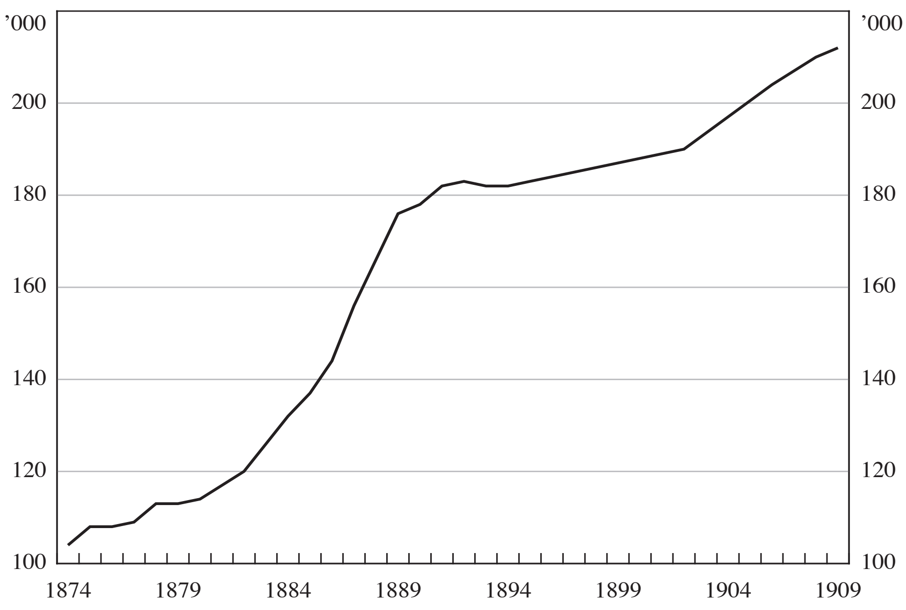
values. Part of the exuberance of the period could be seen in substantial growth in the share market. Tramway shares were an object of great speculation and discoveries of silver by BHP fuelled a rise in mining shares.

The introduction of trams and the rapid growth in population generated a demand for land in the ring suburbs around the centre of the city. The population of Greater Melbourne rose by more than 70 per cent from 283 000 in 1881 to 491 000 in 1891. The population of Melbourne City increased by only 11 per cent, from 66 000 to 73 500 in this period, while that of Brunswick, Northcote, Essendon, Flemington, Hawthorn and Footscray all increased by over 200 per cent.[19] In conjunction with the increase in population there was a surge in the number of dwellings being built. The total stock of dwellings in Victorian cities, towns and boroughs increased by over 50 per cent between 1881 and 1891. Figure 5 shows the total number of rateable properties in Victorian cities, towns and boroughs in the late 1800s.[20]

Through much of the 1880s the *stock* of properties was growing at around 5 per cent per year. The rapid increase in the stock of properties was, additionally, associated

Figure 5: Number of Rateable Properties

Victorian cities, towns and boroughs



Source: *Victorian Year-book*, various years

19. These suburbs are all located around 5 kilometres from downtown Melbourne.
20. This is dominated by Greater Melbourne, which makes up around 75 per cent of the number of properties. Rateable properties were defined as: ‘All contiguous pieces or parcels of land occupied by the same person or persons must be reckoned as only one property; but every house constitutes a separate property together with all land attached thereto’. (*Victorian Year-book 1895–98*, p 106)

with large rises in the price of property. Figure 6 shows an estimate of house prices in Victorian cities, towns and boroughs over the same period.[21]

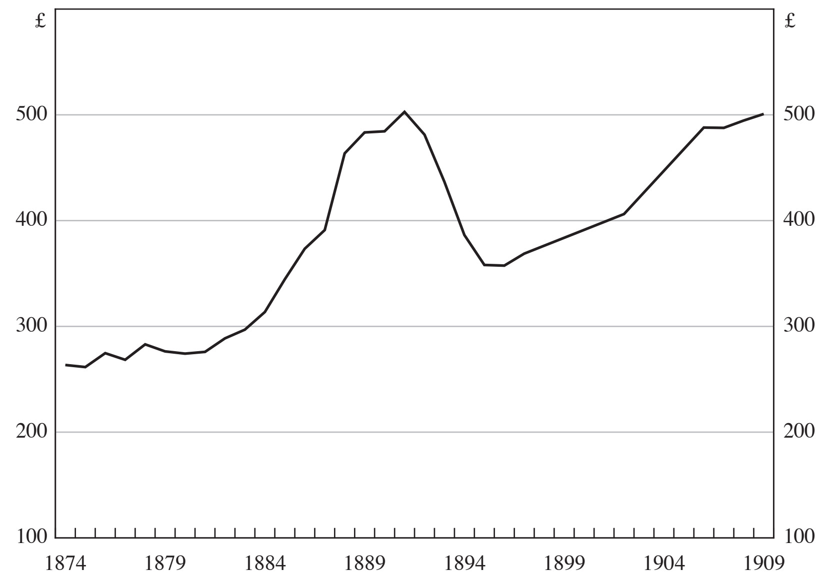
At the same time as the stock was growing at around 5 per cent per year, prices were growing at between 5 and 10 per cent per year. At its peak, in 1888, average values rose by over 18 per cent and the stock increased by 6½ per cent.

This estimate of property values, derived as it is from traditionally conservative taxation data, probably understates the growth in house prices. An alternative source is Silberberg (1975) who tracked sale prices for individual parcels of land in the suburban fringe of Melbourne – those most likely to be subject to speculative attention. Silberberg estimated that the average *annual* rate of return on investment in large plots of land was around 50 per cent for much of the 1880s and peaked at 78.3 per cent in 1887. These figures reflect total investment returns and, probably, the benefits of leverage. Silberberg also provides a series of average price per acre for the transactions. These grow at an average of 35 per cent per year from £40 per acre in 1882 to £335 per acre in 1889 with a peak growth of around 50 per cent in 1885 and 1887.

Even higher growth rates can be found in Cannon (1966). He reports properties in downtown Melbourne being resold for double the original price within a few months. Even on the outskirts of the city there was impressive appreciation; land in Surrey Hills is reported to have increased from 15s a foot in 1884 to £15 a foot

Figure 6: Average Value of Rateable Property

Victorian cities, towns and boroughs



Source: *Victorian Year-book*, various years

21. Once again, this is dominated by Greater Melbourne, which makes up around 80 per cent of the value of properties. More details on the construction of the data are contained in Appendix A.

in 1887.[22] These reports, focusing on individual properties, undoubtedly represent the most excessive transactions and, as such, would be much greater than the average. Nonetheless, they serve to provide some of the flavour of the times. The prices reported in Cannon, to the extent that they were accurate, were drawn from contemporary newspaper reports. As such, they would have undoubtedly been talking points among people during the times in the same way that remarkable real estate transactions get discussed around dinner tables today.

This rapid expansion was not going unnoticed – far from it. Accounts of the period suggest that land speculation affected most members of society. Cannon suggests that most members of parliament were engaged in land speculation and, by influencing where railway and tramway lines would be built, using political power for private gain. Indeed, because parliamentary salaries were low, independent means, which invariably meant substantial property holdings, were required to get elected and serve in parliament in the first place.

Concurrent with the land boom, a boom in share prices was also unfolding. Originally focused on mining companies, the share boom quickly embraced tramway companies as well as land banks. Edward Shann (1948) commented 'The bubble reached its iridescence in 1888 … Its most sensational phases were the speculative dealings of the big men in city land and in mining and "investment" shares'. Cannon presents figures that show that in 1888 two-thirds of the new companies incorporated (by capital issued) were involved in land and finance activities. The reports of the share market bear a striking similarity to those related to the Poseidon boom almost a hundred years later. From the *Illustrated Australian News*:[23]

> You only had to issue a prospectus which contained the magic words Broken Hill, and draw some lines on a piece of paper and say it was a plan showing the lode to run 'right through the centre of this valuable property', and that certain wonderful assays had been made, and an eager frantic public was ready to subscribe £50 000 or £100 000 in half an hour; and next morning the stock was launched upon the market and snapped up at 100, or even 500, per cent premium.

While strong demand and technological innovations started the boom, its progress was spurred by large increases in lending, particularly by so-called, land banks. Land banks were financial institutions that, in addition to lending money on the security of urban land, invested in land on their own account. Investing on their own account turned many of these banks into purely speculative endeavours. The land banks were also closely related to the frauds that proliferated at the peak of the bubble. In many cases the directors of land banks enriched themselves by misappropriating depositors' money.

3.2 The crash

The crash began in 1891. Land values fell to levels around one half their boom levels. In addition to the picture given by Figure 6, data on individual suburbs are

22. There are 20 shillings to a pound. A foot was a measure of street frontage for a standard length block.

23. Quoted in Cannon (1966, pp 49–50).

available. In Prahran, prices peaked at an average of over £1 000 per property in 1888 and fell to £520 by 1898. Similarly, in Brighton, average property values peaked at around £950 in 1888 and then fell to around £400 in 1893 and £300 in 1898. A comparison of these data to the accounts in Cannon (1966) suggests that the picture is fairly accurate but may understate the speed of the bust. For example, Cannon writes that, 'by the end of 1891 the bottom had completely dropped out of the land market … In Collins Street, sites for which £2 000 a foot had been rejected a short time before, were now being offered for £600 a foot – and could not find buyers even at that price' (Cannon 1966, p 18).

The exact trigger for the crash is unclear. Nonetheless, its general nature is fairly clear. From the end of 1887 many reputable banks restricted their lending for land purchase substantially. Regardless, the market continued to grow for another four years largely supported by the activities of the land banks. Many of these financial institutions were obtaining money on deposit from the UK by offering higher interest rates than were available on other investments; foreign investors did not seem to factor in the likelihood of default in making these deposits.[24] However, fundamental factors were beginning to affect the bubble. The huge amount of land that had been brought onto the market meant that rental yields were depressed. Furthermore, the low rental yields combined with high leverage meant that speculators were experiencing increasing cash flow problems. Mortgage defaults and bank runs eventually led to a number of financial institutions going under. This then started a chain of events that led to the bubble completely deflating. Many of the land banks had only recently been floated and had issued partly paid shares. In an effort to continue operating they issued calls for the remainder of the capital, which, in turn, required shareholders to sell land to meet the call on their shares. The additional selling pressure pushed prices down significantly, thereby inducing further financial problems. This then became a full-blown financial collapse, which led into a more general depression.

The population of Greater Melbourne declined from 490 000 in 1891 to 458 000 in 1897 as people sought better opportunities elsewhere. Nonetheless, Victoria was not unique and many other areas experienced depressed conditions. A full examination of the financial crisis and depression are beyond the scope of this paper but an interested reader may wish to consult Fisher and Kent (1999) for a more detailed discussion.

One positive outcome from the bubble and its collapse was an improvement in the legislation governing corporate conduct. The collapse in the land boom induced a change in government as many leading politicians were implicated in the financial scandals. The new government introduced a number of bills designed to raise standards of corporate conduct. The old law, the *Victorian Companies Act* of 1864, had many loopholes that could be exploited by entrepreneurs to engage in unethical but legal activities designed to enrich themselves. Many of these loopholes were closed in the amended legislation – although Cannon reports that opposition from the Upper House restricted the scope of changes.

24. This element, speculation being supported by less informed investors in the UK, also appeared in the Poseidon boom. Many speculative mining companies had their most active trading, and largest price increases, on London markets – see Sykes (1978, pp 64–70) for a discussion of this.

The mining boom of 1969-70 developed into a form of mass hysteria. This may be deplorable, but until we can change the fundamentals of the human psyche, people will be prone to mass hysteria occasionally and the stock exchange is probably the most harmless outlet for it.

After all, it's only money.

(Sykes 1978, p 373)

4. The Poseidon Bubble

Mining is an inherently risky enterprise. Exploration is even riskier. While geologists can highlight the more likely areas for minerals exploration, until a drill is put into the ground, nothing can be known for certain. In this environment it is not uncommon for the stocks of exploration companies to show high volatility. This volatility is most closely related to whether or not a drill discovers any minerals or not. It is entirely possible for a small company to multiply its value hundreds of times over on a successful strike.

In this environment it is unsurprising that share prices can boom or crash spectacularly. Nonetheless, shares experiencing both a boom and a crash in close proximity, essentially a bubble, are still a rare phenomenon. This happened to many companies in 1969 and 1970.

4.1 Background

The 1950s and 1960s have frequently been referred to as the 'long boom' – growth was high, and unemployment and inflation were low. Real growth from 1950 to 1969 averaged 4.5 per cent per annum. Excluding the Korean War boom, inflation averaged 2.5 per cent from 1952 to 1969. Unemployment was low, averaging 1.2 per cent over the 1950s and 1960s with a high of just 2.6 per cent in 1961.

Building on this base of solid economic fundamentals, Australia's mining sector was growing rapidly. Since the first gold discoveries Australia had been known to be rich in minerals. The full extent of those deposits was, however, unknown. The 1950s and 1960s were a period when major new mineral discoveries were being made in Australia, greatly expanding the range and size of known mineral resources. Major iron ore, uranium, bauxite and petroleum discoveries were made in this period: the Weipa bauxite mine, the Mary Kathleen uranium mine, the Mt Tom Price iron ore mine, and the Bass Strait oilfields. The growth of the ASX All Mining Index reflected the overall effect of these major discoveries on the market (Figure 7). The index grew by 25 per cent per annum, on average, over the 11 years from 1958 to 1968.

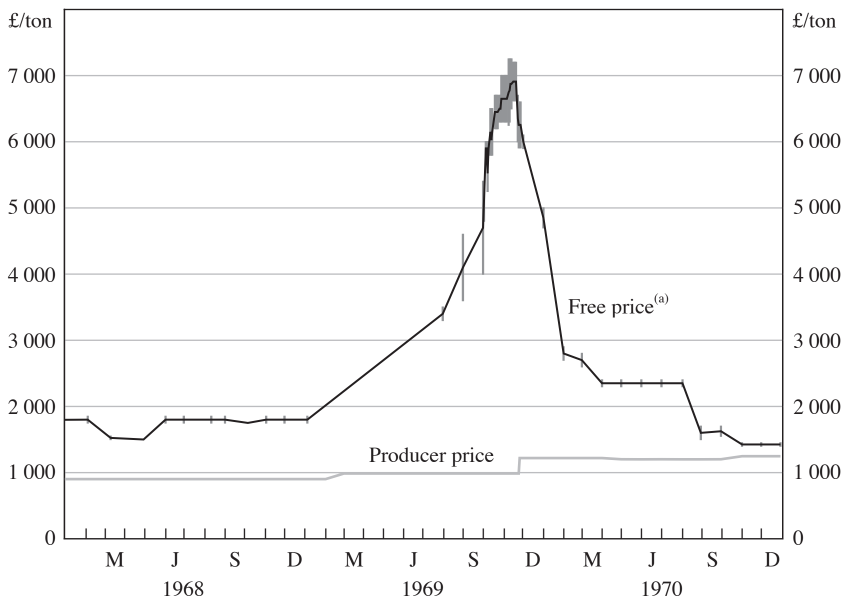
4.2 The bubble

The Poseidon bubble had its genesis in the nickel market. In the second half of the 1960s shortages of nickel were emerging. There was high demand spurred by the Vietnam War and a shortage of supply as the major Canadian producer, Inco, was embroiled in industrial action. This had seen the free price of nickel (as opposed to the controlled producer price) skyrocket (Figure 8). The free price of nickel

Figure 7: ASX All Mining Index

Source: Global Financial Data, Inc.

Figure 8: Nickel Prices



(a) Vertical bars show indicative range, black line is an average of high and low prices.

Source: *Australian Financial Review*

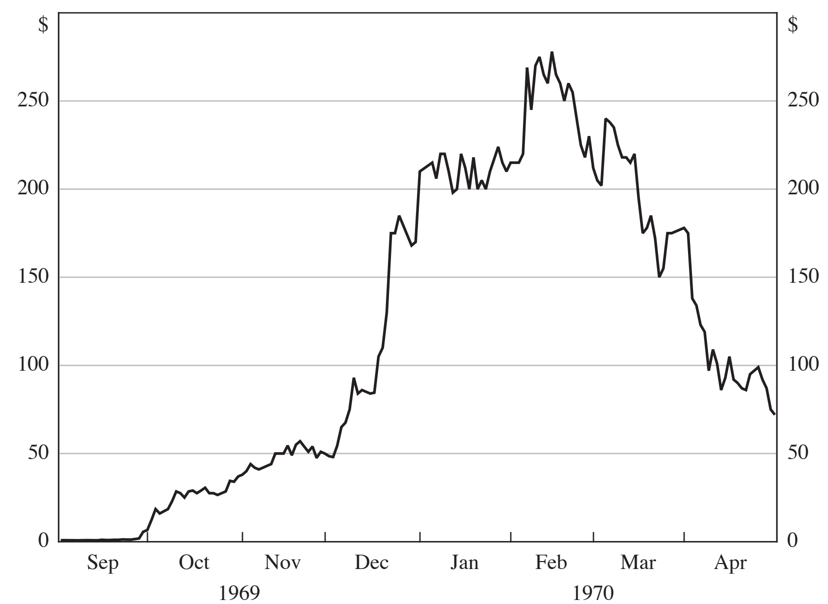
reached a peak around £7 000 per ton on the London market at the beginning of November 1969. Poseidon came to the public's attention at just the right time.

4.3 Poseidon NL

Poseidon NL (no liability) was a mining exploration company that made a major nickel discovery at Windarra in Western Australia in 1969. Poseidon had been languishing for many years before it acquired some exploration leases and hired a prospector in 1968. The exploration leases did not turn into a mine but the prospector, Ken Shirley, did find a promising site at Windarra. Poseidon's shares started rising around September 25, 1969 when results from drilling on the Windarra site became known to some insiders. Shares had been trading around $0.80 in early September and rose to $1.85 on Friday September 26. On Monday September 29 the company made a preliminary announcement that drilling had found nickel and this pushed the share price from $1.85 to $5.60. On October 1, company directors made a more detailed announcement indicating that they had a major nickel find. The share price jumped from $6.60 to $12.30 that day and then kept going up (see Figure 9).

Up until this point all the share price moves can be explained on the basis of fundamentals – a small company with few shares on issue had made a major nickel discovery. The discovery made the front page of the *Australian Financial Review* (*AFR*) on October 3 with the headline 'Nickel boom turns radioactive'.

Figure 9: Poseidon Share Price



Source: *Australian Financial Review*

From here on it captured the public's imagination. Other mining shares started to rise as speculators took positions in nickel stocks, then companies with leases near Windarra, and miners in general. From October to December 1969 the ASX All Mining index rose by 44 per cent from 438 to 632.

The volume of trading also rose substantially, reaching over 37.9 million shares traded on November 3 (compared with a pre-bubble record under 20 million). This put a strain on the stock exchanges' newly installed computers and brokers' back offices. This only served to fuel the excitement as share prices continued to rise.

New information on the Poseidon mine came out only gradually. Around November 19 Poseidon issued another drilling report but its shares, now trading around $50, did not move appreciably. More significant price movement occurred around Friday December 19, the date of Poseidon's AGM. It closed at $110 on Thursday and had run to $175 by the following Monday. Other than these two occasions, the information that underlay market movements was scant.[25]

Calculations as to the value of Poseidon shares were many and, given the lack of solid information, varied. Sykes (1978) presents one that would have been made around the time of the bubble suggesting that Poseidon was worth about $60 a share. A letter to the editor of the *AFR* published on December 31, 1969 suggested that $112 a share was reasonable. In January 1970 a UK broking house published a report that suggested a value of between $300 and $382 per share would not be unreasonable, that report was summarised in the *AFR* on February 11, 1970. In any case, all the calculations were based on a large number of assumptions, the prime one being that the price of nickel would remain as high as it currently was, around £6 000–£7 000 per ton at the end of 1969. Most of the assumptions turned out to be false – the ore concentration was lower than assumed, the price of nickel was lower than assumed and the costs of extraction were higher than assumed.

While the run-up in Poseidon's share price was spectacular, it was at least based on a real discovery. The speculative excess in the market is much more obvious in the behaviour of other mining shares. There were a large number of listings as promoters tried to cash in on the aura surrounding mining stocks.[26] In an echo of the fabled 'company for carrying on an undertaking of great advantage, but nobody to know what it is' from the South Sea bubble – a number of companies floated with 'empty' prospectuses containing no details on any prospects.[27] Indeed, insiders managed to extract a lot of money from the boom. The *AFR* examined one group of promoters' profits in a front-page article 'How to turn $1 into $12m'.[28] Sykes (1978)

25. And, of the information released by Poseidon, much was later found to be inaccurate.
26. Just as promoters tried to cash in on the dot com boom at the end of the 1990s. In a curious echo, many of Australia's dot com companies were languishing mining exploration companies (or shells) that went dot com to cash in on the Internet boom.
27. The *AFR*, February 16, 1970, listed Basin Oil, Pursuit, Ashburton, Weatherly and Barewa as companies that had issued prospectuses with no specific prospects.
28. *AFR* February 17, 1970.

details the exploits of David Paxton with regard to Barewa Oil and Mining where considerable amounts of capital found its way into the promoters' pockets.

Early on in the boom Poseidon stock went out of the reach of many investors – comments to that effect appeared when Poseidon passed $50 on the way up. Instead, speculative attention focused on cheaper shares. Cashing in on this, many companies issued shares at low face values or on a partly paid basis. Barewa had issued $1 shares as well as 10 cent and 1 cent partly paid shares. Also, the mechanics of the market were such that buy orders could be made and payment not made for a couple of weeks. This encouraged people to buy on the prospect of making gains before any money was actually due, by which stage they could sell out for a large profit with no money down.

The speculative activities surrounding the fringe companies are best exemplified by what happened to Tasminex NL at the end of January 1970. Tasminex was an exploration company that was investigating some leases at Mount Venn in Western Australia. On Friday January 23, one of the directors of the company panned some drill samples and identified some heavy metals in it. This seems to have been the basis for a rumour that they had discovered nickel. Prices rose on that Friday from $2.80 to $3.30. On the next trading day, Tuesday, they rose further to $16.80 based on more rumours. Companies with leases bordering Mount Venn also began appreciating. Then, following the publication of an interview by Trevor Sykes with the company chairman, the shares hit $96 in overnight trading on the London market. In Australia the shares traded as high as $75 and closed at $40 on Wednesday. The company chairman sold many of his shares at these prices and realised a substantial profit. Thereafter, the shares trended down as no further news was forthcoming. No discovery was ever made at Mount Venn.[29]

4.4 The crash

The resources market, as measured by the ASX All Mining Index, peaked in January 1970 and Poseidon shares peaked in February.[30] Thereafter, both fell quickly and substantially. There is no clear indication of what triggered the decline but the activities of the fringe companies no doubt helped to tarnish the stock market in many people's minds. At its peak Poseidon had a market capitalisation of $700 million, which was about a third of the capitalisation of BHP (Australia's largest company) at the time. That kind of value was not bad for a company that only had one mine. The peak of the market also coincided with a series of front-page articles in the *AFR* outlining the shady practices of various share promoters. From this time a greater number of negative articles start appearing in the press. On March 17, before the realisation that the bubble had burst had set in, a seminar criticising the mining boom

29. Chapter 12 of Sykes (1978, pp 161–174) provides more details about this episode.

30. On February 5, 1970 Poseidon reached $280 in intraday trading but closed at $269. The peak in its closing price was $278 on February 13.

was reported in the *AFR* (p 18). Dr John Rose of Melbourne University's Institute of Applied Economic and Social Research was quoted as saying:[31]

> There are increasing signs that a large and growing proportion of the amounts being raised are going into buying claims and other assets at inflated values and in paying company associates high salaries and consulting fees …
>
> One cannot help but wonder whether the atmosphere in our stock market trading in mineral securities should not be likened to that which existed when chain letters were the rage. To put it another way, are people buying stocks on the appreciation that they will locate a valuable source of minerals and develop the mine into profitable production, or are they buying merely on the assumption that there will be further demand for the stock … and such additional demand will enable them to sell the stock at a price higher than what they paid?

On March 18 the *AFR* led with 'Shares crack: quality counts – blue sky prospectors turn grey in heavy setback'. After peaking at over 640 in January 1970, the ASX All Mining index fell to around 200 in November 1971.

After the bursting of the bubble, Poseidon's share price drifted down and the business of exploiting the Windarra discovery actually got underway. The mine produced nickel beginning in 1974 but it was not enough to keep Poseidon going. After experiencing many difficulties Poseidon delisted in 1976. The Windarra mine was taken over by Western Mining and operated until 1991 when it was shut down. This is in contrast to the majority of other stocks associated with the bubble – these never even had a viable mine, some didn't even have mining leases.

The Rae Committee report, handed down in 1974, documented the abuses that had gone on during the Poseidon boom.[32] The report highlighted how the stock market had been poorly regulated and that much of the information relied upon by investors was uncorroborated rumour. It recommended a number of changes to financial regulation and the regulation of stock markets which would, presumably, prevent the sort of abuses that occurred during the Poseidon boom from happening again.[33]

With the benefit of hindsight, it is possible to make an estimate of what the Poseidon mine was really worth. Over its life, Windarra produced 5.4 million tons of ore with an average grade of 1.5 per cent nickel. Assuming an average price of \$3 000 per ton for nickel makes the ore body worth about \$250 million. From this must be subtracted capital and labour costs. Given the relatively low ore grade, the extraction costs were very high and, thus, the mine was no more than a break even proposition. Nonetheless, this information was unknown in 1969 and 1970 so it was certainly rational to put a positive value on Poseidon shares. The bubble came when that value of Poseidon was pushed to \$700 million.

---

31. Dr Rose went on to play an important role in the Rae Committee hearings into the regulation of Australian securities markets, serving as an informal advisor to Senator Rae and an economic advisor to the committee.
32. Senate Select Committee on Securities and Exchange (1974).
33. Insider trading, for example, was not illegal during the Poseidon boom.

Greed is all right, by the way. I want you to know that. I think that greed is healthy. You can be greedy and still feel good about yourself.

Ivan Boesky, Commencement address, UC Berkeley School of Business, May 1986

5. The 1987 Stock Market Bubble

Stock markets appear to be the most frequent environment where bubbles occur, and are certainly the most intensively studied. Stock markets are very close to the idealised, frictionless markets of economic theory. Turnover costs are low and there are also a wide variety of derivative products available, including futures markets.[34] In this regard, bubbles in stock markets are difficult to reconcile with economic theory. Theory predicts that the market price of a stock will accurately reflect all available information and that departures from fundamentals should be arbitraged away by rational traders. Despite this, there are numerous episodes where stock markets display apparently irrational behaviour. Abstracting from whether the behaviour is rational or not, the Australian stock market in the late 1980s displayed some strange behaviour.

5.1 The 1980s

The 1980s were a period of relative optimism after the stagflation and economic disruption of the 1970s. In the UK and US Margaret Thatcher and Ronald Reagan were elected and their economic policies helped to promote a favourable environment for 'capitalists'. In Australia, while inflation remained above the OECD average, there were numerous economic policy reforms that gave people reason to expect an improvement in economic conditions. After the recession in the early 1980s unemployment and inflation were generally falling.

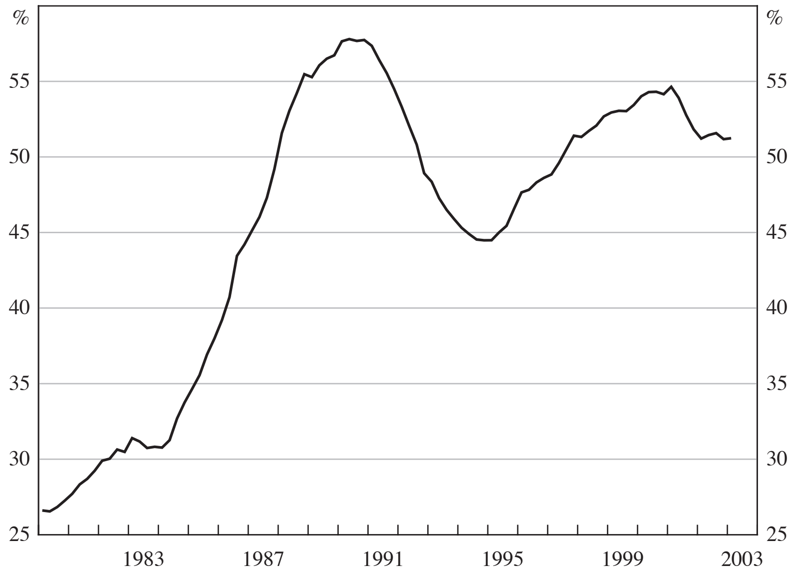
One of the most significant changes to take place was general financial deregulation. Interest rate ceilings on banks were lifted in 1980, the Australian dollar was floated in 1983 and foreign banks were granted full banking licenses in Australia in 1985. Other restrictions were relaxed and loans became much more freely available. The entrance of foreign banks also spurred competition and banks sought ways to expand their lending operations to maintain or expand market share. The primary recipient of this lending was the business sector (Figure 10).

The increase in credit available to the business sector fuelled expansion in corporations and increased takeover activity. The easy availability of credit led to a strong increase in the gearing levels of many companies. Figure 11 shows the overall gearing of listed non-financial Australian companies. The black line shows the gearing of companies operating in 1988. The grey line shows the gearing of companies operating today.

The level of corporate gearing increased rapidly in the 1980s to over 100 per cent on average from below 50 per cent. As the later sample shows, the companies with the highest gearing, on average, are no longer in the sample. This suggests that these

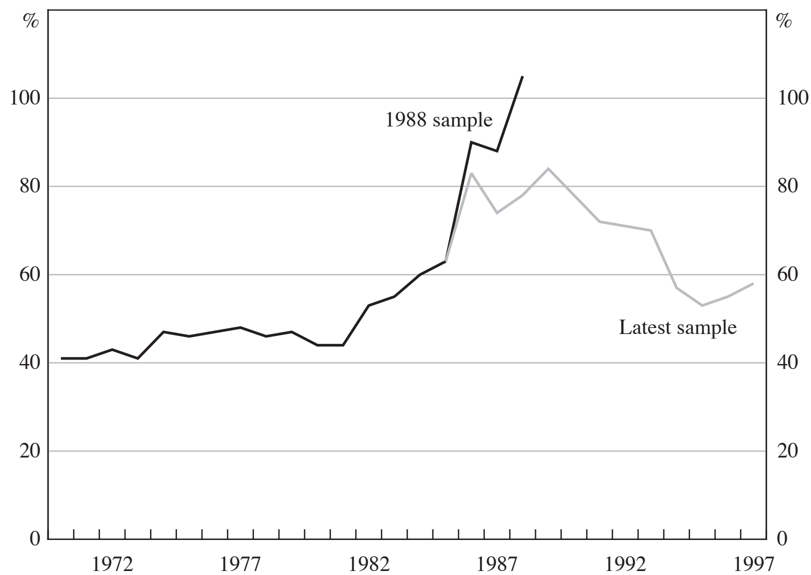
34. Futures markets operated at the time of the Dutch tulip mania in 1636.

Figure 10: Business Credit
Per cent of GDP



Source: RBA

Figure 11: Corporate Gearing



Source: RBA

companies went out of business because of the high debt levels they accumulated. This was certainly the case for Quintex and the Bond group of companies.

The increased liquidity seen in Australia was part of a worldwide pattern. In the US, the growth of the stock market was being fuelled by leveraged buy-outs (LBOs). LBOs involved companies being taken over with a high degree of debt financing. The debt was obtained through the issue of 'junk bonds' – bonds with high default risk. While LBOs were not as common in Australia, there was, nonetheless, a large use of debt secured against shares to finance business activities in Australia. The prevalence of LBOs led to company valuations being based not on the company's underlying prospects, but on the level of debt it could support given its cash flows:

> Nowadays, more and more analysts are valuing stocks based on cash flow rather than earnings. When Coca-Cola spun off its largest bottler in an initial public offering of stock in late 1986 at 110 times earnings, analysts explained away its rich price to investors using the cash-flow thesis. The earnings weren't great, so the story went, but the company did generate buckets of cash. Therefore, the stock looked cheap. Just figure you're buying it for five times cash flow. The argument makes some sense, but it is one more example of how people tend to stretch standards as bull markets progress in order to justify further advances. (Morgenson 1987, p 110)

The outworking of this financial relaxation and the new business methods is best typified by the cases of Alan Bond, Christopher Skase and the merchant banks Tricontinental and Rothwells. The 1980s saw the rise to prominence of a number of 'entrepreneurs' who expanded their business empires rapidly through the use of debt provided by Australian financial institutions. The debt was typically used to take over other businesses. The most aggressive of these financial institutions were Tricontinental – the merchant banking arm of the State Bank of Victoria – and Rothwells – another merchant bank. These merchant banks made very risky loans and were major financers of both Skase's Quintex group and the Bond group. Don Argus, CEO of the National Australia Bank, summed up the experience:

> It is fair to say that in the late 1980s banks paid inadequate attention to pricing for risk. This was partly because we were on a fairly steep learning curve after the shackles of regulation were removed. We were also faced with a scramble for market share by new bank entrants and by State banks which were vigorously – and some may observe disastrously – trying to turn themselves into commercial banks virtually overnight. (Argus 1991)

The heavy use of leverage was not, however, fully recognised at the time. Entrepreneurs obtained their funding from large syndicates of banks, each taking a small part of the overall exposure. Immediately after the crash, Skase's Quintex group was lauded as having escaped the crash and being relatively debt-free.[35] While Bond Corp was recognised as a highly geared company, a restructuring just before the crash was seen as having dealt with many of the company's vulnerabilities.[36]

35. P Gardiner, 'Skase: Behind the baby blue façade', *Australian Business*, November 4, 1987, pp 28–32.

36. Around $510 million of the $1.76 billion package for Bond Brewing's restructuring came from junk bond merchant Drexel Burnham Lambert, i.e., Michael Milken's company – quite telling given later developments.

The Age carried an article on this titled 'Bond Corp's lower debt burden shows virtue in being a stayer, not a sprinter'.[37] In both cases, the true level of gearing was not recognised. The debt was typically disguised in various accounts and distributed across a group of companies to hide the true picture.

The spirit of the times also encouraged a very cavalier attitude among merchant banks (and even some traditional banks). Tricontinental had no prudential controls to speak of and made loans without seeking proper security or credit checks. Many of its loans were secured against shares in the borrowing company – if the company had problems paying its debts, the shares were going to be worthless as well. Rothwells was also lending to the most speculative entrepreneurs without sufficient security – Laurie Connell, a director of Rothwells, was known as 'last resort Laurie' for his willingness to lend to entrepreneurs other financial institutions had rejected.

Asset prices rose strongly in this environment. From January 1985 to January 1987 the All Ordinaries index doubled with an average annual growth rate of over 40 per cent. From January 1, 1987 to September 21, when the market peaked, the stock market rose by 56 per cent to reach 2 306. Stock exchanges around the world experienced similar rises – the UK, Japanese and US indices all rose by over 40 per cent from January 1, 1987 to their peaks.[38] At its peak, companies listed on the Australian Stock Exchange were trading at a price-earnings ratio of over 20 – the highest on record for the Australian market. One justification for these rises was summed up in a *Forbes* magazine article:

> The most vociferous bulls are those who claim the world is so awash in uninvested cash waiting to be deployed in the stock market that share prices can only go higher. Just look at all those dollars—IRA money, Japanese money, pension money, even home equity money. Where else besides the stock market can it go? (Morgenson 1987, p 110)

In a familiar sign of a bubble there was a growing trend towards 'cash-box' companies 'in which over-keen investors simply give their cash to someone with a reputation for making a fast buck'.[39] These companies were just like the 'empty' prospectus companies of the Poseidon boom and the 'company for carrying on an undertaking of great advantage, but nobody to know what it is' from the South Sea bubble.

Throughout 1987 there were warnings about the strength of the market. In March 1987, Rene Rivkin was interviewed by *Australian Business* magazine and said 'I have to be irrational now to make assessments because the market has gone beyond all reason'.[40] In April PD Jack wrote 'As the market climbs ever higher the inevitable day of reckoning comes ever closer. The market will fall but we

37. *The Age*, October 12, 1987, p 32.
38. The Dow Jones rose by 41 per cent, the Nikkei by 42 per cent and the FTSE by 45 per cent.
39. Tim Treadgold, 'Here we go again!', *Business Review Weekly*, March 20, 1987, p 51.
40. Trevor Sykes, 'How Rivkin plans to beat the crash', *Australian Business*, March 18, 1987, p 51.

don't know when. In the meantime there's still money to be made'.[41] In October, immediately before the crash, Trevor Sykes commented, 'On fundamentals such as net tangible asset backing and price-earning multiples, there is hardly a stock on the boards worth buying. But many are still going to rise and the trick is to pick the runners in the market'.[42]

This all suggests that many people involved with the share market recognised how speculative the share market values had become. Nonetheless, the *Business Review Weekly* summed up the prevailing sentiment in September 1987, barely a month before the crash, 'Most agree that the share market still has a considerable way to go and those investors who sell now could miss out on one of the strongest phases of the bull run'.[43]

Right up to the end of the bubble, the optimists were conspicuous. Following a fall of 4.6 per cent on Wall Street on Friday October 16, *The Sydney Morning Herald* of Monday October 19 carried the story 'Market ready for slide … but the brokers maintain the long bull run is far from finished' (p 33). The paper quoted Nestor Hinzack of Ord Minnett saying 'We are looking for a correction. I then believe we are in for another leg in the bull market, and I think that leg could well take us into the early part of 1988'. As it turned out, they were wrong.

The crash in the stock market was initiated in the US and quickly spread around the world. There was no clear reason for the US market to fall and the only reason for the Australian market to fall was that the US had fallen. On October 20, the Australian market fell by 516 points or around 25 per cent. It continued to fall for the next couple of weeks before troughing at 1 151 on November 11 (Figure 12). In all, the market fell by 50 per cent from its peak.[44]

One of the first casualties of the stock market crash was Rothwells. Because of its heavy exposure to the speculative end of the market the crash led to a run on the merchant bank. Alan Bond organised a rescue package in conjunction with the West Australian Government, but, ultimately, the merchant bank failed because it had lent to very speculative enterprises.

In the following years many entrepreneurs who had expanded rapidly in the bull market went under. In the process a number of financial institutions went bankrupt or came very close. Both Christopher Skase and Alan Bond's empires collapsed under the heavy debt burden they had built up. At the time of the October 1987 crash, Bond group had borrowed \$392 million from Tricontinental with \$285 million of that secured against Bond Corp shares.[45] This compares with the merchant bank's

41. PD Jack, 'Making money', column in *Australian Business*, April 29, 1987, p 77.
42. Trevor Sykes, 'Stick with the trend, friend', in 'Riding the bull market', *Australian Business*, October 14, 1987, p 73.
43. Tony Gray, Paul Luker, Julietta Jameson and Eric Ellis, 'Crash of '88: share pessimists' stategies for another 1929', *Business Review Weekly*, September 11, 1987, p 48.
44. This fall was larger than on any other major stock exchange. The Nikkei 225 fell by around 20 per cent, the Dow Jones and FTSE 100 fell by around 35 per cent. The Australian market also took longer to regain its bubble high than other markets.
45. Armstrong and Gross (1995, p 123).

Figure 12: The ASX All Ordinaries Index

Source: Global Financial Data, Inc.

capital base of around $100 million. Tricontinental and the State Bank of Victoria were eventually absorbed by the Commonwealth Bank. As with most previous bubbles there was a large amount of fraud revealed after the crash. Most of the high-flying entrepreneurs of the 1980s ended up with tarnished reputations and several were convicted of various frauds. However, in general there was no severe recession associated with the bursting of the stock market bubble despite the fall being larger than the 1929 share market crash in Australia.

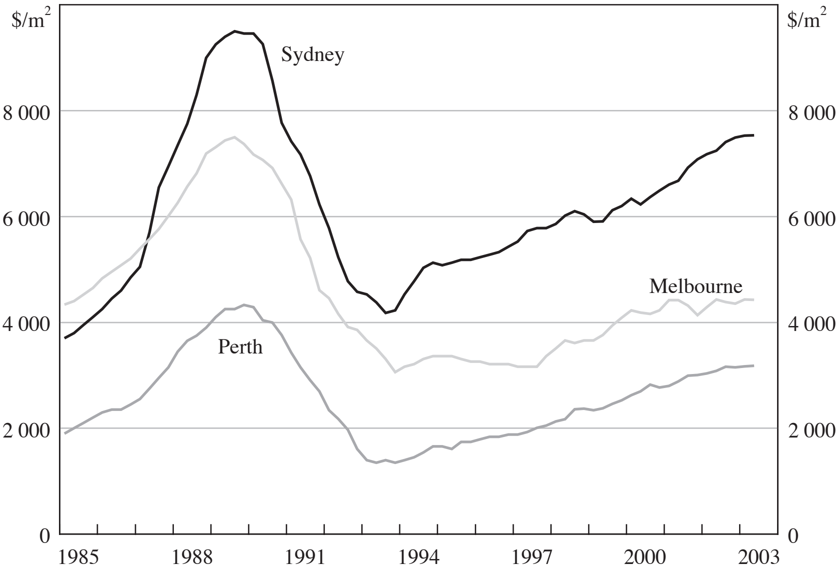
5.2 A second wind: property

While the overall consequences of the stock market crash were remarkably mild, there was one more element of the 1980s bubble to be played out. Property, and in particular, commercial property, boomed after the stock market crash. There had been an element of 'hedging' driving up property prices before the crash: 'When the share bull run ends the smart players will have already moved on – many into that classic haven, real estate. The property market is set to move'.[46] But the most spectacular growth occurred after the share market crash. Figure 13 shows commercial property values in a number of cities around the country.

In Sydney, prices soared to around $9 000 per square metre from below $4 000. This boom was propelled by the large switch of investors away from shares into property after the October crash. This was summed up by an article in *Australian*

46. J Bruce, 'Property: the next boom', *Australian Business*, June 10, 1987, p 60.

Figure 13: Prime Office Capital Values



Source: Jones Lang LaSalle

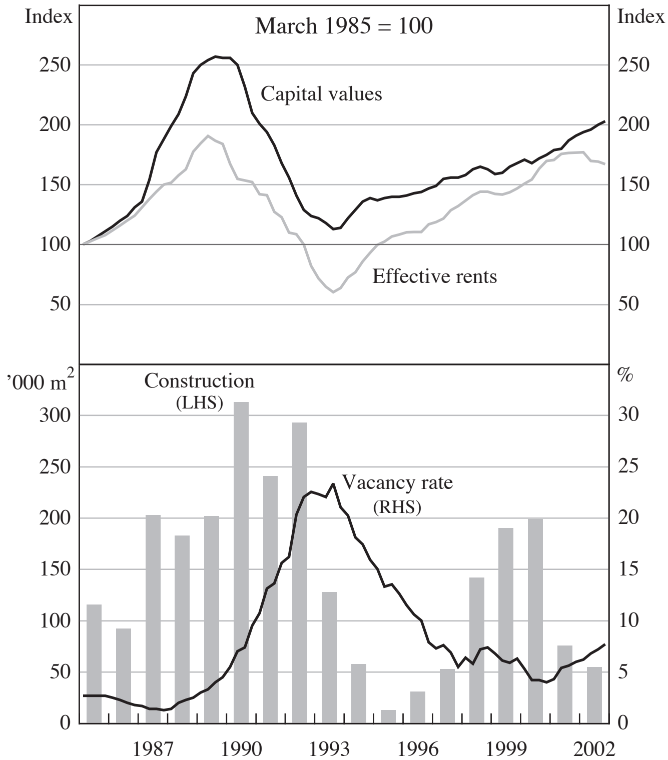
Business in March 1988: 'And one of the simplest truths obscured by half a decade of share madness was that any worthwhile portfolio needs a core of quality long-term assets. Investors are now quickly re-learning that real estate is an indispensable part of this core'. The bubble was supported by banks' continued easy lending practices. As seen in Figure 10, credit to GDP continued rising after the stock market crash and only reached its peak in 1990. In sum the commercial property bubble occurred for the same reason as the stock market bubble – too much money chasing too few assets.

However, the commercial property bubble inevitably burst, and when it did property values halved. In Melbourne and Perth, property values in 1993 were below their 1985 levels while in Sydney values were only slightly above their 1985 level. The commercial property boom ended for pretty much the same reason that most land booms end – supply increased and rental returns couldn't support the prices being paid. This was particularly true of highly-leveraged investors who faced higher and higher interest rates over this period as monetary policy was progressively tightened. This can be seen clearly through figures for prices, rents, construction and vacancies in Sydney (Figure 14).[47]

The collapse in the commercial property bubble, coinciding with a recession, was actually associated with greater financial distress than the earlier share market bubble. Two of the largest banks in Australia experienced significant losses as a result of their exposure to bad debts from failed commercial property developers.

47. The data are similar for other capital cities.

Figure 14: Prices, Rents, Construction and Vacancies
Sydney



Source: Jones Lang LaSalle

The banking sector as a whole had very low returns on shareholder funds through 1990, 1991 and 1992 and generated a negative return on shareholder funds in 1992.[48] While Tricontinental and Rothwells were peripheral to the Australian financial system, the banks affected by the commercial property bubble collapse were at its centre. In this respect the commercial property bubble had greater financial consequences than the share market bubble.

The share market bubble, thus, had a feature not seen in the other Australian bubbles – a second wind. The share market crash did not lead to an immediate reduction in credit availability. Furthermore, the real economy was barely affected by the share market crash. Thus, the conditions that supported the stock market bubble remained in place and people’s speculative enthusiasm was barely diminished. It was only when the commercial property bubble burst that the 1980s speculative enthusiasm could be considered finally ended.

48. See Gizycki and Lowe (2000, p 182).

6. Discussion and Conclusion

The bubbles discussed above all fit the definition of Section 2.2 closely. In each, the prices of shares or property rose spectacularly before falling just as spectacularly. In each case there was a fundamental reason for the initial rise: the rapid growth in the population of Melbourne, combined with the technological developments that made suburban living more amenable; the discovery of nickel at Windarra in Western Australia; and financial deregulation in the 1980s. Nonetheless, on each of these occasions the initial reasons for investing were subsumed by a general desire to buy assets for purely speculative reasons.

In addition to the similarity of price movements, each of the episodes occurred in an environment of general optimism. In each there was also a surge in company formation, and while some of these company formations were merely opportunistic, others were fraudulent. In the Poseidon bubble and the late 1980s bubble there were actual examples of 'compan[ies] for carrying on an undertaking of great advantage, but nobody to know what it is'. However, we have also seen a number of the elements that are commonly, but not necessarily, associated with bubbles. Credit was clearly a factor in the Melbourne land boom and the late 1980s bubble, however, it was not prominent during the Poseidon bubble. New technology was significant in the Melbourne land boom but not in the other two episodes.

It might be hoped that these common features could be used as early warning signs that a bubble was emerging. Hindsight, however, has many benefits; and the ability to clearly spot a bubble seems to be one of them. For example, while fraudulent activity is very common during a bubble, it is typically not revealed until later. Nonetheless, assuming bubbles can be identified early, there are a number of questions for policy. Other papers in this conference address many of these so I will not dwell on them here. Instead, I offer a comment on how the rationality (or otherwise) of bubbles relates to the conduct of policy.

Within the bubble literature there is a branch that deals with the possibility that bubbles could be perfectly rational.[49] This theory proposes that people are fully aware that the market has departed from fundamentals but invest anyway because the profits from being in the bubble outweigh the risk associated with it bursting. There are also economists who believe that 'bubbles' are rooted in fundamental changes, in essence, that there are no true bubbles. If either of these situations are in fact the case, there is less force to arguments that action of some sort is required – after all, people are fully informed and behaving rationally.[50] However, regardless of whether the bubbles examined in this paper were, or were not, 'rational' or fundamentally based, they had significant consequences. In this respect, it is not crucial whether bubbles are rational or fundamentally based – the fact that they have significant consequences is reason enough for policy-makers to be concerned.

49. See, for example, Blanchard and Watson (1982).

50. Eugene White (1990, p 240) summarised the sentiment thus, 'If stock market bubbles are, for the most part, a reflection and reaction to underlying changes in the economy, then the correct policy is simply to let them run their course, however distressing this may be to individual investors'.

Appendix: Historical Data

The data on Melbourne house prices comes from the Victorian Year-books of the time. These record the total value of rateable property and the number of rated properties for Victorian cities, towns and boroughs in a given year. Dividing one by the other gives an estimate of the average value of houses. The data for number of rateable properties was obtained through censuses in 1881 and 1891 and estimation during intervening years. In 1887 Greater Melbourne accounts for 73 per cent of the population of Victorian cities, towns and boroughs and over 83 per cent of the value of rateable property.[51]

The rates information was collected because land tax represented the major source of government revenue at that time. Given its central role in government revenue one might expect the estimates to be reasonably accurate. The estimates do not, however, show the same degree of price fluctuations that are available in some reports of the times that refer to specific properties. Nonetheless, this is to be expected as there would always be particular properties that were mentioned precisely because they were outliers. As this data refer to the entire stock of property, such extreme price swings would not be expected. Importantly, this data is likely to be more accurate than the contemporary equivalent, land tax assessments.

One of the interesting things about the data from this time is that it becomes incomplete immediately following the bust. No Year-book was produced for 1891–92 and annual Year-books ceased being produced altogether in 1894. Their production was only resumed in 1902 with a much reduced quantity of data. The reason was that the Government Statist at that time, Henry Hayter, was in serious financial trouble in 1891, and finally declared insolvency in 1894 when he retired from his position as Government Statist.[52]

51. Greater Melbourne is defined as the area within 16 kilometres of the GPO.
52. He reached a secret composition with his creditors that meant he was not publicly declared bankrupt.

References

Argus D (1991), 'Bank strategic outlook for the 1990s', paper presented at the 3rd Australian Institute of Bankers Banking and Finance Conference, Melbourne, 1–2 July.

Armstrong H and D Gross (1995), *Tricontinental: the rise and fall of a merchant bank*, Melbourne University Press, Melbourne.

Blanchard O and M Watson (1982), 'Bubbles, rational expectations and financial markets', in P Wachtel (ed), *Crises in the economic and financial structure*, D.C. Heath, Lexington, pp 295–315.

Cannon M (1966), *The land boomers*, Melbourne University Press, Melbourne.

Chancellor E (1999), *Devil take the hindmost: a history of financial speculation*, Farrar, Straus and Giroux, New York.

Cooper MJ, O Dimitrov and PR Rau (2001), 'A rose.com by any other name', *Journal of Finance*, 56(6), pp 2371–2388.

DeLong JB and A Shleifer (1991), 'The bubble of 1929: evidence from closed-end funds', NBER Working Paper No 3523.

Fisher C and C Kent (1999), 'Two depressions, one banking collapse', Reserve Bank of Australia Research Discussion Paper No 1999-06.

Flood RP and RJ Hodrick (1990), 'On testing for speculative bubbles', *Journal of Economic Perspectives*, 4(2), pp 85–101.

Garber PM (1990), 'Famous first bubbles', *Journal of Economic Perspectives*, 4(2), pp 35–54.

Gizycki M and P Lowe (2000), 'The Australian financial system in the 1990s', in D Gruen and S Shrestha (eds), *The Australian economy in the 1990s*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp 180–215.

Kindleberger CP (2000), *Manias, panics and crashes: a history of financial crises*, John Wiley & Sons, New York.

Mackay C (1980), *Extraordinary popular delusions and the madness of crowds*, Harmony Books, New York. Originally published in 1841.

McGrattan ER and EC Prescott (2001a), 'The stock market crash of 1929: Irving Fisher was right!', Federal Reserve Bank of Minneapolis Staff Report No 294.

McGrattan ER and EC Prescott (2001b), 'Taxes, regulations, and asset prices', Federal Reserve Bank of Minneapolis Working Paper No 610.

Miller MH (1990), 'The crash of 1987: bubble or fundamental?', in SG Rhee and RP Chang (eds), *Pacific-Basin capital markets research*, North-Holland, Amsterdam, pp 27–40.

Morgenson G (1987), 'A checklist for stock market prognosticators', *Forbes*, 4 May, p 110.

Ofek E and M Richardson (2003), 'DotCom mania: the rise and fall of Internet stock prices', *Journal of Finance*, 58(3), pp 1113–1137.

Rappoport P and EN White (1991), 'Was there a bubble in the 1929 stock market?', NBER Working Paper No 3612.

Santoni GJ and GP Dwyer (1990), 'Bubbles or fundamentals: new evidence from the great bull markets', in EN White (ed), *Crashes and panics: the lessons from history*, Dow Jones-Irwin, Homewood, pp 188–210.

Senate Select Committee on Securities and Exchange (1974), *Australian securities markets and their regulation*, Australian Government Publishing Service, Canberra.

Shann E (1948), *An economic history of Australia*, Cambridge University Press, Cambridge.

Shiller RJ (1981), 'Do stock prices move too much to be justified by subsequent changes in dividends?', *American Economic Review*, 71(3), pp 421–436.

Shiller RJ (2003), 'Diverse view on asset bubbles', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 35–39.

Siegel JJ (2003), 'What is an asset price bubble? An operational definition', *European Financial Management*, 9(1), pp 11–24.

Silberberg R (1975), 'Rates of return on Melbourne land investment, 1880–92', *Economic Record*, 51, pp 203–217.

Stiglitz JE (1990), 'Symposium on bubbles', *Journal of Economic Perspectives*, 4(2), pp 13–18.

Sykes T (1978), *The money miners: Australia's mining boom 1969–1970*, Wildcat Press, Sydney.

Warman PC (1990), 'Comment on bubbles or fundamentals?', in EN White (ed), *Crashes and panics: the lessons from history*, Dow Jones-Irwin, Homewood, pp 224–227.

White EN (ed) (1990), *Crashes and panics: the lessons from history*, Dow Jones-Irwin, Homewood.

Wigmore BA (1985), *The crash and its aftermath: a history of securities markets in the United States, 1929–1933*, Greenwood Press, Westport.

Discussion

1. David Merrett

I would like to thank John Simon of the Reserve Bank of Australia for a very interesting paper about earlier episodes of asset-price bubbles in Australia. I know from experience how hard it is gather the data needed for this type of research. The further we move from the present, the more fragmentary and anecdotal the evidence on asset prices becomes.

What is a 'bubble'? John proposes a common sense view that we know a 'bubble' when we see one. They are events characterised by rapid rises and falls in asset prices over short time periods, generally within 12 months. Moreover, the break in prices occurs without any new information that signals a change in the underlying fundamentals. *Ergo*, market behaviour has been driven by speculation. New buyers enter the market only so long as they believe that prices will continue to rise. Once that expectation no longer holds the asset is dumped. John suggests that a number of environmental effects, either alone or in combination, may provoke 'bubbles'. He identifies three: an easy availability of credit, new technology and an increase in company formation.

John reviews three Australian 'bubbles': the Melbourne land boom of the 1880s and early 1890s; the Poseidon bubble of 1969–1970; and the 1987 stock market bubble and the subsequent property market boom. I have few quarrels with the data John presents or his interpretation of each of these episodes, with the exception of an aside that the paucity of data about Melbourne's land boom makes interpretation of that complex episode problematic. For the rest, there is insufficient substance in points of fine detail to fill my 10 minutes of discussion time.

Rather I shall concentrate on broader issues. John concludes his paper saying 'bubbles' matter, whatever their origins if they are big enough to 'have significant consequences' for policy-makers, especially central bankers. That's why we are all here. An asset 'bubble' of significant proportion, residential property, may burst soon in this country. Will the landing be hard or soft? What will be the flow-on effects of a sudden collapse in property prices on household wealth and the balance sheets of those financial institutions whose lending has underwritten the boom? The dilemma for the authorities is that employing monetary policy to dampen the 'bubble' may have unwanted consequences for the rest of the economy.

In this context John's paper is timely and important. His study is an exercise in early diagnosis, if we understand the conditions that create 'bubbles' we can better cure the disease. He looks for common patterns in three widely differing events, separated by more than a 100 years and that range from 'bubbles' in property – land, residential and commercial property, mining shares and equities more generally. I am not convinced that the episodes John examines provide a generic explanation of why 'bubbles' occur. The three pre- or co-conditions he identifies of a new technology, easy credit and company formation, play dissimilar roles in the various 'bubbles'.

Moreover, John argues that there were major differences in the ‘consequences’ of the bursting of the ‘bubble’ on the real economy. My interpretation of his position is summarised in Table 1. It seems to me that each of the episodes has its own ‘story’ that is complicated and nuanced, and is grounded in temporal and institutional frameworks. The first property boom was set in motion by rapid population growth and the provision of urban infrastructure that allowed subdivision on the margins of Melbourne. It is not clear to me that the current property boom was precipitated by similar drivers. The discovery of a deposit of nickel, whose price was rising, would be expected to push up the price of shares in new nickel mines. Was there a similar piece of information that would have led investors to believe that corporate earnings and dividends would rise in the late 1980s?

Table 1: Comparison of Three ‘Bubbles’[(a)]

	Melbourne land boom	Poseidon	1987 bull market	Property market
Technology	Yes	?	?	?
Expansion of credit	Yes	?	Yes	Yes
Optimism	Yes	Yes	Yes	?
Company formation	Yes	Yes	Yes	?
Fraud	Yes	Yes	Yes	?
Impact on real economy	Major	Trivial	Modest	?

(a) Adapted from Simon (this volume)

Can we construct a model of ‘bubbles’ that has predictive power about when and where they will appear? Hyman Minsky notwithstanding, I am not confident that we can. The underlying factors that John identifies are intuitively satisfying in that each has the ability to impact a shock that would shift demand and supply schedules. However, why do new technologies and/or changes in the availability in credit spark ‘bubbles’ in some markets while not in others? What’s the spark that starts the speculation in a particular class of asset? I suspect it will revolve around a unique set of factors whose interconnections can only be unraveled after the event. The broad influences John deploys in the paper are best seen as permissive rather than directly contributory.

Let me offer a somewhat different interpretation of the history of ‘bubbles’ in Australia. Rather than seeking similarities between episodes I want to stress the differences in the causation, frequency and impact of ‘bubbles’ over time. The differences result from the changing nature of the economy over the long term, particularly the changing size of financial and securities markets relative to the real economy. It is also important to recognise that access to information about investment opportunities, particularly for households, has become more widespread over time.

Australia was a frontier economy for the first 100 years of European settlement. High levels of uncertainty surrounded the future stream of earnings from resource-based industries whose capabilities were slowly discovered through experimentation. The growth of production fluctuated sharply around the trend as output was affected by fire, flood, drought and diseases to animals and plants, and a capricious geology whose promised riches often failed to materialise. Prices were volatile, reflecting short-term swings of world demand and supply. There were frequent 'rushes', in the literal sense of migrations of people, to acquire previously unused assets such as virgin pastures and minerals below ground or to acquire assets, such as stock, in anticipation of rising commodity prices. Moreover, high and irregular levels of immigration injected uncertainty into the value of residential property in the expanding capital cities.

This first century was characterised by frequent 'bubbles', with sharp spikes in asset prices. However, they occurred in a local rather than a colonial or national context. The participants in these speculative asset markets were generally unincorporated enterprises. There was, for the most part, no secondary market in claims. Lending institutions played little part in financing these transactions outside the pastoral industry. While 'bubbles' in assets in the pastoral industry spilled over into recession in New South Wales in the 1820s and 1840s, and the Victorian gold rush of the 1850s had wide economic consequences, the majority of the frequent 'bubbles' left no footprint. Australia was still a series of largely independent colonial economies.

The potential for 'bubbles' to have a wider impact strengthened dramatically from the 1880s. The financial system was broadened by an expansion in the number of banks, their greater geographic reach through the establishment of branch networks and by the growth of non-bank financial institutions. The ratio of the assets of all financial institutions to GDP rose from 55 per cent in 1881 to 115 percent in 1891. The growth of credit shifted the demand schedule for all manner of assets to the right, not just Melbourne's land and property. Though still a small minority, many businesses that owned and traded in real estate, pastoral land and mining leases had listed on the emerging stock exchanges. A market in secondary claims encouraged more people to participate in the speculation. The market value of securities listed on the Stock Exchange of Melbourne rose from 18 per cent of national GDP in 1884 to 31 per cent in 1889.

The rapid growth in credit fuelled the Melbourne 'bubble'. The growth of the share market, comprised of more listed companies, and with higher daily turnover was another important contributory factor. Asset prices were marked to market on a daily basis and reported in the press. The gains of holding securities were there for all to see. Transaction costs of trading financial securities were, as John noted, lower than dealing in real property or other physical assets. The market looked relatively safe, risk could be diversified and you could cash out in a liquid market. Market-makers were important catalysts. Company promoters and share brokers assured investors and clients that this game of pass-the-parcel would never end.

The expanded financial and securities markets leveraged the 'bubble' going up and coming down. There was a new dimension to the end of a 'bubble', a secondary impact as the financial institutions struggled as the customers' speculations turned to losses and defaults. The route between the breaking of the land boom in 1889 and the banking collapses of 1893 is long and tortuous, but there is a strong causal link. The liquidations and reconstructions of many Australian banks depressed the real economy for many years. It should be remembered that many British speculators, investors and bank deposit holders shouldered losses as well as the locals.

The next 100 years provided fewer opportunities for asset 'bubbles' on the scale of the Melbourne land boom. Many of the new technologies in energy, transport and communication that might have excited speculation were brought to market by the public rather than the private sector. The closing of the farming and pastoral frontiers lessened the opportunity for local 'bubbles' associated with the rush to capture newly available resources. Mining, on the other hand, kept up a flow of discoveries of new fields, particularly in the 1890s, 1930s and 1960s, many of which were associated with a traditional 'rush' to acquire shares before the mine or field's reserves were proven. There was widespread speculation in the subdivision of land in Sydney's suburbs through most of the 1920s but it never reached the heights of Melbourne 40 years earlier.

The key reason would seem to have been the modest expansion of credit for a very long time after the bank crashes of the 1890s. A chastened banking system behaved very conservatively, while many of the non-bank financial institutions that had underwritten speculation in the 1880s had perished. The ratio of the assets of financial institutions to GDP rose modestly from 86 per cent in 1921 to 102 per cent in 1929. Depression, war and direct controls over the banking system under the 1945 legislation checked the growth of credit relative to GDP. In 1971, the ratio of the assets of financial institutions to GDP was 102 per cent. In retrospect, the 1880s was a decade of expansion and innovation in the financial system that was severely checked. The Australian financial system was still remarkably immature into the 1960s. We need to remind ourselves that the vast majority of Australian households did not have accounts with commercial banks until after World War II. Access to personal finance dates from the 1950s.

Conditions for a 'perfect storm' were brewing through the 1980s and 1990s. Once again, there was a sea change in the strength of the permissive factors that played such a decisive part in the 1880s. There was a massive increase in credit, especially after financial deregulation. The crude measure of the assets of financial institutions, excluding the central bank, to GDP rose from 107 per cent in 1981 to 160 per cent by 1987. Since World War II more and more firms incorporated and listed on stock exchanges. Households and financial institutions, particularly life offices and pension funds, acquired shares as part of their portfolios. The ratio of the market value of listed equities to GDP rose from 22 per cent in 1976/77 to 70 per cent in 1986/87. Bull markets in other countries provided a strong demonstration effect to local investors. Firms took advantage of favourable sentiment to issue fresh capital.

An important new factor has impinged on the current property boom, public policy. The combination of a shift towards self-funded retirement, compulsory superannuation contributions swelling the coffers of funds managers, first-home-buyer grants and tax laws that inflate the return on property relative to other investments add materially to its strength.

If this 'bubble' is of the same order of magnitude as the Melbourne land boom of the 1880s, will its end be as catastrophic? I suspect that it will not, largely because of policy instruments available today. Falling asset prices will reduce household balance sheet totals and net wealth. How many households are so heavily geared that a drop in price will result in bankruptcy? Will the reduction in wealth spill over into lower consumption expenditures that will feed through to the real economy? If that were to happen the weapons of both monetary and fiscal policy can be deployed. Moreover, there was no lender of last resort facility in the earlier episode. Contagion spread across fringe financial institutions and finally to the banks. Nearly all of those that 'suspended' and reconstructed were solvent. The current regulatory regime enforces higher prudential standards than were exhibited in the late 19th century. Further, the Reserve Bank can act as a lender of last resort if that is necessary.

My broad point is that as the Australian economy developed over time, the causes and consequences of the 'bubbles' occurring within it have altered as well.

2. General Discussion

A number of participants concurred with David Merrett's view that changes in the economy and the financial sector between the events presented by John Simon made it difficult to make generalisations about the nature of bubbles and their impact on the real economy. Several participants commented on particular changes that have occurred which might result in asset-price bubbles today having a smaller impact than they would have had in the past. One participant highlighted that a significant change that had occurred since the 1880s Melbourne land price boom was the move to a flexible exchange rate regime, which allowed monetary policy to react to domestic imbalances. Another participant noted that any policy response to an asset-price misalignment today is likely to be considerably different to that which had occurred in history, as policy-makers have learnt from their past experiences – the tightening of monetary policy by the Federal Reserve Board during the Great Depression in the United States was used as an example. Others highlighted improvements in prudential regulation and supervision, and one participant suggested that the Australian banks had considerably changed their practices after the experience of the early 1990s and the fallout from the last commercial property boom. One possibly offsetting change that was highlighted by Merrett was the greater exposure of households to financial markets, though one participant noted that, while this was undoubtedly true, households today also have considerably more information available to them than previously.

Several participants wondered if the term 'bubble' was something of a misnomer. They suggested that an asset-price bubble need not be associated with a rise and fall in prices, as Simon focused upon in his definition. For example, it was suggested that if the fundamental value of an asset collapsed, but its market price remained unchanged, then this misalignment could be construed as a bubble. However, other participants noted that this sequence would not engender the same market dynamics and herding as would the standard increase in asset prices normally associated with 'bubbles'. In light of this discussion, some participants considered that the term 'asset-price misalignment' may be more appropriate than the term 'bubble'. One participant suggested that these asset-price misalignments could occur as people mistake a shift in the level of fundamentals, such as potential output, for a shift in the growth rate, leading them to be overly optimistic.

There was some debate about whether the real effects of the 1987 bubble in share prices were perhaps more substantial than Merrett had suggested. It was argued by one participant that the subsequent commercial office property-price bubble did have substantial real effects, such as overinvestment. Merrett responded that this was the case, but contended that the effects were small relative to those in the 1890s.

A number of conference participants commented that it was important to consider asset prices in the context of supply and demand. In particular, it was conjectured that the price of assets whose supply is inelastic (unresponsive) with respect to their price may be more prone to misalignment. The property market was used as an example of where this may be the case. Secondly, it was argued that inelastic supply may also mean that higher valuations compared to other assets may be appropriate, as the price may embody some scarcity value. Another participant questioned whether this meant that supply-side policies may be more appropriate in dealing with asset-price misalignments.

There was some discussion about whether property-price bubbles are different to those in the equity market. It was observed that property-price bubbles appear to be more protracted and have larger real effects. The latter was thought to be due to the higher amount of leverage that is typical in property relative to in equity markets.

Some of the discussion focussed upon the role of global factors in the asset-price misalignments examined by Simon. These factors included the role of immigration in the 1880s Melbourne land price bubble and strong global commodity prices in the Poseidon episode. The entry of foreign banks after financial deregulation and the ensuing strong credit growth, as well as strong commercial property prices worldwide after the collapse of the share-price bubble, were also highlighted as global factors contributing to the 1980s commercial property-price bubble in Australia.

Asset Prices, Financial Imbalances and Monetary Policy: Are Inflation Targets Enough?

Charles Bean[1]

Abstract

Some commentators have argued that an exclusive focus of monetary policy on achieving price stability is inappropriate in a world where asset-price misalignments and financial imbalances are increasingly prevalent. This paper reviews the argument that monetary policy should react to asset-price movements and/or financial imbalances over and above their impact on the inflation outlook. I conclude that, while monetary policy-makers should take note of such developments, the macroeconomic implications can be adequately embraced within an appropriately flexible and forward-looking concept of inflation targets. In a simple New Keynesian model, modified to allow for capital and debt accumulation, I then show that the possibility of credit crunches may affect the design of the optimal policy in subtle and unexpected ways. I also consider a variety of other ways that incipient financial imbalances could impinge on the conduct of an optimal monetary policy. Finally I discuss recent developments in the UK household sector as a practical example of the problem of assessing whether an asset price is misaligned and whether balance sheet developments pose a threat to the outlook.

1. Introduction

On the face of it, the last decade and a half has been a successful period for most developed-country central banks. Compared to the previous 15 years, inflation has been low and relatively stable. Moreover, price stability has not been achieved at the expense of the real economy, as growth has also been relatively stable and unemployment has been falling in a number of countries.

Notwithstanding the good macroeconomic out-turns there has, however, been a growing concern that the achievement of price stability may be associated with heightened risks of financial instability, particularly so in the aftermath of the collapse of the dot com bubble and the more recent wider correction to share values. Appreciating asset values and debt accumulation have, in some countries, led to

---

1. Chief Economist and Member of the Monetary Policy Committee, Bank of England. I am grateful to Peter Andrews, Francesco Giavazzi, Ed Nelson, Ignazio Visco and Sushil Wadhwani and participants of the conference on ‘Monetary Stability, Financial Stability and the Business Cycle’ at the Bank for International Settlements, Basel, 28–29 March 2003 for useful comments. The views expressed are those of the author and do not reflect those of either the Bank of England or the Monetary Policy Committee.

stretched household and corporate balance sheets that are vulnerable to the sort of equity-price corrections witnessed recently. That has led some commentators to question the quasi-consensus that monetary policy should be directed exclusively at maintaining price stability and its role in combating financial instability should be restricted to minimising any adverse consequences when over-valuations are corrected or as financial imbalances unwind.

The heterodox view is neatly summarised by Crockett (2003; italics in original):

> (I)n a monetary regime in which the central bank's operational objective is expressed *exclusively* in terms of short-term inflation, there may be insufficient protection against the build up of financial imbalances that lies at the root of much of the financial instability we observe. This could be so if the focus on short-term inflation control meant that the authorities did not tighten monetary policy sufficiently pre-emptively to lean against excessive credit expansion and asset price increases. In jargon, if the monetary policy reaction function does not incorporate financial imbalances, the monetary anchor may fail to deliver financial stability.

In this paper I examine the view that inflation targeting alone, whether explicit or implicit, is not enough and that there is a case for an additional monetary response to asset-price movements and/or developing financial imbalances in order to reduce the risks of future financial instability. My view, in a nutshell, is that (flexible) inflation targeting is best thought of as a description of the objective function of the policy-maker rather than entailing an explicit monetary policy reaction function. The abrupt unwinding of asset-price misalignments and/or financial imbalances that may lead to financial instability will also invariably be associated with significant macroeconomic instability. A forward-looking flexible inflation-targeting central bank should bear in mind those longer-run consequences of asset-price bubbles and financial imbalances in the setting of current interest rates. Consequently there is no need to require an additional response of monetary policy, though inflation-targeting central banks may need to look out further into the future than is customary in order to take on board these concerns.

The remainder of the paper is organised as follows. In the next section, I review some of the recent literature on the extent to which monetary policy should respond to asset prices, and in particular to asset-price bubbles. While it may well be appropriate for interest rates to respond to asset prices, among many other economic indicators, I conclude that such a response is consistent with inflation targeting. In the subsequent section I characterise the optimal monetary policy in a simple New Keynesian macroeconomic model in which financial imbalances play a role and where their subsequent unwinding may lead to a credit crunch or similar financial distress. The possibility of credit crunches turns out to affect the design of the optimal policy in a subtle, and perhaps surprising, way. I also consider a variety of other ways that incipient financial imbalances could impinge on the conduct of an optimal monetary policy. Finally I illustrate some of the difficulties in deciding whether an asset price is misaligned, or an imbalance poses a potential threat to macroeconomic stability, by considering the recent evolution of house prices and consumer debt in the United Kingdom.

2. Asset Prices and Monetary Policy: Some Recent Views

The conventional view that monetary policy can do little more than deal with the fall-out from the unwinding of asset-price bubbles has been clearly enunciated by Chairman Greenspan (2002):

> Such data suggest that nothing short of a sharp increase in short-term rates that engenders a significant economic retrenchment is sufficient to check a nascent bubble. The notion that a well-timed incremental tightening could have been calibrated to prevent the late 1990s bubble is almost surely an illusion. Instead, we … need to focus on policies to mitigate the fallout when it occurs and, hopefully, ease the transition to the next expansion.

But not everyone subscribes to this view, and there has recently been a lively literature debating the extent to which monetary policy should respond to asset-price movements (see e.g. Batini and Nelson (2000); Bernanke and Gertler (2000, 2001); Cecchetti *et al* (2000); Cecchetti, Genberg and Wadhwani (2003); Taylor (2001)). Thus on the one hand Bernanke and Gertler (2000) conclude that:

> The inflation targeting approach dictates that central banks should adjust monetary policy actively and pre-emptively to offset incipient inflationary and deflationary pressures. Importantly for present purposes, it also implies that policy should not respond to changes in asset prices, except insofar as they signal changes in expected inflation.

Against this, Cecchetti *et al* (2000) argue:

> A central bank concerned with both hitting an inflation target at a given time horizon, and achieving as smooth a path as possible for inflation, is likely to achieve superior performance by adjusting its policy instruments not only to inflation (or its inflation forecast) and the output gap, but to asset prices as well. Typically modifying the policy framework in this way could also reduce output volatility. We emphasise that this conclusion is based on our view that reacting to asset prices in the normal course of policymaking will reduce the likelihood of asset price bubbles forming, thus reducing the risk of boom-bust investment cycles.

Each of these contributions evaluate the appropriateness of a policy response to asset prices by exploring the efficacy of a variety of interest rate reaction functions in simple calibrated stochastic model economies in which asset prices play some explicit role. Thus both Bernanke and Gertler (2000, 2001) and Cecchetti *et al* (2000) employ a dynamic New Keynesian model, modified to allow for credit market frictions and exogenous asset-price bubbles. The credit market frictions arise from agency problems in the credit market, so that internal finance is cheaper than external finance and the external finance premium depends on the firm's financial position. In particular a rise in the firm's share price increases the available collateral and leads to a reduction in the marginal cost of external funds, and a consequent increase in borrowing and investment. Furthermore, the equity price may differ from fundamentals by an exogenous and stochastic bubble component, which grows exponentially but may collapse. During the build-up of such a bubble the external finance premium falls, and investment, aggregate demand and future potential output rise, whereas when the bubble collapses the processes reverses.

But despite the apparent similarity of the models employed, the two sets of authors come to strikingly different conclusions about whether it is wise for the monetary authorities to condition their short-term interest rate on the equity price. Cecchetti *et al* (2000) argue that a key difference lies in different assumptions about what shocks are present and exactly what the monetary authorities are allowed to observe.

Similarly, Batini and Nelson explore whether a response to the exchange rate (which may or may not contain a bubble) is advisable in an open-economy setting in which the real exchange rate influences both demand and supply and the exchange rate is determined via uncovered interest parity. For an optimised rule they find no gain in reacting to exchange rate movements. Yet Cecchetti *et al* (2000), using essentially the same model, find that under some circumstances responding to the exchange rate does lead to higher welfare. Again the key difference appears to lie in the assumptions about what shocks are present and exactly what the monetary authorities know.

Now at one level it is not surprising that different assumptions about the stochastic structure of the economy and what the authorities can observe/infer may lead to different conclusions about the advisability of linking interest rates to asset-price movements. And few people would disagree that the authorities should take account of asset-price movements insofar as they affect the outlook for output and inflation. But the question is whether some additional response is called for, as the above quotes should make clear. In addressing this issue, it is helpful to look first at the analytical framework these authors employ.

Essentially all these contributions evaluate whether the addition of asset prices – or an estimate of the bubble component therein – to a simple feedback rule for the policy rate instrument leads to a lower value of a suitable loss function. Two general classes of simple rules are employed. Either an augmented Taylor rule:

$$i_t = i^*_t + \phi_\pi \pi_t + \phi_y x_t + \phi_q q_t \tag{1}$$

where i_t is the nominal interest rate, i^*_t is the 'natural' level of the nominal interest rate, π_t is inflation (strictly, the deviation from target), x_t is the deviation of output from its flexible-price level, i.e. the output gap, and q_t is an asset price (relative to some suitably defined normal or equilibrium value). Or else an augmented inflation-forecast-targeting rule:

$$i_t = i^*_t + \mu_\pi E_t \pi_{t+k} + \mu_q q_t \tag{2}$$

where E_t denotes the mathematical expectation conditional on information available to the policy-maker at time t and k is some suitably chosen time horizon.

The authorities are assumed to have an objective function that is quadratic in the deviation of inflation from target and in the output gap:

$$L_t = (1-\beta)E_t[\sum_{k=0}^{k=\infty} \beta^k(\pi_{t+k}^2 + \lambda x_{t+k}^2)/2] \tag{3}$$

where β is a discount factor. As β tends to unity, so this loss function tends to a simple weighted average of the conditional variances of inflation about the target and of the output gap. The authors then, in essence, search over the parameters in the Taylor-type rule (1) and/or the inflation-forecast-targeting rule (2) to find the values of the feedback coefficients that minimise the loss function (3).

However, it is worth recalling that, despite their appeal, Taylor-type rules imply feedback from a relatively restricted state vector and the optimal feedback rule can only be written as a Taylor rule in very simple settings. The same is true of inflation-forecast-targeting rules, which furthermore are dynamically inconsistent (see Svensson (2001)). A relevant question is why we should be interested in whether an asset price, or indeed any other variable for that matter, appears in some ad hoc class of feedback rule, even though the coefficients of that rule may have been optimised? It seems more instructive to ask first what an optimal rule looks like, and then consider how asset prices ought to figure in it. One might then go on to consider whether particular simple rules represent sufficiently close approximations to the optimal rule to be useful guideposts for policy.

In order to say more we need to assume something about the structure of the economy. Suppose, for illustrative purposes, the demand side is given by a New Keynesian IS schedule, including the asset price:

$$x_t = E_t x_{t+1} + (r^o_t - r_t)/\sigma + \chi q_t + v_t \tag{4}$$

where r_t ($\equiv i_t - E_t\pi_{t+1}$) is the real interest rate, r^o_t is the flexible-price, or natural, real interest rate and v_t is an aggregate demand shock. The IS schedule is augmented by a suitable intertemporal arbitrage condition determining the asset price (including, perhaps, a bubble component or a stochastic risk premium). And the supply side is given by a New Keynesian Phillips curve:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \tag{5}$$

where u_t is a supply (cost) shock. Both shocks are observed by the monetary authorities and for simplicity are assumed to be serially uncorrelated.

Then, as shown by Svensson and Woodford (2003), Svensson (2002), Giannoni and Woodford (2002) and others, the optimal policy under discretion satisfies the first-order condition:

$$\pi_t = -(\lambda/\kappa) x_t \tag{6}$$

This dictates that policy should ‘lean against the wind’ in the event of supply shocks, but that demand shocks are neutralised. However, in optimising over the choice of coefficients in the simple rule (1)/(2), the existing literature implicitly assumes that the central bank has access to a suitable commitment technology. In that case, the appropriate comparison should be against the optimal policy under commitment (from the ‘timeless perspective’), which satisfies the set of first-order conditions, for all $k \geq 0$:

$$E_t \pi_{t+k} = -(\lambda/\kappa)(E_t x_{t+k} - E_t x_{t+k-1}) \tag{7}$$

The optimal plan thus equates the marginal rate of transformation between output and inflation that is embodied in the supply schedule with the marginal rate of substitution that is embodied in the loss function. It ensures that inflation will be brought back to target, but at a rate that recognises the consequences for activity.

Svensson has characterised an optimality condition of this type as describing 'flexible inflation-forecast targeting'. Note that even though there are no lagged endogenous variables in the model, the optimal policy is nevertheless history-dependent.[2] This property plays an important role in Section 3 below.

A key feature of these optimality conditions is that they contain neither the policy instrument[3], nor indeed anything to do with the structure of the demand side of the economy. In particular there is no role for asset prices. This observation would hold true for more general specifications of the economy, provided that the asset price affects neither the marginal rate of transformation nor the marginal rate of substitution.[4] So in that sense the analysis supports the conventional wisdom as summarised in the quote above from Bernanke and Gertler – with the modification that policy responds to changes in asset prices only insofar as they signal changes in expected inflation *or activity*.

Is this a reasonable interpretation of what inflation-targeting central banks are about, as opposed to an inflation-forecast-targeting rule like (2)? Take for instance the statutory objective of the Bank of England since it was given operational independence in 1997. The *Bank of England Act (1998)* charges the Bank 'to maintain price stability, and subject to that to support the economic policy of (the) government, including the objectives for growth and employment'. An annual 'Remit' from the Chancellor of the Exchequer then defines price stability – currently as an annual rate of inflation of 2.5 per cent for RPIX at all times[5] – and also fleshes out the 'economic policy of the government', namely the maintenance of a high and stable rate of growth. This can be thought of as defining the bliss point for inflation, but instructing the Monetary Policy Committee to seek to achieve it in a way that avoids undue volatility in economic activity. However, the remit is non-specific about the relative weight that we should put on deviations of output from potential and deviations of inflation from target. Both King (1997) and Bean (1998) discuss the UK inflation-targeting regime in these terms; the latter also explores the consequences of the incompleteness of the remit.

Similarly the objectives of the Reserve Bank of Australia (RBA) as laid out in the *Reserve Bank Act (1959)* are 'to ensure that ... monetary and banking policy ... is directed ... [so as to] contribute to: ... the stability of the currency ... the maintenance

---

2. To see this just set k=0, which gives $\pi_t = -(\lambda/\kappa)(x_t - x_{t-1})$.
3. If the objective function contains a term in the interest rate, as in Woodford (1999), then the policy instrument appears in the optimality condition. It is then, however, a rather different animal from the instrument rules (1) and (2).
4. In an open economy subtle issues arise as to whether the real exchange rate should also appear in the optimality condition as a result of the impact of the terms of trade on consumer prices. Under some assumptions, the closed economy model of the text can be translated directly into an open economy setting (see e.g. Clarida, Galí and Gertler (2001)), but under other formulations that is not necessarily the case. However, it is clear that the presence of the real exchange rate in the optimality condition under such circumstances has little to do with arguments about the appropriate response to asset price bubbles.
5. The Chancellor has recently announced his intention to switch the targeted measure to the Harmonised Index of Consumer Prices (HICP) at a future date.

of full employment ... and ... the economic prosperity and welfare of the people ...'. The counterpart of the UK Remit from the Chancellor in Australia is the joint Second Statement on the Conduct of Monetary Policy between the Governor and the Treasurer. The target is for an inflation rate for the underlying CPI of 2–3 per cent 'over the cycle'. Again the 'first-level' target for inflation is specified explicitly, together with a general injunction that the central bank should care about the level of activity. I think this view of what monetary policy-makers are seeking to achieve is also a fair description of central banks like the Federal Reserve or the European Central Bank that do not describe themselves explicitly as inflation targeters.

But that does leave open the extent to which asset prices should affect the setting of the instrument, because they will affect the outlook for growth and inflation. Given the relevant optimality condition, the IS schedule (Equation (4)) can be used to back out the associated value of the instrument, i_t. Clearly this reaction function in general will contain the asset price, q_t. That is consistent with the views of Cecchetti *et al* (2000), though the finding that the inclusion of asset prices in an augmented Taylor or inflation-forecast-targeting rule reduces the expected loss does not imply an independent role for asset prices *beyond* their impact on the outlook for inflation and activity. And, in fairness to Cecchetti *et al*, they never really claim it does.

The substantive issue that divides those who advocate a more activist response to asset prices from those who do not, is really the extent to which asset-price movements are informative about the prospects for inflation and growth, and whether pre-emptive action against a bubble is either possible or effective. Here it is worth recalling the difficulty of establishing significant and stable econometric relationships between asset prices and subsequent movements in output or inflation; see e.g. Stock and Watson (2001) for a recent survey. But there are good reasons why such links should be unstable as asset prices can move for a variety of reasons, each of which may have different implications for growth and inflation.

For instance, even if valued according to their fundamentals, equity prices could fall because of a reduction in expected future earnings, an increase in the expected risk-free discount rate, or a change in the equity risk premium. And that reduction in earnings might come about because of, for example, a fall in the expected rate of growth of productivity, an increase in corporate taxes, or an increase in product market competition. And finally equity prices may include a non-fundamental or bubble component. But these various shocks all have rather different implications for growth and inflation, either qualitatively or quantitatively.

That suggests that an automatic response to any single asset price is likely to be in general inappropriate, as stressed by Goodfriend (2003). As an aside we might note that this applies not only to equity prices, but also to exchange rates. Monetary Conditions Indices (MCIs) that weight together nominal interest rates and the exchange rate are often used to indicate whether monetary conditions have changed, on the argument that a fall in the exchange rate – seen as a monetary variable – boosts demand in the same way as does a reduction in nominal interest rates. But this ignores the fact that the exchange rate can change for a variety of reasons, including shifts in preferences or productive potential at home or abroad, changes in current or expected interest rates, changes in portfolio preferences and risk premia, and bubbles and fads. The nature of the shock, as well as the initial degree of over- or under-valuation of the exchange rate, will affect the pass-through into activity and inflation and consequently the appropriate monetary response.

The danger in following an MCI too closely in setting policy is well illustrated by the experience of New Zealand during the Asia crisis. At that time the Reserve Bank of New Zealand (RBNZ) employed an MCI as an operating target for the implementation of monetary policy. As a consequence the depreciation of the New Zealand dollar during 1997–98 led more or less automatically to an increase in domestic interest rates. But the depreciation of the Kiwi dollar was part of a more general depreciation of currencies in the region, and was associated with a contraction in the markets for New Zealand exports. A more appropriate monetary response would have been to reduce interest rates – as the RBA did – rather than to raise them. Australia's subsequent economic performance was noticeably superior to that of New Zealand, and the RBNZ abandoned an MCI as an operating target the following year.

But the fact that asset prices may move for a variety of reasons is not a justification for ignoring them completely. Rather, as stressed by Cecchetti *et al* (2000), it is an argument for using the full array of asset prices and other information in order to try to extract an estimate of the underlying shocks driving them. Policy-makers are already used to trying to draw such inferences from the co-movements of a set of variables, and even an imperfect estimate of the underlying shocks is better than ignoring the information altogether. The case for exploiting the information contained in asset prices thus seems irrefutable in principle, though the difficulties involved in doing so are considerable and due recognition needs to be paid to the imprecision of the resulting estimates.

As to the possibility of preventing asset-price bubbles and misalignments through pre-emptive action, I am rather more sceptical. As with the more general problem of imbalances discussed below, early diagnosis of such problems is fraught with difficulties. Once one can be fairly confident that a bubble has emerged, it is probably too late to take significant action against it without causing just the disruption to the real economy that one wants to avoid. If one is confident that an asset-price bubble will continue, then one might want to raise interest rates in order to try to moderate it. But the presence of lags between an interest rate change and its effect on the real economy means that if one expects the bubble to burst imminently, then policy relaxation is appropriate now in order to prepare for the fallout. Tightening policy to deal with an asset-price bubble may thus end up being counterproductive if the bubble then bursts, so that the economy is subject to the twin deflationary impulses of an asset-price collapse and the lagged policy tightening. Gruen, Plumb and Stone (this volume) explore this issue and show that the informational requirements necessary to make such activist policy effective are extreme. At best there seems likely to be only a very narrow window of opportunity during which action is likely to be effective.

3. Financial Imbalances and Monetary Policy

Borio and Lowe (2002) argue persuasively that the issue is not really whether monetary policy should respond to asset-price bubbles *per se*. Rather booms and busts in asset prices – which may reflect the presence of bubbles, but may also reflect shifts in assessments of the underlying fundamentals – should be seen as part of a broader set of symptoms that typically also include a build-up of debt and frequently a high rate of capital accumulation. Thus during a period of exuberance – irrational or otherwise – optimism about future returns drives up asset values, prompting private agents to borrow in order to finance capital accumulation. Moreover, appreciating asset values raise the value of collateral, hence facilitating the accumulation of debt. During the upswing, balance sheets may look healthy as the appreciation in asset values offsets the build-up of debt. But if that optimism turns to pessimism, leading to a correction in asset valuations and a sharp deterioration in net worth, then financial distress may be the result as the financial imbalances are exposed. That is particularly likely if financial intermediaries respond to the deterioration in their own, and their creditors', balance sheets by tightening credit conditions. This process may apply to the corporate sector and productive capital, but may equally well apply to the household sector and housing capital.

Borio and Lowe also argue that while low and stable inflation may promote financial stability overall, such financial imbalances can nevertheless build up in a low-inflation environment. Indeed beneficial supply shocks – resulting either from faster productivity growth or from structural or institutional reform – are likely both to lower inflationary pressure and to foster the build-up of such imbalances. And that may be aggravated when monetary policy has a high degree of counter-inflationary credibility as excessive expansion in aggregate demand beyond the natural rate of output may have only limited impact on inflationary pressures.

In order to explore some of the implications of debt-financed asset accumulation for the conduct of monetary policy, I shall employ a simple New Keynesian macroeconomic model of the sort considered above, modified to allow for debt-financed capital accumulation and the possibility of credit crunches.

There are two types of agents in the economy: households and firms. Households supply labour and save a constant fraction of their income. They also own a non-tradable diversified portfolio of shares in firms, so that all profits are returned to households in lump-sum form. Firms are monopolistic competitors, and nominal prices are fixed with a fraction of prices being reset each period as in the standard New Keynesian Phillips curve. Capital lasts a single period, is installed a period in advance, and is financed entirely by borrowing from households. Debt lasts a single period and is denominated in real terms.

Credit crunches occur with a fixed probability, ρ. When they do occur their effect is to lower the level of supply in the economy. One rationalisation for this assumption could be that a credit crunch leads to bankruptcies and the necessary administration or reorganisation of the firm's assets absorbs resources. Another could be that firms need access to working capital within the period in order to pay their workers, buy inputs, etc. If firms cannot get access to the required working capital then their supply will necessarily be curtailed. In effect a credit crunch is thus treated as a negative shock to total factor productivity, though it reflects events in financial markets rather than a change in the technical capabilities of the economy.

Moreover, if a credit crunch does occur, it is assumed to be more severe the higher is the *overall* debt outstanding. It is this feature that provides the incentive for the central bank to moderate a current debt-financed investment boom. Since an individual firm's borrowing decision has negligible impact on overall debt, firms ignore the impact of their borrowing on the severity of any future credit crunch, i.e. there is a negative externality present. Of course, in that case the first-best policy would be to invoke other policies that tackle the market failures more directly, such as prudential capital requirements, etc. Nevertheless, it seems fruitful for central bankers to ask how monetary policy should be conducted in a second-best world where those market failures remain.

The equations of the model are developed in the Appendix, but can be reduced to a conventional New Keynesian Phillips curve, as in Equation (5), and a forward-looking IS schedule:

$$x_t = \eta E_t x_{t+1} + r^o_t - r_t + v_t \tag{8}$$

This is similar to the standard New Keynesian IS schedule, though its interpretation is somewhat different. In particular the terms on the right-hand side reflect the determinants of investment, rather than consumption as in the standard approach. A high level of expected future output increases the marginal product of capital, thus encouraging investment, while it is discouraged by a high cost of capital. Likewise the shock, v_t, can be thought of as reflecting the 'animal spirits' of entrepreneurs.

Now consider the central bank's control problem. Crucially we assume the objective is to stabilise output around its *technically* feasible level, i.e. the natural rate of output that would obtain in the absence of a credit crunch. In the Appendix it is shown that the output gap relative to the natural rate that would apply in the absence of a credit crunch, x^*_t, can be expressed as:

$$x^*_t = x_t - [\nu(\varpi + \omega v_{t-1}) + \omega\eta E_{t-1}x_t]\varepsilon_t \tag{9}$$

where ε_t is an indicator variable that takes the value unity (zero) if a credit crunch occurs (does not occur) and the other Greek symbols are parameters (ϖ and ω parameterise the cost of a credit crunch, and η and ν are functions of tastes and technology). The quantity in square brackets represents the output cost of a credit crunch, with terms reflecting the fact that debt carried into the period will be high if 'animal spirits' had been buoyant in the preceding period or if output had been expected to be high.

It is noteworthy that the impact of the credit crunch is *not* affected directly by the rate of interest in the preceding period. A higher rate of interest reduces capital formation and debt accumulation during period t–1, but that is exactly nullified by the higher interest payments on the debt. Consequently the total amount that has to be repaid is left unchanged. In general whether an increase in the rate of interest in period t–1 raises or lowers the debt stock in period t depends on the semi-elasticity of borrowing with respect to the interest rate. In the present example the assumption of a Cobb-Douglas technology ensures that this is unity, so that the two effects exactly offset. This means that the effect of monetary policy today on the severity of any future credit crunch must operate entirely through its impact on the expected future level of activity.

First consider the case when the central bank is unable to commit. In the Appendix it is shown that the optimal monetary policy can be characterised by the optimality condition:

$$\pi_t = -(\lambda/\kappa)x^*_t \tag{10}$$

This is analogous to Equation (6), except that it is written in terms of the output gap measured relative to the level of potential output that would obtain in the absence of a credit crunch. Thus in the absence of a credit crunch (i.e., $x^*_t = x_t$), policy is unaffected by the possibility of credit crunches in the future. If, on the other hand, there is a credit crunch in period t (i.e., $x^*_t < x_t$), policy is set looser than it would otherwise be. So policy is in effect as espoused by Chairman Greenspan in the quotation at the start of Section 2 (though perhaps for a different reason): ignore the bubble in the upswing, but mitigate the fallout if and when it bursts. Furthermore the possibility of such a loose monetary policy in the face of a credit crunch tomorrow will raise expected inflation today. Consequently, even in the absence of a credit crunch there will be an upward bias to inflation today.

The reason that the possibility of future credit crunches does not affect policy in the upswing directly (there is an indirect effect via inflation expectations) is quite simple. Tightening policy today has no effect of the debt-income ratio that obtains tomorrow, because the reduction in investment and borrowing is exactly counterbalanced by the higher interest payments entailed. The only way the debt-income ratio can be affected is by lowering expectations of future activity, but this is impossible when the monetary authorities cannot precommit.

Now suppose the monetary authorities can precommit. In the Appendix it is shown that the 'timelessly optimal' plan under commitment satisfies the optimality conditions (for all t and for all $k \geq 0$):

$$E_t\pi_{t+k} = -[\lambda(1-\rho\omega\eta)/\kappa](E_t x^*_{t+k} - E_t x^*_{t+k-1}) \tag{11}$$

The structural similarity to the model of Section 2 – obtained by setting ρ to zero – makes it easy to see the impact of the possibility of a credit crunch on policy design. Assuming that $\rho\omega\eta < 1$, introducing the possibility of a credit crunch is similar in effect to reducing the weight on output in the central bank's objective function (compare also with Equation (7)).

That there is apparently less incentive to stabilise current output when the economy is overheating and building up larger imbalances today[6] may appear counter-intuitive. However, recall that this model is forward-looking in nature. And, though an increase in interest rates today cannot affect the severity of a credit crunch tomorrow because the interest semi-elasticity of borrowing is unity, policy

6. Recall that the constant savings rate assumption implies that higher output must be associated with higher capital formation and therefore more debt accumulation.

does affect debt levels through another channel, namely expectations of the *future* output gap. The expectation of a large positive output gap tomorrow thus boosts capital accumulation today, so raising the future debt stock and the costs associated with a credit crunch.

Now, as noted in Section 2, optimal policy in the standard New Keynesian model without credit crunches is history-dependent despite the absence of any backward-looking structural dynamics. That is because the optimal policy exploits the fact that a credible commitment to hold output above potential in the future raises inflation today via the expectations term in the Phillips curve. Thus, given the convexity of the loss function, the optimal response to a temporary supply disturbance involves a small, but *persistent*, output gap, rather than returning inflation straight away to target through a larger, but more short-lived, one. Demand shocks are contemporaneously and fully neutralised, of course.

When there is a possibility of a credit crunch, however, the gradualist response to, say, a beneficial supply shock generates additional expected future costs in the shape of a more severe credit crunch, should one occur. Consequently the optimal policy involves a less accommodative policy today, i.e. more variation in the current output gap, and less persistence than in the standard set-up. Moreover, the optimal policy under commitment involves a weaker monetary policy response to the occurrence of a credit crunch than is the case under discretion. That is because the central bank recognises that a policy of accommodating credit crunches through the loosening of monetary policy has adverse effects on inflation expectations. Consequently there is less monetary response to a credit crunch than under discretion, but average inflation is lower. There are echoes here of the supposed dangers of the 'Greenspan put' (see Miller, Weller and Zhang (2002)).

Of course this model is rather simple and omits some important channels whereby policy can influence the accumulation and unwinding of imbalances. Consequently the results may not be robust (though Groth (2003) develops a somewhat different model that shares some of the same characteristics). Nevertheless the analysis illustrates the fact that allowing for such phenomena in a forward-looking setting may affect the design of policy in subtle, as well as more obvious, ways.

One aspect that is missing from the analysis is an explicit role for asset prices. Falling asset prices reduce collateral and may induce a sharp change in the behaviour of potential borrowers as collateral constraints start to bind. That can act as an important amplification and propagation mechanism, as in the work of Kiyotaki and Moore (1997). Bordo and Jeanne (2002) construct a model in which firms can only borrow against collateral, and a credit crunch occurs if asset prices fall sufficiently. As in the model of this paper, the credit crunch then leads to a loss of output. But the resulting model is highly non-linear, and Bordo and Jeanne show that an appropriately forward-looking policy that responds to the initial asset-price inflation and build-up of debt by pre-emptively raising interest rates[7] dominates a purely reactive policy that responds to current inflation and activity.

7. This channel is absent in the model described in this paper because of the assumption that the semi-elasticity of debt with respect to the interest rate is unity.

Bordo and Jeanne go on to conclude that this demonstrates that a monetary policy that reacts only to output and inflation is insufficient, and that a (non-linear) response to asset prices, etc, is also desirable. They suggest this is inconsistent with inflation targeting. However, Bordo and Jeanne assume a standard loss function that is quadratic in the output gap and inflation. If one accepts the argument that an inflation target is really a statement about the objective function rather than the reaction function, a flexible inflation targeter would also choose their recommended policy. But their analysis does suggest that a richer interest rate reaction function may be required in the pursuance of that inflation target.

Financial instability and credit crunches are probably of the greatest significance when they adversely affect the supply potential of the economy. But even without such adverse supply effects, the unwinding of financial imbalances may cause problems for the design and conduct of monetary policy. In most settings, the appropriate response to the fall in aggregate demand occasioned by the unwinding of cumulative imbalances, triggered say by a fall in asset prices or a downward revision in expectations about future income or earnings, is simply to offset the shock to demand by lowering interest rates. But this may not be possible if the zero lower bound on nominal interest rates starts to bind. Although other monetary policy options may be available, including purchases of a broader range of assets than the central bank usually undertakes, as well as more exotic approaches such as taxing money balances *à la* Gesell (1958), their effectiveness is less certain than conventional interest rate policy. Consequently it will make sense to conduct a policy during the period of accumulating imbalances that reduces the likelihood of encountering the zero lower bound as the imbalances unwind.

Stochastic simulations with macroeconometric models suggest that, at an average inflation rate of 2 per cent, the fraction of time spent at the zero lower bound is likely to be around 2 per cent. And even for an average inflation rate of 1 per cent, the corresponding figure is only up to around 5 per cent (see the studies surveyed in Yates (2003)). That might appear to suggest this is not likely to be a very serious issue. But those stochastic simulations assume shocks similar to those experienced in the past. The unwinding of imbalances is likely to be sharp, particularly in the context of a credit crunch or similar financial instability, and so corresponds to shock realisations in the bottom tail of the distribution. That suggests the zero lower bound on interest rates provides a more compelling argument for pre-emptive action to prevent the build-up of imbalances in the first place.[8]

A second consideration arises from the fact that a sharp unwinding of imbalances is likely to make aggregate demand somewhat less predictable than normal. Knowledge of the current state of the economy is highly imperfect – unlike in the models above – and increased uncertainty about demand will inevitably be transmitted into greater variability in activity. Moreover the impact of interest rate changes on aggregate demand is also likely to become more uncertain in such an environment, especially

8. Note that this argument suggests that greater uncertainty may lead to greater policy activism, in contrast to the classic Brainard (1967) result.

if credit channel effects assume greater importance or if there is a credit crunch. Greater uncertainty about policy multipliers will then impact on the optimal policy setting, eg as in the seminal analysis of Brainard (1967).

In this case one would expect there to be something of a trade-off facing the policy-maker. Action taken today to reduce the build-up of imbalances might pay off in the longer term by reducing the future uncertainty that the policy-maker will face as the imbalances unwind. But, as before, that seems entirely consistent with the approach of flexible inflation targets, taken as a description of the objectives of policy rather than the route whereby they are achieved.

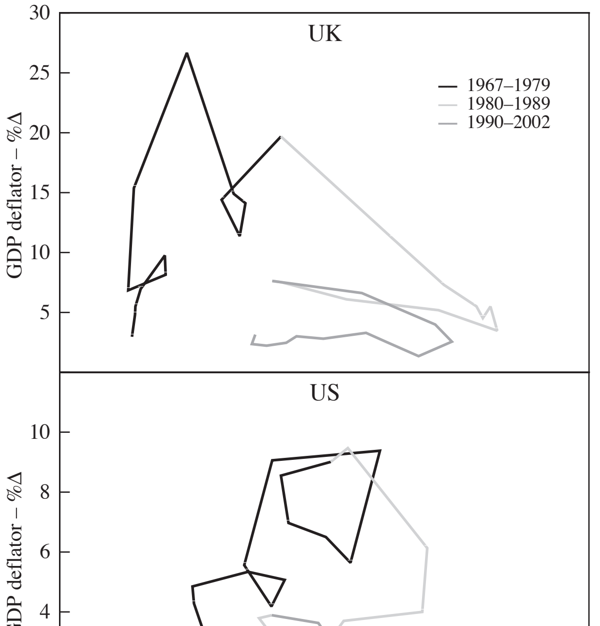
4. Identifying Imbalances: A Case Study

These considerations suggest that even inflation targeters – indeed especially inflation targeters – should take cognisance of the risks to future macroeconomic stability posed by cumulating financial imbalances and/or asset-price misalignments. No additional consideration of asset prices or financial imbalances need be introduced into the description of the objectives of policy beyond inflation and activity. But as it may be some while before imbalances unwind or misalignments correct, the policy-maker does need to look sufficiently far ahead in assessing the risks to the outlook posed by the build-up of imbalances and misalignments.

A key issue is, of course, the identification of threatening imbalances before they grow too large. But without the wisdom of hindsight, it is often hard to identify those that pose a real threat, as rapid debt accumulation or large asset-price movements may be a rational and justified response to a change in the economic environment. The empirical results of Borio and Lowe (2002), building on Kaminsky and Reinhart (1999), seek to develop indicators of imminent financial crises based on the joint behaviour of asset prices, credit and investment and using only information available to the policy-maker at the time. Such indicators will no doubt be a useful addition to the armoury of central banks, but early diagnosis of incipient imbalances is always likely to be difficult. By the time it is obvious that there is a problem, it may be too late to do much about it – at least with conventional macroeconomic tools – without causing the macroeconomic instability that the policy-maker wishes to avoid.

Moreover, as noted by a number of authors, the greater counter-inflationary credibility of monetary policy in the last decade or so itself complicates the identification of imbalances (see, e.g., Borio and Lowe (2002) or Goodfriend (2003)). Debt accumulation is likely to prove excessive if it is associated with unsustainably high levels of activity. When credibility was low, levels of activity above the natural rate tended to show up relatively quickly in accelerating inflation. But a feature of the last decade has been the apparent flattening of the short-run output-inflation trade-off (see Figure 1). There are at least three possible reasons for this. First, New Keynesian models of nominal price inertia relying on the presence of menu costs suggest that the slope of the output-inflation trade-off should be flatter at low average inflation rates (Ball, Mankiw and Romer 1988). Second, models of the Phillips curve in which expectations of inflation play a role – whether of the Friedman-Phelps-Lucas or New Keynesian varieties – suggest that an increase in activity above the natural rate will raise inflation less if those expectations are well anchored. Consequently the enhanced belief that monetary policy will be used to stabilise inflation will itself help to keep inflation low. Moreover, that credibility will also help to stabilise long-term interest rates. Third, increased competitive pressures in product markets, associated in particular with increased international trade, may also act to restrain inflationary pressures.

Figure 1: Phillips Curve
1967–2002



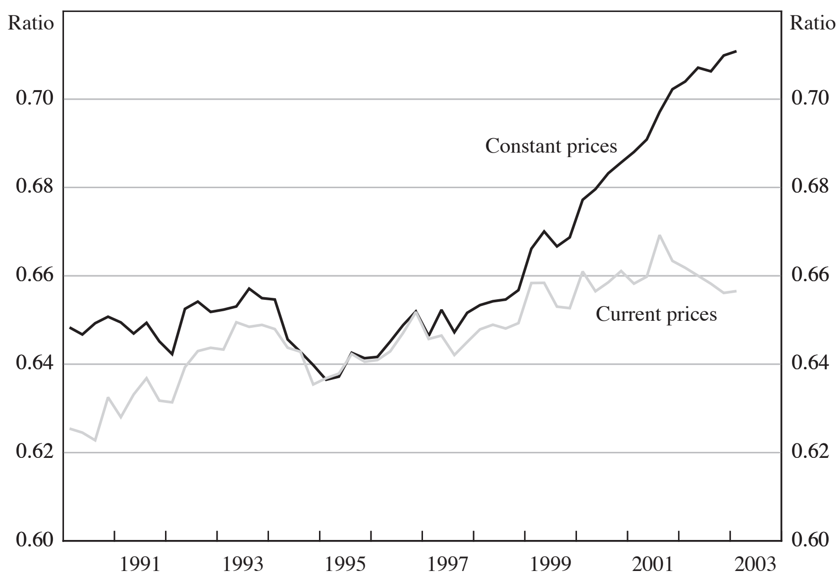
Sources: IMF; OECD

In such a world, excess debt accumulation and levels of demand above the natural rate will not immediately show up in higher inflation rates. Moreover, that in itself may encourage market participants and policy-makers to believe that the natural rate of output is higher than it really is. That in turn is likely to boost asset prices, further raising demand. Instead of showing up in inflation, the excess demand will show up in other indicators, such as profit rates, measures of labour shortage and the like. That suggests focusing attention on other indicators, as well as inflation, in identifying when demand is excessive and imbalances are unsustainable.

Rather than add to the body of work that seeks to develop early-warning indicators of potentially dangerous imbalances, I conclude with a review of current developments in the United Kingdom that illustrates the difficulties in assessing whether or not asset-price movements and credit growth constitute a potential problem. A key feature of the UK economy in the past six years has been the buoyancy of household spending which has consistently grown faster than output, in both real and nominal terms (see Figure 2). And associated with that has been a build-up of household debt and rapid house price inflation (see Figures 3 and 4). Moreover, the Bank of England's Monetary Policy Committee has over the past two years sought to offset the impact of the global slowdown by relaxing policy in order to further boost domestic spending, and in particular private consumption. That has added to the accumulation of household debt and raised house prices further. Is there any evidence that the financial imbalances in the household sector have reached the point where they might pose a threat to the economic outlook?

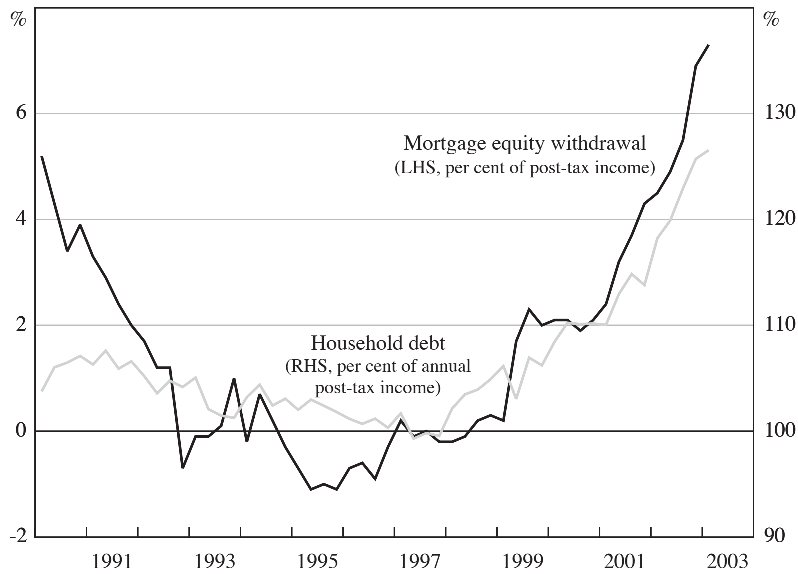
In addressing this question, it is helpful first to ask why consumer demand might have been so buoyant. Standard theory suggests that it should be 'permanent' income rather than current income that drives consumer spending, though the extent to which households will shift expenditure intertemporally will also depend on the cost of borrowing and the return to saving. The recent strong growth in consumption has coincided with robust growth in real disposable household incomes and falling unemployment, and for a while also with rising equity prices. So one explanation for the strength of consumer spending is that households have been revising up their assessment of their permanent income. To the extent that there has indeed been an

Figure 2: Consumption to GDP Ratio



Source: Office of National Statistics (ONS)

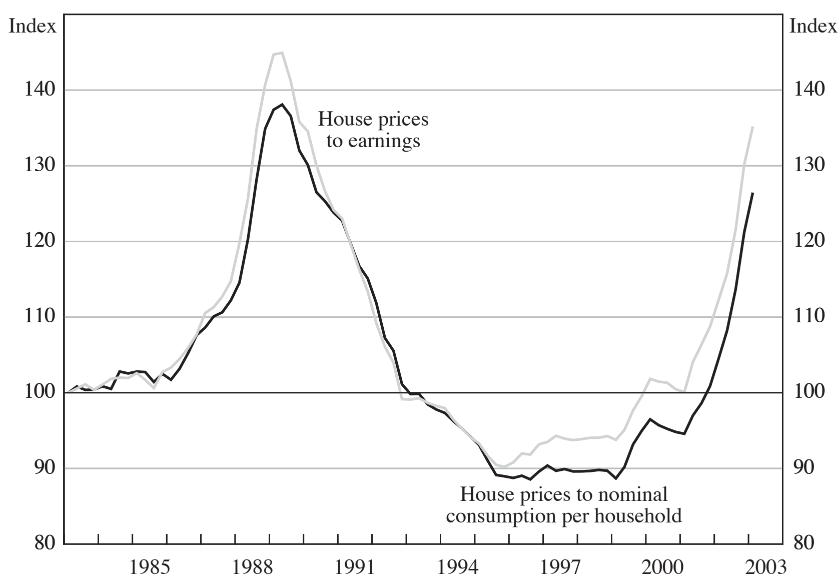
Figure 3: Household Debt and Mortgage Equity Withdrawal



Sources: Bank of England; ONS

Figure 4: House Prices Ratios

March quarter 1983 = 100

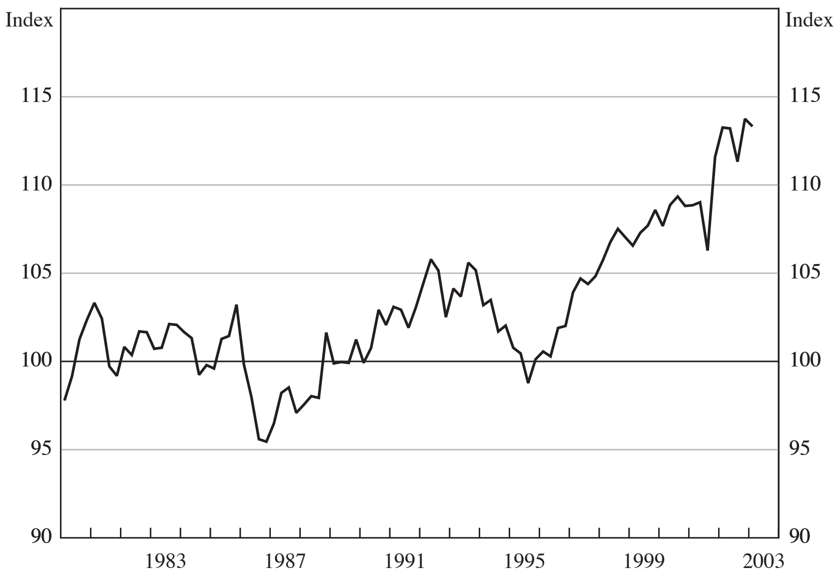


Sources: Bank of England; Halifax; Office of the Deputy Prime Minister; ONS increase in households' permanent income, then we would expect consumption growth in due course to fall back in line – or strictly speaking a little below – the rate of growth of their income, with the extra accumulated debt being gradually repaid. But if expectations prove to be over-optimistic then a sharper future correction to consumer spending is likely.

Furthermore, a significant fraction of the increase in real household incomes has been associated with the substantial improvement in the terms of trade – up 13 per cent since 1996 (see Figure 5). An important issue is whether the improvement from this source is permanent, reflecting the exploitation of comparative advantage, or whether it is associated instead with a temporarily high level of the exchange rate, in which case real incomes and consumption will eventually both drop back. The answer to this question is not obvious.

A second explanation for the rapid growth in consumer spending and debt is easier access to, or cheaper, borrowing. Here house prices enter the picture. The most important channel through which house prices affect consumer spending is probably not via a conventional wealth effect. Rather it is through increasing the value of the collateral against which owners – who would otherwise be credit-constrained – can borrow, or else by allowing them to borrow at lower rates. The higher house prices of recent years have allowed owner-occupiers to increase their borrowing, using the proceeds in part to boost spending. That is reflected in high rates of mortgage equity withdrawal, currently estimated to be equivalent to about 7 per cent of personal disposable income (see Figure 3).

Figure 5: Terms of Trade
1995 = 100



Source: ONS

But why has the price of houses risen? The demand for housing services should be driven by the same factors that drive the demand for consumer goods and services, i.e., permanent income. Figure 4 also shows the evolution of house prices relative to the nominal value of consumer spending per household (a proxy for consumers' estimates of their permanent income). That ratio has risen sharply in recent years, although the picture is not quite as dramatic as when house prices are compared to earnings.

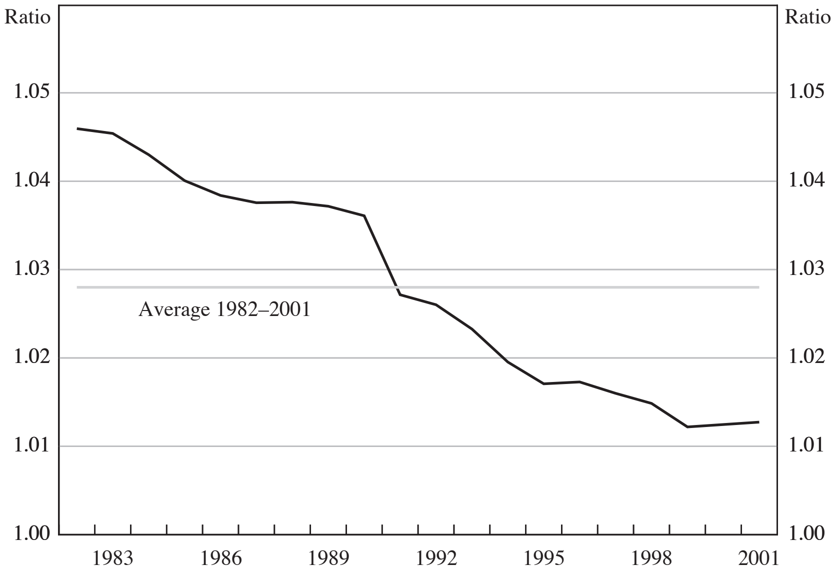
So something else has also been driving house prices, and with them the value of the collateral against which owner-occupiers can borrow. At first glance, Figure 4 might seem to indicate an incipient house-price bubble, but there are at least three reasons why the demand for housing might have risen more than might be suggested simply by looking at permanent income. First, the transition to a low-inflation environment implies that nominal interest rates should also be lower on average. As standard mortgages entail an even flow of nominal payments over the life of the mortgage, the initial real payments on a given nominal debt are smaller than they would be if inflation and interest rates were high, with the real burden of payments towards the end of the loan period being correspondingly greater. Shifting the pattern of real payments into the future in this way makes households that are constrained by their cash flow more willing or able to borrow, thus driving up the demand for housing. But a legitimate concern is that borrowers may not have fully factored in the corresponding increase in future real payments. Second, increased competition amongst lenders and the application of better credit scoring techniques may have increased the supply of loans. And third, population growth and demographic developments – more people wanting to live alone and an increased desire for second homes – will also have boosted demand.

In addition, on the supply side of the market, the rate of construction of new dwellings in the United Kingdom has lagged behind the expansion in the number of households, in part because of a shortage of land and the impact of planning restrictions. Figure 6 shows that the ratio of dwellings to households – a measure of spare capacity in the housing market – has been steadily falling over the last two decades. One might reasonably expect that this might also be reflected in higher house prices relative to nominal consumption per household.

In sum, there are good reasons why a higher house-prices-to-consumption ratio (or house-prices-to-earnings ratio) might be warranted by underlying economic developments. But there is inevitably very considerable uncertainty about the underlying equilibrium value of house prices. An optimal monetary policy almost certainly would dictate a differential response to a movement in house prices associated with a misalignment to one that is associated with movements in the fundamentals. Yet diagnosing whether there *is* a misalignment is far from straightforward.

Whether the movement in house prices is justified by fundamentals or not is clearly also central to assessing whether there is any danger posed by the build-up of household debt that is the counterpart to the increase in the value of housing wealth. But even if a sharp correction were to occur to house prices, it would not necessarily imply a correspondingly sharp fall in household spending. Net household

Figure 6: Ratio of Dwellings to Households[(a)]



(a) Figures for the stock of dwellings are for 31 December each year prior to 1991 and 31 March from 1991 onwards. That may account for most of the fall in the ratio in 1991.

Source: Office of the Deputy Prime Minister

wealth would fall, but rational consumers would spread the required adjustment over the rest of their lives. Even consumers who were credit-constrained and had previously exploited the higher collateral to increase their borrowing would not need to cut back their spending sharply unless the lender were to foreclose on them for some reason.[9]

High levels of outstanding debt could, however, increase the impact on consumer spending of other adverse shocks to activity, especially those leading to higher unemployment. Households with adequate liquid assets, or who can still access the credit market, would not need to cut back their consumption much if they experience a spell of unemployment, assuming it does not harm their future earning potential. Instead they would simply run down their savings or borrow more. On the other hand, households with no assets, and who cannot borrow, would be forced to cut back spending in line with their reduced income. So the impact of this adverse shock on aggregate consumption will be greater, the higher is the fraction of constrained

9. Note that the mere fact that the value of the collateral is less than the value of the loan does not necessarily imply the borrower will choose to walk away from the debt and forfeit the asset. Some borrowers may, for reputational reasons, prefer to repay their debts even though they are worth more than the value of the collateralised asset. Hence lenders, having extended the loan on the basis of what turns out to be a temporarily inflated collateral value, may prefer not to foreclose.

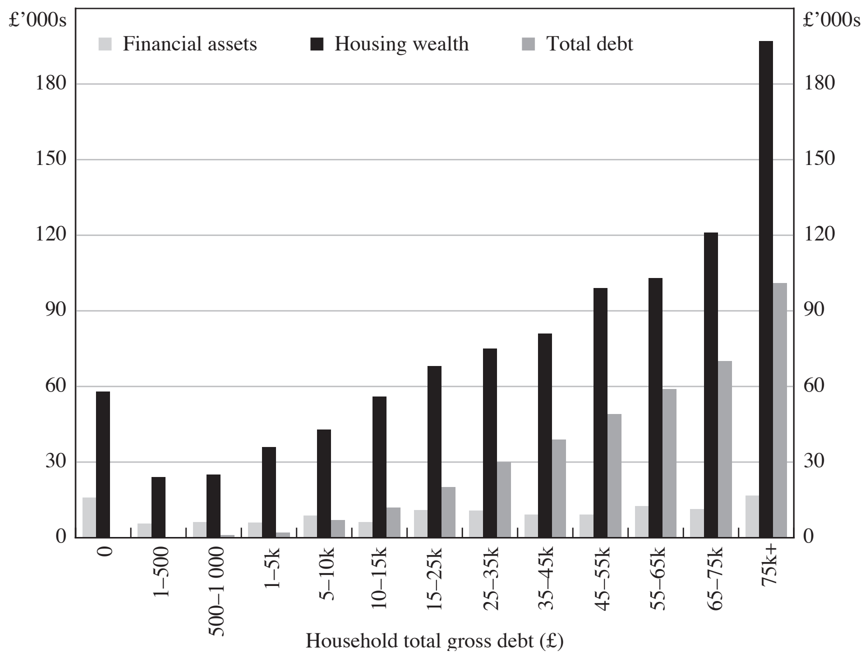
households. Furthermore that fraction will tend to be higher, the greater is the amount of debt already extended.

So a key question is whether those who hold the debt are particularly likely to be exposed to adverse shocks, such as job loss, and whether they have other assets that they could run down. The good news is that it is those households who hold the most debt who also tend to have higher income and more assets (see Figure 7). But this is not very surprising as most of the debt is in the form of mortgages and bigger mortgages are typically associated with more expensive houses!

Perhaps more relevant in assessing the potential vulnerability of the household sector to shocks is the matching of debts to liquid assets. Here the news is not quite so good. Figure 8 illustrates the distribution of total liabilities and liquid assets across individual households, drawn from a 10 per cent random sample of the 5 000 households in the 2000 British Household Panel Survey (BHPS). It is notable that a large fraction of households are positioned on one or other axis. In particular, roughly a third had no liquid assets to speak of. This suggests that the financial position of the household sector might be rather less resilient than is suggested merely by looking at aggregate balance sheet data.

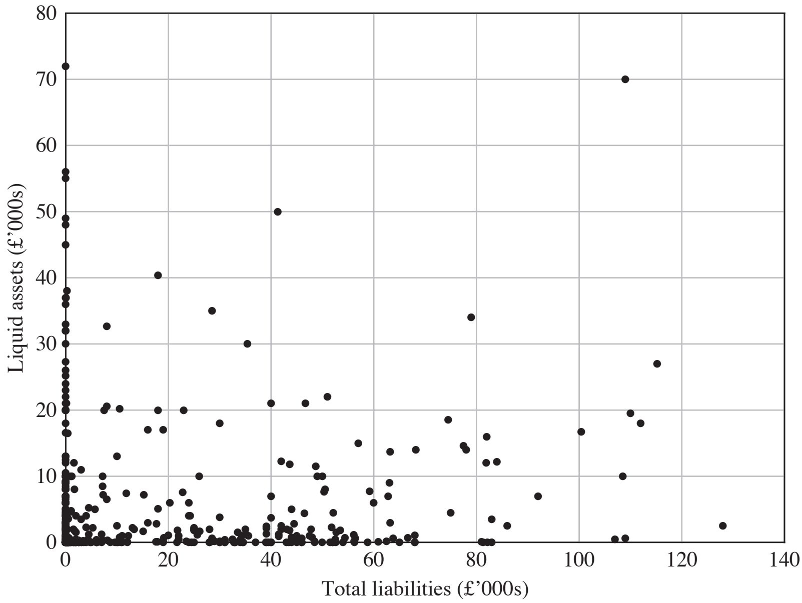
Figure 7: Average Financial Assets, Housing Wealth and Debt at Different Levels of Household Indebtedness

2000



Sources: Bank of England calculations; British Household Panel Survey, 2000

Figure 8: Distribution of Total Liabilities and Liquid Assets Across Individual Households[(a)]



(a) The full BHPS survey for 2000 contains information on the total liabilities and the liquid assets of more than 5 000 households. Households in the upper percentile of either the liquid assets or the total liabilities distribution were removed. This figure is based on a random 10 per cent sample of the remaining households, with each dot representing one of those households.

Source: British Household Panel Survey, 2000

This example illustrates the problems that confront policy-makers in assessing whether strong credit growth and asset-price appreciation are merely the consequence of movements in underlying economic fundamentals or represent something more dangerous. Moreover, even if it is the latter, aggregate data may need to be supplemented by microeconomic information in order to evaluate in full the possible problems caused by their unwinding.

5. Concluding Remarks

Financial imbalances, asset-price misalignments and the instability that may result as they correct may pose significant problems for monetary policy-makers. Achieving price stability is no guarantee that financial instability can be avoided. But taking account of financial imbalances in the design of monetary policy does not require a change in the formal structure of inflation targets. Significant financial instability invariably will also have a significant impact on activity and inflation. The attraction of inflation targets is that they focus on the goals of policy – not the means by which they are achieved, as is the case under regimes such as money supply targets and fixed exchange rates. An inflation-targeting regime comprising a 'first-level' target for the inflation rate together with a subsidiary objective of stabilising activity is a practical solution to the problem of describing the principal's objective function. A flexible inflation targeter – in the specific sense of Svensson – does not then require the explicit addition of financial imbalances or asset prices to be added to their remit. Rather the implications of possible imbalances and misalignments for the macroeconomic goal variables must necessarily be factored into the assessment of expectations of future growth and inflation in order to execute the optimal plan. So the answer to the question posed in the title of this paper is: Yes, (flexible) inflation targets *are* enough. But taking on board the possible risks posed by cumulating financial imbalances may require a shift in the rhetoric of inflation targeters towards the longer term.

More investigation is, however, needed into understanding the way in which financial imbalances and asset-price misalignments in practice affect economic prospects. There are at least two distinct sets of issues where further work would be useful. First, it would be helpful to advance our ability to detect when rapid credit expansion and asset-price increases are symptomatic of the development of underlying imbalances that are susceptible to future correction, rather than simply reflecting sustainable movements in the underlying economic fundamentals. Second, improving our understanding of how imbalances unwind and their associated costs would facilitate the design of appropriate policies, on both the monetary and regulatory front. It is safe to assume that these two issues will remain on the agenda for both monetary economists and central bankers for many years to come.

Appendix

There are two types of agents in the economy: households and firms. Households are infinitely lived, supply labour, consume and can borrow and lend freely. All debt lasts a single period and is denominated in real terms. Households also own a non-tradable diversified portfolio of shares in firms, so that all profits are returned to households in lump-sum form. Firms are monopolistic competitors, and nominal prices are fixed with a fraction of prices being reset each period as in the standard New Keynesian Phillips curve. Capital lasts a single period, has to be installed a period in advance, and is financed entirely by borrowing from households.

Credit crunches occur with a fixed probability, ρ. When they do occur their effect is to lower the level of supply in the economy. In effect a credit crunch is a negative shock to total factor productivity, though it reflects events in financial markets rather than a change in the technical capabilities of the economy. If a credit crunch does occur, it is assumed to be more severe the higher is the level of overall debt outstanding. An individual firm's borrowing decision has a negligible impact on *overall* debt. Consequently firms ignore the impact of their borrowing on the severity of any future credit crunch, i.e. there is a negative externality present.

The production function is Cobb-Douglas in capital and labour:

$$y_t = a_t + \alpha k_t + (1-\alpha)n_t \tag{A1}$$

where y_t is (the logarithm of) output in period t, a_t is (the logarithm of) total factor productivity in period t, k_t is (the logarithm of) the capital stock at the start of period t, inherited from the previous period and n_t is (the logarithm of) employment in period t. Total factor productivity is given by the process:

$$a_t = e_t - [\varpi + \omega(d_t - E_{t-1}y_t)]\varepsilon_t \tag{A2}$$

where e_t is a shock to the technology, d_t is the (logarithm of) debt outstanding and ε_t is an indicator variable that takes the value unity if a credit crunch occurs and zero otherwise. The severity of the credit crunch thus depends on the debt-to-(expected)-output ratio. We write (A2) in terms of expected output rather than realised output because the latter depends on whether a credit crunch occurs or not; writing the credit crunch in terms of realised output complicates the analysis considerably.

Equation (A1) may be inverted to give labour demand conditional on the level of output:

$$n_t = (y_t - a_t - \alpha k_t)/(1-\alpha) \tag{A3}$$

The demand for capital is then obtained by minimising expected costs, conditional on the expected future level of output and recognising that employment will subsequently be determined through the labour requirement Equation (A3):

$$\begin{aligned} k_{t+1} &= E_t y_{t+1} - E_t a_{t+1} + (1-\alpha)(E_t w_{t+1} - E_t p_{t+1} - r_t + v_t) \\ &= E_t n_{t+1} + E_t w_{t+1} - E_t p_{t+1} - r_t + v_t \end{aligned} \tag{A4}$$

where w_t is (the logarithm of) the nominal wage in period t, p_t is (the logarithm of) the price level in period t, r_t is the real rate of return on debt and v_t can be thought of as representing a shock to ‘animal spirits’, i.e. irrationally over- or under-optimistic expectations. For simplicity, v_t is assumed to be serially uncorrelated, and inessential constants are normalised to zero through appropriate choice of units throughout.

Following Calvo (1983), prices are set on a staggered basis, with those firms that are able to change their price choosing an optimal one based on expected marginal cost.

$$\pi_t = \beta E_t \pi_{t+1} + \delta m_t + u_t \tag{A5}$$

where $m_t (= w_t - p_t + n_t - y_t)$ is (the logarithm of) marginal cost and u_t is an uncorrelated shock to the mark-up.

Turning to the household sector, savings are assumed to be a constant fraction of income, and labour supply is an increasing function of the real wage alone:

$$w_t - p_t = \phi n_t \tag{A6}$$

The model can be developed along standard lines with an inter-temporal optimality equation for consumption and a corresponding intra-temporal optimality condition for labour supply, but that merely complicates the dynamics without changing the basic insights.

Given the constant savings rate assumption, an IS schedule can then be obtained from (A4) and using the equality of marginal cost and the labour share:

$$y_t = E_t y_{t+1} + E_t m_{t+1} - r_t + v_t \tag{A7}$$

This is similar to the standard New Keynesian IS curve, save for the appearance of expected marginal cost.

Using Equations (A3) and (A6), marginal cost is:

$$m_t = (\alpha+\phi) y_t/(1-\alpha) - (1+\phi)(a_t + \alpha k_t)/(1-\alpha) \tag{A8}$$

The flexible price level of output, y^o_t, is then obtained by setting $m_t = 0$:

$$y^o_t = \nu(a_t + \alpha k_t) \tag{A9}$$

where $\nu = (1+\phi)/(\alpha+\phi)$. The model may then be condensed into the two equations:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \tag{A10}$$

where x_t $(= y_t - y^o_t)$ is the output gap and $\kappa = \delta(\alpha+\phi)/(1-\alpha)$, and:

$$x_t = \eta E_t x_{t+1} + r^o_t - r_t + v_t \tag{A11}$$

where $r^o_t = E_t y^o_{t+1} - y^o_t$ is the natural real rate of interest and $\eta = (1+\phi)/(1-\alpha)$ $(=\kappa\nu/\delta)$.

The policy-maker seeks to stabilise output around its *technically* feasible level:

$$y^*_t = \nu(e_t + \alpha k_t) \tag{A12}$$

When there is no credit crunch, this is just the same as the flexible price equilibrium, y^o_t. But when a credit crunch occurs, there will be a gap between the two, which is larger the greater is the current debt-output ratio. Using the fact that $d_t = k_t + r_{t\text{-}1}$, the relevant gap, x^*_t is:

$$\begin{aligned} x^*_t &= (y_t - y^o_t) + (y^o_t - y^*_t) \\ &= x_t - \nu[\varpi + \omega(k_t + r_{t-1} - E_{t-1}y_t)]\varepsilon_t \qquad \text{(A13)} \\ &= x_t - [\nu(\varpi + \omega v_{t-1}) + \omega\eta E_{t-1}x_t]\varepsilon_t \end{aligned}$$

Consider first the optimal policy under discretion. Under discretion, the central bank is forced to treat private sector expectations as exogenous and unaffected by its current policy choice in carrying out the optimisation; let $\bar{E}$ denote such a private sector expectation. The Lagrangian for the optimisation problem for the central bank at date τ may then be written:

$$\Omega_\tau = (1-\beta)E_\tau[\sum_{t=\tau}^{t=\infty}\beta^{t-\tau}\{(\pi_t^2 + \lambda x^{*2}_t)/2 + \varphi_t(\pi_t - \beta\bar{E}_t\pi_{t+1} - \kappa x^*_t - z_t)\}] \qquad \text{(A14)}$$

where $z_t = \kappa[\nu(\varpi + \omega v_{t-1}) + \omega\eta\bar{E}_{t-1}x_t]\varepsilon_t + u_t$. The first-order conditions are, for all $t \geq \tau$:

$$0 = \pi_t + \varphi_t \qquad \text{(A15)}$$

$$0 = \lambda x^*_t - \kappa\varphi_t \qquad \text{(A16)}$$

Eliminating the multiplier gives:

$$\pi_\tau = -(\lambda/\kappa)x^*_\tau \qquad \text{(A17)}$$

This is essentially the same as Equation (6), but written in terms of the deviation of output from its technically feasible level, rather than the flexible price equilibrium.

Now consider the optimal policy when the central bank is able to pre-commit, in which case it will take account of how private sector expectations will be affected by its choice of policy. First note that Equation (A13) implies that:

$$E_{t-1}x^*_t = (1-\rho\omega\eta)E_{t-1}x_t - \nu\rho(\varpi + \omega v_{t-1}) \qquad \text{(A18)}$$

Using this, the Lagrangian for the central bank's optimisation problem at date τ may be written:

$$\Omega_\tau = (1-\beta)E_\tau[\sum_{t=\tau}^{t=\infty}\beta^{t-\tau}\{(\pi_t^2 + \lambda x^{*2}_t)/2 + \varphi_t(\pi_t - \beta\pi_{t+1} - \kappa x^*_t - z_t)\}] \qquad \text{(A19)}$$

where: $z_\tau = \kappa[\nu(\varpi + \omega v_{\tau-1}) + \omega\eta E_{\tau-1}x_\tau]\varepsilon_\tau + u_\tau$

and, for all $t > \tau$: $z_t = \kappa[\nu(\varpi + \omega v_{t-1}) + \omega\eta E_{t-1}x^*_t]\varepsilon_\tau/(1-\rho\omega\eta) + u_t$.

The first-order conditions are then:

$$0 = \pi_t + \varphi_t - \varphi_{t-1} \qquad \text{for all } t \geq \tau, \textit{ with } \varphi_{\tau-1} = 0 \qquad \text{(A20)}$$

$$0 = \lambda x^*_\tau - \kappa\varphi_\tau \qquad \text{(A21)}$$

$$0 = \lambda x^*_t - \kappa\varphi_t/(1-\rho\omega\eta) \qquad \text{for all } t > \tau \qquad \text{(A22)}$$

These equations describe a ‘τ-optimal’ equilibrium, reflecting the fact that expectations formed prior to date τ are treated as bygones. As noted by Svensson and Woodford (2003), it would not be optimal to stick to this plan for dates after τ, i.e. it is time inconsistent. But if the authorities can pre-commit, it makes sense to consider not the ‘τ-optimal’ solution, but rather a ‘timelessly optimal’ plan in which the optimisation is assumed to occur arbitrarily far in the past and so is independent of initial conditions. In that case, the initial condition $\varphi_{\tau-1}=0$ and the first-order condition (A21) that treats $E_{\tau-1}x_\tau$ in z_τ as a bygone are both irrelevant, and the optimum is effectively characterised by (A20) and (A22). Combining these by eliminating the multipliers then gives a set of optimality conditions analogous to Equation (7) that applies for all decision dates τ:

$$E_\tau \pi_t = -\,[\lambda(1-\rho\omega\eta)/\kappa](E_\tau x^*_t - E_\tau x^*_{t-1}) \tag{A23}$$

References

Ball L, NG Mankiw and D Romer (1988), 'The New Keynesian economics and the output-inflation trade-off', *Brookings Papers on Economic Activity*, 1, pp 1–65.

Batini N and E Nelson (2000), 'When the bubble bursts: monetary policy rules and foreign exchange market behaviour', Bank of England, mimeo.

Bean CR (1998), 'The new UK monetary arrangements: a view from the literature', *Economic Journal*, 108(451), pp 1795–1809.

Bernanke BS and M Gertler (2000), 'Monetary policy and asset price volatility', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, Kansas City, pp 77–128.

Bernanke BS and M Gertler (2001), 'Should central banks respond to movements in asset prices?', *American Economic Review*, 91(2), pp 253–257.

Bordo MD and O Jeanne (2002), 'Boom-busts in asset prices, economic instability, and monetary policy', NBER Working Paper No 8966.

Borio C and P Lowe (2002), 'Asset prices, financial and monetary stability: exploring the nexus', BIS Working Paper No 114.

Brainard W (1967), 'Uncertainty and the effectiveness of policy', *American Economic Review*, Papers and Proceedings, 57(2), pp 411–425.

Calvo GA (1983), 'Staggered prices in a utility-maximum framework', *Journal of Monetary Economics*, 12(3), pp 383–398.

Cecchetti SG, H Genberg, J Lipsky and S Wadhwani (2000), *Asset prices and central bank policy*, Geneva Reports on the World Economy No 2, International Center for Monetary and Banking Studies and Centre for Economic Policy Research, Geneva.

Cecchetti SG, H Genberg and S Wadhwani (2003), 'Asset prices in a flexible inflation targeting framework', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 427–444.

Clarida R, J Galí and M Gertler (2001), 'Optimal monetary policy in open versus closed economies: an integrated approach', *American Economic Review*, 91(2), pp 248–252.

Crockett A (2003), 'International standard setting in financial supervision', Institute of Economic Affairs Lecture, Cass Business School, London, 5 February.

Gesell S (1958), *The natural economic order*, Peter Owen Ltd, London.

Giannoni MP and M Woodford (2002), 'Optimal interest-rate rules: II. Applications', Princeton University, mimeo.

Goodfriend M (2003), 'Interest rate policy should not react directly to asset prices', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*', MIT Press, Cambridge, Mass, pp 445–457.

Greenspan A (2002), 'Economic volatility', remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–`30 August.

Groth C (2003), 'Monetary policy and asset price fluctuations', paper presented to the European Economic Association Conference, Stockholm, 20–24 August.

Kaminsky GL and C Reinhart (1999), 'The twin crises: the causes of banking and balance-of-payments problems', *American Economic Review*, 89(3), pp 473–500.

King MA (1997), 'The inflation target five years on', *Bank of England Quarterly Bulletin*, 37(4), pp 434–442.

Kiyotaki N and JH Moore (1997), 'Credit cycles', *Journal of Political Economy*, 105(2), pp 211–248.

Miller M, P Weller and L Zhang (2002), 'Moral hazard and the US stock market: analysing the "Greenspan put"', *Economic Journal*, 112(478), pp C171–C186.

Stock JH and MW Watson (2001), 'Forecasting output and inflation: the role of asset prices', NBER Working Paper No 8180.

Svensson L (2001), 'Requiem for forecast-based instrument rules', Institute for International Economic Studies, Stockholm University, mimeo.

Svensson L (2002), 'What is wrong with Taylor rules? Using judgment in monetary policy through targeting rules', Princeton University, mimeo.

Svensson L and M Woodford (2003), 'Implementing optimal policy through inflation-forecast targeting', NBER Working Paper No 9747.

Taylor JB (2001), 'The role of the exchange rate in monetary-policy rules', *American Economic Review*, 91(2), pp 263–267.

Woodford M (1999), 'Optimal monetary policy inertia', NBER Working Paper No 7261.

Yates A (2003), 'Monetary policy and the zero bound to nominal interest rates', *Bank of England Quarterly Bulletin*, 43(1), pp 27–37.

What the FOMC Says and Does When the Stock Market Booms

Stephen G Cecchetti[1]

Abstract

Central bankers and monetary economists continue to debate the wisdom of adjusting policy in reaction to asset-price misalignments or bubbles. Experts on both sides have marshalled theoretical and practical arguments, but failed to achieve consensus. In this paper, I first summarise the argument in favour of interest rate reactions to equity-price misalignments, and then provide evidence that Federal Reserve words and actions were influenced by the Internet bubble as it was in progress. That is, I show that as equity prices boomed, members of the Fed's policy-making body, the Federal Reserve's Open Market Committee (FOMC), spoke more intensively about the stock market, and adjusted interest rates accordingly. The debate should not be about whether they should have reacted, but whether they did enough.

1. Introduction

From August 1997 to June 1999 I sat on the backbench at the meetings of the FOMC and received all of the material distributed to the participants. Prior to each of these meetings a number of things were distributed to meeting participants, including a set of economic forecasts. Prepared by the Division of Research and Statistics at the Federal Reserve Board, these forecasts were contained in what is known as the 'Green Book'. The Green Book would arrive in my office on Thursday afternoon prior to the coming Tuesday meeting. Before that, on Thursday morning, the Deputy Secretary of the FOMC Normand Bernard would convene a conference call with representatives from all twelve Federal Reserve Banks. The primary purpose of this call was to describe the assumptions that went into the Green Book forecasts. These assumptions were about things like oil prices, exchange rates, and the stock market, were not written down in the Green Book itself, and as far as I know are not readily available. The interesting thing is that during the period when I took part in this process, the Board staff preparing the forecasts invariably assumed that the US stock market would decline significantly – 10 to 20 per cent declines in

---

1. Professor of International Economics and Finance, International Business School, Brandeis University; and Research Associate, NBER. This paper was prepared for the Reserve Bank of Australia's annual research conference on Assset Prices and Monetary Policy in Sydney, 18–19 August 2003. I would like to thank Lianfa Li and Craig Evers for excellent research assistance, as well as Blake LeBaron and Jeremy Stein for discussions that help clarify some of my fuzzy thinking, and the conference participants for their comments. Finally, I continue to owe a substantial debt to both Hans Genberg and Sushil Wadhwani with whom I started the research program of which this is the next instalment. I am responsible for all the remaining errors, ambiguities, and policy prescriptions.

the Wilshire 5000 index were commonly the basis for the forecasts.[2] They clearly believed that the stock market was overvalued.

While we can argue over whether it made sense to forecast a decline in the American equity markets in 1998, the need for a forecast is not debatable. The future path of consumption depends on wealth, and stocks are a significant component of wealth. Without a forecast of consumption, there is no way to forecast GDP. And inflation forecasts depend on the forecasts of the output gap, which themselves depend on these GDP forecasts. Central bankers have no choice; to do their job they must forecast the stock market. And during the boom of the late 1990s, FOMC actions were based at least in part on forecasts that were built on an assumed decline in equity prices.

At the time this was all happening, I confess that I was scandalised. I regularly ranted about the practice of forecasting a dramatic decline in the stock market. Like the vast majority of academics, I adhered to the efficient markets view. How could the Board staff forecast a stock market decline? Hadn't they read any of the thousands of papers showing that stock market movements aren't predictable? Yes, there are anomalies at the level of individual stocks, but in the aggregate, the market looks very efficient. So while we needed to assume something about the stock market, shouldn't we assume the equity index would stay constant at its current level indefinitely? After all, if we were so smart why weren't we rich?

This happened five years ago (which is why I can talk about it now), and in the interim I have changed many of my views.[3] I have a new appreciation for what the Board staff was doing – what they had to do – and have been working to understand the consequences of my changed view for how policy-makers should go about their jobs.

All of this is by way of introducing this paper and the question 'what the FOMC says and does as the stock market booms'. While the material distributed to the attendees in 1998 clearly had buried in it assumptions that the stock market would decline, did those concerns find their way into the discussions at the meeting itself? Even if it did, as economists like to say, talk is cheap. We are more interested in what people do than what they say, and that brings us to interest rate actions. Did the federal funds rate target move in reaction to the stock market? These are the questions that I hope to answer.

2. These assumptions were called 'Mike's assumptions' as they were ascribed to Michael Prell, the Director of the Division of Research and Statistics and the person responsible for the preparation of the Green Book at the time.

3. In fact, in an essay written immediately prior to my time in the Federal Reserve, I wrote that one of the Great Depression's lessons for current policy is that 'if central bankers allow fluctuations in asset market prices to affect their decisions, it may distract them from concentrating on some combination of output growth and inflation. The focus of the Federal Reserve on the level of equity prices in 1929 clearly led to a disastrously contractionary path for policy' (Cecchetti 1998, p 178). This is no longer my view.

The remainder of this paper is divided into two parts. In the first, contained in Sections 2 and 3, I provide a brief summary of the debate over the role that asset prices *should* play in interest rate setting and regulatory policy. I do not pretend that my synopsis is either balanced or exhaustive. Instead, I take this opportunity to react to those who have criticised my earlier writings. In Sections 4 and 5, I shift from a normative discussion of what the FOMC should have done to a positive examination of what they actually did. This new empirical work first looks at what FOMC members said at their meetings. In Section 4, I report that the frequency with which the FOMC discussed the stock market increased as the market climbed in the 1990s. Section 5 moves on to what the FOMC did. Here I report estimates of a policy reaction function that suggests the federal funds rate was moving in response to a measure of equity-price misalignments. Overall I conclude that when they met, the FOMC talked about the stock market, and when they set policy, they reacted to misalignments.

2. Should Interest Rates Respond to Asset Prices? The State of the Debate

Nearly everyone agrees that asset-price bubbles are bad and that we would all be better off without them. Abrupt changes in asset prices affect virtually every aspect of economic activity. Wealth effects cause consumption to expand rapidly and then collapse. Increases in equity prices make it easier for firms to finance new projects, causing investment to boom and then bust. The collateral used to back loans is overvalued, so when prices collapse it impairs the balance sheets of financial intermediaries that did the lending.

Over the last few years we have seen even more unpleasant consequences of the recent stock market bubble. Pension funds, booking the high returns of the 1990s, were unprepared for the collapse and are now underfunded.[4] Insurance company reserves are too low. And, most importantly, government finances have been distorted. As equity prices rose, capital gains tax revenue went up with them. This increased government revenue, which led to both increased expenditure and reduced taxes. With the bursting of the bubble, tax revenues have fallen dramatically. In the current political environment, it is impossible to raise taxes, and so the result is a combination of expenditure cuts and increased borrowing.

Another, more subtle, difficulty comes from the fact that higher investment during the boom both drove up observed real growth and raised the apparent productive capacity of the economy, further confusing permanent from cyclical movements in output. The problem is that some portion of the investment during the boom should not have been undertaken. That is, if prices had been correct these projects

4. The pension fund story is particularly worrisome. The bulk of American pension funds are privately managed. Rules allow for companies to withdraw funds from their pension systems when their actuaries find them to be overfunded based on their interpretation of the accounting rules. Companies have an incentive to make these withdrawals, as they add to reported profits, so many did it. In retrospect this was not very prudent. By some estimates, the pension funds are now short in excess of US$300 billion.

would not have had positive internal rates of return. When prices fell, many of these investments were abandoned – we all recall the pictures of warehouses piled high with discarded computer equipment. This makes potential GDP look higher than it actually is. For policy-makers this creates the risk of trying to stabilise growth at too high a level. For the rest of us it means overly optimistic expectations about growth of income and consumption.

The evidence is not in dispute. Bubbles increase the volatility of growth, inflation, and threaten the stability of the financial system. The 2003 IMF *World Economic Outlook* estimates that the average equity-price bust lasts for 2½ years and is associated with a 4 per cent GDP loss that affects both consumption and investment.[5] It is the job of central bankers to eliminate the sort of economic distress caused by asset-price bubbles. The idea that they should ignore them seems absurd on its face. But what should they do?

Over the past few years a large number of papers have addressed this question both from a theoretical and practical viewpoint. There are now so many papers that examine the connection between asset prices and monetary policy that it would be foolhardy for me to try to summarise them here. I will instead identify three views. The first is the Bernanke and Gertler (2000, 2001) conclusion that central bankers should respond to asset prices only in so far as they affect forecasts of future inflation. Related to this is the view put forth by Mishkin and White (2002) and Schwartz (2002), both of whom suggest that asset-price bubbles should only be a concern when they affect the stability of the financial system. And finally, in my previous work, I have explained why I believe that the best way for policy-makers to temper the impact of bubbles on inflation and growth is to adjust interest rates in response to asset-price misalignments.[6]

To be absolutely as clear as possible, my previous co-authors and I agree that policy-makers should not *target* asset prices, and we have said so repeatedly. Let me quote from Cecchetti *et al* (2003, p 428):

> It is our view that central banks can improve macroeconomic performance by **reacting** to asset price misalignments. We are not now saying, nor have we ever said, that policymakers should **target** asset prices. [Emphasis is in original.]

The debate is explicitly *not* about central bank objectives. It is about how to go about achieving whatever combination of price and output stability policy-makers are aiming to deliver. The proposal that interest rates respond to bubbles is completely consistent with inflation targeting or any other policy framework based on standard stabilisation objectives.[7]

5. See the excellent essays in Chapter II of IMF (2003) for a summary of the evidence.
6. See Cecchetti *et al* (2000) and Cecchetti, Genberg and Wadhwani (2003).
7. The debate over whether interest rate policy should respond to asset-price misalignments is distinct from the question of whether asset prices should be included in measures of inflation. That is, whether asset prices should enter central bank objectives through the back door of their inclusion in the targeted price index. Bryan, Cecchetti and O'Sullivan (2001, 2002) take up this question in detail and conclude that the answer is yes for housing, but no for equity.

There is a growing body of literature supporting the idea that asset prices have a place in monetary policy rules. Dupor (2002) builds a model with sticky prices in which firms over-invest in physical capital when stocks become overvalued. The optimal monetary policy reaction in the Dupor model is to raise interest rates to drive down employment, driving down the marginal product of capital, thereby reducing its price. Gilchrist and Leahy (2002) come to a similar conclusion when considering the consequences of a shock to the net worth of entrepreneurs.[8] In their set-up a rise in net worth reduces the risk premium on loans, creating investment increases that are unwarranted by long-run economic fundamentals. Raising interest rates will reduce this distortion and stabilise the economy in the long run.

It is fair to say that the conclusion that asset prices should appear in monetary policy rules is not robust. One example is the paper by Gruen, Plumb and Stone (this volume). In a series of simulation experiments they compare responses to large and small asset-price bubbles and find that an 'activist' policy-maker determined to respond to a bubble may want a looser policy than a sceptic when the bubble is large. Since it is large bubbles that we really care about, their conclusion is that we are better off not doing anything explicit about it.

Many people have attacked the view that monetary policy should react to deviations of asset prices from their fundamental values. Borio and Lowe (2002) provide a nice summary of the three arguments against using interest rates to combat the instability caused by bubbles. They are:

1. The difficulty authorities have in identifying imbalances in a timely and precise fashion.
2. The risk that policy responses will compound the problem.
3. The difficulty in justifying the action to the public.

Let's consider each one of these in turn.

The most common criticism of the activist view is that central bankers aren't going to be able to identify bubbles when financial markets can't. My previous response to this criticism is that just because something is hard to measure is no reason to ignore it. Cecchetti *et al* (2003) argue that it is surely no more difficult to measure asset-price misalignments than it is to estimate potential GDP, and that there are surely times when asset prices are obviously misaligned.

The criticism of this view is based on the efficient markets logic that markets incorporate all available information and this automatically eliminates bubbles. But there are many circumstances under which the argument fails. The dynamic stories that we tell to explain market efficiency are based on the arbitrage. And when arbitrage fails, so does market efficiency. In fact, even if everyone knows that there

8. Entrepreneurial net worth is the critical factor in determining creditworthiness in a world with asymmetric information. The primary way to reduce both adverse selection and moral hazard is to insist that the owners of firms seeking financing have a sufficient stake in their own success. This is the mechanism that is at the foundation of the lending view of monetary policy transmission first described by Bernanke and Gertler (1989).

is a bubble, there is a broad set of realistic circumstances under which arbitrageurs will not eliminate it.

In a recent paper, Stein (2003) constructs just such a model. He starts from the realistic premise that we cannot identify good from bad money managers. In order to signal that they are good and overcome the information asymmetry, a manager must allow redemptions from the fund being managed – that is, the fund has to be open-ended rather than closed-end. And an open-ended fund is exposed to withdrawal if it underperforms its benchmark. That is, investors will monitor short-run performance and take their money out of a fund that underperforms because that is evidence that the manager may be bad.[9]

To understand the importance of this line of reasoning, consider a bubble in the aggregate equity market that is certain to eventually burst. Specifically, imagine that the bubble grows at 5 per cent each quarter, and has a 5 per cent probability of bursting each quarter. The existence of the bubble is common knowledge among the well-informed fund managers, but their naïve investors aren't sure about it. Will the manager of an open-ended fund take a short position to profit from the bubble? The answer is almost surely no. With the bubble growing each quarter, a manager that is long will have a 5 per cent return every quarter until the bubble bursts. Alternatively, if the manager sells the market short, the fund will lose 5 per cent every quarter until the bubble bursts.[10] Since the fund is open-ended and investors worry about manager quality, they will withdraw their money from the fund that sells short. In equilibrium, no-one sells short, everyone goes long, and the benchmark against which performance is judged is the bubble return, and arbitrage doesn't drive prices to fundamentals even though everyone knows the bubble is there.

It is natural to ask why hedge funds can't profit from this. Hedge fund managers have significant access to leverage, few restrictions on their investment strategy, and appear to severely restrict withdrawals. While all this may be true, the fact is that the vast majority of hedge funds look for trades that converge rapidly. And performance is evaluated at least quarterly. Unfortunately, there is no survey of hedge fund withdrawal policies, but anecdotal evidence suggests that they are structured essentially as open-ended funds. Large investors can negotiate with the manager to allow for frequent withdrawals in the event of underperformance. While we don't know as much about this as we would like, casual observation suggests that the hedge funds are out there taking short positions that would have to be in place for several years before they pay off.

What about the risk that interest rate actions will destabilise the economy? The problem with this argument is that estimates of the impact of policy actions on the economy are extremely imprecise under normal circumstances. While we have rules of thumb for how much an interest rate change will affect growth and inflation after

9. Stein's model is a version of the Shleifer and Vishny's (1997) 'limits to arbitrage'.

10. Even if a manager has the fortitude to take the short position, it can be difficult to maintain. Since the market is moving against the position, the manager will have to constantly post additional margin to maintain it. And since the lender of the stock can always recall share without notice, there is always the possibility of being closed out before the bubble bursts. For a thorough discussion of the institutional details of short selling see d'Avolio (2002).

one or two years, the statistical basis for these is relatively weak. The precision with which we can estimate the impact of policy changes on central bank objectives is very poor. While this imprecision naturally brings caution, it should not lead to paralysis. An equity-price bubble should be viewed as just another shock.

Finally, there is communication. It is always difficult to explain interest rate hikes. And the normal explanation is that policy adjustments are necessary to stabilise prices and growth in medium term. That explanation will surely work here as well.[11]

Mishkin and White (2002) argue against an overly intense focus on asset prices, concluding instead that central bank policy should focus on financial stability *per se*. To the extent that asset-price bubbles materially affect the balance sheet positions of financial firms, there should be a reaction. But if balance sheets are strong, and the financial system is able to withstand being whipsawed by asset-price booms and busts, then policy-makers should simply sit by and watch. Central bankers should, however, respond to disruptions in financial markets. Mishkin and White refer to approving lender-of-last-resort operations such as the Federal Reserve's injection of over US$100 billion of reserves into the banking system after September 11, 2001.

It is difficult to disagree with the Mishkin and White view as a prescription for policy after the fact. Whenever the financial system is at risk, it is incumbent on central bankers to act. The real question is what they should do before we get to that point. And here, interest rate policy is one option. Another is to adjust regulations in order to minimise the potential for damage. I take up that issue next.

3. Regulation vs Monetary Policy Reponses

Once monetary economists realised that high and stable real growth required a stable financial system, they became interested in financial regulation. The work of the past decade or so has led to a new understanding of the interactions between the financial system and real economy, and specifically how to design a banking system that will support growth. This new view is evident in the proposed reforms to the Basel Capital Accord, Basel II.

An important concern of those designing the financial regulatory framework is that regulations themselves not exacerbate business cycle fluctuations. The potential for this arises from the way in which traditional capital requirements function. To see what can happen, consider the consequences of a broad economic slowdown. As the economy slips into recession, borrowers become less able to repay loans, and so defaults increase. Defaults mean a reduction in the value of bank assets. Unless the bank can raise additional capital, this leads immediately to shrinkage in the quantity of loans the bank is able to make. Reduced bank lending further slows economic activity, making the recession worse. Capital requirements themselves become pro-cyclical.

11. In his paper for this volume, Charles Bean discusses this issue in some detail. His conclusion is that the solution is for central bankers to change their rhetoric, moving toward statements that clearly imply longer time horizons and less stringent adherence to short-term inflation targets.

Borio, Furfine and Lowe (2001) provide a detailed description of this mechanism, and go on to suggest a set of policy options including the implementation of cyclically sensitive capital requirements. That is, raising capital requirements in booms, and reducing them in recessions. The recent episode in the US suggests that bank risk management practices may cause this to happen naturally. During the boom of the late 1990s, banks increased their capital to levels well in excess of the regulatory minimum and so have not been forced to contract in the aftermath of the bursting of the bubble.

Schwartz (2002) suggests a similar solution to the problem posed by asset-price bubbles. Again focusing on the ensuring financial system stability, she proposes that capital requirements be made sensitive to the extent to which assets whose prices have recently risen collateralise loans. In the words of Federal Reserve Board Governor Ben Bernanke (2002) 'the Fed should use monetary policy to target the economy … [and] use its regulatory, supervisory, and lender-of-last resort powers to protect and defend the financial system'. And it is the danger to the financial system that is at the core of the difficulties caused by asset-price bubbles.

In evaluating these proposals, we need to ask whether it is practical to adjust capital requirements in the manner proposed. Adopting the suggestion of Borio *et al* would mean indexing capital requirements to something like the output gap. The Schwartz recommendation means indexing the capital requirements to something like inflation in equity and housing prices. The political power of the bankers being regulated means that they would have to agree to the indexing provisions. It is difficult to see bankers and regulators agreeing on how to compute such indices or on the formula to implement the adjustments in a way that would accomplish the desired goals. At a minimum, it would politicise the computation of the output gap and asset-price index used as an input into the formula. In the end, I don't see how this can succeed.

Hardouvelis and Theodossiou (2002) and Hardouvelis (2003) argue for using a different regulatory tool to protect the system from asset-price booms and busts. Instead of tempering the actions of the lenders, they suggest going after a particular group of borrowers, those who use margin loans to purchase equity. They present evidence that increases in margin requirement during booms help to reduce both mean reversion and volatility in equity markets, helping to reduce mispricing. The suggestion is that regulators implement a margin policy that raises requirements as the market goes up, and eases them as it goes down.

There have been a number of criticisms leveled at this suggestion. First, there is the fact that margin loans account for only 1 to 2 per cent of total stock market capitalisation. Second, people have argued that sophisticated traders can always go into derivatives markets if what they want is leverage. And finally, there is the claim that the data do not support the conclusion. Hardouvelis (2003) takes on all of these criticisms. First, size really isn't everything. While margin accounts may be small, that doesn't mean they aren't important.[12] Margin trading accounts for approximately 20 per cent of total trading in US equity markets. Second, as I have

12. As Frank, the alien disguised as a dog in Men in Black said when referring to a galaxy that was being hidden in a charm on a cat's collar: 'You humans, when're you gonna learn that size doesn't matter? Just 'cause something's important, doesn't mean it's not very, very small'.

already argued there seem to be serious barriers to certain forms of arbitrage that would also make it difficult for investors to take the derivative positions that replicate leveraged long positions in the equity market. And finally, critics of the empirical claims simply conclude that margin requirements don't matter. As Hardouvelis emphasises, just because a policy instrument may be ineffective is no reason to give up on using it.

These ideas have tremendous appeal. Authorities should use regulatory tools to address stock price misalignments, leaving interest rates to pursue more traditional policy goals. Over the past decade, however, the regulators have not taken this route. I know of no country in which capital requirements have been adjusted in the manner suggested. And in the US, at least, margin requirements have been completely ignored. While technicians might be able to agree that such policies should be tried, I suspect that the political difficulties in implementing them would be insurmountable.

That does not mean that the authorities should do nothing. Another option, explored in Cecchetti and Li (2003), is for monetary policy to react to the health of bank balance sheets. That is, central banks can use interest rate policy to neutralise the procyclical effects of capital requirements by taking explicit account of the impact capital requirements have on bank balance sheets in the policy reaction function. That is, if policy-makers ease interest rates as banking system balance sheets deteriorate, they can eliminate the procyclical impact of capital requirements.

Throughout most of the period of the Internet bubble, Federal Reserve officials were remarkably silent about the stock market. Perhaps chastened by the reaction to Chairman Greenspan's December 5, 1996 statement about the financial markets 'irrational exuberance', policy-makers consistently refused to discuss equity prices in public. But as I suggested in the introduction, this does not mean that they were ignoring them. Did public silence imply private indifference? Or were officials both discussing and reacting to the asset-price bubble and its impact on the banking system? What was the FOMC saying and what were committee members doing? An empirical analysis of this question is the subject of the remainder of this paper.

4. What Was the FOMC Saying?

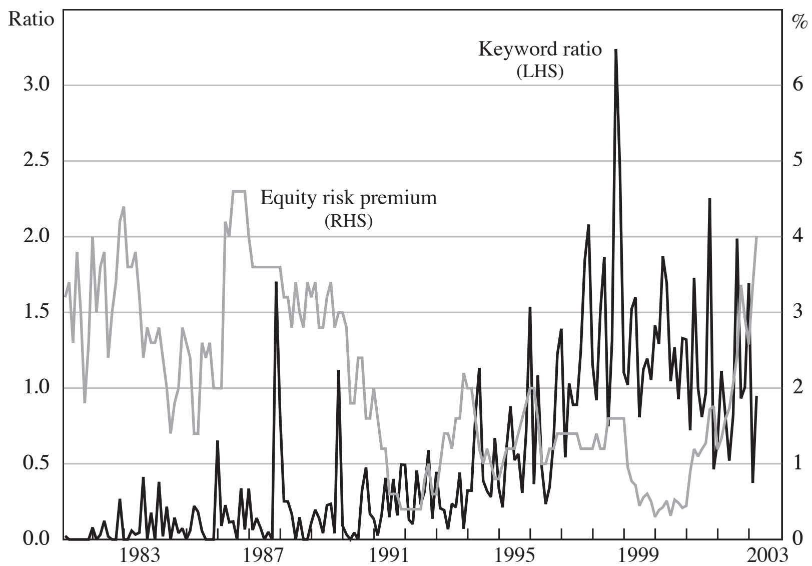
While they might publicly deny that they are paying much attention to equity markets, it is interesting to look at what FOMC members were actually talking about at their meetings. To do this, I examined FOMC minutes and transcripts beginning in 1981 looking for a set of keywords. The procedure involved simply counting the number of occurrences of a set of words, not reading statements and evaluating content. For each transcript from 1981 to 1997, and each set of minutes since then, I looked for the following words: asset, equity, equities, stock, stock market, securities, investment, financial market, index, index prices, S&P, Dow Jones, NYSE, bubble, and exuberance.[13] In order to account for things like the fact that

13. A large set of the documents is available in searchable PDF format, so the work was done completely mechanically. For the earlier transcripts, where the Federal Reserve has posted scanned bitmaps, someone with no experience in reading FOMC documents read the documents.

FOMC meets for two half days twice a year (in February and June) and one half day six times a year, I measured the occurrences as a proportion of the total number of words in each document. And to adjust for the fact that minutes are qualitatively different from transcripts, I used an overlapping year to estimate a simple regression of transcript on minute occurrences, and use the fitted values for the last five years of the sample.[14]

Were FOMC members (and staff) talking about the stock market at the same time that there was a stock market bubble? Figure 1 plots 1 000 times the ratio of keywords to total words in the transcripts (the black line), along with the equity risk premium described in more detail in Section 5 (the grey line).[15] The two series have a correlation of –0.42 (robust s.e. = 0.07).[16] As the stock market became a concern in the mid 1990s, the frequency with which it was mentioned at FOMC meetings rose dramatically. As the equity premium fell in the early 1990s, the frequency of the keywords started to rise, peaking just before the equity risk premium bottomed out. As the stock market boomed, the FOMC members increased the rate at which it was mentioning equities.

Figure 1: Keyword Ratio and Equity Risk Premium



14. For a detailed description of what goes on at an FOMC meeting see Meyer (1998).

15. The aperiodic frequency of FOMC meetings means the grey line in Figure 1 is not directly comparable to the line in Figure 2.

16. The correlation of the keyword frequency with the excess equity risk premium that is the focus of the next section is –0.23 (robust s.e. = 0.06).

5. What Was the FOMC Doing?[17]

Was this cheap talk? Or, did the equity prices place a material role in interest rate decisions? To characterise the actions of the FOMC, I adopt the now standard framework of estimating a policy reaction function, or Taylor rule. In his original work, John Taylor (1993) characterised his now famous policy rule as a description of the Federal Reserve behaviour from the mid 1980s through the early 1990s. That is, he suggested that what the FOMC actually did was to set the nominal federal funds rate target so that

$$r_t = 2 + \pi_t + \tfrac{1}{2}(\pi_t - \pi) + \tfrac{1}{2} y_t \tag{1}$$

where r is the nominal federal funds rate, π_t is current inflation, π is the inflation target (Taylor set this to 2 per cent), and y_t is the percentage deviation of actual output from a measure of potential or trend output. Clarida, Galí and Gertler (1998, 2000) have suggested estimating a forward-looking version of this interest-rate rule based on the view that policy-makers are forward-looking. That is, starting with a simple macroeconomic model, they derive a reaction function of the form

$$r_t^* = r^* + \beta_\pi [E(\pi_{t,k} \mid \Omega_t) - \pi^*] + \beta_y [E(y_{t,q} \mid \Omega_t)] \tag{2}$$

where r_t^* is the desired (equilibrium) short-term interest rate, r is the equilibrium real interest rate plus the inflation target, $\pi_{t,k}$ is inflation from t to $t+k$, $y_{t,q}$ is the average output gap from t to $t+q$, and $E(\cdot \mid \Omega_t)$ is the expectation conditional on information at t. In the experiments below, I set target inflation π equal to a Hodrick-Prescott trend of inflation in the sample, and the equilibrium real interest rate equal to a constant 2 per cent.[18] The observed interest rate adjusts smoothly to this desired level according to the partial adjustment equation

$$r_t = \rho(L) r_{t-1} + (1-\rho) r_t^* + \upsilon_t \tag{3}$$

where $\rho(L)$ is a polynomial in the lag operator L such that $\rho(1) = \rho$, and υ_t is an i.i.d. random variable that we can think of as a monetary policy control error resulting from things like unanticipated shifts in the demand for bank reserves.

Equation (3) summarises the standard view that policy-makers are responding smoothly to a combination of inflation and output gaps. The question is whether they also respond to equity-price bubbles and banking system stress. To see, we can augment Equation (2) with measures of each. That is, I study

$$r_t^* = r^* + \beta_\pi [E(\pi_{t,k} \mid \Omega_t) - \pi^*] + \beta_y [E(y_{t,q} \mid \Omega_t)] + \beta_b b_t + \beta_s s_t \tag{4}$$

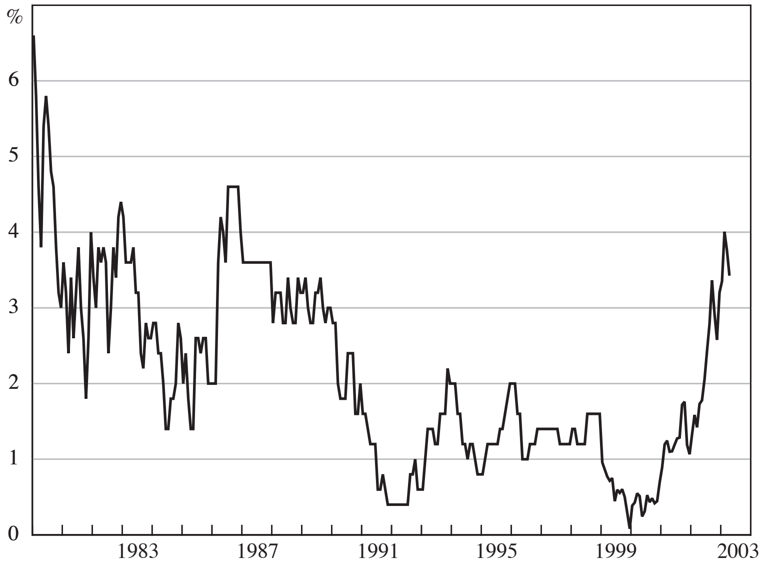
17. This section is based on work reported in detail in Cecchetti and Li (2003).

18. This assumption is almost surely not innocuous, but it is hard to know what to do about it. The fact is that the equilibrium or neutral real interest rate surely changes over time as the growth rate of the economy changes. See Warwick McKibbin's comment following this paper for a discussion of the likely importance of this issue.

where b_t is a measure of the bubble in the stock market and s_t is a measure of the stress in the banking system. The task is to estimate the reaction of interest rates to each one of these.

I start with estimates of the equity premium constructed from a simple dividend-discount (i.e. Gordon) model.[19] That is, I take the dividend yield from the Standard and Poor's 500 index, and subtract both an estimate of the dividend growth (adjusted for share repurchases) and an estimate of the risk-free interest rate taken from the US Treasury market. The results are plotted in Figure 2 (and are the basis for the grey line in Figure 1).

Figure 2: Estimated Equity Risk Premium



These estimates of the equity premium are the basis for my estimate of the size of the bubble. To allow for the possibility that the equity premium has a low-frequency trend, I estimate misalignments in equity prices as the deviation of the estimated equity premium from a 20-year lagged moving average. Figure 3 shows the path of the excess equity risk premium since 1980. A negative excess equity risk premium suggests that stocks are overvalued and so there is a bubble.

19. That is, the equity premium is estimated as the dividend yield minus the risk-free interest rates, plus the growth rate of dividends of 2.35 per cent, adjusted for stock repurchases of 0.9 per cent. From 1998 on, the real risk-free rate is the interest rate on Treasury index bonds. Prior to that, it is estimated from the Treasury bonds minus realised inflation.

Figure 3: Excess Equity Risk Premium

This figure may look surprising at first glance, as the bubble of the late 1990s is not very prominent – certainly not as prominent as it is in the raw equity premium data. The explanation for this is in the mechanics of the way in which the excess equity risk premium is computed. Using a backward-looking moving average means that as the equity premium slowly falls, the excess is small. Looking back at Figure 2, you will notice that the estimates of the equity risk premium fall dramatically at the beginning of the 1990s, and stay at this lower level until the beginning of the current decade. This explains the pattern.

To account for banking system stress, I include a measure of the banking system leverage ratio. That is, the ratio of total assets to total capital, both taken from the call reports. Figure 4 plots these data. There has been a clear downward trend in the data that can be ascribed to changes in prudential regulator standards during the 1980s. In addition, notice the tendency for the leverage ratio to rise slightly during the late 1990s.

To estimate the model, start by substituting the augmented Taylor rule (4) into the partial adjustment formula Equation (2), assuming three lags in $\rho(L)$. The resulting expression is estimated using Generalised Method of Moments (GMM) using quarterly data from 1990 to 2003.[20] The results, together with robust standard errors that take account of the fact that the data are overlapping, are reported in Table 1.

20. The information set in the estimation used three lags of the federal funds rate, the inflation index in the policy rule, the output gap, producer price inflation, growth in M2, the spread between the 10-year Treasury bond yield and the yield on 3-month Treasury bills, the excess equity risk premium, and the leverage ratio.

Figure 4: Leverage Ratio in the US Banking System

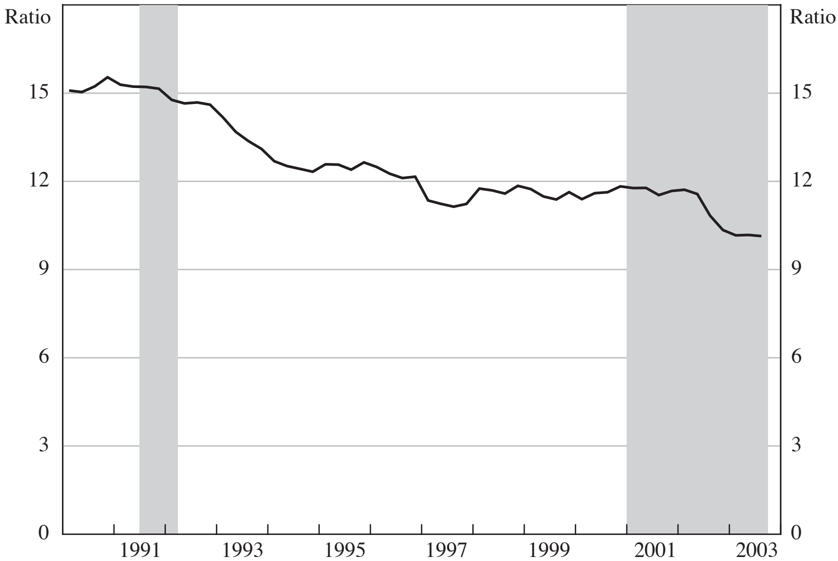


Table 1: Augmented Taylor Rule for the US

1990:Q1 to 2003:Q1

Policy rule	Inflation gap β_π	Output gap β_y	Equity market bubble	Banking system stress	Sum of adjustment lags ρ	Test of over-identifying restrictions	Goodness of fit (R^2)
Consumer price index							
	0.34	**0.57**			**0.23**	0.51	0.80
	(0.30)	(0.00)			(0.00)		
	0.20	**0.57**	0.09		**0.25**	0.80	0.81
	(0.24)	(0.00)	(0.47)		(0.00)		
	0.46	**0.41**		**–0.17**	**0.41**	0.94	0.86
	(0.03)	(0.00)		(0.02)	(0.00)		
	0.67	**0.50**	**–0.65**	**–0.23**	**0.40**	0.88	0.88
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
PCE chain-type price index							
	–0.42	**0.70**			**0.29**	0.61	0.84
	(0.29)	(0.00)			(0.00)		
	–0.18	**0.68**	0.06		**0.30**	0.87	0.85
	(0.51)	(0.00)	(0.64)		(0.00)		
	–0.20	**0.62**		**–0.12**	**0.40**	0.96	0.87
	(0.21)	(0.00)		(0.00)	(0.00)		
	0.27	**0.63**	**–0.53**	**–0.16**	**0.40**	0.91	0.88
	(0.30)	(0.00)	(0.00)	(0.00)	(0.00)		

Notes: GMM estimates of Equation (4) substituted into Equation (2). Numbers in parentheses are *p*-values for the test that the coefficient estimate is equal to zero. When *p*-values are 5 per cent or lower, the coefficient is printed in bold face. Sourced from data appendix in Cechetti and Li (2003).

A full set of results is presented for two measures of inflation: the consumer price index and the chain-type price index for personal consumption expenditure.[21] The two sets of results give the same overall picture, and so I will focus my discussion on the top panel, the one reporting results using the conventional CPI. The first row reports results for a traditional Taylor rule. The rule-of-thumb is that for the model to be well-behaved, the coefficient on inflation has to be positive (recall Taylor's original rule-of-thumb was to set β_π equal to one-half). Using the CPI, the coefficient on the inflation gap is one-third, although it is imprecise, while the estimate of the coefficient on the output gap is very nearly one-half.

Turning to the final line of each panel, we see that the data support adding measures of an equity bubble and banking system stress to the policy rule. Remember that a bubble is measured as a negative excess equity risk premium. If policy-makers increased interest rates in the face of a bubble, this would show up as a negative coefficient in the reaction function. That's exactly what's in Table 1. A 1 percentage point reduction in the equity premium leads to a two-thirds of a percentage point increase in the interest rate, all other things equal.

While it is possible that the excess equity premium measure is showing up because of its correlation to something else that is omitted from the policy reaction function, it is difficult to see what that might be. It is, however, likely that the FOMC is not reacting directly to the bubble. The most plausible explanation for these findings is that policy-makers are reacting to the extent that assumed asset-price fluctuations create variation in forecasts of consumption, through their impact on wealth, and investment, due to changes in the ease with which firms can obtain financing.

The reaction to financial system stress is also as we would expect. An increase in the leverage ratio is a sign that bank balance sheets are coming under pressure. All other things equal, this is met with a decline in the interest rate. The estimates suggest that a 1 percentage point increase in banking system leverage leads to a 25 basis point cut in the federal funds rate. Taken together, we can adjust Taylor's original rule- of-thumb to include the excess equity risk premium (b_t) and the banking system leverage ratio (s_t):

$$r_t = \pi_t + {}^1\!/\!_2(\pi_t - \pi) + {}^1\!/\!_2 y_t + {}^2\!/\!_3 b_t + {}^1\!/\!_4 s_t \qquad (5)$$

This is very similar to the rule-of-thumb studied in Chapter 4 of Cecchetti *et al* (2000). While we were proposing it, they were doing it – and had been for years!

To understand the consequences of this change, we can look at the pattern of interest rates over the 1990 to 2003 period. Figures 5 and 6 plot the effective federal funds rate against the fitted values from the simple forward-looking Taylor rule (the first line in Table 1) and the augmented Taylor rule (the fourth line of Table 1). The differences in the two figures are subtle. The augmented model does better in the

21. As students of American monetary policy know, the FOMC, and Chairman Greenspan in particular, follow the PCE chain-type index closely. As a chained index, the PCE does not suffer some of the well-known biases that plague fixed-weight price indices like the CPI.

Figure 5: Actual Federal Funds Rate and Fitted Value from Original Forward-looking Taylor Rule

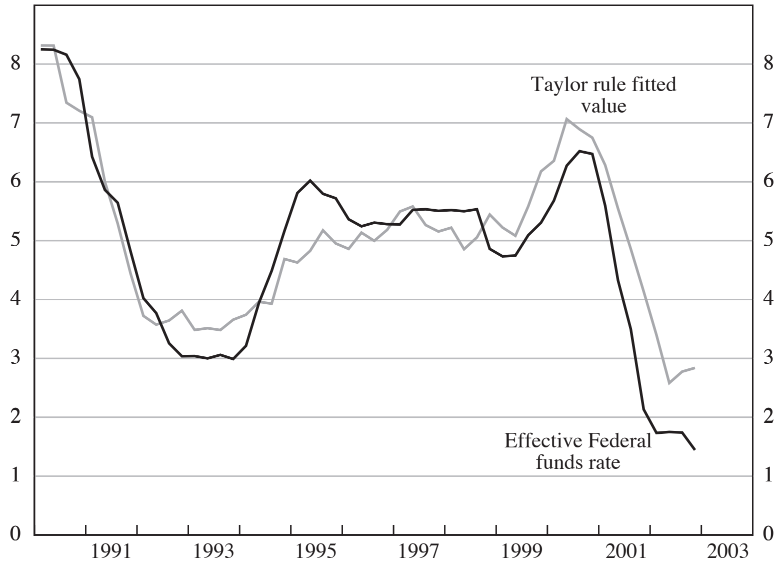
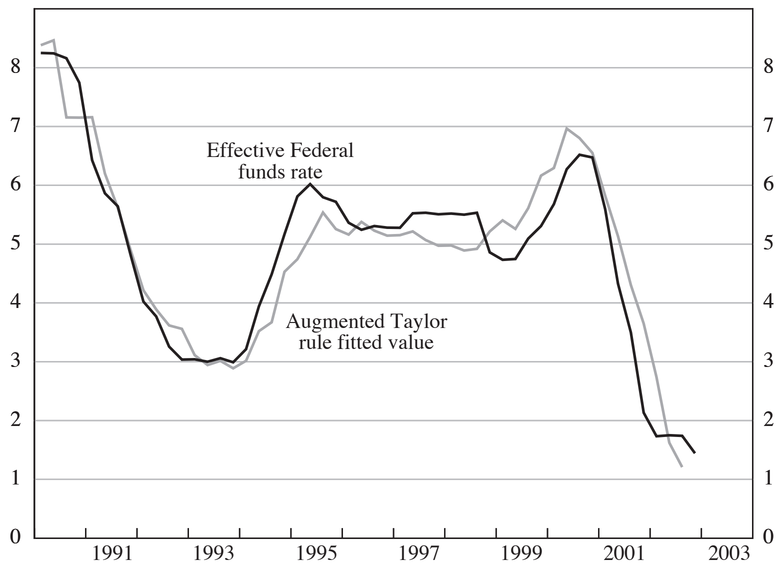


Figure 6: Actual Federal Funds Rate and Fitted Value from Augmented Forward-looking Taylor Rule



first half of the sample by taking account of financial system stress, and in the latter half by including the excess equity premium.

These results are not robust to replacing the *excess* equity risk premium with the equity risk premium itself. The analog to the fourth line in Table 1, the model based on the CPI, results in a coefficient estimate on the equity risk premium of –0.10 with a standard error of 0.15. That is, an estimated effect that is both smaller in absolute value and much less precise. Taken together with the results in Table 1, this suggests that the FOMC is in fact reacting to something like a bubble.

Cecchetti and Li (2003) report results similar to those in Table 1 from both Germany and Japan. These are reproduced in Table 2. The German augmented Taylor rule, estimated over the period from 1979 to 1993, suggests that the Bundesbank set interest rates taking account of the domestic German stock market and leverage in the banking system. While Japan appears to have reacted aggressively to the equity market bubble, the response to changes in the banking system leverage ratio has the wrong sign. All other things equal, increased leverage in the Japanese banking system was associated with an increase in interest rates.

Table 2: Comparing the US, Germany and Japan
Augmented Taylor rules

	Inflation gap	Output gap	Equity market bubble	Banking system stress	Sum of adjustment lags, ρ	Goodness of fit (R^2)
US	**0.67**	**0.50**	**–0.65**	**–0.23**	**0.40**	0.88
1990–2003	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Germany	**1.23**	**0.31**	**–0.39**	**–0.58**	**0.95**	0.98
1979–1993	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Japan	**1.99**	**0.36**	**–1.46**	**0.11**	**0.97**	0.99
1979–2001	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Notes: GMM estimates of Equation (4) substituted into Equation (2). Numbers in parentheses are *p*-values for the test that the coefficient estimate is equal to zero. When *p*-values are 5 per cent or lower, the coefficient is printed in bold face.

Source: Cecchetti and Li (2003)

6. Conclusion

In August 2002, citing evidence that stock prices rose following the series of federal funds rate increases ending in February 1989, February 1999 and May 2000, Chairman Alan Greenspan concluded:

> It seems reasonable to generalize from our recent experience that no low-risk, low-cost, incremental monetary tightening exists that can reliably deflate bubble. But is there some policy that can at least limit the size of the bubble and, hence, its destructive fallout? From the evidence to date, the answer appears to be no. (Greenspan 2002, p 5)

The immediate reaction to this was very harsh. How, given the problems in the intervening years, could he defend the FOMC's failure to respond to the Internet bubble as it was happening? In light of the evidence presented here there is a second interpretation that might be more apt. That is, the Chairman is saying that they tried and failed. Doing any more, in his view, would have been catastrophic.

The case for this more flattering view starts with the observation that during the period of the bubble, the Board staff forecasts used by the FOMC were based on an assumed decline in the stock market. And the Board staff works for the Chairman, so he clearly knew about this. Add to this the fact that FOMC members increased the intensity with which they discussed the stock market as it rose, and the evidence that the federal funds rate reacts to measures of asset-price misalignments, and we come to the conclusion that policy-makers were doing what they could. Aware of the possibility that equity prices very well might collapse, and understanding the disruptive consequences of a stock market bust, the FOMC took out small amounts of bubble insurance. Greenspan argues that it would have been risky to do more. Is he right? That is where the debate should shift now.

References

Bernanke BS (2002), 'Asset-price "bubbles" and monetary policy', remarks before the New York Chapter of the National Association of Business Economics, New York, 15 October. Available at <http://www.federalreserve.gov/boarddocs/speeches/2002/20021015/default.htm>.

Bernanke BS and M Gertler (1989), 'Agency costs, net worth, and business fluctuations', *American Economic Review*, 79(1), pp 14–31.

Bernanke BS and M Gertler (2000), 'Monetary policy and asset price volatility', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, Kansas City, pp 77–128.

Bernanke BS and M Gertler (2001), 'Should central banks respond to movements in asset prices?', *American Economic Review*, 91(2), pp 253–257.

Borio C, C Furfine and P Lowe (2001), 'Procyclicality of the financial system and financial stability: issues and policy options', in *Marrying the macro- and micro-prudential dimensions of financial stability*, BIS Papers No 1, Basel, Switzerland, pp 1–57.

Borio C and P Lowe (2002), 'Asset prices, financial and monetary stability: exploring the nexus', BIS Working Paper No 114.

Bryan MF, SG Cecchetti and R O'Sullivan (2001), 'Asset prices in the measurement of inflation', *De Economist*, 149(4), pp 405–431.

Bryan MF, SG Cecchetti and R O'Sullivan (2002), 'A stochastic cost-of-life index', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*', MIT Press, Cambridge, Mass, pp 277–290.

Cecchetti SG (1998), 'Understanding the great depression: lessons for current policy', in M Wheeler (ed), *The economics of the Great Depression*, WE Upjohn Institution for Employment Research, Michigan, pp 171–194.

Cecchetti SG, H Genberg, J Lipsky and S Wadhwani (2000), *Asset prices and central bank policy*, Geneva Reports on the World Economy No 2, International Center for Monetary and Banking Studies and Centre for Economic Policy Research, Geneva.

Cecchetti SG, H Genberg and S Wadhwani (2003), 'Asset prices in a flexible inflation targeting framework', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*', MIT Press, Cambridge, Mass, pp 427–444.

Cecchetti SG and L Li (2003), 'Do capital adequacy requirements matter for monetary policy?', Ohio State University, unpublished manuscript.

Clarida R, J Galí and M Gertler (1998), 'Monetary policy rules in practice: some international evidence', *European Economic Review*, 42(6), pp 1033–1067.

Clarida R, J Galí and M Gertler (2000), 'Monetary policy rules and macroeconomic stability: evidence and some theory', *Quarterly Journal of Economics*, 115(1), pp 147–180.

d'Avolio G (2002), 'The market for borrowing stock', *Journal of Financial Economics*, 66(2/3), pp 271–306.

Dupor B (2002), 'Nominal price versus asset price stabilization', The Wharton School, University of Pennsylvania, unpublished manuscript.

Gilchrist S and JV Leahy (2002), 'Monetary policy and asset prices', *Journal of Monetary Economics*, 49(1), pp 75–97.

Greenspan A (2002), 'Economic volatility', remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–30 August.

Hardouvelis GA (2003), 'Asset prices and the need for new policy instruments: the case of countercyclical margin policy', paper presented for the International Symposium of the Banque de France, Paris, 7 March.

Hardouvelis GA and P Theodossiou (2002), 'The asymmetric relations between initial margin requirements and stock market volatility across bull and bear markets', *Review of Financial Studies*, 15(5), pp 1525–1559.

IMF (International Monetary Fund) (2003), *World economic outlook*, Washington DC.

Meyer LH (1998), 'Come with me to the FOMC', remarks at The Gillis Lecture, Willamette College, Oregon, 2 April.

Mishkin FS and EN White (2002), 'U.S. stock market crashes and their aftermath: implications for monetary policy', NBER Working Paper No 8992.

Schwartz AJ (2002), 'Asset price inflation and monetary policy', NBER Working Paper No 9321.

Shleifer A and RW Vishny (1997), 'The limits to arbitrage', *Journal of Finance*, 52(1), pp 35–55.

Stein JC (2003), 'Why are most funds open-end? Competition and the limits to arbitrage', Harvard University, unpublished manuscript.

Taylor J (1993), 'Discretion versus policy rules in practice', *Carnegie-Rochester Conference Series on Public Policy*, 39, pp 195–214.

Discussion

1. Philip Lowe

It is a privilege for me to be able to comment on these papers by two of the main contributors to the debate on asset prices and monetary policy. Both Steve and Charlie have been able to combine their academic rigour with their high-level policy experience to produce the type of thought-provoking papers that we have heard this morning.

By and large I agree with the ideas that they put forward. In my comments this morning, therefore, I would like to touch on four very practical issues that the papers address. These are:

- the difficulty of identifying bubbles or imbalances;
- the appropriate forecast horizon;
- the political economy of responding to potential imbalances; and
- the use of prudential policy.

If there is a central theme to my comments, it is that good monetary policy needs to be not only concerned with central forecasts, but also with the risks around those forecasts. And inevitably this means that, occasionally, monetary policy may need to respond to risks being built up in private-sector balance sheets, even if those risks pose no threat to the *immediate* outlook for inflation or economic activity.

Identification

As Steve alluded to, the debate on asset prices and monetary policy can quickly become polarised by those who argue that central banks cannot judge fundamental asset values any better than the market. In my view, polarisation on this point is unfortunate, because I don't really see it as the main issue. Instead the focus should be on the ability of central banks to assess whether developments in credit and asset markets are materially increasing macroeconomic and financial system risk. In my opinion such assessments, while difficult, are not impossible. Knowing the answer to the bubble question would obviously be helpful, but it is not essential. It seems perfectly reasonable to argue that one is agnostic as to whether asset prices have become overvalued after an extended period of credit and asset-price increases, and at the same time, argue that the level of risk in the system has increased. History provides us with too many examples in which credit and asset-price booms, often accompanied by high levels of investment, have ended in severe economic contractions. While clearly not all booms end in this way, the record of the past century or so strongly suggests that these developments can materially increase the risk of something going wrong.

And ultimately, good monetary policy involves good risk management. Another way of saying this is that a given set of forecasts for inflation and output are, by themselves, not enough to determine the level of the policy interest rate. Central banks need to be thinking about the risks around those forecasts, and whether changes in monetary policy are likely to increase or decrease those risks. This does not mean that central banks should target asset prices. It does not mean that they should target credit growth. It does not mean that they should set out to burst 'bubbles'. It does mean, however, that they need to be asking themselves whether developments in credit and asset markets are leading to greater macroeconomic risk, and whether monetary policy can lessen those risks in a welfare-improving way. As I have said, I think we do know something about the determinants of risk and, in some circumstances, monetary policy may well be able to alter those risks in a way that passes the cost-benefit test.

Forecast horizon

The second issue is the appropriate forecast horizon. Sometimes I hear the argument that if central banks are so worried about medium-term risks arising from credit and asset-price booms then they should simply increase their forecast horizons. So instead of setting the interest rate so that the inflation forecast at a two-year horizon is equal to the target, they should set it so that the inflation forecast is at the target at a three- or four-year horizon.

As Charlie argues, using longer horizons in policy assessments makes sense. However, just extending the horizon over which one prepares and publishes central forecasts is of relatively little benefit. The problem is twofold. The first is that beyond two years, forecasts invariably revert to trend. I know from my own experience once you go out this far it is very hard to fight the feeling that 'the trend is your friend'. Second, the type of risks that we are talking about can't easily be incorporated into central forecasts. While we might feel reasonably comfortable with an assessment that macroeconomic risk has increased, we are inevitably much less comfortable in assessments about timing. Given this, the types of events we are talking about are difficult to factor into central forecasts, and we tend not to do it.

In practical terms, then, where I think this leaves us is not so much extending the forecast horizons for our central forecasts, but extending our risk assessment horizons. Perhaps in discussion we might be able to turn to how this could be done in practice.

Political economy

The third issue is the political economy of responding to risks arising from developments in credit and asset markets.

As Steve notes in his paper, the most cited argument against responding to developments in credit and asset markets is the identification issue. Given what I have just said, I do not see this as the biggest problem. Rather, it is the political economy that is the obstacle; or in other words, the difficulty that the central bank faces in explaining its actions to the public. While it is undeniable that there are serious communication issues here, I think some central banks have probably made it more difficult for themselves by virtue of the way that they have communicated with the public over recent years.

Too often, inflation-targeting central banks have implied that inflation targeting is about setting the policy interest rate so that the inflation forecast is at the target at the policy horizon, say around two years. Once you have told people that this is what you should be doing, it is very hard to do anything else. And doubly so, if the main form of public communication is an 'inflation report' whose main job is to establish the credibility of the forecast.

Now there may have been a time when convincing the public that this was what inflation targeting was about was useful, particularly when central banks did not have a lot of credibility. But it is probably now time to move on. And part of this process of moving on is communicating a slightly different message, or as Charlie says, changing the rhetoric.

In his paper Charlie did not say exactly what the rhetoric should be, so I thought it might be useful to spell out four possible elements of the message. The first is that inflation targeting is about medium-term inflation control, not about keeping the annual rate of inflation always within a very tight band. The second is that monetary policy needs to take account of medium-term risks to price stability, and this means that interest rates do not always need to be set so that the inflation forecast is at the target at a fixed horizon. The third is that medium-term risks to price stability are most likely to find their roots in developments in credit and asset markets, and consequently central banks may need to respond to these developments even if they pose no immediate threat to inflation. And the fourth is that the case for a monetary policy response need not rest on an increased risk of financial instability, but rather on a general threat to macro stability. As we are seeing in the United States now, the macroeconomic fallout from an asset-price boom can be significant even if financial institutions do not get themselves into difficulties.

As Charlie notes, such rhetoric is not inconsistent with inflation targeting. While the message is a little more sophisticated than that sometimes delivered by central banks, the way that central banks communicate is beginning to change. The papers that we have heard this morning are part of this process, for I doubt that the Bank of England would have expressed such ideas five years ago. One place that the rhetoric does not seem to have changed much is the US, although interestingly Steve's paper says actions have changed. I found this result a little surprising and perhaps Steve could elaborate on how robust his findings are to ways of calculating the excess risk premium. More generally, in discussion it might be useful to address the issue of how central banks should communicate with the public.

Regulatory responses

The final issue is the possibility of using regulatory instruments to address an increase in financial system and macroeconomic risk. The logic of the idea seems impeccable: if risk is increasing, then capital buffers in the banking system should rightly be higher, and lending criteria should rightly be tightened. And if the private sector is not delivering these outcomes because of problems in measuring the cyclical dimension of risk, or because of incentive problems, then the public sector – through the regulatory authorities – should arguably require institutions to make these adjustments.

While the logic is straightforward, the practice is not. Many regulatory authorities run a mile when you start talking along these lines. They simply don't see it as their role to second-guess financial institutions about how risk is moving over the course of the business cycle. Nor do they want to be making discretionary adjustments in prudential requirements for macroeconomic reasons. Given the current intellectual approach that underpins bank regulation this reluctance is understandable, although increasingly it will come under the spotlight with the implementation of Basel II, given the way that both internal and external ratings move over the course of the business cycle.

An alternative to discretionary adjustments in prudential requirements is adjustments based on some form of rule. While Steve notes that there are formidable obstacles to such an approach, one idea that I think is worth further consideration is to apply the concept of 'statistical provisioning', as used in Spain, to bank capital, rather than provisions. Under such a system if a bank's actual losses turn out to be less than its expected losses, the 'unexpected profit' would be added to the bank's regulatory capital requirement, up to some limit. The result would be a build-up of bank capital in good times which would then be available in bad times. Such a system could easily sit along Basel II and I think it is preferable to statistical provisioning, as it does not run foul of accountancy and transparency concerns.

While this idea is worthy of further study, it suffers from two major difficulties. The first is that if institutions perceive capital requirements to be 'too high' they will simply securitise the lending. The second is that some imbalances might pose a threat to the macroeconomy, but only a small threat to the health of financial institutions. In such cases, the logic for using prudential instruments is considerably weakened. These difficulties mean that at the end of the day we may be left with monetary policy having to shoulder most of the burden, although perhaps over the next day we might hear some other ideas.

2. Warwick McKibbin

The papers by Bean and Cecchetti (this volume) are together an excellent overview of the existing theoretical debate on monetary policy and asset prices. In these comments I aim to summarise the key messages from the papers, raise some issues regarding each paper and then present some results from a more complete model of the economy that raises issues not addressed in the simpler models that underlie the papers. The main issue that the theoretical literature and the papers need to focus more on is the different impacts of asset-price fluctuations for aggregate supply versus aggregate demand and the importance of this distinction for monetary policy settings in practice and the specification of simple monetary policy rules in theory.

There are two broad questions asked in these papers. The first question covered by both papers is 'Should monetary policy respond to asset price movements?' The second question, taken up by Cecchetti is 'Has the Fed responded to asset prices in practice?' Surprisingly, given the academic debate to date and the apparent position of the two authors in that debate, there is now almost consensus reached in these papers. Bean argues that there is no need for additional responses by policy-makers to changes in asset prices because the changes in asset prices would already be incorporated in sensible forward-looking policy rules. Cecchetti argues that there should be an asset-price term in a modified Taylor rule[1], but that is because the rule is not as forward-looking as Bean proposes. In reality both papers make the same point that asset prices matter for monetary policy to the extent that they affect future inflation and output. In the empirical part of his paper, Cecchetti finds that the Fed has responded to asset prices (defined as a significant term on asset prices in a Taylor rule), although I have some questions about the empirical approach later in this comment.

There is a point in the Bean paper where it might appear ambiguous to the reader that asset prices matter at all, in the comment that the first order condition (Equation (6)) has no asset prices appearing. It is true that the asset prices do not appear in this condition, but once the inflation and demand terms are substituted out to derive the policy rule for interest rates, asset prices will appear in the fully optimal rule to the extent that they affect aggregate demand. As Bean stresses they are completely offset in this simple class of models and therefore have no additional influence on policy.

A key element of most of the literature on policy rules and asset prices is the focus on asset prices and aggregate demand. Yet I believe that the most important issues are not the impact of asset prices on aggregate demand but the impact of asset prices on aggregate supply. If asset prices only affect aggregate demand then it is clear that monetary policy clearly should respond to the change in asset prices so as to neutralise the demand effects – indeed Bean focuses on this point about demand management in his paper. Yet the main problems for policy are when the asset prices also feed into aggregate supply. An illustration as to why this is likely to be the main problem in set out in the following section. Charlie Bean begins to raise this issue in his Appendix but the issues are far more wide-ranging than a simple model can adequately deal with.

Before proceeding, it is important to identify what is meant by a 'bubble' or a 'misalignment' of asset prices. For example suppose there is a shift out of US equities into other assets because of an increase in the equity risk premium (i.e. the excess return required to hold equities relative to government bonds).[2] Is the rise in price of other assets such as housing and bonds as people sell equities and buy

1. This is one of a more general class of rules in Bryant, Hooper and Mann (1993).

2. Some might interpret this as a bursting bubble.

these other assets a misalignment? Or are the sharp observed price movements due to fundamentals which might have a long dynamic profile in which it takes time for the supply of these assets to respond.[3] To identify a misalignment in asset prices, it is important to identify the underlying fundamental valuations, and then identify movements in asset prices in excess of fundamentals as a possible misalignment. It is also important to stress that the fundamental components of the price changes in assets are not just related to earnings but also can include some capital gains or losses. Since in the example of a rise in the equity risk premium, if there is a non-responsive (or inelastic) supply of assets, then some of the fundamental adjustment will be in terms of capital gains to holders of existing assets. This also needs to be taken into account in calculating the short-run value of an asset. To illustrate how long some of the adjustment lags might be, consider the example from a recent paper.

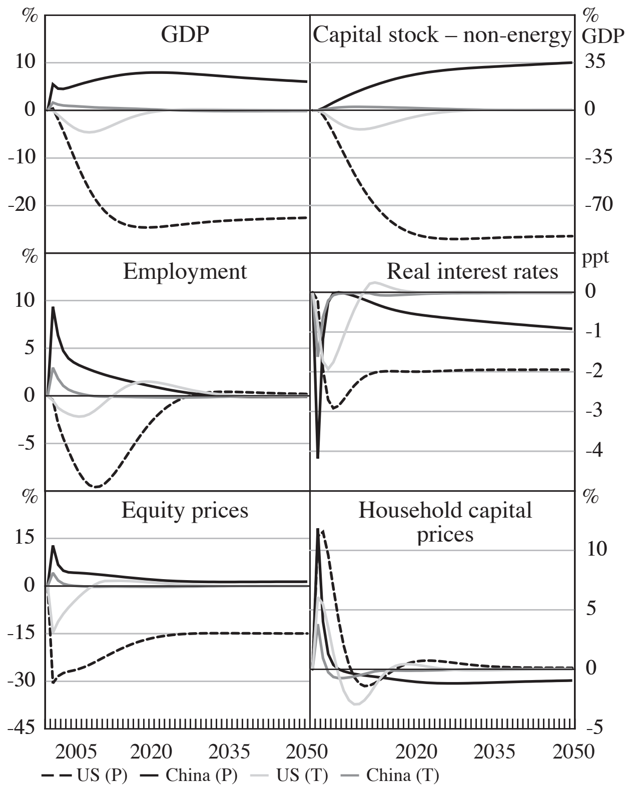
In McKibbin and Vines (2003) we used the G-cubed model[4] to simulate a 5 per cent rise in the equity risk premium in the US as well as across the OECD economies – under alternative assumptions about whether this was a permanent increase or a temporary increase in equity risk. The G-cubed model has the same basic foundations as the model in Bean (this volume) but it has a more extensive treatment of assets and asset markets. It is a new Keynesian model with substantial sectoral disaggregation and country coverage. There is explicit treatment of financial assets (bonds, equity, housing, foreign debt) with stickiness in physical capital differentiated from flexibility of financial capital. As well there is short-run deviation from optimising behaviour due to stickiness in labour markets and some myopia in the behaviour of firms and households. This creates a short-run 'New Keynesian' model with a Neoclassical steady state. The presence of various types of sticky behaviour is important because of the co-existence with flexible asset prices.[5]

We explore what happens if the US equity risk premium rises from 0 to 5 per cent permanently in 2001 versus a temporary change, defined as a jump to 5 per cent and then 4.5 per cent above base etc until it is back to baseline by year 2010. Some of the results are shown in Figures 1 and 2. All results are presented as the deviation from a baseline projection of the model, as a result of the change in the equity risk premium. Figure 1 focuses on results for the United States (experiencing the shock) and China (not directly experiencing the shock) for the permanent versus temporary OECD-wide equity shock. Figure 2 contains the results of the optimal policy response (similar to the approach in Bean) when there are three types of central bankers in the United States. The first is the 'base' which has the Fed following a simple nominal income-targeting rule. The second labeled 'inf' is a pure inflation targeter. The third is 'infemp' where the policy-maker calculates a time-consistent policy rule that trades off targets for inflation with unemployment with double the weight on inflation relative to the log of employment.

3. The elasticity of supply is critical. Housing has a slow supply response thus we would expect housing prices to move more sharply than other assets with high supply elasticities.
4. See McKibbin and Wilcoxen (1999) for the analytical basis of the model.
5. See McKibbin and Vines (2000) for discussion on the importance of stickiness in intertemporal models.

Figure 1: Permanent versus Temporary OECD-wide Equity Risk Premium Shocks

Deviation from baseline

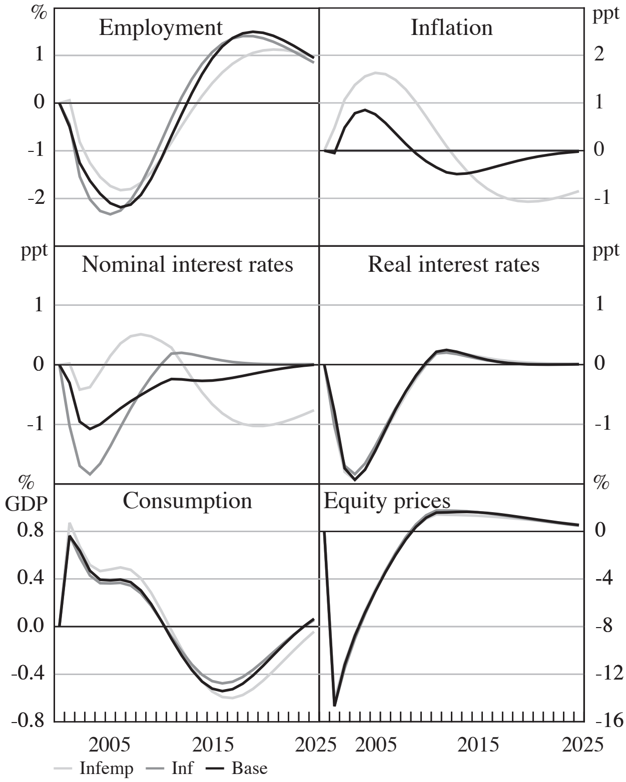


Source: MSG3 model version O50

Figure 1 illustrates that a 5 per cent rise in the equity risk premium permanently reduces US GDP by around 23 per cent relative to base by 2030. This is an enormous effect and demonstrates how important asset market valuation might be for economic activity. With a higher equity risk premium, the return on capital must rise relative to bonds and therefore the desired capital stock must fall by a substantial amount. Over the period from 2001 to 2015, the growth rate of the US economy is approximately 1 per cent per year lower than baseline (which was roughly 3.5 per cent per year). The US economy eventually returns to the long-run growth rate driven by population and productivity growth in the baseline but the level of GDP is permanently lower relative to base. This lower economic growth for a sustained period of time is due to a significant fall in investment which leads to the running-down of the capital stock as the US economy shifts from the initial growth path equilibrium to a new equilibrium with a substantially lower desired capital stock. The higher rate of return on capital is achieved by reducing the capital-labour ratio. By contrast, China receives some of the capital that is pulled out of US equities and experiences stronger

Figure 2: Optimal Policy Response in US to Temporary OECD-wide Equity Risk Premium Shocks

Deviation from baseline; inflation/employment versus inflation targeting



Source: MSG3 model version O50

growth for a decade. More details on the international transmission can be found in McKibbin and Vines (2003).

In the case of the temporary shock to the equity risk premium, this effect disappears, however there is still a long adjustment period.

An important aspect of Figure 1 is that the prices of other assets such as housing jump sharply as households sell equity and buy other assets in the United States and globally. Over time the supply of housing capital responds and prices begin to move back to base, but it takes a decade before the permanent shock has dissipated in the housing market. Another important result in Figure 1 is that the real interest rate (globally) is permanently lower as a result of the shock. This might seem surprising in a model with intertemporally optimising consumers. Usually, theory suggests that the real rate of interest is tied directly to the rate of time preference. However, because we have a full vector of assets in this model, the condition from the consumer's Euler equation that holds is that the average return on wealth is equal to the rate of time preference. Since wealth is held in equities, which are now assumed to have a higher rate of return than government bonds, the only way that the equilibrium condition can hold is that the return of bonds must be lower. In this case the average return across the portfolio is equal to the rate of time preference with the real return of equities permanently higher and the real return on bonds permanently lower.

The results in Figure 1 have important implications for the Taylor-type rule[6] in Cecchetti as well as in the existing literature on policy rules. In the face of an equity risk shock (or any change in asset preferences), both the level of potential output as well as the equilibrium real interest rate need to be re-calculated otherwise the simple rule will impart an inflation bias into the economy. The critical issue is how likely is it, that asset-price misalignments (or other shocks) will enter the supply side of an economy. The results of simulations from this large-scale general equilibrium model suggest that it is highly likely once a fully specified rather than a simplified economic model is considered. Indeed surely the historical experience of asset-price misalignments demonstrates that the losses from supply collapses are more harmful than the aggregate demand effects when asset prices change dramatically.

In Figure 2, the optimal response of monetary policy to the shift in asset prices is calculated under different assumptions about the preferences of policy-makers, or the rules being followed. This figure illustrates that the real adjustments such as in consumption and employment are dominated by the underlying shock. The monetary policy change, although important, only has a relatively small impact relative to the scale of the shock. Note that equity prices are almost unchanged when conditioned on the monetary response. The outcomes for inflation and nominal interest rates are very different. The assumption of complete credibility of each type of policy-maker causes the nominal interest rate to be lower under the inflation-targeting regime because the inflation premium in interest rates is lower. Employment is importantly affected by monetary policy but around the much larger real cycle generated by the shock.

The results from this model illustrate that aggregate supply is expected to be affected by changes in equity risk premia, or changes in the pricing of assets. The first point is that the role of monetary policy in this case is to manage changes in demand around changes in aggregate supply, which is very different to much of the theoretical literature (including the two papers) that treats asset price changes as primarily issues of demand management. Secondly, in the simple Taylor-type rule in both papers, the problem to grapple with is how to evaluate the change in potential output in the rule but also how to evaluate the changes in the equilibrium real interest rate in the rule. Almost all empirical implementations of the Taylor-type rules assume the equilibrium real rate of interest is constant. This is clearly incorrect for the type of shocks evaluated in this paper.

There is still a large amount of research required in order to understand the consequences of asset-price misalignments for real activity and for policy in general.

6. This is one of a more general class of rules in Bryant *et al* (1993).

The two papers in this volume are useful contributions to our understanding of these issues and a good place from which to start.

References

Bryant R, P Hooper and C Mann (eds) (1993), *Evaluating policy regimes: new research in empirical macroeconomics*, Brookings Institution, Washington DC.

McKibbin WJ and D Vines (2000), 'Modelling reality: the need for both inter-temporal optimization and stickiness in models for policy-making', *Oxford Review of Economic Policy*, 16(4), pp 106–137.

McKibbin WJ and D Vines (2003), 'Changes in equity risk perceptions: global consequences and policy responses', ANU Working Papers in Trade and Development No 2003/15. Available at <http://rspas.anu.edu.au/economics/publish/papers/wp2003/wp-econ-2003-15.pdf>.

McKibbin WJ and P Wilcoxen (1999), 'The theoretical and empirical structure of the G-cubed model', *Economic Modelling*, 16(1), pp 123–148.

3. General Discussion

There was some discussion about the practice of central banks warning the public about possible asset-price misalignments. This discussion was in part framed in the context of the US Federal Reserve's early warnings about the possible existence of 'irrational exuberance' within share market participants, and the perception that its subsequent views on the acceleration in US productivity growth appeared to endorse higher valuations for equities. Several conference participants argued that central bank commentary on the possibility of misalignments in asset prices was a strategy with little discernable downside risk, and so should at least be attempted. It was also suggested that such a strategy allowed a targeted response to a particular sector of the economy affected by the asset-price misalignment. Related to this, one participant thought that it may be difficult to communicate a focused policy response in an inflation-targeting framework as in their view most of the communication associated with inflation targeting pertains to the aggregate economy.

There was some disagreement with Cecchetti's view that estimating the fundamental value of an asset was no less difficult than estimating potential output. It was raised that asset prices tend to fluctuate considerably more than the real economy, which may make discerning long-term trends more difficult. In addition, a number of participants wondered if Cecchetti's empirical results would be robust to alternative specifications. One participant suggested that real-time forecasts could have been used in the augmented Taylor rule to better reflect the information set the US Federal Reserve had at the time of making its decision. Cecchetti responded that doing so would have meant the loss of the last five years of the sample, and that it was not always clear from the US Federal Reserve's Green Books what the official forecasts were. Other participants raised issues about the construction of the equity premium measure used as a proxy for equity-price misalignment, and about the assumption of a constant neutral real rate in the Taylor rule.

Several of the participants commented on the simulations presented in McKibbin's comments. They noted the magnitude and prolonged nature of the effects of asset-price misalignments in the simulations.

There was substantial discussion of the issues involved in augmenting a strict inflation-targeting regime to account for the macroeconomic risks introduced by asset-price misalignments. One participant argued strongly that extending the forecast horizon was not a practical option for dealing with such misalignments. Bean responded that the analysis of longer horizons could be qualitative, rather than quantitative. Another participant wondered if the 'risk management' framework proposed by Lowe was sufficiently concrete. However, in general there appeared to be substantial agreement that a risk management framework for determining policy was appropriate. Lowe argued that particular importance should be placed upon any negative skewness apparent in assessment of risks. There was also agreement that the augmentation of a simple policy reaction function (such as a Taylor rule) would not be an adequate representation of such a monetary policy framework.

A number of participants endorsed Lowe's suggestion that prudential regulation should be considered as a possible tool for addressing financial sector risks and thereby reducing macroeconomic risks. However, there were some reservations about the feasibility of such an approach. One participant suggested that it would be difficult to communicate any change in prudential regulation that was not related to financial sector stability. Other participants endorsed the view in Cecchetti's paper that rules-based adjustments to capital requirements would be difficult to implement.

Stock Market Volatility and Monetary Policy: What the Historical Record Shows

Barry Eichengreen and Hui Tong[1]

1. Introduction

This paper presents a fact – we are tempted to say a 'new fact', since to our knowledge it has not been recognised before. The fact is that stock market volatility, when viewed from a long-term perspective, tends to display a u-shaped pattern.[2] When we take data spanning the 20th century for today's now-advanced economies – all of the economies for which such a long time series of financial data are available – we generally see that volatility first falls at the beginning of the period before stabilising and then rising in recent years.[3]

Any blanket generalisation about financial market behaviour is problematic when one attempts to apply it to a significant number of countries. There are exceptions to the rule, as noted below. But there is some evidence of the u-shaped pattern in a substantial majority of the countries we consider.

Our interpretation of this pattern is as follows. The decline in volatility in the early, pre-World War I period reflects ongoing improvements in the information and contracting environment, which find reflection in the improved operation of financial markets. Indeed, there is a considerable literature on the growth and development of financial markets in this period, although it has paid relatively little attention to stock markets, given their still limited role in resource allocation. Following

1. The authors are George C Pardee and Helen N Pardee Professor of Economics and Political Science and Graduate Student in Economics, both at the University of California, Berkeley. This paper was prepared for the Reserve Bank of Australia's annual research conference on Asset Prices and Monetary Policy, Sydney, 18–19 August 2003. We are grateful to Andrew Rose, Michael Jansson, James Powell, Thomas Rothenberg and Adrian Pagan for helpful comments.

2. The closest precedent for this observation of which we are aware is Catao and Timmerman (2003a, 2003b), who analyse monthly returns for firms from 13 countries from 1973 through 2002. Using switching regressions, they find that returns switch repeatedly from high-volatility to low-volatility states. That markets were in the high-volatility state at the end of the period is consistent with the existence of the right-hand arm of our intertemporal u, but the authors themselves (2003b, p 132) take the fact that volatility has shifted between the high- and low-volatility regimes repeatedly as 'dispel[ling] the notion, held by some, that stock market volatility has been trending upward as financial markets become more globalised'. Their sample period is not long enough to determine whether the left-hand arm is present.

3. We are tempted to say that this finding is contrary to the conventional wisdom, but it is not clear what the conventional wisdom is. Some will approach the question with the presumption that financial markets should have grown progressively more stable as market institutions and regulatory policies in the advanced countries have strengthened over time. Others, impressed by events like the LTCM crisis and the high-tech bubble, will question whether there has been any trend. Still others will presume the existence of an inverted u, dominated by high levels of volatility in the Great Depression of the 1930s.

the Great Depression of the 1930s, there was then a period of tight regulation of financial markets and institutions, one consequence of which was limited volatility (with some sharp exceptions, such as during World War II). The subsequent rise in volatility reflects financial liberalisation inadequately supported by prudential control; an increase in the instability of macroeconomic policies, especially following the breakdown of the Bretton Woods System; and financial globalisation, which may have been a factor in rising volatility in some countries.[4]

Changes in asset prices are not a bad thing in and of themselves. They convey signals to investors about changes in likely future outcomes and their implications for resource allocation. They reflect changes in the price of risk, responding to changes in the risk to which the economy is subject and/or the tolerance of investors for holding it. At the same time, to the extent that the volatility of asset prices reflects the volatility of policy, more volatility may be an indication of a deteriorating policy environment. Similarly, to the extent that the volatility of asset prices is indicative of the limited ability of banks and firms to manage risk, reflecting *inter alia* inadequate capitalisation or diversification, more volatility may be an indication of such problems. Our evidence provides some support for both the positive and negative interpretations of volatility trends over time.

2. The Fact

There are several common ways of estimating volatility. In the present context, all of them produce similar results. Specifically, all of them produce evidence of a u-shaped pattern.

A first approach is to compute the standard deviation of returns over successive periods of time – for example, to take end-of-month data for the 12 months of the year and calculate volatility as the standard deviation of those 12-monthly observations, and then to roll the window forward in time (drop month 1 and add month 13). An application of this method is Officer (1973). A potential problem with Officer's approach is that the use of overlapping observations will create a correlation between standard deviations at different points in time.[5] An alternative is to use non-overlapping observations: to compute the standard deviation using, say, months 1 through 12, 13 through 24, and so forth. The problem here is that the periodisation is arbitrary and the result is relatively few data points. In practice, however, we obtain extremely similar results using the two approaches.

An alternative is to specify a parametric model of asset returns and to use it to derive estimates of volatility. Based on the observation of serially correlated volatility, Bollerslev (1986) suggested the Generalised AutoRegressive Conditionally

---

4. Here it is important to emphasise 'some countries'. As we shall see, for a minority of countries in our sample, including Australia, financial internationalisation appears to be associated with less stock market volatility, not more.

5. Suppose that the true standard deviation is not correlated over time – that is to say, that the past standard deviation cannot forecast the future standard deviation. Two consecutively estimated standard deviations from Officer's approach would still be highly correlated, since M–1 of the M observations used for estimating these two standard deviations are in common.

Heteroskedastic (GARCH) model as a basis for deriving such estimates. The GARCH model starts by specifying an equation for the conditional mean of stock returns. Because the current stock return may depend on past stock returns, the equation for the mean is specified to allow for intertemporal dependence:

$$R_t = c + \lambda_1 R_{t-1} + \lambda_2 R_{t-2} + \cdots + \lambda_s R_{t-s} + u_t \tag{1}$$

where R_t is the stock return at time t, c is a constant term, and u_t is the disturbance. The disturbance is modeled as:

$$u_t = \sqrt{h_t} v_t \tag{2}$$

where v_t has the i.i.d. normal distribution with zero mean and unit variance, and h_t evolves according to:

$$h_t = k + \beta_1 h_{t-1} + \cdots \beta_p h_{t-p} + \alpha_1 u_{t-1}^2 + \cdots + \alpha_q u_{t-q}^2 \tag{3}$$

This is the GARCH (p,q) model, where the equations for the conditional mean and variance can be jointly estimated using maximum likelihood. The GARCH (1,1) model is commonly used in empirical applications because it does not require estimation of many coefficients and seems to capture return dynamics relatively well.[6] In the GARCH (1,1) model, α (in Equation (3) above) measures the extent to which a volatility shock today translates into volatility tomorrow, while $\alpha+\beta$ measures the rate at which volatility dissipates over time. If $(\alpha+\beta)<1$, then u_t^2 will be covariance stationary, and the unconditional mean of u_t^2 will be:

$$E(u_t) = k/(1-\alpha-\beta) \tag{4}$$

Lee and Hansen (1994) discuss the asymptotic distribution of the GARCH (1,1) maximum likelihood estimator when $(\alpha+\beta)<1$. However, $(\alpha+\beta)>=1$ (the case where the effects of volatility shocks are permanent) can also occur in practice. In Bekaert and Harvey (1997), the study closest in spirit to our own, half of the stock markets considered have estimated values such that $\alpha+\beta >=1$.[7]

One possible solution to this problem is to add deterministic time trends, $f(t)$, to the volatility equation of the GARCH (1,1) model:

6. We use the GARCH (1,1) model in what follows. Increasing the number of lags on the two terms changes none of our conclusions – either positive or negative.

7. Analysing dollar returns for 20 emerging markets using data from the International Finance Corporation of the World Bank, the authors find that volatility is higher in emerging than mature markets (as much as five times higher) and that returns are more persistent. But in cases where $\alpha+\beta>=1$, it is not clear how to interpret these results. Lumsdaine (1996) discusses the consistency and asymptotic normality of the quasi-maximum likelihood estimator when $(\alpha+\beta)=1$ and finds that, in contrast to the case of a unit root in the conditional mean, the presence of a unit root in the conditional variance does not affect the limiting distribution of the estimators and that estimators are normally distributed. But this result is only for the simplest case where $(\alpha+\beta)=1$ and no explanatory variables are included in the conditional variance equation. No result has been given for the case $(\alpha+\beta)>1$. The current practice is to estimate α and β without restrictions and not to consider the implications for stationarity. For testing the null that $\alpha+\beta=1$, Hong (1987) shows that traditional test procedures are still valid, so a Dickey-Fuller type of test for a unit root is not needed.

$$h_t = k + \beta \ h_{t-1} + \alpha \ u_{t-1}^2 + f(t) \tag{5}$$

Specifically, we add a linear combination of time and the square root of time. Standard arguments suggest that the estimated coefficients for the time terms will be consistent, assuming of course that their addition eliminates the unit root problem.[8]

We analyse the stock markets of 12 now-developed countries using time series from Global Financial Data (GFD). The countries are Australia, Canada, Denmark, Finland, France, Italy, Japan, New Zealand, Sweden, Switzerland, United Kingdom and the United States. We have monthly data (end-of-month closes, as calculated by central banks, national statistical agencies, or stock exchanges themselves).[9] The end-of-month return data are calculated for each of these countries from the late 19th or early 20th century to 2002. Details are in Table 1.

Ideally, we would like to measure stock market volatility in terms of total returns (inclusive of both price changes and dividends). Unfortunately, information on dividends for the earlier period is fragmentary. We therefore construct the return series as the log-difference of the stock price index. This is not ideal, but it is the same

8. Given that we have a nonlinear term in t, we must consider not only the consistency of the estimates (consistency being an asymptotic property) but also how quickly they converge to the true parameter values in finite samples. To obtain some intuition about this question when there is no unit root, consider the case where $u_t^2 = k + \omega_1 t + \omega_2 t^{0.5+\lambda} + (k + \omega_1 t + \omega_2 t^{0.5+\lambda})(v_t^2 - 1)$, and regard it as an OLS regression. When $\lambda \in (0,0.5)$, the coefficients for t and $t^{0.5+\lambda}$ will both be consistent in a sample of infinite size. The speed with which the estimated value of ω_2 converges to the true value is on the order of T^{λ} (where T is the number of observations). Thus, as λ goes up, the speed of convergence goes up as well; this makes it desirable to work with relatively large values of λ. Unfortunately, as λ approaches 0.5, $t^{0.5+\lambda}$ becomes close to t, and a problem of singularity is more likely to arise (since t is also included in the regression). Experimenting with different values of λ in the 0–0.5 range, we find that singularity is still not severe when λ is as high as 0.45. Recall that the speed of convergence in the standard OLS regression without non-stationary time series is on the order of $T^{0.5}$. Hence, the speed of convergence of the estimated value of ω_2 with $\lambda = 0.45$ in a sample of 1 000 observations, which is roughly what we have, is comparable to the speed of convergence of the standard OLS regression without non-stationary time series in a sample of 500 observations. In previous studies of historical financial market data, samples of 500 or fewer observations are not uncommon. Thus, the estimates reported here converge to the true values at least as quickly as in those studies. In practice, it makes relatively little difference for the point estimates we obtain – and for the u-shaped pattern in particular – what values of λ we use. We thank Adrian Pagan for forcing us to think harder about the convergence issue.

9. Daily indices for most of these countries are not available from GFD prior to the 1930s, although they could in principle be constructed from contemporary sources. In the 1920s, when interest in stock market indices grew, a number of these series were reconstructed back to the 1870s using procedures that are likely to create survivor bias. The other forms of survivor bias of concern to recent investigators are unlikely to be a problem here. For example, Goetzmann, Li and Rouwenhorst (2001) are concerned with the implications of the fact that firms disappear from market indices as they fail or are wound up. But since we wish to characterise market-wide returns made up of the returns to firms in the market at each point in time, we are not as concerned with this complication.

Table 1: Data and Sample Periods

Country	Monthly stock index period	Yearly stock index starting date	Return index starting date
Australia	1875–2003	1875	1882
Canada	1918–2003	1915	1933
Denmark	1921–2003	1914	1969
Finland	1922–2003	1922	1961
France	1895–2003	1856	1895
Italy	1906–2003	1906	1924
Japan	1914–2003	1914	1920
New Zealand	1931–2003	1926	1986
Sweden	1906–2003	1901	1918
Switzerland	1916–2003	1910	1966
UK	1694–2003	1694	1694
US	1800–2003	1800	1802

Source: Global Financial Data, Inc.

procedure followed in other historical studies, e.g. Jorion and Goetzmann (1999). We subtract the rate of currency depreciation relative to the US dollar and the US inflation rate in order to express all returns in constant dollar terms.[10]

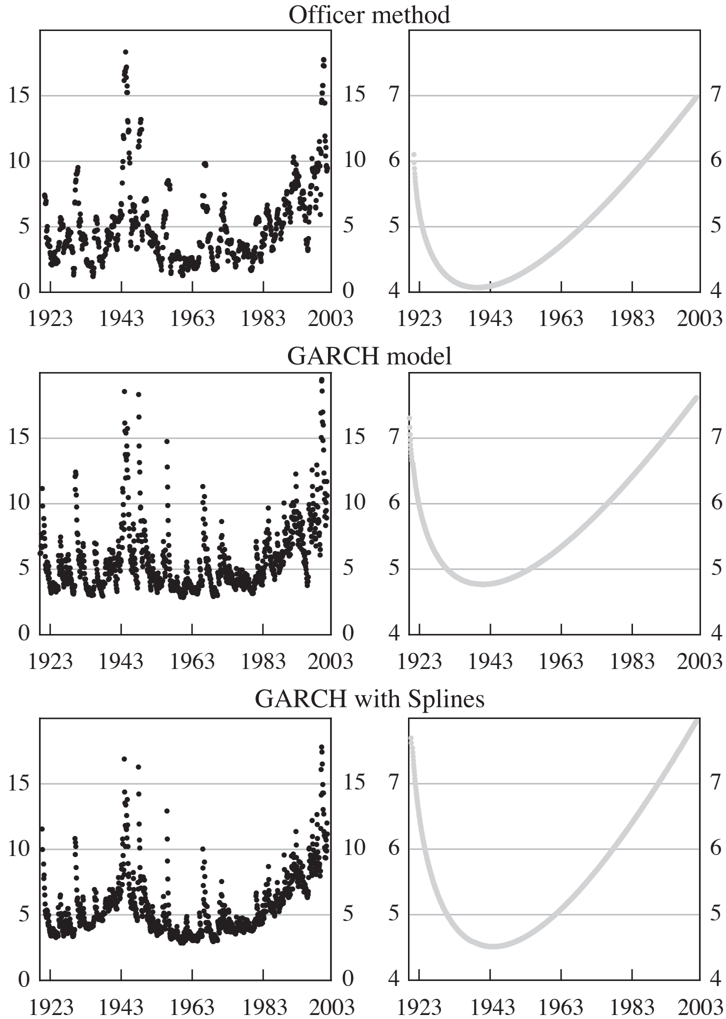
We can illustrate the method with reference to a specific country, Finland, the data for which yield relatively clean results.[11] We start with the familiar Officer method. We estimate the stock return standard deviation for month 1 to month 12, next estimate the standard deviation from month 2 to month 13, and then repeat the procedure, rolling the sample forward continuously. The estimated conditional standard deviation appears to fall in the early part of the sample before rising again in recent decades (see the left-hand side of the first row of Figure 1). This resembles a quadratic to the naked eye (at least to our eyes). To make our ocular econometrics more precise, we can fit a quadratic time trend to the estimated volatilities; doing so yields a u-shape (see the right-hand side of the first row of Figure 1). The estimated coefficients are in the first column of Table 2, where the quadratic form is:

$$\hat{\sigma}_t = k + \omega_1 t + \omega_2 t^{1/2} \tag{6}$$

10. For present purposes, it seems to make the most sense to express returns in different countries in a common unit (US dollars). In practice, this conversion does not affect our key results, as we explain below.

11. Finland was also the first country that we considered in this research project. Research, like history, tends to display path dependence.

Figure 1: Estimated Standard Deviations for Finland



Note: The right panels display fitted values.

Both coefficients are significantly different from zero (the *p*-values are less than 0.01). This means that a quadratic fits the data significantly better than a constant term or a linear trend. The signs clearly suggest a u-shape.[12]

Alternatively, we can estimate the standard GARCH (1,1) model, starting with the volatility equation:

$$h_t = k + \beta \; h_{t-1} + \alpha \; u_{t-1}^2 \qquad (7)$$

12. We obtain virtually the same u-shape and very similar coefficients on ω_1 and ω_2 when we instead calculate the standard deviation of returns using 12 non-overlapping monthly returns (giving us 81 annual observations). The coefficient on ω_1 is 0.016 with a *p*-value of 0.03, while the coefficient on ω_2 is –1.5 with a *p*-value of 0.07.

Table 2: Results for Finland

	Quadratic with Officer method[(a)]	GARCH (1,1)[(b)]	Quadratic[(c)]	Deterministic trends[(d)]	Splines[(e)]	Quadratic with Splines[(f)]
Number of observations	940	940	940	940	940	940
Wald χ^2 (6)	46.77	151.21	33.81	133.61	108.95	92.96
Stock return (one lag)		0.273 (0.036)		0.2626 (0.0357)	0.2626 (0.0397)	
Stock return (two lag)		–0.011 (0.035)		–0.0110 (0.0365)	0.0197 (0.0378)	
Stock return (three lag)		0.059 (0.032)		0.0434 (0.0402)	0.0268 (0.0401)	
Stock return (four lag)		0.022 (0.032)		0.0050 (0.0355)	0.0268 (0.0341)	
Stock return (five lag)		0.111 (0.030)		0.0786 (0.0372)	0.0798 (0.0341)	
Stock return (six lag)		0.093 (0.031)		0.0964 (0.0350)	0.1136 (0.0299)	
Constant		0.205 (0.150)		0.1863 (0.1532)	0.2101 (0.1558)	
t_{11}	0.0126 (0.0019)		0.0121 (0.0018)	0.5797 (0.8217)	0.0205 (0.0065)	0.0148 (0.0015)
t_{12}					0.0385 (0.0042)	
t_{13}	–0.3926 (0.0726)		–0.3771 (0.0658)	–0.0835 (0.1036)	–0.3577 (0.1553)	–0.4650 (0.0562)
t_{14}					–1.7810 (0.1987)	
k	7.0982 (0.6537)	1.587 (0.274)	7.6689 (0.5010)	–1.3261 (2.8297)	2.5758 (0.9753)	8.1081 (0.5014)
α		0.210 (0.025)		0.2203 (0.0282)	0.1957 (0.0334)	
β		0.767 (0.025)		0.7632 (0.0285)	0.6761 (0.0479)	

(a) Officer method
(b) GARCH (1,1) model with $\omega_1 = \omega_2 = 0$
(c) Fitting the estimated standard deviation from the GARCH (1,1) model onto a quadratic form
(d) GARCH (1,1) model without restricting $\omega_1 = \omega_2 = 0$
(e) GARCH (1,1) model without restricting $\omega_1 = \omega_2 = 0$, adding Spline function
(f) Estimated standard deviation from GARCH (1,1) model with Spline function fitted onto a quadratic form

The result is in the second column of Table 2. On the left-hand side of the second row of Figure 1 we plot the estimated standard deviation series against time. Again, the series resembles a quadratic to the naked eye. Once more we can fit a quadratic to these estimates of volatility:

$$\hat{\sigma}_t = k + \omega_1 t + \omega_2 t^{1/2} \tag{8}$$

where ω_1 and ω_2 are the estimated coefficients on time and its square root, as before. And, once more, a quadratic time trend fits the estimated volatilities relatively well. The third column of Table 2 shows that both coefficients are significantly different from zero (the *p*-values are less than 0.01). The right-hand side of the second row of Figure 1 plots these fitted values.

The estimated value of $\alpha+\beta$, at 0.976, is close to unity, and we cannot reject the hypothesis that it equals one.[13] In order to eliminate the unit root, we add deterministic time trends to the volatility equation of the GARCH (1,1) model:

$$h_t = \exp(k + \omega_1 t + \omega_2 t^{1/2}) + \beta h_{t-1} + \alpha u^2_{t-1} \tag{9}$$

However, $\alpha+\beta$ is still close to 1 (see the fourth column of Table 2). We address this problem by supplementing GARCH (1,1) model with Spline functions. Since the Officer method provides a general picture of the volatility process, we use it to guide the fitting of Splines. Figure 1 suggests that volatility rose significantly during World War II and dropped sharply following its conclusion. This implies that controlling separately for this period may eliminate the unit root. Adding a World War II dummy variable (D_{1t}) to the volatility specification function entails estimating a model of the form:

$$h_t = \exp(k + \gamma D_{1t}) + \beta h_{t-1} + \alpha u^2_{t-1} \tag{10}$$

But estimating Equation (10) would be tantamount to assuming no trend during World War II and that there were discontinuities in the volatility process at the start and the end of that event. Figure 1 suggests, in contrast, that volatility rose gradually during World War II and dropped gradually following its conclusion, instead of jumping up, remaining constant at this higher level during the war, and then jumping back down following the armistice. We therefore introduce a Spline function for the time trend in the volatility specification. Applying a Spline function with one break/cut-off point to:

$$h_t = \exp(k + \omega_1 t + \omega_2 t^{1/2}) + \beta h_{t-1} + \alpha u^2_{t-1} \tag{11}$$

is the same as estimating:

$$h_t = \exp(k + \gamma_1 t_{11} + \gamma_2 t_{12} + \gamma_3 t_{13} + \gamma_4 t_{14}) + \beta h_{t-1} + \alpha u^2_{t-1} \tag{12}$$

13. Below we find the same result for most of our other countries. Not surprisingly, other authors have found the same in analyses of shorter historical periods (over which the tendency for level reversion in the variance is presumably less). See Bollerslev, Chou and Kroner (1992) for discussion.

We divide the sample into halves in August 1945 (the end of World War II). t_{11} is equal to t until the observation for August 1945.[14] The Spline method ensures that the volatility process will be continuous. For each of the two periods (before and after August 1945), we fit a quadratic to allow for the possibility that volatility may not follow a linear trend. The conditional maximum likelihood estimates of the parameters are reported in the fifth column of Table 2. The time trend constructed from:

$$\exp(k + \gamma_1 t_{11} + \gamma_2 t_{12} + \gamma_3 t_{13} + \gamma_4 t_{14}) \tag{13}$$

suggests that there is a quadratic form for each period. The end-point of the first quadratic form and the starting point of the second necessarily meet in August 1945. The standard deviation of the fitted returns is shown on the left side of the third row of Figure 1.

In the fifth column of Table 2, the unit root has disappeared. The estimated value of $\alpha+\beta$, at 0.872, is significantly different from unity at the 1 per cent confidence level.[15] Again, we may want to ask whether we can fit a single quadratic form to the estimated standard deviation series. Ordinary least squares suggests that the answer is yes (see the sixth column of Table 2 and the right-hand side of the third row of Figure 1).

A key point is that we obtain very similar results using alternative methods, as will be evident from comparing the three rows of Figure 1. No method is perfect. The Officer method is unparameterised, and the division of the sample into periods is arbitrary. The standard GARCH model suffers from unit root problems, which raise questions about whether the estimated parameters are distributed normally and estimated consistently. The GARCH model with Splines requires us to make a choice between the convergence rate and singularity (see footnote 8). But, as Figure 1 shows, the three methods produce very similar estimates of the standard deviation of returns. Importantly for our purposes, those estimates are all consistent with very similar estimates of the u-shaped intertemporal pattern. Different readers will prefer different empirical approaches. Our own preference is the GARCH (1,1) model with Splines. But the choice makes little difference for our central finding.

We now apply this approach to other countries. When we estimate the simple GARCH (1,1) model, we find that the unit root problem ($\alpha+\beta>=1$) is present virtually everywhere.[16] We then use Officer's method to obtain a general picture of stock return volatility. Next we fit Spline functions to the GARCH (1,1) model, with the Spline function cut-off points being the peaks in volatility as estimated using Officer's method.[17] In the GARCH (1,1) model with Splines, $\alpha+\beta$ is significantly less

14. Since the sample for Finland starts at March 1922, t_{11} will reach 279 at August 1945 and will stay at 279 till the end of the sample. t_{12} is equal to 0 until August 1945, and then takes on the value of t–279 thereafter. t_{13} is equal to $t^{1/2}$ until August 1945. t_{13} reaches 16.7032 in August 1945, and stays at that value through the end of the sample. t_{14} is equal to 0 until the observation point August 1945, then it will be equal to $t^{1/2}$–16.7032 thereafter.

15. We use the standard OLS χ^2 test as in Bollerslev, Engle and Nelson (1994), as suggested by the preceding discussion.

16. Japan being the sole exception.

17. The number of Splines differs across countries, as reflected in the number of estimated coefficients reported in the different columns of Table 3.

than 1 at the 2 per cent level, according to the standard χ^2 test, for all 11 additional countries.[18]

The results using the GARCH (1,1) model with Splines are summarised in Figures 2–4 and Tables 3–5. The figures contain two panels for each country. The one on the left displays the estimated conditional standard deviations obtained using the Officer method (which we use as guidance for fitting Splines). The one on the right shows the conditional standard deviations from the GARCH (1,1) model with Splines, with the quadratic (or other relationship) that best fits these estimates superimposed.[19]

The following aspects of stock market returns may be of particular interest.

1. *The estimated coefficients*. Consider, to take a country not entirely at random, Australia. The estimates of the equation for the mean return indicate that the one-period lagged stock return affects the current stock return: the coefficient for the one-period lagged stock return is 0.116, with a standard error of 0.031, which is thus significantly different from 1 (see Table 3). This is an unexceptional level of persistence; the analogous coefficients are higher in about half of our countries and lower in the other half. The estimates of the volatility equation suggest that the Spline functions are important. (Recall that t_1, t_2, and t_3 are the three Spline components for the linear time trend t, while $(t^{0.5})_1$, $(t^{0.5})_2$, and $(t^{0.5})_3$ are the three Spline components for the non-linear time trend $(t^{0.5})$. By construction, the cut-off points/dates for the Spline components are the same for t and $(t^{0.5})$.) For Australia, the coefficient on t_1 is 0.005, with a standard error of 0.002, which is thus significantly different from zero. $\alpha+\beta$, the persistence of volatility shocks, is 0.908. This is an unexceptional level of volatility persistence by international standards. A χ^2 test of the unit-root hypothesis ($\alpha+\beta=1$) gives a test statistic of 47.87, which suggests that the unit root is rejected at all reasonable significance levels.
2. *The trend of volatility*. This is constructed from the coefficients for the time functions t and $t^{0.5}$.
3. *Changes in the trend in different sub-periods*. These can be seen from the estimated stock return standard deviation.[20]

18. For six countries, $\alpha+\beta$ is significantly less than 1 at the 1 per cent level. For these six cases, we say there is no unit root. For the others, we say that the unit root problem is not severe (in Table 5).
19. In some cases, Canada for example, the casual reader may believe that two parabolas have been superimposed on the estimated conditional standard deviations. In fact, there is only one: the relatively flat u (whose coefficients are reported in Table 4). The other points are simply the estimated conditional standard deviations, which make up a cluster that resembles three parabolas when we estimate the GARCH (1,1) model with three Splines. Why is no mystery: the same parabolic shapes are vaguely evident in the left-hand panel, where standard deviations of stock returns are estimated using the nonparametric Officer method.
20. We need to be careful in characterising the results for the early years in countries where there are data gaps at the beginning of the sample period. For example, the estimates for Switzerland suggest that the standard deviation increased in the early part of the sample period. Note, however, that the monthly stock market index only becomes available in 1916 (annual data begin in 1910). Thus, the timing for this country is somewhat different than the others.

Table 3: GARCH (1,1) Model with Spline Functions

	Australia	Canada	Denmark	France	Italy	Japan	NZ	Sweden	Switzerland	UK	US
Stock return (one lag)	0.116	0.125	0.131	0.077	0.134	0.125	0.094	0.130	0.133	0.097	0.142
	(0.031)	(0.034)	(0.034)	(0.029)	(0.031)	(0.033)	(0.046)	(0.032)	(0.034)	(0.018)	(0.022)
Stock return (two lag)	–0.027		0.096	–0.037	–0.076	–0.011	0.117	–0.027	–0.087	0.020	–0.004
	(0.028)		(0.037)	(0.031)	(0.030)	(0.031)	(0.043)	(0.030)	(0.036)	(0.014)	(0.020)
Stock return (three lag)	0.015		0.095								0.069
	(0.029)		(0.037)								(0.020)
Constant	0.251	0.267	0.055	0.079	–0.097	0.162	0.108	0.343	0.280	0.014	0.031
	(0.073)	(0.134)	(0.082)	(0.105)	(0.137)	(0.157)	(0.141)	(0.117)	(0.123)	(0.045)	(0.060)
t_1	0.005	0.035	0.023	0.052	0.071	0.009	0.015	0.041	0.044	0.004	0.020
	(0.002)	(0.012)	(0.002)	(0.012)	(0.026)	(0.004)	(0.001)	(0.015)	(0.057)	(0.001)	(0.004)
t_2	–0.272	0.030	0.585	0.016	0.090	0.0011	–0.010	0.460	0.265	–0.022	0.008
	(0.066)	(0.003)	(0.211)	(0.004)	(0.031)	(0.0005)	(0.003)	(0.142)	(0.036)	(0.005)	(0.003)
t_3	–0.120	0.313		0.666	0.016			0.023	0.045	0.039	
	(0.017)	(0.055)		(0.237)	(0.011)			(0.004)	(0.005)	(0.011)	
t_4									0.083	–0.033	
									(0.029)	(0.018)	
$(t^{0.5})_1$	–0.183	–0.459	–0.723	–0.817	–0.817	–0.260	–0.418	–0.617	–0.204	–0.237	–0.438
	(0.067)	(0.218)	(0.065)	(0.286)	(0.478)	(0.104)	(0.033)	(0.256)	(0.603)	(0.041)	(0.105)
$(t^{0.5})_2$	14.814	–1.239	–34.555	–0.790	–3.407			–14.789	–6.135	1.604	–0.478
	(3.677)	(0.134)	(12.359)	(0.202)	(1.073)			(4.568)	(0.853)	(0.365)	(0.164)
$(t^{0.5})_3$	8.511	–18.601		–44.386	–0.777			–1.082	–1.842	–3.734	
	(1.140)	(3.224)		(15.772)	(0.614)			(0.211)	(0.200)	(1.038)	
$(t^{0.5})_4$									–4.997	3.840	
									(1.711)	(1.996)	
K	1.761)	3.350	3.815	1.423	1.167	2.507	2.687	2.517	2.026	2.935	0.841
	(0.591)	(1.000)	(0.494)	(1.938)	(2.310)	(0.728)	(0.324)	(1.049)	(1.438)	(0.405)	(0.664)
α	0.215	0.068	0.089	0.080	0.117	0.152	0.100	0.138	0.127	0.121	0.154
	(0.018)	(0.034)	(0.019)	(0.017)	(0.026)	(0.023)	(0.018)	(0.030)	(0.032)	(0.008)	(0.016)
β	0.693	0.181	0.853	0.849	0.809	0.755	0.808	0.736	0.487	0.843	0.761
	(0.019)	(0.330)	(0.021)	(0.038)	(0.043)	(0.043)	(0.035)	(0.065)	(0.142)	(0.008)	(0.023)
Test of unit root (χ^2)	47.870	5.320	18.400	5.740	6.030	10.310	16.280	7.640	9.590	60.920	34.140

Note: Standard errors in parentheses
Source: Authors' calculations

Table 4: Estimated Standard Deviations from GARCH (1,1) Model with Spline Functions, Fitted to a Quadratic Form

	Australia	Canada	Denmark	France	Italy	Japan	NZ	Sweden	Switzerland	UK	US
t	0.0083	0.0015	0.0239	–0.0089	0.0013	0.0065	0.0173	0.0113	0.0079	0.0051	–0.0008
	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0008)	(0.0008)	(0.0011)	(0.0006)	(0.0006)	(0.0001)	(0.0002)
$t^{0.5}$	–0.3270	–0.0185	–0.8419	0.4655	0.0372	–0.1973	–0.5036	–0.3742	–0.2528	–0.3875	0.1206
	(0.0308)	(0.0224)	(0.0271)	(0.0249)	(0.0325)	(0.0314)	(0.0379)	(0.0249)	(0.0260)	(0.0101)	(0.0102)
Constant	5.9992	4.0590	9.4489	–0.1705	4.0507	6.695	6.775	6.5362	5.7818	10.2116	0.7383
	(0.3345)	(0.2019)	(0.2532)	(0.2466)	(0.3074)	(0.2570)	(0.305)	(0.2398)	(0.2753)	(0.1726)	(0.1366)
Number of observations	1 532	1 017	980	1 224	1 118	1 045	862	1 153	1 047	3 685	2 412
R^2	0.230	0.070	0.610	0.330	0.150	0.095	0.340	0.370	0.200	0.287	0.370

Note: Standard errors in parentheses

Source: Authors' calculations

4. *The u-shape*. Finally, we can analyse whether the estimated standard deviation can be fitted on a quadratic form.[21] The results, in Table 4, are consistent with a u-shape in 8 of the 11 countries included there, in that the coefficient on time is positive and that on the square root of time is negative. Adding Finland, where we already detected a u-shape in Table 2, we thus find evidence of this pattern in 9 of our 12 countries (the exceptions being France, Italy and the US).[22] With the exception of Canada, the coefficients on both time and its square root are significantly different from zero at standard confidence levels.[23] The findings are summarised in Table 5.

Two interesting variations on this theme are Australia and New Zealand, which conform to the general pattern but display some tendency for volatility to drop back down in recent years. This is easiest to see in the left-hand side of Figure 2, where we show the Officer estimates. We will have more to say about this pattern below.

An obvious question is whether very recent volatility (the 'high-tech bubble' at the end of the sample period) is responsible for our finding of a u-shaped pattern. Is it possible that, absent this exceptional episode, we would find evidence of secularly declining volatility, reflecting improvements in market institutions and regulatory quality as the now-advanced industrial countries matured? To get at this question, we omitted the data for the post-1997 period. The basic results, including the evidence of a u-shaped pattern, remained unchanged.

We also wondered whether evidence of rising volatility of US dollar returns for countries other than the United States is being driven by the increasingly volatility of the dollar exchange rate. (Recall that we convert own-currency returns into US dollars.) In fact, when we instead compute real returns in own currency (deflating them by the national price index), we obtain very similar results.[24]

21. Finland is not included here because the relevant results already appear in Table 2.

22. Note that the Spline function for Japan takes a special form: we fit a quadratic for the pre-1945 period but only the linear term for the second half of the sample. In other words, there is no coefficient for $(t^{0.5})_2$ in Table 3. That a special functional form is appropriate for Japan is not surprising; it was the one country for which there is no evidence of a unit root in the simple GARCH (1,1) model.

23. Volatility estimates often get into trouble at the end of sample periods. Thus, some readers may worry that there is something spurious about the construction of our volatility estimates that produces high levels of volatility at the beginning and end of the sample. Note, however, that we have already eliminated the necessary lagged values at the beginning and end of the sample. If we eliminate more observations at the two sample ends, we are still unable to reject the null of a u-shaped pattern in Table 4 (since the coefficients there tend to be significantly different from zero at relatively high confidence levels).

24. The main differences are that the coefficients for the u-shaped relationship estimated in Table 4 are no longer significant for Japan, and we obtain an inverted u for Canada. Note however that Canada was the country where evidence of the u-shaped pattern was statistically insignificant before. The implications of the conversion are less serious here than in, say, Goetzmann *et al* (2001), who are concerned with cross-market correlations. In that context, shocks to the value of the US dollar would affect the returns on every foreign market, expressed in US dollars, increasing the measured correlation. Here, in contrast, we analyse each country separately and are not concerned with cross-market correlations.

Table 5: Summary of Results

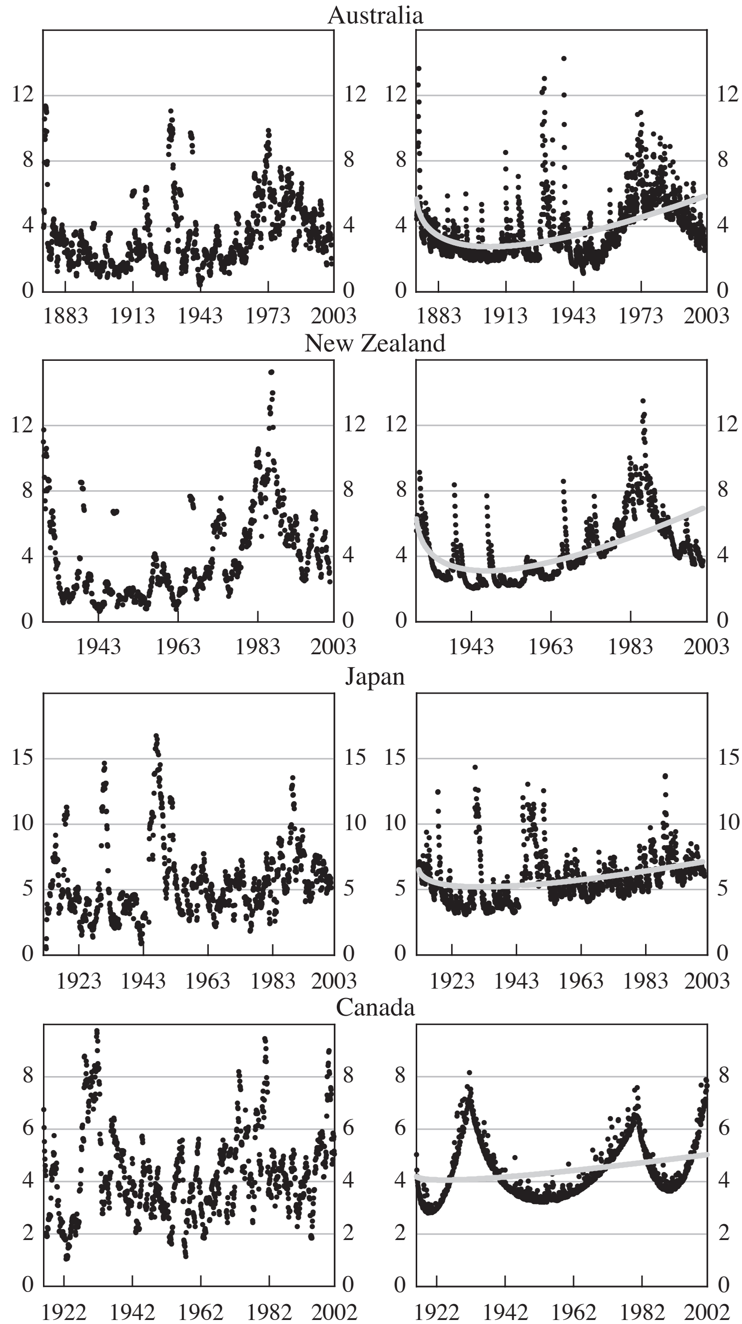
Country	Early years	Recent years	Unit root before Spline	Unit root after Spline	u-shape?
Australia	Dropping	Increasing, then dropping	Yes	No	Yes
Canada	Dropping	Increasing	Yes	Not severe	Yes, but poorly determined
Denmark	Dropping	Increasing	Yes	No	Yes
Finland	Dropping	Increasing	Yes	No	Yes
France	Dropping	Increasing	Yes	Not severe	Inverted u-shape
Italy	Dropping	Increasing	Yes	Not severe	Monotonically increasing
Japan	Dropping	Increasing	No	No	Yes
New Zealand	Dropping	Increasing, then dropping	Yes	No	Yes
Sweden	Dropping	Increasing	Yes	Not severe	Yes
Switzerland	Increasing	Increasing	Yes	No	Yes
UK	Dropping	Dropping, then increasing	Yes	No	Yes
US	Dropping	Increasing	Yes	No	Inverted u-shape

Source: Authors' calculations

We also estimated the GARCH(1,1) model with Splines for 11 emerging markets (so identified by IMF (2003)): Argentina, Brazil, Chile, the Czech Republic, Hong Kong, Hungary, Malaysia, Poland, Singapore, South Korea and Thailand. The data are weekly, starting in the 1960s or 1970s. This paper's findings are summarised in Table 6. These suggest that volatility dropped in the early stages of stock market development and dropped further in recent years. It is tempting to characterise the countries as still on the downward-sloping arm of the intertemporal u. But patterns in these countries are diverse and difficult to generalise about. We suspect that it will be necessary to wait for more historical data before accepting or rejecting the hypothesis of a u-shaped pattern.

Figure 2: Standard Deviation of Stock Returns

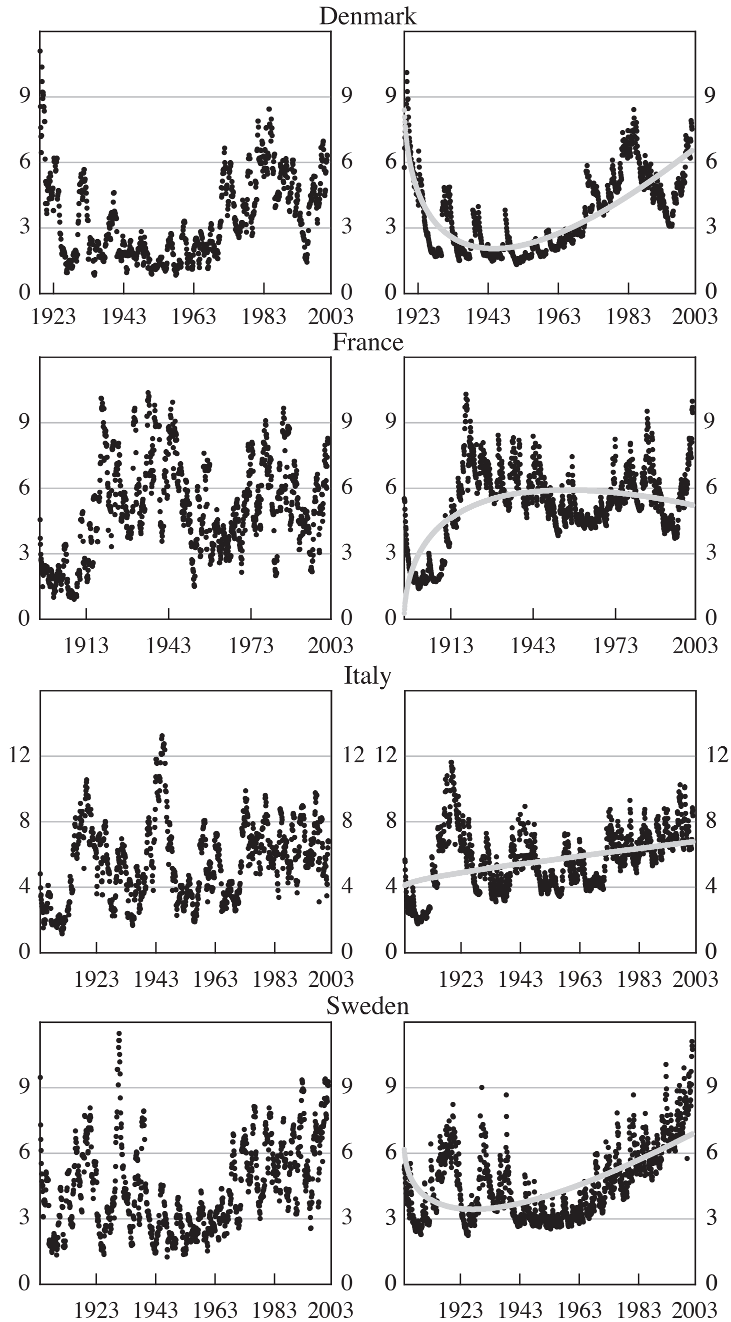
Officer method (left panels) and GARCH with Splines (right panels)



Notes: The right panels display the conditional standard deviations from the GARCH (1,1) model with Splines, along with the quadratic (or other relationship) that best fits these estimates superimposed.

Figure 3: Standard Deviation of Stock Returns

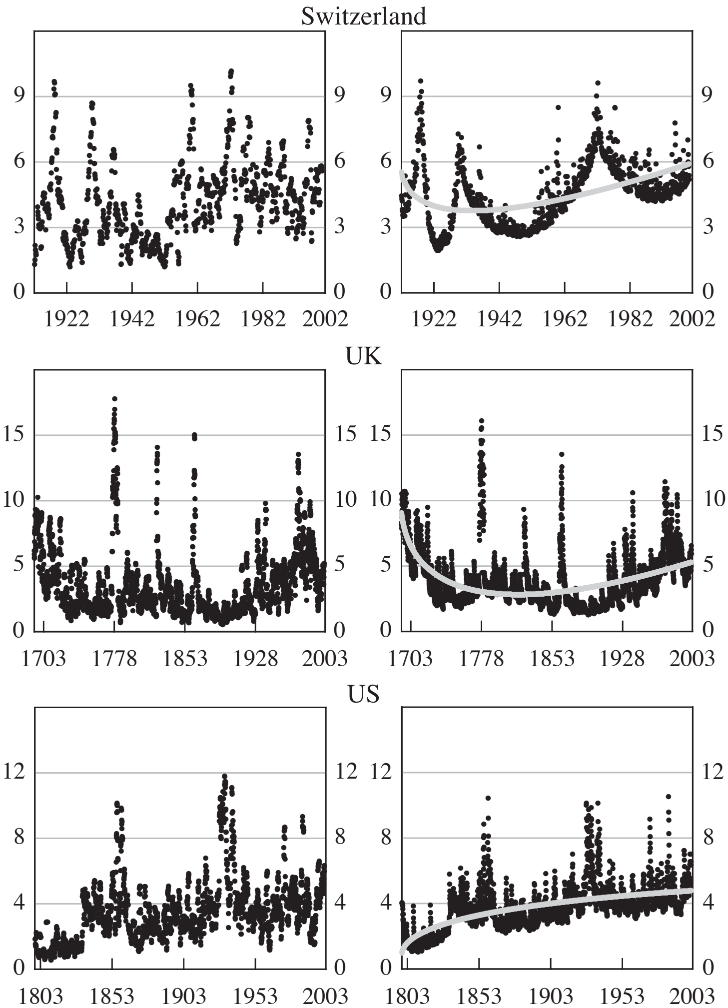
Officer method (left panels) and GARCH with Splines (right panels)



Notes: The right panels display the conditional standard deviations from the GARCH (1,1) model with Splines, along with the quadratic (or other relationship) that best fits these estimates superimposed.

Figure 4: Standard Deviation of Stock Returns

Officer method (left panels) and GARCH with Splines (right panels)



Notes: The right panels display the conditional standard deviations from the GARCH (1,1) model with Splines, along with the quadratic (or other relationship) that best fits these estimates superimposed.

Table 6: Summary of Results for Emerging Markets

Country	Early years	Recent years	Unit root after Spline	Unit root before Spline	u-shape
Chile	Dropping	Dropping	No	No	Decreasing time trend
Argentina	Dropping for the first year	Dropping	No	Weak unit root	Inverted u-shape
Singapore	Dropping for the first year	Dropping	No	No	Constant
Brazil	Dropping for the first two years	Increasing	No	Yes	Increasing time trend
Thailand	Dropping for the first two years	Dropping	No	Weak unit root	Increasing time trend
South Korea	Dropping	Dropping	No	Weak unit root	u-shape
Czech Republic	Dropping	Dropping	No	No	u-shape
Poland	Dropping	Dropping	No	Yes	Decreasing time trend
Hungary	Dropping for the first half year	Constant	No	Yes	Inverted u-shape
Malaysia	Dropping	Dropping	No	No	Dropping first, then staying constant
Hong Kong	Dropping	Dropping	No	Yes	Inverted u-shape

Source: Authors' calculations

3. Explanations

Having presented evidence of a u-shaped pattern for stock market volatility in the advanced economies, we now turn to the question of why it obtains. The obvious answer is changes in the volatility of the economy and the volatility of policy. But Schwert (1989b), analysing a long-time series of historical data like us (but in his case focusing exclusively on the United States), found only weak evidence that stock market volatility is associated with the volatility of the economy. Although he found that both stock returns and output are more volatile in recessions, which can explain why volatility is higher in some periods than others, the additional volatility of activity in such periods appears to be insufficient to explain the additional volatility in asset markets. The point is most obvious for episodes like the Great Depression of the 1930s, but it is more general. In terms of this paper's finding, the point can be put as follows. Most investigators agree that there has been a secular decline in macroeconomic volatility in the now-advanced economies.[25] But while this decline in output volatility has been broadly linear, the same has not been true of stock market volatility.[26] Thus, it is hard to see how the former can explain the latter. At a minimum, other factors must also be at work.

These observations have led researchers in two directions.[27] Schwert (1989b) himself posited that there might be increasing uncertainty about policy and performance in certain periods (he emphasised periods of slow growth and recession). Thus, the rise in stock market volatility in such periods could reflect not just the actual increase in the volatility of the economy but the even greater increase in expected volatility (and dispersion of expectations).[28] Volatility could thus be driven by a small and changing probability of extreme events (the collapse of markets in the Great Depression, for example), events that may not in fact be observed in the sample period.[29] Schwert (1989a) also suggested that bank failures and related forms of financial distress are more prevalent in such periods and that these events are associated with stock market volatility, both because they disrupt the operation of the financial system (including the stock market) and because they raise the probability of sharp policy changes in response. But while Schwert's mechanism can amplify the relationship between output volatility and stock market volatility (if expectations of the former are extrapolative), it cannot obviously explain the nonlinear pattern in volatility levels that we observe.

Subsequent authors challenged Schwert's conclusion that changes in stock market volatility cannot be adequately explained by observed changes in macroeconomic policies and conditions. In effect, they responded by introducing additional macroeconomic variables. Binder and Merges (2001) regressed the volatility of the US S&P Composite Index on measures of monetary uncertainty, the risk premium, and the risk-free rate. All of these variables entered with significant coefficients. In effect, they reversed Schwert's conclusion by augmenting his list of macroeconomic

25. Although they disagree in the extent of the output stabilisation; see Romer (1986) and Balke and Gordon (1989).
26. Even if one is not convinced of our characterisation of volatility trends as u-shaped, the same implication follows from Catao and Timmerman's (2003a) conclusion that volatility levels have shifted repeatedly over time.
27. In addition, authors like Campbell and Cochrane (1995) were led to explore the hypothesis that the additional volatility of the economy in certain periods can explain the rise in the conditional variance of returns when one allows for habit persistence in consumption.
28. In effect, he argued for the existence of a 'peso problem'.
29. Bittlingmayer's (2002) analysis of stock market volatility in the Great Depression is consistent with this view; he constructs proxies for the probability of major changes in US policy (from a count of articles in the *New York Times* on anti-trust matters) and finds that this is strongly associated with stock market volatility. Voth (2002) constructs proxies for these probabilities in the 1920s and shows that they significantly explain stock market volatility. A related paper by Perotti and van Oijen (2001) also finds that political risk and stock market outcomes are correlated, but their study is not directly comparable in that it takes other stock market outcomes – market capitalisation, for example – as the dependent variable.

variables to include additional monetary and financial factors. Similarly, Errunza and Hogan (1995) show that the variability of European returns is associated not just with the fluctuation of output but also with that of money supplies. They argue that the two factors – macroeconomic volatility and financial volatility – go a long way together toward explaining observed stock market volatility.[30]

Other authors extended this approach by introducing a role for financial integration. Kose, Prasad and Terrones (2003) suggest that financial integration (due mainly to the removal of capital controls) is responsible for an increase in the relative volatility of consumption and asset returns, especially in countries that have liberalised their capital accounts only relatively recently and partially. When negative shocks hit these countries, these authors observe, they tend to lose access to international capital markets. The rapid reversal of capital flows in response to these events amplifies the volatility of their consumption and asset market outcomes.[31] Dellas and Hess (2002), on the other hand, find that the removal of capital controls is associated with less output and stock market volatility. This runs counter to the thesis that financial integration increases stock market volatility.[32]

A possible reconciliation may be as follows. Kose *et al* find that consumption and financial market volatility rise with financial liberalisation mainly in countries that have liberalised only partially and relatively recently – that is, in low- and middle-income countries.[33] This suggests that the dominant effect of the removal of capital controls in high-income countries is to enhance the liquidity, depth and efficiency of financial markets.[34] In low-income countries, in contrast, the main

30. In related work, Dellas and Hess (2002) analyse data for 47 countries and also find that stock market volatility is associated with output volatility, and that output volatility is associated in turn with exchange rate volatility – suggesting a role for the monetary regime. Similarly, Billio and Pelizzon (2002) find that the advent of the euro has reduced volatility in traditionally high-volatility European stock markets such as those of Spain and Italy. They also find that volatility has risen in Germany following the advent of the euro. This suggests that the new exchange rate regime may have implied a change in the actual or expected future policy regime (more stable for Italy and Spain, less stable for Germany).

31. This is similar to the conclusion of Schwert (1989b), who finds that stock market volatility has fallen when the Fed has raised margin requirements, which is consistent with the notion that leverage is a source of volatility, working for example through the operation of positive feedback dynamics.

32. It is, however, consistent with the finding in Bordo *et al* (2001) and Glick and Hutchison (2001) that currency crises – episodes of high asset market volatility and extreme realisations– are more prevalent in the presence of capital controls.

33. Klein (2003) similarly identifies threshold effects for growth – per capita income levels only above which the effects of capital account liberalisation on growth are positive.

34. Consistent with this, Claessens, Klingebiel and Schmukler (2002) find that the direct effect of capital account openness on market liquidity is positive, and that more market liquidity is generally associated with less market volatility.

effect of the removal of capital controls is to expose the economy to sudden stops, exacerbating consumption and financial volatility.[35]

In what follows we focus on the role of monetary policy and international financial integration in explaining the u-shaped time profile of stock market volatility. We privilege monetary policy because it is the subject of this conference.[36] We focus on financial globalisation because, like stock market volatility, it also displays a u-shaped pattern; it has been high when stock market volatility has been high (toward the end of the 19th century and again in recent years).[37] There also is Calvo and Mendoza's (2000) conjecture that the globalisation of financial markets has reduced the incentive for investors to assemble and process information about individual market conditions, resulting in greater volatility.[38]

The additional data are from the Bordo *et al* (2001) database, suitably updated.[39] The first step is to estimate the annual standard deviation of the money supply as in Schwert (1989b, p 1117). For most countries we have only annual money stock

35. This has led various authors to further analyse market liquidity in order to gain insight into whether additional liquidity is likely to accentuate or diminish the volatility of financial markets. Claessens *et al* (2002) show that market liquidity is positively associated with incomes per capita (a general measure of the stage of economic development), the soundness of macroeconomic policies, more efficient legal systems with better shareholder protection, and a more open capital account. Other authors argue that more liquid markets tend to be more information efficient, suggesting that they may be more stable. Using data for the US, Lamoureux and Lastrapes (1990) show that trading volume, which they take as a proxy for information flow, significantly predicts future volatility. Dellas and Hess (2002) also find that the volatility of stock market returns declines with the development of a deeper and higher quality banking system. They argue that banks are important providers of both liquidity and information to stock markets. This is consistent with the view of Klein (2003) and Presad *et al* (2003) that financial integration will tend to reduce stock market volatility in countries with relatively well-developed financial systems and efficient information environments, but that it may have the opposite effect where these preconditions are absent.
36. And because there are comparably long-time series on it for the subject countries, facilitating systematic analysis. In addition, many economists will find intuitively appealing the idea that the volatility of stock markets is connected, indeed causally, to the volatility of macroeconomic policies. In particular, those associated with the Reserve Bank of Australia will be tempted to ascribe the decline in stock market volatility in that country, which we document below, to the RBA's adoption of a more stable monetary policy framework (inflation targeting). We will have more to say about this later.
37. See Bordo and Eichengreen (1999). At the same time, there is the counter-case of the 1930s, when financial globalisation declined sharply but stock market volatility rose. We will return to this as well in what follows.
38. One could in principle add more explanatory variables (changes in domestic financial regulation, terms of trade shocks, fiscal disturbances); we leave this for future work.
39. Requiring that we now drop New Zealand.

estimates (quasi M2) for the entire period.[40] We therefore implement the following procedure:

(1) We estimate a 2nd-order autoregression for the money supply growth rate m_t, using all the annual data available:

$$m_t = k_1 + \phi_1 m_{t-1} + \phi_2 m_{t-2} + \mu_{mt} \tag{14}$$

where μ_{mt} is the disturbance term.

(2) We then estimate a 2nd-order autoregression for the absolute values of the errors from the regression in Equation (14),

$$\left|\hat{\mu}_{mt}\right| = \rho_0 + \rho_1\left|\hat{\mu}_{mt-1}\right| + \rho_2\left|\hat{\mu}_{mt-2}\right| + \zeta_t \tag{15}$$

(3) The fitted values $\left|\tilde{\hat{\mu}}_{mt}\right|$ from Equation (15) estimate the conditional standard deviation of m_t, given information available before time t. We impute the monthly standard deviation by dividing the annual standard deviation by the square root of 12.[41]

To estimate the effect of monetary volatility on the stock return deviation, we follow Schwert (1989b, p 1144) by estimating an ordinary least squares regression of the form:

$$\hat{\sigma}_{st} = c + \pi_1\left|\tilde{\hat{\mu}}_{mt}\right| + \pi_2 D_{ct} + \eta_t \tag{16}$$

where $\hat{\sigma}_{st}$ is the stock return standard deviation estimated from our GARCH model with Splines, c is the constant term, $\left|\tilde{\hat{\mu}}_{mt}\right|$ is the fitted standard deviation of the money supply growth rate, and D_{ct} is the capital control indicator.

The results, in Table 7, show that the volatility of money supplies, and by implication the instability of the monetary regime, enters positively as a determinant of stock market volatility in 10 of 11 country cases, and that it is a significant determinant of stock market volatility in every country but one.[42] Thus, we have here at least one potential explanation for changes over time in stock market volatility. In particular, the increase in monetary volatility in many countries in the 1970s and 1980s may be part of the explanation for the rise in stock market volatility in these decades.[43]

40. Although we have monthly data for the US and the UK for all 12 decades and monthly series for the other countries for most of the post-World War II period, as described below. Measuring monetary policy using interest rates is even more problematic, since there do not exist consistent series for market-determined interest rates for all 12 sample countries.

41. When monthly data become available, we re-calculate volatility on their basis. The results turn out to be very similar (see below). This reassures us that the monthly deviation estimated from the annual frequency is close to the monthly deviation estimated from the monthly frequency.

42. Denmark being the exception. Note that we are regressing $\hat{\sigma}_{st}$ on a weighted average of *lagged* standard deviations of the money supply growth rate (lagged one and two years). Timing does not always provide identification, but these lags increase our confidence that what we are picking up is causality running from monetary volatility to stock market volatility rather than the other way around.

43. We will have more to say about this later.

Table 7: Effect of Monetary Policy and Capital Controls on Stock Return Standard Deviation

	Australia	Canada	Denmark	Finland	France	Italy	Japan	Sweden	Switzerland	UK	US
Money supply	0.469 (0.065)	1.565 (0.299)	–0.005 (0.041)	0.479 (0.052)	0.494 (0.052)	0.963 (0.080)	0.263 (0.050)	0.102 (0.048)	2.548 (0.329)	0.618 (0.050)	0.316 (0.163)
Capital controls	1.334 (0.114)	–0.641 (0.051)	–1.464 (0.110)	–1.984 (0.207)	1.679 (0.107)	–0.444 (0.137)	–0.594 (0.119)	–0.755 (0.122)	–0.656 (0.115)	1.677 (0.117)	Dropped
Constant	2.423 (0.139)	2.570 (0.324)	4.604 (0.119)	6.175 (0.242)	3.103 (0.138)	4.530 (0.190)	5.373 (0.151)	4.861 (0.140)	1.761 (0.364)	2.574 (0.097)	3.924 (0.157)
R^2	0.167	0.084	0.148	0.199	0.280	0.146	0.057	0.050	0.179	0.216	0.002
Number of observations	1 114	872	967	885	861	1 018	944	969	575	1 115	1 210

Notes: Standard errors in parentheses. Money supply is at annual frequency.

Source: Authors' calculations

Similarly, that there is a spike in stock market volatility in the 1930s, most notably in the United States, is consistent with this conclusion, given the large literature emphasising the role of unstable monetary policies in the Great Depression. Note further that while Australia's stock market volatility broadly follows the u-shaped pattern common to other countries, there is also evidence of volatility dropping relative to earlier levels in recent years.

It is not clear what lies behind this recent trend in Australia. The decline in stock market volatility roughly coincides with the RBA's shift to an inflation-targeting regime and the associated decline in monetary volatility, although the downward trend in stock market volatility seems to predate the switch to inflation targeting, which suggests that the change in monetary policy operating strategy may not have been all that was going on.[44] Other possibilities include strengthened supervision and regulation (the fall in leverage following the boom period analysed by Simon, (this volume)), the reduction in the underlying volatility of the economy associated with Australia's diversification out of natural resources, and the growth of the stock market itself, which may have increased the representation of relatively small, relatively volatile firms.[45]

Another result from Table 7 is that the dummy variable for the presence of capital controls enters with a negative coefficient in 7 of 10 cases and differs significantly from zero for all 10 countries.[46] A negative coefficient is consistent with the view that financial internationalisation is associated with stock market volatility. Thus, the fact that capital accounts were open both in the late 19th century and in recent years may be part of the explanation for why stock market volatility was relatively high at the beginning and end of our period – for why we observe a u-shaped pattern in volatility.

But three countries deviate from this pattern: in their cases the coefficient in question is significantly positive. The data seem to be telling us that the effects of financial openness on financial volatility are more complex and contingent than those of monetary policy – not surprisingly insofar as this is what both

44. Monthly data and our methods indicate that the standard deviation of money supply growth fell from 1.33 in the period 1985–1989 to 1.20 in the period 1991–1995. Between the same periods the volatility of stock prices fell from 5.44 to 4.66.

45. Another possibility is international financial liberalisation. We show momentarily that the removal of capital controls may have had a stabilising influence on financial markets in the Australian case. Here the timing is somewhat closer: Australia's controls were removed in 1983.

46. Note that we are now forced to drop the US for lack of variation in the capital controls variable.

policy-makers and the recent literature have been telling us as well.[47] Thus, the contingent nature of the effects of financial openness may be what we are picking up in the present results.

This audience may be particularly interested that controls are positively associated with volatility in Australia: the estimates suggest that for this country financial globalisation has been a stabilising force. We obtain this result both using annual data for 12 decades and monthly data for the period since 1957.

These findings are robust to a variety of sensitivity analyses. The results using monthly data, which are available for this group of sample countries starting in the 1950s, are similar to those reported above. We obtain the same variety of coefficients on capital controls as for the longer period. And in all cases we obtain the same positive coefficient for monetary volatility as when we use annual money stock data for the longer period.[48]

A further form of sensitivity analysis is to compare the results for the period when monthly data become available using annual data (that is, eliminating the annual observations for preceding decades, which means that all differences are attributable to the periodicity of the data and not the time span covered). When we do this, we again obtain qualitatively similar results. In the case of Australia, for example, the coefficients on monetary volatility and capital controls both keep their positive signs when we use annual data starting in 1957, and both coefficients remain statistically significant at the 95 per cent confidence level.

For two countries, the United States and the United Kingdom, we also have consistent monthly money supply series for longer historical periods. For the US, we have monthly M2 data starting in 1907 from Friedman and Schwartz (1963); for the UK, we have monthly data starting in 1880 from Capie and Wood (1985). Estimates using these monthly series yield similar results to before (see Table 8).

47. Specifically, a number of recent authors have suggested that capital account openness is stabilising for domestic financial markets only when a country's institutional development and regulatory quality surpass a critical threshold (see e.g. Presad *et al* (2003)). That said, it is not clear how to interpret the constellation of coefficients estimated here. For example, it is not obviously the case that the effect of controls is different in countries with relatively well-developed financial markets: the coefficient on controls is negative for Switzerland but positive for the UK. It is not obvious that financial openness is associated with lower volatility in higher-income countries: controls are associated with additional volatility in France but less volatility in Japan. It is tempting to argue that capital account liberalisation is volatility-increasing in countries with bank-based financial systems and volatility-reducing in countries that rely on securitised finance, but France and, arguably, Australia fall into the wrong category. It could be that the effects are not constant over time, or that they are contingent on other factors, like the strength of domestic institutions and regulation, which is the direction in which the literature on the connections between international financial openness and economic growth has been heading in recent years. It is hard to say more at this point than that this complex relationship deserves further study.

48. Levels of statistical significance are somewhat lower for a number of countries when we use monthly data for the shorter (post-World War II) period.

Table 8: Effect of Monetary Policy and Capital Controls on Stock Return Standard Deviation
Monthly data

	Australia	Canada	Denmark	Finland	France	Italy	Japan	Sweden	Switzerland	UK	US
Starting month	1957:1	1957:1	1957:1	1969:1	1957:1	1962:1	1963:1	1960:1	1957:1	1880:1	1907:1
Money supply	1.086	0.098	1.051	5.286	0.119	0.043	0.405	1.537	0.147	0.310	0.901
	(0.184)	(0.096)	(0.166)	(4.655)	(0.064)	(0.057)	(0.119)	(0.151)	(0.089)	(0.082)	(0.183)
Capital controls	0.829	Dropped	–0.849	–4.108	0.319	–1.601	–1.240	–2.380	–0.615	1.957	Dropped
	(0.137)		(0.123)	(0.202)	(0.127)	(0.115)	(0.101)	(0.138)	(0.126)	(0.068)	
Constant	3.528	4.538	3.176	8.781	5.010	7.466	5.909	5.900	4.686	1.635	4.173
	(0.242)	(0.140)	(0.294)	(0.255)	(0.173)	(0.136)	(0.242)	(0.218)	(0.156)	(0.128)	(0.074)
R^2	0.0881	0.0033	0.1358	0.6036	0.0331	0.2668	0.2566	0.590	0.1805	0.507	0.0626

Notes: Standard errors in parentheses. Money supply is at monthly frequency.
Source: Authors' calculations

Finally, we substituted alternative estimates of the dependent variable (the conditional standard deviation of the stock market return). For example, we constructed the dependent variable using the Officer method instead of the GARCH model with Splines. Again, the results were very similar.

Together, these sensitivity analyses reassure us that our findings on the connections between monetary volatility and stock market volatility are not a product of the particular way in which we estimate the conditional standard deviation of the stock market return. They are not a figment of annual data. Nor are they entirely driven by the exceptional volatility of the 1930s.

Two further comments on money supply volatility are important in this context. First, the rise in monetary volatility following the breakdown of the Bretton Woods System, which removed the only existing orientation for monetary policy in many countries, has been widely remarked upon (see DeLong (1996) and Sargent (1999)). Comparing 1945–1970 with subsequent years, we see an increase in the volatility of monetary policy, as measured by Equation (15), in 9 of our 11 countries.[49] In retrospect, that this should contribute to greater stock market volatility is hardly surprising.

Second, the idea that the pre-1913 period was one of monetary volatility may surprise readers familiar with the gold-based monetary arrangements of the time, which limited the scope for discretionary policy. But the gold standard was also marked by not infrequent crises, which affected the currency/deposit multiplier, and by periodic gold discoveries. Moreover, money supply under the gold standard was at least partly endogenous; it responded to output fluctuations, as under any fixed exchange rate regime. To the extent that output was more volatile before 1913 than after 1945, so too would have been money supply, *ceteris paribus*.[50] Whatever the explanation, in 5 of the 10 countries for which we have sufficient annual data to make the comparison, the standard deviation of the money supply (again estimated following Equation (15) above) was larger before 1914 than in 1945–1970.[51]

One way of gaining purchase on these questions is to replace our measure of monetary volatility with dummy variables for the exchange rate regime.[52] We adopt the standard tripartite distinction of fixed rates, intermediate regimes, and flexible rates. The results are shown in Tables 9 and 10. Consider again the case of Australia. The coefficients on both fixed and intermediate regimes are negative (compared to the omitted alternative, of flexible regimes) and statistically significant at standard confidence levels. In addition, the coefficient on capital controls remains positive as before. When we include the two exchange rate regime measures and our measure of monetary volatility in the same equation (in Table 10), each of these variables matters.

49. The exceptions are Denmark and Japan.

50. This reminds us that while monetary volatility may be associated with stock market volatility, both variables may in fact be reflecting the volatility of deeper determinants.

51. The standard deviation of the money stock as we construct it becomes available for Finland only in 1916, so for that country we are unable to make the comparison.

52. Which can be considered as largely predetermined over the long historical sweep.

Table 9: Effect of Exchange Rate (EX) Regimes and Capital Controls on Stock Return Standard Deviation

	Australia	Canada	Denmark	Finland	France	Italy	Japan	Sweden	Switzerland	UK	US
Fixed EX regime	–2.360	–0.613	–1.986	–1.240	–2.678	–0.551	–1.300	–0.259	0.546	–1.199	–0.731
	(0.094)	(0.045)	(0.227)	(0.418)	(0.135)	(0.126)	(0.289)	(0.103)	(0.247)	(0.133)	(0.064)
Intermediate EX regime	–0.754	0.733	0.282	–2.067	–2.480	1.177	0.277	1.968	0.466	1.304	0.825
	(0.145)	(0.063)	(0.226)	(0.395)	(0.139)	(0.133)	(0.283)	(0.110)	(0.213)	(0.150)	(0.152)
Capital controls	1.318	–0.218	–0.709	–1.757	1.301	–0.628	–0.371	–0.859	–1.112	1.023	Dropped
	(0.096)	(0.041)	(0.099)	(0.219)	(0.108)	(0.118)	(0.282)	(0.082)	(0.120)	(0.092)	
Constant	4.865	4.209	4.839	8.569	6.629	5.715	6.005	4.249	4.069	3.656	4.603
	(0.083)	(0.046)	(0.216)	(0.421)	(0.113)	(0.168)	(0.087)	(0.100)	(0.200)	(0.123)	(0.055)
R^2	0.31	0.47	0.51	0.1746	0.36	0.1826	0.058	0.4744	0.117	0.45	0.191
Number of observations	1 114	872	967	885	861	1 018	944	969	575	1 115	1 210

Notes: Standard errors in parentheses. Money supply is at annual frequency.

Source: Authors' calculations

Table 10: Effect of Monetary Policy, Exchange Rate (EX) Regimes and Capital Controls on Stock Return Standard Deviation

	Australia	Canada	Denmark	Finland	France	Italy	Japan	Sweden	Switzerland	UK	US
Money supply	0.186	1.229	–0.052	0.487	0.411	0.842	0.260	–0.123	2.461	0.274	–0.309
	(0.060)	(0.189)	(0.037)	(0.056)	(0.063)	(0.094)	(0.047)	(0.048)	(0.340)	(0.042)	(0.153)
Fixed EX regime	–2.310	–0.538	–2.057	–1.349	–2.311	–0.053	–1.355	–0.282	0.431	–1.300	–0.644
	(0.096)	(0.050)	(0.247)	(0.408)	(0.154)	(0.128)	(0.288)	(0.104)	(0.232)	(0.141)	(0.069)
Intermediate EX regime	–0.948	0.785	0.209	–2.115	–1.995	1.228	0.198	1.974	0.369	1.835	0.940
	(0.137)	(0.064)	(0.252)	(0.389)	(0.165)	(0.129)	(0.270)	(0.110)	(0.206)	(0.149)	(0.168)
Capital controls	1.794	–0.237	–0.719	–1.467	1.537	–0.581	–0.511	–0.859	–0.867	1.820	Dropped
	(0.106)	(0.044)	(0.099)	(0.220)	(0.114)	(0.114)	(0.273)	(0.082)	(0.119)	(0.085)	
Constant	4.430	2.761	5.044	7.397	5.343	4.313	5.380	4.441	1.640	3.196	4.872
	(0.156)	(0.226)	(0.288)	(0.452)	(0.207)	(0.218)	(0.145)	(0.120)	(0.397)	(0.148)	(0.138)
R^2	0.40	0.50	0.51	0.26	0.38	0.25	0.10	0.47	0.19	0.67	0.18

Notes: Standard errors in parentheses. Money supply is at annual frequency.

Source: Authors' calculations

We obtain similar results for other countries, with one important exception, namely that in the majority of cases we obtain a positive coefficient for intermediate exchange rate regimes. This is consistent with the scepticism of many observers (including one of the present authors) of the durability and credibility of such regimes. If intermediate regimes do not effectively constrain potentially erratic monetary policies, they will not be associated with low levels of stock market volatility, other things equal. There is now a large literature questioning whether the constraint they impose is effective.

The volatility of the money supply retains its significance in the vast majority of sample countries. In other words, while events like the breakdown of the gold standard following World War I and subsequent interlude of floating or the breakdown of the Bretton Woods System and the subsequent shift to flexible rates may partly explain the rise in stock market volatility in the 1920s and 1970s, they are not the entire story; the shift to floating implied a greater increase in monetary volatility in some countries than others, and this is being picked up by the additional effect of the standard deviation of money supplies even after controlling for the change in exchange rate regime. Our interpretation of this finding is that if the exchange rate anchor for monetary policy is removed, then it is important to put an alternative anchor for policy in its place in order to avoid amplifying financial volatility.[53]

4. Conclusions

In this paper we have studied the volatility of stock markets in the long run. We first established that volatility has not been constant. For the majority of countries we consider, there is evidence of a u-shaped pattern, with volatility first falling before turning back up in recent decades. The early decline is explicable in terms of improvements in the information and contracting environment – that is, in terms of the development of financial markets during the initial phases of modern economic growth. The recent rise is more disturbing and controversial.

We then considered the roles of monetary policy and financial internationalisation, two candidates for explaining these trends. We found a positive association of monetary volatility with stock market volatility; an interpretation is that the conduct of monetary policy and the nature of the monetary regime are important for stock market volatility. That monetary policy became increasingly volatile in a number of countries in the 1970s and 1980s thus may be part of the explanation for why stock markets have been more volatile in recent decades.

Probing deeper, we found that fixed exchange rate regimes are associated with relatively low levels of stock market volatility, flexible exchange rate regimes with relatively high ones. This makes it tempting to conclude that the collapse of currency pegs and the transition to floating explain the recent rise in stock market

53. To be clear, we do not wish to draw implications from these results for the comparative merits of pegged and floating exchange rates. That would involve a larger calculation entailing much more than the implications for stock market volatility (which are, as we have seen, contingent in any case).

volatility. But not only the official exchange rate regime but also the conduct of monetary policy under that regime appear to matter, in that we find a positive effect of monetary volatility on stock market volatility even after controlling for the exchange rate regime. Not just the putative exchange rate regime matters for the volatility of financial market outcomes, in other words; also important is the credibility and conduct of monetary policy under that regime.

We further find, for the majority of countries considered, that financial internationalisation is positively associated with stock market volatility. That international financial markets were open both in the late 19th century and in recent decades thus may be another part of the explanation for why we observe a u-shaped pattern in stock market volatility. This interpretation is consistent with Calvo and Mendoza's (2000) conjecture that the globalisation of financial markets has reduced the incentive for investors to assemble and process information about individual market conditions, resulting in greater financial volatility. But it is important to emphasise the existence of a substantial minority of countries – including Australia – where financial internationalisation does not display this association. In these countries, financial openness is associated with less stock market volatility, not more. The only safe conclusion may be that the effects of international financial openness are complex and contingent – something which careful observers will already have concluded from the experience of recent years.

For Australia, our host country, we find some evidence of a u-shaped pattern in stock market volatility but also signs of a decline in volatility in the 1980s and 1990s. This break coincides with the removal of capital controls and with a decline in monetary volatility associated with the adoption by the Reserve Bank of its inflation-targeting strategy. We thus see Australia as an illustration of how the shift to greater exchange rate flexibility and financial openness need not imply greater financial volatility if monetary policy is anchored in a credible and coherent operating strategy and if capital account convertibility is well sequenced and supported.

Stock market volatility, in and of itself, is neither good nor bad. As emphasised at the beginning of this paper, equity-price fluctuations convey signals that play an important role in resource allocation. But if equity markets are dominated by noise rather than signal, their volatility is less reassuring. This perspective suggests that it is important to limit the noise added by monetary policy and international transactions. Specifically, if the exchange rate anchor for monetary policy is cut adrift, it is important to put another anchor such as inflation targeting in its place. And, if the capital account is opened, it is important to put in place the institutional supports needed to ensure that capital account transactions are a stabilising force.

For the emerging markets that are following in the footsteps of the now-advanced economies, the implications are mixed. On the one hand, the historical decline in stock market volatility enjoyed by the advanced economies as their financial markets developed and matured suggests that emerging markets may similarly experience a decline in volatility as they graduate from the early stages of financial development. Insofar as volatility and crises go together – note that the concept of a crisis is sometimes operationalised as an extremity in the distribution of asset market returns (see, for example, Eichengreen, Rose and Wyplosz (1995)) – this change over time would suggest a tendency for the frequency of crises in emerging markets to decline to the lower levels characteristic of the now-advanced economies. On the other hand, the recent tendency for volatility to rise in the now-advanced economies suggests that there are also disturbing counter-currents – that something, be it changes in the monetary regime, the financial implications of globalisation or another factor, may be making for additional crisis risk. Unfortunately, the data for emerging markets do not speak clearly. The available time series are too short and buffeted by too many disturbances and structural breaks to allow us to conclude with any confidence that a similar u-shaped pattern is or will be evident there. This is a question that will have to be left for future historians.

References

Balke N and R Gordon (1989), 'The estimation of prewar GNP: methodology and new results', *Journal of Political Economy*, 97(1), pp 38–92.

Bekaert G and CR Harvey (1997), 'Emerging equity market volatility', *Journal of Financial Economics*, 43(1), pp 29–77.

Billio M and L Pelizzon (2002), 'The European single currency and the volatility of European stock markets', University of Venice and University of Padua, unpublished manuscript.

Binder J and M Merges (2001), 'Stock market volatility and economic factors', *Review of Quantitative Finance and Accounting*, 17(1), pp 5–26.

Bittlingmayer G (2002), 'The 1920's boom, the great crash, and after', University of Kansas, unpublished manuscript.

Bollerslev T (1986), 'Generalized autoregressive conditional heteroskedasticity', *Journal of Econometrics*, 31(3), pp 307–327.

Bollerslev T, R Chou and K Kroner (1992), 'ARCH modeling in finance: a review of the theory and empirical evidence', *Journal of Econometrics*, 52, pp 5–59.

Bollerslev T, RF Engle and DB Nelson (1994), 'ARCH models', *Handbook of econometrics*, 4, North Holland, Amsterdam, pp 2961–3038.

Bordo M and B Eichengreen (1999), 'Is our current international economic environment unusually crisis prone?', in D Gruen and L Gower (eds), *Capital flows and the international financial system*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp 18–74.

Bordo M, B Eichengreen, D Klingebiel and MS Martinez-Peria (2001), 'Is the crisis problem growing more severe?', *Economic Policy*, 32, pp 53–82.

Calvo G and E Mendoza (2000), 'Rational contagion and the globalization of securities markets', *Journal of International Economics*, 51(1), pp 79–113.

Campbell J and J Cochrane (1995), 'By force of habit: a consumption-based explanation of aggregate stock market behavior', NBER Working Paper No 4995.

Capie F and G Wood (1985), *A monetary history of the United Kingdom, 1870–1982*, Allen & Unwin, London.

Catao L and A Timmerman (2003a), 'Country and industry dynamics in stock returns', IMF Working Paper WP/03/52.

Catao L and A Timmerman (2003b), 'Deciphering the determinants of stock market volatility', *IMF Survey*, 32, pp 132–134.

Claessens S, D Klingebiel and S Schmukler (2002), 'Explaining the migration of stocks from exchanges in emerging economies to international centers', University of Amsterdam and World Bank, unpublished manuscript.

Dellas H and M Hess (2002), 'Financial development and stock returns: a cross-country analysis', Center for Economic Policy Research Discussion Paper Series No 3681.

DeLong JB (1996), 'America's only peacetime inflation: the 1970s', NBER Historical Paper No 84.

Eichengreen B, A Rose and C Wyplosz (1995), 'Exchange market mayhem: the antecedents and aftermath of speculative attacks', *Economic Policy: A European Forum*, 21, pp 251–312.

Errunza V and K Hogan (1995), 'Macroeconomic determinants of European stock market volatility', Barclays Global Investors, unpublished manuscript.

Friedman M and A Schwartz (1963), *A monetary history of the United States 1867–1960*, National Bureau of Economic Research Studies in Business Cycles No 12, Princeton University Press, Princeton.

Glick R and M Hutchison (2001), 'Stopping "hot money" or signaling bad policy? Capital controls in the onset of currency crises', Federal Reserve Bank of San Francisco and University of California, Santa Cruz, unpublished manuscript.

Goetzmann WN, L Li and KG Rouwenhorst (2001), 'Long-term global market correlations', NBER Working Paper No 8612.

Hong CH (1987), 'The integrated generalized autoregressive conditional heteroskedasticity model: the process, estimation and some Monte Carlo experiments', University of California, San Diego, unpublished manuscript.

IMF (International Monetary Fund) (2003), *Global financial stability review*, Washington DC.

Jorion P and W Goetzmann (1999), 'Global stock markets in the twentieth century', *Journal of Finance*, 54(3), pp 953–980.

Klein M (2003), 'Capital account openness and the varieties of growth experience', NBER Working Paper No 9500.

Kose MA, ES Prasad and ME Terrones (2003), 'Financial integration and macroeconomic volatility', IMF Working Paper No WP/03/50.

Lamoureux CG and WD Lastrapes (1990), 'Heteroskedasticity in stock return data: volume versus GARCH effects', *Journal of Finance*, 45(1), pp 221–229.

Lee SW and B Hansen (1994), 'Asymptotic theory for the GARCH(1,1) quasi-maximum likelihood estimator', *Econometric Theory*, 10(1), 29–52.

Lumsdaine RL (1996), 'Consistency and asymptotic normality of the quasi-maximum likelihood estimator in IGARCH(1,1) and covariance stationary GARCH(1,1) models', *Econometrica*, 64(3), pp 575–596.

Officer R (1973), 'The variability of the market factor of the New York Stock Exchange', *Journal of Business*, 46(3), pp 434–453.

Perotti E and P van Oijen (2001), 'Privatization, political risk and stock market development in emerging economies', *Journal of International Money and Finance*, 20(1), pp 43–69.

Presad E, K Rogoff, S Wei, and MA Kose (2003), 'Effects of financial globalization on developing countries: some empirical evidence', manuscript available at <http://www.imf.org/external/np/res/docs/2003/031703.htm>.

Romer CD (1986), 'Is the stabilization of the postwar economy a figment of the data?', *American Economic Review*, 76(3), pp 314–334.

Sargent T (1999), *The conquest of American inflation*, Princeton University Press, Princeton.

Schwert GW (1989a), 'Business cycles, financial crises and stock volatility', NBER Working Paper No 2957.

Schwert GW (1989b), 'Why does stock market volatility change over time?', *Journal of Finance*, 44(5), pp 1115–1153.

Voth H (2002), 'Why was stock market volatility so high during the Great Depression? Evidence from 10 countries during the interwar period', Centre for Economic Policy Research Discussion Paper Series No 3254.

Discussion

1. Robert McCauley[1]

Introduction

This discussion raises five questions. First, what are the questions that policy-makers are posing to economic historians about asset-price inflation and monetary policy? Second, what is the relationship between medium-term equity price inflation and higher frequency equity price volatility? Third, what can be said of the relationship of such volatility to monetary volatility? Fourth, how should we conceive of financial openness to the rest of the world: as a cause of equity volatility or as a propagating mechanism? Finally, what sort of answer did the evidence marshalled by the historian of land prices in Chicago offer to the question of the connection between monetary policy regime and asset-price inflation?

What are the questions?

What do policy-makers want from the economic historian on this subject? They want answers to the following questions:

1. Does the successful stabilisation of consumer prices imply that asset inflation and associated credit excesses are less likely?
2. Or should asset inflation and credit excess be expected to appear more or less without regard to the monetary regime?
3. Or should we expect asset inflation to be a bigger or more frequent problem in a regime of stable prices or in the transition thereto?

In arguing for the benefits of lower inflation, central bankers tended to promise greater financial stability, as if only highly variable nominal returns (or tax distortions) under inflation caused inflation of real assets like equities or real estate. More recently, the thought that low inflation is no proof against asset inflation and associated credit excesses has gained acceptance.[2] Now, some observers have begun to argue that low inflation can actually make asset inflation more likely or worse.

In this conference, Charles Bean noted that the credibility of a low-inflation policy can reduce the transmission of asset prices into consumer prices, allowing potentially hazardous imbalances to build up without producing a ready justification to respond

---

1. Deputy Chief Representative, Representative Office for Asia and the Pacific, Bank for International Settlements (BIS). Views expressed are those of the author and not necessarily those of the BIS. Thanks are due to Claudio Borio and Eli Remolona for discussions on the subject of this paper. All errors of fact and problematic interpretations remain those of the author.
2. See Borio and White (2003).

to them under a policy of inflation targeting (Bean, this volume).[3] Another argument is that falling inflation interacts with money illusion to make asset inflation more likely. In the equity market, the Modigliani-Cohn effect means that lower inflation provides a spurious fillip to profit growth as nominal interest rates fall in response to lower inflation.[4] In the real estate market, standard housing affordability criteria (such as monthly mortgage servicing in relation to income) hard-wire money illusion. In particular, lower (nominal but not real) interest payments from lower inflation put home purchase within reach of households further down the income scale.

What's vol got to do with it?

It is easy both to overstate and to neglect the relationship between asset inflation and asset-price volatility. Asset inflation, sometimes referred to as asset-price misalignment, is something like a medium-term deviation from trend, and can be measured by something like an integral. Associated extension of credit cumulates into a stock that gets large in relation to underlying income. Volatility, as traded in the market and measured by economists, is a summary measure of the (*ex ante* or *ex post*) change over some short period in price or return (BIS 1996). Volatility ignores the sign of movements, while asset inflation or deflation requires the predominance of one sign over a sustained period. In principle, asset-price inflation does not imply high volatility nor does high volatility imply asset-price inflation. The former can be of first order macroeconomic importance, as high equity prices boost consumption and investment. In contrast, the effect of volatility, taken in isolation, is typically hard to detect.

In practice, Black (1976) and later Christie (1982) found that volatility is 'directional', that is, tends to be higher in down markets. The implication is that volatility can be moderate in the period of asset inflation but tends to be higher in a period of asset deflation.[5] Why this is so is not well understood. Black proposed a 'leverage effect': a lower share price puts the value of the firm closer to the put to the creditors, raising the option element in share prices and thereby making them more volatile. But Borio and McCauley (1996) found higher volatility in bond market sell-offs, as seen most recently in June–July 2003, which cannot have the same explanation. Instead, we suggested that leverage at the level of the holder of the security, whether banks, securities firms or hedge funds, forced stop-loss sales into declining markets.

The implication of the distinction between asset inflation and volatility is that Eichengreen and Tong are not really addressing the questions in which policy-makers are primarily interested. In particular, findings that monetary volatility or financial

3. See also Borio and Lowe (2002) and Kent and Lowe (1997).

4. See McCauley, Ruud and Iacono (1999, pp 215–219) for estimates of the portion of profit growth in the US in the late 1990s that derived from the Modigliani-Cohn effect. See Shiller (2000, pp 36–39) for a discussion.

5. This means that short-term measures of financial risk, like value-at-risk, can misleadingly signal low risk at the top, when risk is highest.

openness are associated with somewhat higher volatility do not move forward a discussion that involves, not marginal if statistically significant differences in volatility, but rather sustained asset inflation and deflation.

The implication of the directionality of volatility is that the estimation of the latent variable of volatility in the paper could in all likelihood be improved. Technically, this latent variable is estimated as a moving average of squared errors from a (poor) model of price movements – so that, in practice, volatility is a moving average of squared returns. The latent measure of volatility should be allowed to be greater in response to downward price movements ('bad news') than to price rises ('good news'), as in Nelson (1991), Glosten, Jagannathan and Runkle (1993) and Hentschel (1995). A dummy for negative returns interacted with the (squared) return would probably work as well as anything.

What is the relationship between equity volatility and monetary volatility?

Eichengreen and Tong find that monetary volatility is associated with equity volatility across their sample of now-industrialised countries. It is, however, not clear whether this relationship should be read right to left or left to right. Looking just at the US, Wilson, Sylla and Jones (1990) argue reverse causation, from stock market crashes to monetary panics, especially in 1893 and 1907. Most recently, the Federal Reserve put aside its characteristic gradualism in 2001 in responding to a shallow recession but a large loss of stock market wealth.

Eichengreen and Tong find lower volatility under fixed exchange rates, contrary to the widely held 'ball of volatility' notion – you can hold down volatility in one market but it only rises in another. This finding contrasts with that of Eichengreen and Mitchener (2003), who observe that 'the amplitude of credit booms as measured by the standard deviation was greater in periods when exchange rates were pegged than when they were floating'.

Have the authors measured monetary volatility in a satisfactory manner? Almost surely their measure of money is not consistent across time or across countries. At the same time, it is not clear that a consistent measure is desirable or practical given the financial innovation that can make a narrower aggregate less stable or useful than a broader aggregate. The authors could test for robustness using short-term interest rate volatility where possible, although the results of Wilson *et al* (1990) are not encouraging.

Financial openness: cause or propagating mechanism?

The authors treat financial openness as a factor additional to monetary volatility as a potential explanation for equity price volatility. Clearly, financial openness allowed the 1987 crash, for instance, to spread to continental Europe, even though prices of German stocks had not shared in much of the rise in US or UK stocks. But did financial openness explain the volatility of German stocks? Or did financial openness permit volatility to be communicated from New York to Frankfurt? To take another example, most of the recent bond market sell-off was transmitted from the US dollar market to the euro and Australian dollar bond markets. Again, financial openness permitted propagation. But some explanation (e.g. interaction of a revised outlook for monetary policy and leverage in mortgage holdings and elsewhere) is needed to explain the sell-off and accompanying volatility in the US.

What did Homer Hoyt find regarding asset inflation and monetary regime?

Writing 70 years ago, Homer Hoyt found that there had been five major peaks in land prices in Chicago. He found that some, but not all, of these had followed (or in the case of the 1920s, preceded) equity price peaks, and that conversely, some, but not all, equity price peaks had been associated with peaks in land prices.[6] Hoyt's asset-price cycles span gold standard, floating exchange rates and gold exchange standard. They also span wildcat banking and the *National Bank Act*, as well as a long span with no proper central bank and a shorter span after the founding of the Federal Reserve. The post-Bretton Woods combination of floating exchange rates and an activist Federal Reserve has featured further episodes of real estate booms in Chicago and national equity booms. Prima facie, it seems that asset-price inflation is a hardy plant that can grow in very different climates.

Table 1: Hoyt on US Asset-price Inflation over 100 years

Land peak	1836	1856	1873		1892		1925
Equity peak	1835 (–50.6%)	1853 (–50.6%)		1881 (–26.7%)		1906 (–19.4%)	1929 (–73.4%)

Note: Declines in parentheses are peak-to-trough movements in stock prices as reported by Bordo in Eichengreen and Mitchener (2003, p 85).

Source: Hoyt (1933)

Conclusions

Eichengreen and Tong have made an important contribution to the study of long-term equity price volatility. Policy-makers will continue to look for guidance from economic historians on the connection between monetary regimes and policy, on the one hand, and asset-price inflation, on the other.

6. See BIS (2003, pp 116–119) for evidence on the lag between equity price peak and housing price peak.

References

BIS (Bank for International Settlements) (1996), 'Financial market volatility: measurement, causes and consequences', BIS Conference Papers No 1.

BIS (2003), *73rd Annual Report*, Basel.

Black F (1976), 'Studies of stock price volatility changes', in *Proceedings of the 1976 Meeting of the American Statistical Association, Business and Economics Statistics Section*, American Statistical Association, pp 177–181.

Borio C and P Lowe (2002), 'Asset prices, financial and monetary stability: exploring the nexus', BIS Working Papers No 114.

Borio C and RN McCauley (1996), 'The economics of recent bond market yield volatility', BIS Economic Papers No 45.

Borio C and WR White (2003), 'Whither monetary and financial stability? The implications of evolving policy regimes', paper presented at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–30 August.

Christie AA (1982), 'The stochastic behavior of common stock variances', *Journal of Financial Economics*, 10(4), pp 407–432.

Eichengreen B and K Mitchener (2003), 'The Great Depression as a credit boom gone wrong', BIS Working Papers No 137.

Glosten LR, R Jagannathan and DE Runkle (1993), 'On the relation between the expected value and the volatility of the nominal excess return on stocks', *Journal of Finance*, 48(5), pp 1779–1801.

Hentschel L (1995), 'All in the family: nesting symmetric and asymmetric GARCH models', *Journal of Financial Economics*, 39(1), pp 71–104.

Hoyt H (1933), *One hundred years of land values in Chicago: the relationship of the growth of Chicago to the rise of its land values, 1830–1933*, University of Chicago Press, Chicago.

Kent C and P Lowe (1997), 'Asset-price bubbles and monetary policy', Reserve Bank of Australia Research Discussion Paper No 9709.

McCauley RN, JS Ruud and F Iacono (1999), *Dodging bullets: changing US corporate capital structures in the 1980s and 1990s*, MIT Press, Cambridge, Mass.

Nelson DR (1991), 'Conditional heteroskedasticity in asset returns: a new approach', *Econometrica*, 59(2), pp 347–370.

Shiller R (2000), *Irrational exuberance*, Broadway Books, New York.

Wilson JW, RE Sylla and CP Jones (1990), 'Financial market panics and volatility in the long run, 1830–1988', in EN White (ed), *Crashes and panic: the lessons from history*, Dow Jones-Irwin, Homewood, pp 85–125.

2. General Discussion

A number of conference participants raised issues about the statistical methodology of Eichengreen and Tong's paper. One participant noted that in general it is difficult to measure volatility, as statistical measures will tend to be dominated by large, one-off events, such as the Great Depression or the 1987 stock market crash. The participant suggested that when these events are removed the pattern of the level of volatility in the stock market may look substantially different. In addition, it was also raised that there is a conceptual issue as to whether it was appropriate to treat these one-off events as volatility, rather than as shifts in the level of share prices. Another participant wondered whether a methodology of starting with a higher-order polynomial and then paring down the insignificant powers would still have yielded the 'u' or 'n' shape found for volatility in most countries. Two participants suggested that, rather than treating each country separately, it might have been interesting to use panel-regression techniques, as this would have captured the effects of common (global) shocks.

There was also comment about the use of monetary aggregates to measure the stance and conduct of monetary policy in the paper, as changes in the financial intermediation process have caused the relationship between monetary aggregates and the real economy to change over time. In response, Eichengreen agreed that monetary aggregates were an imperfect measure, however he argued that it was difficult to obtain consistent historical series of interest rates for all of the countries.

Much of the discussion focused on possible other variables that might explain the observed pattern of equity market volatility. One participant noted that over the second half of the 20th century there was a considerable decline in the volatility of the real economy for the G7 countries, however, only financial variables had been considered in this paper. The size of financial markets relative to the real economy was also suggested as a possible explanatory variable. Some participants thought that differences in the level of equity market volatility across countries could in part reflect differences in financial and legal structures, and the consequent variation in the extent of reliance on equity financing by businesses.

Focusing on the Australian stock market, a factor raised as a possible explanation for the decrease in equity market volatility over the past two decades was the change in industrial composition that has occurred. The example cited was the considerably lower weight of resource stocks in the overall market today. This could have led to lower volatility as the prices of resource stocks tend to be more volatile than the broader market as they are heavily influenced by fluctuations in global commodity prices. Another factor cited as possibly contributing to the decline of volatility was the process of financial deregulation that occurred in the early 1980s.

The question of whether asset-price misalignments were more common during periods of low and stable inflation was also discussed. Some participants questioned the tentative conclusion reached by Eichengreen and Tong that the adoption of inflation targeting may have caused the decrease in equity market volatility observed in Australia. They noted that decreases in volatility were not reflected in the results for other countries that had also followed inflation targeting (or pseudo inflation targeting). It was also noted that historically, asset-price misalignments have frequently occurred in times of low inflation (or deflation), such as during the 1920s in the United States, the 1880s in Victoria and the 1980s in Japan.

Home-buyers, Housing and the Macroeconomy

Karl E Case, John M Quigley and Robert J Shiller[1]

Abstract

We present the results of a new survey of US home-buyers in 2002. The most important finding is that the survey suggests that home-buyers' expectations are substantially affected by recent experience. Even after a long boom that has taken prices to very high levels, home-buyers typically have expectations that prices will show double-digit annual price growth over the next 10 years, apparently with only a modest level of risk. We conjecture that these characteristics of individuals' expectations may contribute to the substantial swings that are observed in housing prices. Changes in housing wealth, especially if they are perceived as long-lasting, may have substantial macroeconomic effects through private consumption. In the second part of the paper, we examine the link between increases in housing wealth, financial wealth, and consumer spending. We rely upon a panel of 14 countries observed annually for various periods during the past 25 years and a panel of US states observed quarterly during the 1980s and 1990s. We find a statistically significant and rather large effect of housing wealth upon household consumption.

1. Introduction

Since 1995 housing prices in virtually every metropolitan area in the US have been rising faster than incomes and faster than other prices. Despite the fact that the economy was in recession during the first three quarters of 2001 and despite the loss of nearly 3 million jobs, the price of single-family homes, the volume of existing home sales and the number of housing starts in the US have remained at near-record levels. There can be no doubt that the housing market and spending related to housing sales have kept the US economy growing and has prevented a 'double dip' recession since 2001.

However, the historical record provides reasons for concern over the substantial price growth that has occurred in recent years. During the 1980s, spectacular home-price booms in California and the Northeast helped stimulate the underlying economy on the way up, but they ultimately encountered a substantial drop in demand in the late 1980s and contributed significantly to severe regional recessions in the early

1. Prepared for the Reserve Bank of Australia conference on Asset Prices and Monetary Policy, Sydney, 18–19 August 2003. Karl E Case is the Katherine Coman and A Barton Hepburn Professor of Economics at Wellesley college. John M Quigley is the I Donald Terner Distinguished Professor, and Professor of Economics, at the University of California, Berkeley. Robert J Shiller is the Stanley B Resor Professor of Economics at Yale University and Researcher, NBER. This paper has benefited from the assistance of Victoria Borrego, Tanguy Brachet, George Korniotis, Sonya Lai, Maryna Marynchenko and Semida Munteanu.

1990s. Indeed, in the current episode, the housing market is also beginning to show signs of cooling. Inventories and vacancy rates are rising, and volume numbers are showing signs of a potential turnaround. The popular press is full of speculation that the housing bubble is about to burst. *Barrons*, *Money Magazine* and *The Economist* have all run recent feature stories about the potential for a crash in home prices.

This pattern of strength in housing prices amid weakness in equity prices has also been seen in many other countries. These developments have sparked further interest in understanding the effect of different components of household wealth, not merely stock market or financial wealth, upon consumption levels. Indeed, there is every reason to expect that changes in housing wealth exert effects upon household behaviour that are similar in nature (if not in size) to those hypothesised for the stock market, especially given that institutional innovations (such as second mortgages in the form of secured lines of credit) have made it as simple to extract cash from housing equity as it is to sell shares or borrow on margin.[2] However, there has been virtually no comparative research on this issue, which suggests it may be worthwhile to test whether the tendency to consume out of stock market wealth is different from the tendency to consume out of housing wealth.

This paper addresses two major issues. First, we explore the dynamics of home prices between 1982 and 2003. We begin by reviewing our own work on the cycles of the late 1980s in which we found substantial evidence of inertia and speculative behaviour. We then analyse state-level data on home prices and incomes over a period of 71 quarters. Finally, we will present the results of a survey of home-buyers in 2002. The survey replicates one done in 1988 in four metropolitan areas: Orange County (California), San Francisco, Boston and Milwaukee. The goal is to shed light on the nature of the recent boom, the extent of speculative behaviour on the part of home-buyers and the potential for a near-term collapse. The results from this section suggest that household attitudes and behaviour might have speculative elements that contribute to the price dynamics in the housing market and thereby have important effects on the macroeconomy.

The second part of the paper provides empirical evidence on the relationship between house and stock prices and private consumption. We rely on two bodies of data: a panel of annual observations on 14 countries, measuring aggregate consumption, the capitalisation of stock market wealth, and aggregate housing wealth; and an analogous panel of quarterly observations on US states, estimating consumption, stock ownership, and aggregate housing wealth. These data exploit variations in the geographical distribution of stock market and housing market wealth among the US states and the substantial variations in the timing and intensity of economic activity across developed countries. Our time-series cross-section method

2. Indeed, in a speech to the Mortgage Bankers Association, Federal Reserve Chairman Alan Greenspan has ruminated: ‘One might expect that a significant portion of the unencumbered cash received by [house] sellers and refinancers was used to purchase goods and services … However, in models of consumer spending, we have not been able to find much incremental explanatory power of such extraction. Perhaps this is because sellers’ extraction [of home equity] is sufficiently correlated with other variables in the model, such as stock-market wealth, that the model has difficulty disentangling these influences’ (Greenspan 1999).

is eclectic; we present analyses in levels, first differences, and in error-correction-model (ECM) forms, and with alternative assumptions about error terms and fixed effects.

Section 2 below discusses the results of our survey of home-buyer attitudes and behaviour, along with some empirical analysis of house prices in different US states. Section 3 provides a brief theoretical motivation for the distinction between housing and financial wealth and a review of the limited evidence on the effects of housing wealth on consumption and savings behaviour. Section 4 describes the data sources, imputations, and the computations used to create the two panels. Section 5 presents our statistical results. Section 6 is a brief conclusion.

2. A Comparison of the Current and Previous US Housing Booms

2.1 The 1980s booms

Housing prices began rising rapidly in Boston in 1984. In 1985 alone house prices in the Boston metropolitan area went up 39 per cent. In Case (1986), repeat sales indices were constructed to measure the extent of the boom in constant quality home prices. In addition, a structural supply and demand model, which explained house price movements over 10 years and across 10 cities, failed to explain what was going on in Boston. The model predicted that income growth, employment growth, interest rates, construction costs and other fundamentals should have pushed Boston prices up by about 15 per cent. Instead, they went up over 140 per cent before topping out in 1988. The paper ends with the conjecture that the boom was at least in part a bubble.

Case and Shiller (1987) described price changes by constructing a set of repeat sales indices from large databases of transactions in Atlanta, Chicago, Dallas and San Francisco. These indices were used in Case and Shiller (1989) to provide evidence of positive serial correlation in real house prices. In fact, the paper showed that a change in price observed over one year tends to be followed by a change in the same direction the following year between 25 per cent and 50 per cent as large. The paper finds evidence of inertia in excess returns as well.

Case and Shiller (1988) present the results of a survey of a sample of around 2 000 households that bought homes in May 1988 in four markets: Orange County (California), San Francisco, Boston, and Milwaukee. The four cities were chosen to represent hot (California), cold (Boston) and steady (Milwaukee) markets. The survey was inspired by an article on page one of the June 1, 1988 *Wall Street Journal,* which described the current ‘frenzy in California’s big single family home market’. The results provide strong evidence that buyers are influenced by an investment motive, that they have strong expectations about future price changes in their housing markets, and that they perceive little risk. Responses to a number of questions revealed that emotion plays a significant role in house purchase decisions. In addition, there was no agreement among buyers about the causes of recent house price movements.

One additional finding in Case and Shiller (1988) lends support to an important stylised fact about the US housing market that has not been well documented in the literature, which is that house prices are sticky downward. That is, when excess supply occurs, prices do not immediately fall to clear the market. Rather, sellers have reservation prices below which they tend not to sell.

Finally, Case and Shiller (1990) use time-series cross-section regressions to test for the forecastability of prices and excess returns using a number of independent variables. The paper finds that the ratio of construction costs to price, changes in the adult population, and increases in real per capita income are all positively related to house prices and excess returns. The results add weight to the argument that the market for single-family homes is inefficient.

2.2 House prices and income 1985–2002

One question that seems never to have been explored in the literature is the stability of the relationship between income and house prices over time and space. If that relationship is stable, then clearly fundamentals explain house prices. This section looks at the relationship between house price and per capita personal income by state quarterly from 1985:Q1 to 2002:Q3. In all (50 states and the District of Columbia and 71 quarters) the data contain 3 621 observations.

Our data for home prices were constructed from repeat sales price indices applied to the 2000 Census median values by state. Case-Shiller weighted repeat sales indices (see Case and Shiller (1987, 1989)) constructed by Fiserv Case Shiller Weiss, Inc. are available for 16 states and were used where available. For other states we use state-level repeat value indices produced by Fannie Mae and Freddie Mac.[3] The baseline figures for state level mean home prices are based on owner estimates in the 2000 Census. The panel on home prices was constructed as follows for each state:

$$P_i^t = P_i^{1999:1} I_i^t \tag{1}$$

where

P_i^t = adjusted median home value in state *i* at time *t*,

$P_i^{1999:1}$ = mean value of owner-occupied homes in state *i* in 1999:Q1, and

I_i^t = weighted repeat sales price index for state *i*, 1999:Q1 = 1.

Our data for per capita personal income are based on data for personal income by state from the Bureau of Economic Analysis. It is a consistent time series produced on a timely schedule. However, population figures by state are not easy to obtain quarterly and the most carefully constructed series that we could find was put together by Economy.com, formerly Regional Financial Associates.

3. While the Office of Federal Housing Enterprise Oversight (OFHEO) uses a similar index construction methodology (the weighted repeat sales measure of Case and Shiller (1987), their indices are in part based on appraisals rather than exclusively on arms-length transactions. Case-Shiller indices use controls, to the extent possible, for changes in property characteristics, and it can be shown that they pick up turns in price direction earlier and more accurately than do the OFHEO indices.

Table 1 presents the ratio of house price to per capita income for the eight most volatile states and the seven least volatile states. The least volatile states exhibit remarkable stability and very low ratios. Wisconsin, for example, a state that we will explore at some length later, has a ratio that remains between 2.1 and 2.4 for the entire 18 years. A simple regression of house price on per capita income in Wisconsin generates an R^2 of 0.99.

On the other hand, the eight most volatile states exhibit equally remarkable instability. Connecticut, for example, has a ratio that varies between 4.5 and 7.8, and we find that income only explains 45 per cent of the variation in house price. Table 2 shows the variation for all 50 states and the District of Columbia (DC). Glancing down the table reveals that 43 of the 51 observations have a standard deviation at or below 0.41, while only those eight described in Table 1 are above 0.41. These calculations reveal that states seem to fall into one of two categories. For the vast majority of states, prices seem to move very much in line with income. But in New England, New York, New Jersey, California and Hawaii, prices seem to be significantly more volatile.

Table 1: Ratio of House Price to Per Capita Personal Income
1985:Q1–2002:Q3, most and least volatile states

State	Min	Max	Std dev	2002:Q3	Quarter of peak	$R^{2\,(a)}$
Hawaii	7.8	12.5	1.30	10.1	1992:Q3	0.83
Connecticut	4.5	7.8	1.10	5.4	1988:Q1	0.45
New Hampshire	4.0	6.6	0.84	5.3	1987:Q2	0.49
California	6.0	8.6	0.80	8.3	1989:Q4	0.78
Rhode Island	4.6	7.1	0.75	6.1	1988:Q1	0.65
Massachusetts	4.3	6.6	0.71	5.9	1987:Q3	0.70
New Jersey	4.5	6.8	0.67	5.6	1987:Q3	0.73
New York	3.8	5.6	0.51	4.9	1987:Q3	0.77
Nebraska	1.8	2.1	0.09	1.9	1985:Q2	0.96
Wisconsin	2.1	2.4	0.08	2.4	2002:Q3	0.99
Illinois	2.6	2.9	0.08	2.9	2002:Q3	0.98
Kentucky	2.1	2.4	0.07	2.2	1985:Q1	0.99
Indiana	2.0	2.3	0.06	2.1	1986:Q4	0.99
Iowa	1.7	1.9	0.06	1.8	2002:Q3	0.98
Ohio	2.3	2.5	0.04	2.5	2002:Q3	0.99

(a) R^2 from a regression of Ln(house price) on Ln(per capital income), 71 observations.

Table 2: Ratio of House Price to Per Capita Personal Income *(continued next page)*
1985:Q1–2002:Q3

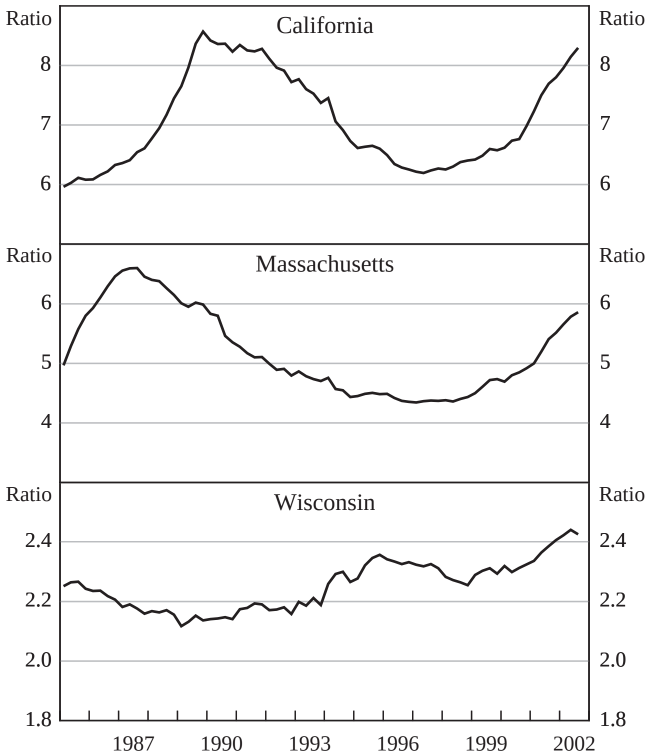
State	Median	Min	Max	Std dev	Mean
Hawaii	9.79	7.83	12.50	1.34	10.03
Connecticut	5.41	4.47	7.84	1.06	5.67
New Hampshire	4.68	3.98	6.63	0.84	4.94
California	6.76	5.96	8.57	0.80	7.07
Rhode Island	5.49	4.58	7.12	0.75	5.62
Massachusetts	4.97	4.34	6.60	0.72	5.20
New Jersey	5.25	4.48	6.77	0.68	5.34
New York	4.54	3.83	5.60	0.52	4.55
Texas	2.48	2.20	3.59	0.41	2.61
Maine	3.98	3.44	4.77	0.40	3.98
DC	3.61	3.10	4.52	0.37	3.66
Vermont	4.11	3.64	4.85	0.37	4.19
Louisiana	2.56	2.42	3.53	0.33	2.70
Alaska	3.26	2.48	4.07	0.33	3.29
Oregon	2.25	1.49	2.69	0.32	2.23
Utah	2.87	2.29	3.21	0.31	2.81
Mississippi	2.28	2.21	3.15	0.29	2.43
Maryland	4.01	3.62	4.69	0.29	4.05
Oklahoma	2.13	2.05	3.04	0.28	2.25
Washington	3.12	2.28	3.36	0.26	3.00
Delaware	3.62	3.33	4.14	0.26	3.69
Colorado	2.60	2.19	3.18	0.25	2.57
Virginia	3.47	3.04	3.87	0.24	3.44
Georgia	2.76	2.58	3.25	0.23	2.83
Arizona	3.53	3.38	4.17	0.22	3.63
North Dakota	2.24	2.05	2.98	0.22	2.32
Arkansas	2.22	2.13	2.84	0.22	2.33
Montana	2.55	2.02	2.71	0.22	2.44
Florida	3.04	2.80	3.51	0.21	3.08
Missouri	2.32	1.18	2.71	0.21	2.38
Pennsylvania	2.70	2.43	3.14	0.21	2.73
Wyoming	2.12	1.82	2.65	0.21	2.15
New Mexico	3.38	3.12	3.85	0.20	3.40
Tennessee	2.35	2.23	2.80	0.19	2.43

Table 2: Ratio of House Price to Per Capita Personal Income *(continued)*
1985:Q1–2002:Q3

State	Median	Min	Max	Std dev	Mean
Nevada	3.56	3.32	3.97	0.18	3.59
Alabama	2.38	2.31	2.84	0.17	2.47
Michigan	1.93	1.69	2.37	0.17	1.98
Minnesota	2.40	2.27	2.92	0.16	2.47
North Carolina	2.60	2.50	2.98	0.16	2.67
Idaho	2.58	2.27	2.91	0.15	2.58
West Virginia	2.32	2.22	2.79	0.15	2.38
South Carolina	2.69	2.57	3.06	0.15	2.74
Kansas	1.97	1.84	2.30	0.14	2.02
South Dakota	1.87	1.73	2.20	0.11	1.89
Nebraska	1.88	1.76	2.12	0.09	1.89
Illinois	2.74	2.57	2.87	0.08	2.73
Wisconsin	2.26	2.12	2.44	0.08	2.25
Kentucky	2.21	2.11	2.41	0.08	2.23
Iowa	1.78	1.68	1.92	0.06	1.79
Indiana	2.12	2.03	2.25	0.06	2.13
Ohio	2.34	2.27	2.46	0.04	2.34

Plots of the ratio of price to per capita income for the states of California, Massachusetts and Wisconsin (Figure 1) show clearly that the pattern of variation is anything but a random walk in California and Massachusetts. In these states the pattern is long inertial upswings followed by long inertial downturns followed by another rise that has lasted several years. In Wisconsin, the ratio is much smaller and remarkably stable.

Figure 1: Ratio of House Prices to Per Capita Personal Income



2.3 Home-buyer behaviour: 1988 and 2002

These patterns are a backdrop for our survey results. Earlier we described the results of a survey of home-buyers done in 1988 in four metropolitan areas: Orange County (California), San Francisco, Boston and Milwaukee. We turn now to some new results, from a replication of that survey done for home-buyers in mid 2002.

Our 2002 survey was sent to 2 000 persons who bought homes between March and August of 2002. A random sample of 500 sales was drawn from each of four counties: Orange County, California; Alameda County (San Francisco), California; Middlesex County (Boston), Massachusetts; and Milwaukee County, Wisconsin. Just under 700 surveys were returned completed and usable this time; the response rate was somewhat higher for the 1988 survey. Response rates for each county are given in Table 3.The questionnaire was 10-pages long and included questions on a number of topics. The focus was on the home-buyers' expectations and behaviour. During the first cycle of surveys, we had two markets booming (the California counties), one market at its peak and showing excess supply (Boston) and one drifting market (Milwaukee). This time we got all four markets at recent highs, but with the economy in recession or slowly coming out of recession. In addition, this time the

Table 3: Samples and Response Rates

City/ Metropolitan area	Sample		Returns tabulated		Response rate Per cent	
	1988	2002	1988	2002	1988	2002
Orange County	500	500	241	143	48.2	28.6
San Francisco	530	500	199	164	37.5	32.8
Boston	500	500	200	203	40.0	40.6
Milwaukee	500	500	246	187	49.2	37.4
All regions	2 030	2 000	886	697	43.9	34.9

Fed had lowered interest rates to historic lows at the time these buyers were signing purchase and sale agreements. In 1988, interest rates were on the rise.

Table 4 describes the sample. A substantial majority of buyers were buying a primary residence, and only a small minority were buying to rent. First-time buyers were a majority of the sample in Milwaukee. The lowest percentage of first-time buyers was in Orange County. We were surprised to see that more than 90 per cent of respondents to the 2002 survey in all four markets were buying single-family houses, whereas this proportion was a significantly smaller portion in the 1988 survey. We have no explanation as yet for this.

Although the timing of their cycles has not been identical, Orange County, San Francisco and Boston have experienced two boom cycles and a bust over the last 20 years. Table 5 describes the timing and the extent of these cycles which are also shown in Figure 2. The first booms in California were similar in Los Angeles and San Francisco. Both metropolitan areas peaked in the second quarter of 1990 after a 125 per cent run-up which began slowly, gradually accelerating into 1988 and then slowing as it approached the peak. The first boom in Boston was similar

Table 4: General Description of Respondents' Home Purchases
Per cent of responses

	Orange County		San Francisco		Boston		Milwaukee	
Description	1988	2002	1988	2002	1988	2002	1988	2002
Single-family home	70.0	95.2	55.9	96.4	39.7	97.5	71.1	91.6
First-time purchase	35.8	31.7	36.2	46.0	51.5	41.6	56.9	53.1
Bought to live in as a primary residence	88.4	95.6	72.7	93.3	92.0	97.1	88.2	90.0
Bought to rent to others	3.7	2.8	12.1	3.0	3.0	0.9	4.1	5.3

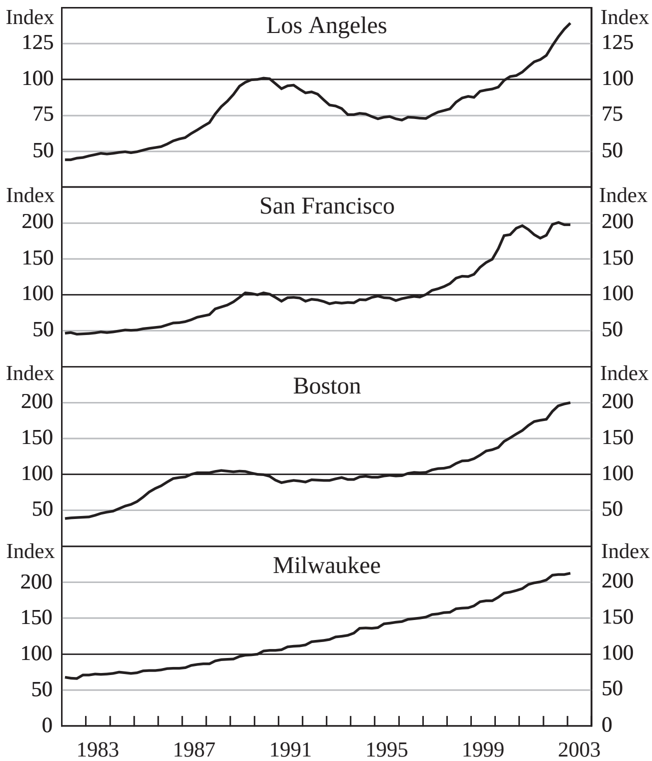
Table 5: Housing Price Cycles

	Los Angeles	San Francisco	Boston	Milwaukee
1982–peak	+128%	+126%	+143%	–
Peak quarter	1990:Q2	1990:Q2	1988:Q3	
Peak to trough	–29%	–14%	–16%	–
Trough quarter	1996:Q1	1993:Q1	1991:Q1	
Trough to peak	+94%	+129%	+126%	–
Peak quarter	2003:Q1	2002:Q3	2003:Q1	
1982:Q1–2003:Q1	+214%	+325%	+419%	+213%
Average, annual rate	5.6%	7.1%	8.2%	5.6%

Source: Fiserv Case Shiller Weiss, Inc., repeat sales indexes

Figure 2: Home Price Indices

March quarter 1990 =100



but it accelerated earlier and actually peaked in the third quarter of 1988 after a 143 per cent increase. The bust that followed was most severe and long-lived in Los Angeles, which dropped 29 per cent from the peak to a trough in the first quarter of 1996. San Francisco only dropped 14 per cent and began rising again in the first quarter of 1993, three years earlier. Boston was on the mend even two years earlier than that. All three metropolitan areas have seen a prolonged boom period ever since, although San Francisco has shown some volatility since mid 2002. Home prices during this boom rose 129 per cent in San Francisco, 94 per cent in Los Angeles and 126 per cent in Boston. At the time that respondents to the second survey were buying their homes, prices were still rising in all four metropolitan areas.

The price index for Milwaukee could not be more different. It shows a very steady climb at a rate of 5.6 per cent annually, essentially the same rate of growth as per capita income. Interestingly, over the entire cycle, Milwaukee did about as well as Los Angeles, but not as well as Boston. Over the entire cycle, house prices in Boston increased more than five-fold, while prices in San Francisco quadrupled and prices in both Milwaukee and Los Angeles tripled.

Table 6 looks at the latest boom cycle in a bit more detail. Using the state data described above, the table makes two points. First, in all three states, home price

Table 6: House Price, Income and Payments
1995:Q1–2002:Q3

	California	Massachusetts	Wisconsin
House price 1995:Q1	158 954	121 091	50 557
House price 2002:Q3	276 695	231 994	73 071
Total change	+74%	+92%	+45%
Annual rate	7.7%	9.1%	5.1%
Personal income/pop 1995:Q1	24 044	27 224	22 203
Personal income/pop 2002:Q3	33 362	39 605	30 138
Total change	+39%	+45%	+35%
Annual rate	4.5%	5.1%	4.1%
House price/income 1995:Q1	6.61	4.45	2.28
House price/income 2002:Q3	8.29	5.86	2.42
Annual mortgage payment 1995:Q1	12 145	9 253	3 862
Annual mortgage payment 2002:Q3	15 908	13 338	4 201
Payment/income 1995:Q1[(a)]	0.51	0.34	0.17
Payment/income 2002:Q3[(a)]	0.47	0.34	0.14

(a) Annual mortgage payment assumes 80% LTV, 30-year fixed rate; February 1995: 8.8%, August 2002: 6.0% (sourced from Fannie Mae).

Sources: State personal income – US Department of Commerce, Bureau of Economic Analysis; state population – Regional Financial Associates (Economy.com); house price – 1989 median, US Census adjusted using Case Shiller Weiss or blended repeat sales price index increases outpaced income growth. Note that the price increases were not as great as in the metropolitan area data because the indices were for the entire state. All three states had increases in their ratios of home price to income, but the changes were dramatically larger in the boom-bust states. Second, we note that the decline in interest rates this cycle from 8.8 per cent (30-year fixed) in 1995 to 6 per cent at the time the sample was drawn kept the monthly payment required to buy the median home from rising. It actually fell in California and Wisconsin.

2.4 Attitudes to housing as an investment

Table 7 presents the responses to questions about housing as an investment. For the vast majority of buyers, investment was 'a major consideration' or they at least 'in part' thought of it as an investment. Interestingly, a slightly smaller percentage in 2002 cited investment as a factor on the coasts than was the case in 1988. In Milwaukee and San Francisco it was a major consideration for a majority of buyers.

Similarly, only a small percentage of buyers thought that housing involved a great deal of risk in all cities, although the figure was not surprisingly highest in San Francisco in 2002. By and large there was more perception of risk on the coasts in 2002 than in 1988, but less perception of risk in Milwaukee. In all four counties, people were less likely to be buying a home 'strictly for investment purposes' in 2002. The decline was particularly sharp for California.

Table 8 presents the responses to three questions that we did not ask in 1988. There has been a lot of discussion about people shifting their assets toward housing because the stock market has done so poorly since 2000. However, a falling stock market could have a negative wealth effect on home-buying decisions. Note that the survey was completed well before the stock market rally of 2003.

The responses here present mixed evidence. In all four counties people believe that housing is indeed a better long-term investment than the stock market. However, the vast majority of people in all four counties said that the performance of the stock market 'had no effect on my decision to buy my house'. Between a quarter and a third found the stock market's performance 'encouraged' them to buy a home while only a small proportion found it discouraging.

Table 7: Housing as an Investment

Per cent responses in each category

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'In deciding to buy your property, did you think of the purchase as an investment?'	(N=238)	(N=143)	(N=199)	(N=164)	(N=200)	(N=203)	(N=243)	(N=187)
'It was a major consideration'	56.3	46.8	63.8	51.8	48.0	33.9	44.0	50.3
'In part'	40.3	46.2	31.7	34.4	45.0	56.2	45.7	42.2
'Not at all'	4.2	7.0	4.5	9.8	7.0	9.9	10.3	7.5
'Why did you buy the home that you did?'	(N=238)	(N=143)	(N=199)	(N=164)	(N=199)	(N=203)	(N=246)	(N=187)
'Strictly for investment purposes'	19.8	7.5	37.2	10.6	15.6	8.2	18.7	13.8
'Buying a home in ______ today involves:'	(N=237)	(N=143)	(N=192)	(N=164)	(N=197)	(N=203)	(N=237)	(N=187)
'A great deal of risk'	3.4	7.9	4.2	14.8	5.1	7.8	5.9	4.3
'Some risk'	33.3	47.5	40.1	51.9	57.9	62.5	64.6	57.3
'Little or no risk'	63.3	44.6	55.7	33.3	37.1	29.6	29.5	38.4

Table 8: Real Estate vs Stock Market 2002
Per cent responses

Question	Orange County	San Francisco	Boston	Milwaukee
'Do you agree with the following statement: "Real estate is the best investment for long-term holders, who can just buy and hold through the ups and downs of the market"?'	(N=145)	(N=162)	(N=204)	(N=185)
'Strongly agree'	53.7	50.6	36.7	31.3
'Somewhat agree'	33.1	39.5	48.5	45.9
'Neutral'	10.3	6.7	9.3	11.3
'Somewhat disagree'	2.7	2.4	4.9	9.1
'Strongly disagree'	0.0	0.6	0.4	2.1
'Do you agree with the following statement: "The stock market is the best investment for long-term holders, who can just buy and hold through the ups and downs of the market"?'	(N=145)	(N=162)	(N=203)	(N=187)
'Strongly agree'	8.2	8.0	14.7	14.9
'Somewhat agree'	32.4	38.2	44.3	33.6
'Neutral'	32.4	27.7	17.7	25.6
'Somewhat disagree'	20.0	16.0	15.2	20.3
'Strongly disagree'	6.8	9.8	7.8	5.3
'The experience with the stock market in the past few years:'	(N=143)	(N=161)	(N=202)	(N=186)
'Much encouraged me to buy my house.'	13.9	15.5	14.3	9.1
'Somewhat encouraged me to buy my house.'	11.1	16.7	13.8	13.9
'Had no effect on my decision to buy my house.'	74.1	64.5	70.7	74.7
'Somewhat discouraged me from buying my house.'	0.0	2.4	0.9	2.1
'Much discouraged me from buying my house.'	0.6	0.6	0.0	0.0

2.5 Rational expectations?

Table 9 gets to the meat of the issue of the role of price expectations in the decision to buy. Although virtually *all* Californians in 1988 knew that prices were going to rise in the next few years and were right, a mere 90 per cent thought so in 2002. The number who expected prices to rise jumped in Milwaukee to 95 per cent. After 21 years of steady increase, they are learning. While the number of respondents who thought prices were headed up in Boston dropped, it remains at 83 per cent.

Home-buyers are very optimistic about the future of home prices. In fact, when asked about the average rate of increase *per year* over the next 10 years, in Orange County they replied 13.1 per cent (14.3 per cent in 1988); in San Francisco they were even more optimistic at 15.7 per cent (14.8 per cent in 1988); in Boston the answer was 14.6 per cent (8.7 per cent in 1988); and in Milwaukee it was 11.7 per cent (7.3 per cent in 1988). It is important to note, however, that the standard errors were much larger in 2002. In all four cities, expectations about house prices are not quite as optimistic about the next year as they are about the next 10 years. Nonetheless, buyers expect healthy increases also at this shorter horizon.

As in 1988, home-buyers' expectations about the future are backward-looking. The degree of their short-term optimism depends on their perceptions of what is happening now. Very few outside of Boston and Milwaukee in 1988 believed prices were falling at the time they bought. The pattern of belief about the present is consistent with their expectations for the next year, but their longer-run expectations were not.

While fewer respondents in 2002 say that it is a good time to buy a house because prices may be rising in the future, at least two-thirds of respondents agree with the statement in all four cities. In addition, the number who admit to being influenced by 'excitement' is down on the coasts but up to more than a third in Milwaukee. Finally, housing prices remain a frequent topic of conversation for many, the vast majority report at least sometimes discussing them.

2.6 Theories about recent events

Table 10 and an open-ended question were designed to probe people's interpretations of price movements and possible triggers that changed their opinions. It is critical to distinguish between mob psychology, excessive optimism and a situation in which a solid reason to expect price increases exists. Since most have expressed a strong investment motive, one would assume significant knowledge of underlying market fundamentals. The efficient market hypothesis assumes that asset buyers make rational decisions based on all available information and based on a consistent model of underlying market forces.

There is mixed evidence in the results. First of all, Californians correctly think that a lot of people want to live there. Demand pressure is a factor in California. In Boston, the demographics are simply poor, yet 77.8 per cent of buyers in 2002 point to the idea that people want to live there. Both Boston and California residents point to a shortage of available land, and zoning has indeed been a big issue on the coasts.

Table 9: Current Price Expectations 2002 *(continued next page)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
‘Do you think that housing prices in the ____ area will increase or decrease over the next several years?’	(N=240)	(N=145)	(N=199)	(N=158)	(N=194)	(N=201)	(N=233)	(N=187)
‘Increase’	98.3	89.7	99.0	90.5	90.2	83.1	87.1	95.2
‘Decrease’	1.7	10.3	1.0	9.5	9.8	16.9	12.9	4.8
‘How much of a change do you expect there to be in the value of your home over the next 12 months?’	(N=217)	(N=139)	(N=185)	(N=147)	(N=176)	(N=179)	(N=217)	(N=160)
Mean	15.3	10.5	13.5	5.8	7.4	7.2	6.1	8.9
(Standard error)	(0.8)	(6.1)	(0.6)	(7.6)	(0.6)	(5.8)	(0.5)	(12.2)
‘On average over the next 10 years, how much do you expect the value of your property to change each year?’	(N=208)	(N=137)	(N=181)	(N=152)	(N=177)	(N=186)	(N=211)	(N=169)
Mean	14.3	13.1	14.8	15.7	8.7	14.6	7.3	11.7
(Standard error)	(1.2)	(14.3)	(1.4)	(22.0)	(0.6)	(25.0)	(0.5)	(17.1)
‘Which of the following best describes the trend in home prices in the ____ area since January 1988?’	(N=239)	(N=143)	(N=196)	(N=161)	(N=198)	(N=199)	(N=230)	(N=185)
‘Rising rapidly’	90.8	76.2	83.7	28.6	3.0	29.6	8.7	33.0
‘Rising slowly’	8.8	22.4	12.8	51.0	34.3	49.2	53.0	57.3
‘Not changing’	0.4	1.4	3.1	14.3	37.4	12.6	23.9	8.6
‘Falling slowly’	0.0	0.0	0.5	6.2	22.2	8.5	11.7	1.1
‘Falling rapidly’	0.0	0.0	0.0	0.0	3.0	0.0	2.6	0.0

Table 9: Current Price Expectations 2002 *(continued)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
‘It’s a good time to buy because housing prices are likely to rise in the future?’	(N=206)	(N=126)	(N=180)	(N=145)	(N=171)	(N=174)	(N=210)	(N=161)
‘Agree’	93.2	77.0	95.0	82.1	77.8	66.1	84.8	87.0
‘Disagree’	6.8	23.0	5.0	17.9	22.2	33.9	15.2	13.0
‘Housing prices are booming. Unless I buy now, I won’t be able to afford a home later.’	(N=200)	(N=124)	(N=167)	(N=134)	(N=169)	(N=175)	(N=194)	(N=154)
‘Agree’	79.5	48.8	68.9	59.7	40.8	37.1	27.8	36.4
‘Disagree’	20.5	51.2	31.1	40.3	59.2	62.9	72.2	63.6
‘There has been a good deal of excitement surrounding recent housing price changes. I sometimes think that I may have been influenced by it.’	(N=230)	(N=141)	(N=191)	(N=156)	(N=181)	(N=199)	(N=233)	(N=184)
‘Yes’	54.3	46.1	56.5	38.5	45.3	29.6	21.5	34.8
‘No’	45.7	53.9	43.5	61.5	54.7	70.4	78.5	65.2
‘In conversations with friends and associates over the last few months, conditions in the housing market were discussed.’	(N=238)	(N=143)	(N=195)	(N=163)	(N=198)	(N=203)	(N=235)	(N=185)
‘Frequently’	52.9	32.9	49.7	37.4	30.3	31.0	20.0	27.6
‘Sometimes’	38.2	50.3	39.0	43.6	55.1	53.7	50.2	40.5
‘Seldom’	8.0	14.7	9.7	17.2	12.1	14.3	25.1	28.1
‘Never’	0.8	2.1	1.5	1.8	2.5	1.0	4.7	3.8

Table 10: Buyers' Interpretation of Recent Events *(continued next page)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'Housing prices have boomed in ____ because lots of people want to live here.'	(N=210)	(N=128)	(N=178)	(N=147)	(N=181)	(N=176)	(N=193)	(N=148)
'Agree'	98.6	93.8	93.3	89.1	69.6	77.8	16.1	23.0
'Disagree'	1.4	6.2	6.7	10.9	30.4	22.2	83.9	77.0
'The real problem in ______ is that there is just not enough land available.'	(N=197)	(N=121)	(N=174)	(N=141)	(N=168)	(N=177)	(N=192)	(N=158)
'Agree'	52.8	60.3	83.9	59.6	54.2	72.9	17.2	35.4
'Disagree'	47.2	39.7	16.1	40.4	45.8	27.1	82.8	64.6
'When there is simply not enough housing available, price becomes unimportant.'	(N=197)	(N=116)	(N=165)	(N=141)	(N=171)	(N=172)	(N=193)	(N=151)
'Agree'	34.0	31.9	40.6	32.6	26.9	32.0	20.7	25.2
'Disagree'	66.0	68.1	59.4	67.4	73.1	68.0	79.3	74.8
'Which of the following better describes your theory about recent trends in home prices in ____?'	(N=226)	(N=130)	(N=180)	(N=153)	(N=188)	(N=195)	(N=215)	(N=168)

Table 10: Buyers' Interpretation of Recent Events *(continued)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'It is a theory about the psychology of home buyers and sellers.'	11.9	10.8	16.7	15.0	21.3	11.8	10.7	13.7
'It is a theory about economic or demographic conditions such as population changes, changes in interest rates or employment.'	88.1	89.2	83.3	85.0	78.7	88.2	89.3	86.3
'In a hot real estate market, sellers often get more than one offer on the day they list the property. Some are even over the asking price. There are also stories about people waiting in line to make offers. Which is the best explanation?'	(N=210)	(N=135)	(N=177)	(N=153)	(N=176)	(N=197)	(N=211)	(N=173)
'There is panic buying, and price becomes irrelevant.'	73.3	63.7	71.2	73.9	61.4	73.1	34.6	46.8
'Asking prices have adjusted slowly or sluggishly to increasing demand.'	26.7	36.3	28.8	26.1	38.6	39.9	65.4	53.2

Demographics and a shortage of land have never been problems in Milwaukee, and buyers correctly perceive this.

At the time of the first survey, interest rates were flat to up, but they were having little effect on the market. Nonetheless, respondents to the open-ended question mentioned interest rates more than any other factor in explaining home prices. In 2002, interest rates were again mentioned most frequently in all four counties, but this time interest rates really were having an effect. Interest rates fell sharply in the months leading up to our survey, and they had a dramatic effect on affordability.

In 2002 over 85 per cent of respondents in each county say they have a theory of recent trends based on fundamentals, and fewer than 15 per cent point to the psychology of home-buyers. Only in Boston in 1988 did more than 20 per cent directly point to psychology. Having said that, a significant majority point to panic buying everywhere except in Milwaukee. These results are consistent with evidence in Pound and Shiller (1987) about institutional investors in corporate stocks, most of whom thought stock prices were driven by fundamentals even when particular stocks boomed and had very high PE ratios.

While it seems that home-buyers are reasonably well informed and perhaps better informed in 2002 than they were in 1988, one gets the impression from the responses that backward-looking price extrapolation is playing a major role in driving buyers' expectations of future price increases.

2.7 Excess demand and upward rigidity in asking prices

In boom cities, newspaper articles feature stories of homes that sold well above asking price. It was the article in the *Wall Street Journal* that referred to 'frenzy in California's big single family home market' that inspired our original survey. In fact, this seems to be a fairly common occurrence in boom cities. An amazing 45 per cent of respondents report selling at above asking prices in San Francisco in 2002 (Table 11), well after the sharp decline in employment following the NASDAQ collapse which began in 2000. Sellers report that about 20 per cent of properties sell for more than the asking price in Orange County and this figure was only slightly smaller in Milwaukee, which had no boom.

Many of those who sold felt that they could have gotten more also thought that if they had charged 5 or 10 per cent more, the property would have sold just as quickly. This was the sense of over 20 per cent of sellers in all markets, up substantially in 2002 except in Orange County where it stayed the same.

An amazing number of respondents, in fact a majority in San Francisco and Boston in 2002, a near majority in Milwaukee and 26 per cent in Orange County thought that charging more would be unfair. However, the number who reported that their house was not intrinsically worth more than they were asking dropped in the latest survey compared to 1988.

Table 11: Upward Rigidity in Asking Prices *(continued next page)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'Did you finally settle on the price that was:'	(N=237)	(N=141)	(N=194)	(N=153)	(N=200)	(N=203)	(N=242)	(N=183)
'Above the asking price'	6.3	19.9	9.8	45.8	0.5	21.3	3.3	17.5
'Equal to the asking price'	38.0	50.4	26.8	27.5	23.5	59.1	22.7	52.4
'Below the asking price'	55.7	29.7	63.4	26.7	76.0	28.6	74.0	31.1
'If you had asked 5 to 10 per cent more for your property, what would the likely outcome have been?'	(N=89)	(N=68)	(N=64)	(N=59)	(N=61)	(N=83)	(N=43)	(N=46)
'It wouldn't have been sold.'	21.3	23.5	23.4	27.1	31.1	27.7	32.5	26.1
'It would have sold but it would have taken much more time.'	44.9	47.1	46.9	40.7	54.1	38.6	37.2	39.3
'If buyers had to pay that much they might not be able to obtain financing (a buyer cannot obtain financing unless an appraiser confirms the worth of the property).'	7.9	4.1	9.4	6.8	0.0	4.8	9.3	8.7
'It probably would have sold almost as quickly.'	24.7	23.5	17.2	20.3	11.5	26.5	16.3	21.7
'Other'	1.1	1.5	3.1	5.1	3.3	2.4	4.7	4.4

Table 11: Upward Rigidity in Asking Prices *(continued)*

Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'If you answered that it would have sold almost as quickly, which of the following (you can check more than one) explains why you didn't set the price higher?'	(N=37)	(N=31)	(N=22)	(N=26)	(N=26)	(N=37)	(N=16)	(N=15)
'The property simply wasn't worth that much.'	32.4	25.8	27.3	23.1	38.5	13.5	25.0	13.3
'It wouldn't have been fair to set it that high; given what I paid for it. I was already getting enough for it.'	16.2	25.8	22.7	61.5	15.4	54.1	31.3	46.7
'I simply made a mistake or got bad advice; I should have asked for more.'	21.6	19.4	18.2	7.7	19.2	8.1	25.0	13.3
'Other'	29.7	29.0	31.8	7.7	26.9	24.3	18.8	26.7
'In the six months prior to the time you first listed the property, did you receive any unsolicited calls from a real estate agent or any one else about the possibility of selling your house?'	(N=89)	(N=68)	(N=61)	(N=63)	(N=62)	(N=83)	(N=48)	(N=44)
'Yes'	71.9	69.1	59.0	55.6	38.7	53.0	43.2	
'No'	28.1	30.9	41.0	44.4	61.3	46.0	56.8	
Approximate number of calls								
Mean	8.7		5.0		3.9		2.7	
(Standard error)	(1.2)		(0.3)		(0.4)		(0.2)	

2.8 Downward rigidity and excess supply

An important question on which the survey sheds some light is what happens in a bust? How do sellers respond to rising inventories and increasing time on the market? It is first important to point out that the housing market is not a traditionally-defined auction market. Prices do not fall to clear the market quickly as one observes in most asset markets. Selling a home requires agreement between buyers and sellers. It is a stylised fact about the housing market that 'bid-ask' spreads widen when demand drops, and the number of transactions falls sharply. This must mean that sellers resist cutting prices.

The survey does indeed support the fact that buyers lower their asking prices only as a last resort. A majority in all counties and in both years of the survey argued that the best strategy in a slow market is to 'hold up until you get what you want' (Table 12). In fact, only a small minority of respondents reported that they would have 'lowered the price till I found a buyer'. In addition, from 78.8 per cent in San Francisco in 1988 to 93 per cent in post-boom Boston reported having reservation prices.

There is clear evidence that such resistance prevents house prices from falling at the onset of a down period and that if the underlying fundamentals come back quickly enough, it can prevent a bubble from 'bursting'. Instead, the danger when demand drops in housing markets is that the volume of sales may drop precipitously. The fallout would include: lower consumption from a reduction in the equity withdrawal that frequently accompanies housing changes; a reduction in the consumer expenditures that are associated with changing housing; reduced fee income to financial institutions; and a reduction in the flexibility of the labour market. These and other related effects could do more damage to the US economy today than a modest decline in prices.

Table 12: Excess Supply and Downward Rigidity in Asking Prices
Per cent of responses

Question	Orange County		San Francisco		Boston		Milwaukee	
	1988	2002	1988	2002	1988	2002	1988	2002
'Since housing prices are unlikely to drop very much, the best strategy in a slow market is to hold up until you get what you want for a property.'	(N=174)	(N=111)	(N=148)	(N=129)	(N=160)	(N=166)	(N=180)	(N=147)
'Agree'	69.0	64.0	69.6	69.0	57.5	51.2	50.6	61.9
'Disagree'	31.0	36.0	30.4	31.0	42.5	48.8	49.4	38.1
'If you had not been able to sell your property for the price that you received, what would you have done?'	(N=88)	(N=65)	(N=62)	(N=61)	(N=61)	(N=83)	(N=43)	(N=43)
'Left the price the same and waited for a buyer, knowing full well that it might have taken a long time.'	42.0	32.3	38.7	29.5	32.8	21.7	32.6	39.5
'Lowered the price step by step hoping to find a buyer'	20.5	32.3	38.7	26.2	42.6	47.0	20.9	30.2
'Lowered the price till I found a buyer.'	4.5	7.7	3.2	11.5	4.9	12.0	7.0	9.3
'Taken the house off the market.'	18.2	21.5	17.7	27.9	11.5	15.7	27.9	16.3
'Other'	14.8	6.2	1.6	4.9	8.2	3.6	11.6	4.6
'If you answered that you would have lowered your price, is there a limit to how far you would have gone if the property still hadn't sold?'	(N=33)	(N=35)	(N=38)	(N=32)	(N=29)	(N=57)	(N=16)	(N=32)
'Yes'	81.8	85.7	78.9	81.3	93.1	87.7	87.5	90.3

3. Differential Wealth Effects from Housing and Equities: Theories and Evidence

The results of the sample survey discussed above suggest that households may be subject to various behavioural biases (e.g., irrational expectations about future price growth that are excessively affected by recent trends) that may contribute to the large swings in house prices that are apparent in the data. The question then arises as to whether these swings in house prices also have significant effects on aggregate activity via their impacts on household wealth. Ultimately, however, this is an empirical question. Accordingly, the remainder of the paper assesses the extent to which movements in house prices have wealth effects on consumption, and whether these wealth effects are quantitatively different to effects arising from swings in equity prices.

A simple formulation of the life cycle savings hypothesis suggests that consumers will distribute increases in anticipated wealth over time and that the marginal propensity to consume out of all wealth, whether from stocks, real estate, or any other source, should be the same small number, something just over the real interest rate. Clearly, such a proportionate effect must exist in the long run. However, there are a number of concerns about the identification of the short-run effects of changes in wealth on household spending.

There are, in fact, many reasons why consumption may be differently affected by the form in which wealth is held. First, increases in measured wealth of different kinds may be viewed by households as temporary or uncertain. Second, households may have a bequest motive which is strengthened by tax laws that favour holding appreciated assets until death. Third, households may view the accumulation of some kinds of wealth as an end in and of itself. Fourth, households may not find it easy to measure their wealth, and may not even know what it is from time to time. The unrealised capital gains held by households in asset markets may be transitory, but they can be measured with far more precision in thick markets with many active traders. Fifth, people may segregate different kinds of wealth into separate ‘mental accounts’, which are then framed quite differently. The psychology of framing may dictate that certain assets are more appropriate to use for current expenditures while others are earmarked for long-term savings (Shefrin and Thaler 1988).

Each of these concerns suggests a distinction between the impact of housing wealth and stock market wealth on consumption. The extent to which people view their currently-measured wealth as temporary or uncertain may differ between the two forms of wealth. People may have quite different motives about bequeathing their stock portfolios and bequeathing their homesteads to heirs. The emotional impact of accumulating stock market wealth may be quite different from that of real estate wealth, particularly owner-occupied housing. People are, perhaps, less aware of the short-run changes in real estate wealth since they do not receive regular updates on its value. Stock market wealth can be tracked daily in the newspaper.

Differential impacts of various forms of wealth on consumption have already been demonstrated in a quasi-experimental setting. For example, increases in unexpected wealth in the form of lottery winnings lead to large effects on short-run consumption.

Responses to surveys about the uses put to different forms of wealth imply strikingly different 'wealth effects'. By analogy, it is entirely reasonable to expect that there should be a different impact of real estate and housing wealth, as compared with stock market wealth, on consumption.

Exogenous changes in housing wealth could also have an impact different from lottery winnings or stock market windfalls by affecting the consumption behaviour of renters or younger cohorts of consumers. An exogenous increase in house values and housing wealth means that these latter groups of households must save more today to become home-owners tomorrow. In principle, some or all of the increased consumption made by current owners could be offset by increased savings of renters who aspire to become home-owners (see Sheiner (1995)).

The empirical importance of housing wealth for consumption has not been widely explored. An early study by Elliott (1980) relied upon aggregate data on consumer spending, financial wealth, and non-financial wealth, finding that variations in the latter had no effect upon consumption. Elliott's analysis suggested that 'houses, automobiles, furniture, and appliances may be treated more as part of the environment by households than as a part of realisable purchasing power' (p 528). These results were challenged by Peek (1983) and by Bhatia (1987) who questioned the methods used to estimate real non-financial wealth. More recently, Case (1992) reported evidence of a substantial consumption effect during the real estate price boom in the late 1980s using aggregate data for New England.

Using data on individual households from the Panel Study of Income Dynamics (PSID), Skinner (1989) found a small but significant effect of housing wealth upon consumption. Sheiner (1995) explored the possibility noted above that home price increases may actually increase the savings of renters who then face higher downpayment requirements to purchase houses. Her statistical results, however, were quite inconclusive.

A more suggestive relationship was reported by Yoshikawa and Ohtake (1989) who found that savings rates for Japanese renter households planning to purchase homes was higher with higher land prices, but that the incidence of household plans to purchase housing was sufficiently lower with higher land prices, so that the net effect of higher prices was to increase consumption by renters as well as owners.

Analogous results were found for renters in Canada by Engelhardt (1994); higher housing prices substantially reduced the probability that renter households saved for a downpayment. A C$4 000 increase in house prices decreased the probability of saving by 1 percentage point, and led to a reduction in accumulated assets of C$1 200.

From surveys of US home-buyers assembled by a major title and trust company, it was estimated that transfers from family members provided downpayment assistance for 20 per cent of first-time home-buyers, accounting, on average for half of the first payment (Engelhardt and Mayer 1998). Transfers from others reduced household savings by 30–40 cents per US dollar (see also Engelhardt and Mayer (1994)).

Thus it appears that higher housing prices reduce, rather than increase, the savings of renters. Moreover, to the extent that higher housing prices increase the resources (leveraged at almost four to one) available for intra-familial transfers, this further reduces the savings of those renters who expect to become home-owners.

Engelhardt (1996) also provided a direct test of the link between house price appreciation and the consumption of current home-owners, also using the PSID. He estimated that the marginal propensity to consume out of real capital gains in owner-occupied housing is about 0.03, but this arose from an asymmetry in behavioural response. Households experiencing real gains did not change their savings and consumption behaviour appreciably, while those experiencing capital losses did reduce their consumption behaviour.

Much of the limited evidence on the behavioural response to changes in housing wealth has arisen from consideration of the 'savings puzzle'. During the late 1990s, personal savings as measured in the National Income and Product Accounts fell sharply, to about zero in 2000. But it was shown that if unrealised capital gains in housing were included in both the income and savings of the household sector (as suggested by the original Haig-Simons criteria), then the aggregate personal savings rates computed were much higher (Gale and Sabelhaus 1999).

Similarly, Hoynes and McFadden (1997) used micro (PSID) data to investigate the correlation between individual savings rates and rates of capital gains in housing. Consistent with the perspective of Thaler (1990), the authors found little evidence that households were changing their savings in non-housing assets in response to expectations about capital gains in owner-occupied housing.

The only other study of the 'wealth effect' which has disaggregated housing and stock market components of wealth is an analysis of the Retirement History Survey by Levin (1998). Levin found essentially no effect of housing wealth on consumption.

All of these micro studies of consumer behaviour rely upon owners' estimates of housing values. Evidence does suggest that the bias in owners' estimates is small (see below), but these estimates typically have high sampling variances (Kain and Quigley 1972; Goodman and Ittner 1992). This leaves much ambiguity in the interpretation of statistical results.

4. Data for Wealth and Consumption

We address the linkage between stock market wealth, housing wealth, and household consumption using two distinct bodies of panel data that have been assembled in parallel for this purpose. The datasets have different strengths and weaknesses, which generally complement each other for the study of these relationships.

The first dataset consists of a panel of quarterly data constructed for US states from 1982 through 1999. This panel exploits the fact that the distribution of increases in housing values has been anything but uniform across regions in the US, and the increases in stock market wealth have been quite unequally distributed across households geographically. This panel offers the advantage that data definitions and institutions are uniform across geographical units. In addition, the sample size is large. One disadvantage of this dataset arises because one key variable must be imputed to the various states on the basis of other data measured at the state level. Another disadvantage of these data is that the US stock market has trended upwards during the entire sample period, and the period may have been unusual (Shiller 2000).

The second body of data consists of a panel of annual observations on 14 developed countries for various years during the period of 1975–1999. This dataset relies upon consumption measures derived from national income accounts, not our imputations, but we suspect that housing prices and housing wealth in this panel are measured less accurately. In addition, the sample of countries with consistent data is small. Finally, there are substantial institutional differences among countries, for example, variations in the taxation of wealth and capital gains and in institutional constraints affecting borrowing and saving.

Both datasets contain substantial time series and cross-sectional variation in cyclical activity and exhibit substantial variation in consumption and wealth accumulation.

4.1 US state data

We estimate stock market wealth, housing market wealth and consumption for each US state, quarterly, for the period 1982–1999.

Estimates of aggregate financial wealth were obtained annually from the Federal Reserve Flow of Funds (FOF) accounts and compared to the aggregate capitalisation of the three major US stock markets. From the FOF accounts, we computed the sum of corporate equities held by the household sector, pension fund reserves, and mutual funds. The FOF series has risen in nominal terms from under US$2 trillion in 1982 to US$18 trillion in 1999. It is worth noting that more than half of the gross increase between 1982 and 1999 occurred during the 4 years between 1995 and 1999. The total nominal increase for the 13 years between 1982 and 1995 was US$7.5 trillion; the total nominal increase during the 4 years between 1995 and 1999 was an astonishing US$8.4 trillion. Nearly all variation in the FOF aggregate arises from variation in the capitalisation of the stock market. To distribute household financial assets geographically, we exploit the correlation between holdings of mutual funds and other financial assets. We obtained mutual fund holdings by state from the Investment Company Institute (ICI). The ICI data are available for the years 1986, 1987, 1989, 1991 and 1993. We assumed that for 1982:Q1 through 1986:Q4, the distribution was the same as it was in 1986; similarly we assumed that the 1993 distribution held for the period 1993–1999. We further assumed that direct household holdings of stocks and pension fund reserves were distributed in the same geographical pattern as mutual funds. These are clearly strong assumptions, but there are no alternative data.

Estimates of housing market wealth were constructed from repeat sales price indices similar to those described in Section 2, from Fiserv Case Shiller Weiss, Inc. where available, and otherwise from indices produced by Fannie Mae and Freddie

Mac. One difference is that the data used here are based on the base values reported in the *1990 Census of Population and Housing* by state.

Equation (2) indicates how the panel on aggregate housing wealth was constructed for each state

$$V_{it} = R_{it} N_{it} I_{it} P_{io} \tag{2}$$

where

V_{it} = aggregate value of owner-occupied housing in state *i* in quarter *t*,

R_{it} = home-ownership rate in state *i* in quarter *t*,

N_{it} = number of households in state *i* in quarter *t*,

I_{it} = weighted repeat sales price index, Fiserv Case Shiller Weiss, Inc. or OFHEO, for state *i* in quarter *t* (I_{i1} = 1, for 1990:Q1), and

P_{io} = mean home price for state *i* in the base year, 1990.

The total number of households *N* as well as the home-ownership rates *R* were obtained from the *Current Population Survey* conducted by the US Census Bureau annually and interpolated for quarterly intervals. Aggregate wealth varies as a result of price appreciation of the existing stock as well as additions to the number of owner-occupied dwellings.

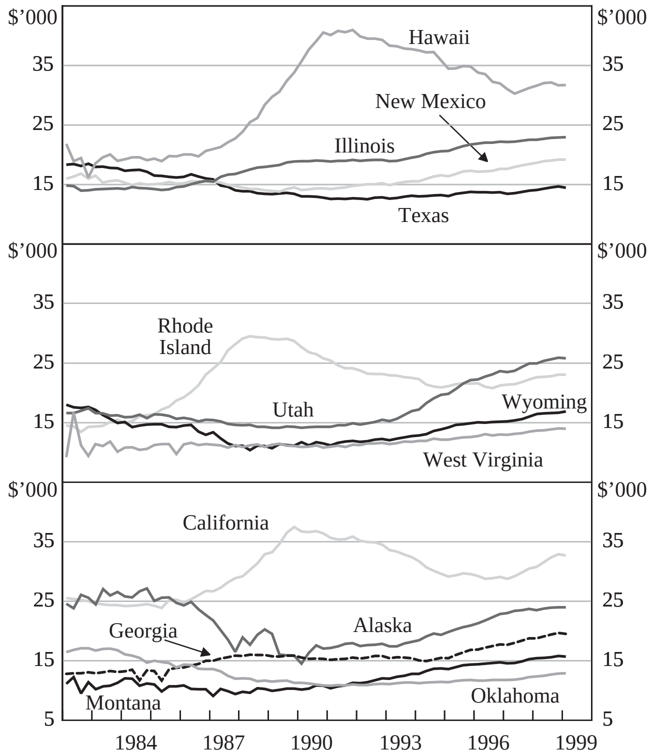
As noted above, the baseline figures for state level mean home prices P_{io} are derived from estimates of house values reported in the 1990 Census. Several studies have attempted to measure the bias in owner estimates of house values. The estimates range from –2 per cent (Follain and Malpezzi 1981; Kain and Quigley 1972) to +6 per cent (Goodman and Ittner 1992). However, Goodman and Ittner point out that for many purposes, owners' estimates may indeed be the appropriate measures of housing wealth; household consumption and savings behaviour is likely to be based upon perceived home value.

The aggregate nominal value of the owner-occupied stock in the US grew from US$2.8 trillion in 1982 to US$7.2 trillion in 1999. Figure 3 reports the evolution of real per capita owner-occupied housing wealth during the period 1982–1999. There is considerable variation in the course of housing wealth across states. For the states illustrated, the levels vary by 300 per cent, and the timing of changes varies substantially.

Unfortunately, there are no measures of consumption spending by households recorded at the state level. However a panel of retail sales has been constructed by Regional Financial Associates (RFA; now Economy.com). Retail sales account for roughly half of total consumer expenditures.[4] The RFA estimates were constructed from county level sales tax data, the *Census of Retail Trade* published by the US Census Bureau, and the Census Bureau's monthly national retail sales estimates. For states with no retail sales tax or where data were insufficient to support imputations, RFA based its estimates on the historical relationship between retail sales and retail

4. In 1997, for example, gross domestic product was US$8.08 trillion, household consumption spending was US$5.49 trillion, and retail sales amounted to US$2.63 trillion.

Figure 3: Evolution of Real Per Capita Owner-occupied Housing Wealth in Selected US States
Constant 1990:Q1 dollars



employment. Data on retail employment by state are available from the Bureau of Labor Statistics. Regression estimates relating sales to employment were benchmarked to the *Census of Retail Trade* available at five-year intervals. Estimates for all states were within 5 per cent of the benchmarks.

Retail sales can be expected to differ systematically from consumption spending for several reasons. Clearly, in states with relatively large tourist industries, recorded retail sales per resident are high. Nevada, for example, with 26 per cent of its labour force employed in tourism, recorded per capita retail sales of US$3 022 in 1997:Q1, third-highest among the 50 states. In addition, states with low or no sales tax can be expected to have high retail sales per resident. For example, New Hampshire with no sales tax, recorded per capita retail sales of US$3 200 in 1997:Q1, highest among the 50 states. Most states, however, were more tightly clustered around the mean of US$2 385 in 1997:Q1.

While there are systematic differences between retail sales and consumption, to the extent that the differences are state-specific, this can be accounted for directly in multivariate statistical analysis. Data on retail sales, house values, and stock market valuation, by state and quarter, were expressed per capita in real terms using the *Current Population Survey* and the GDP deflator.

4.2 International data

It was possible to obtain roughly comparable data for a panel of 14 developed countries during the period 1975–1996.[5] In an analogous manner, we estimate stock market wealth, housing market wealth, and consumption for each country for each year.

Estimates of aggregate stock market wealth for each country were obtained from the Global Financial Database, which reports domestic stock market capitalisation annually for each country. To the extent that the fraction of the stock market wealth owned domestically varies among countries, this can be accounted for in the statistical analysis reported below by permitting fixed effects to vary across countries. We can introduce country-specific time trends to control for variations over time in home-country investment bias, by country.

Estimates of housing market wealth were constructed in a manner parallel to those used for the panel of US states which are summarised in Equation (2). Indices of annual housing prices I_{it} were obtained from the Bank of International Settlements (BIS), which consolidated housing prices reported for some 15 industrialised countries (see Kennedy and Andersen (1994) or Englund and Ionnides (1997)). The BIS series for the US was quite short, so the national OFHEO-Freddie Mac series described earlier is used for the US.

Consistent data on housing prices for a benchmark year, P_{io}, were not available for the panel of countries. This means that regression estimates without fixed effects for each country (which control for country-specific benchmarks) are meaningful only under very restrictive assumptions.

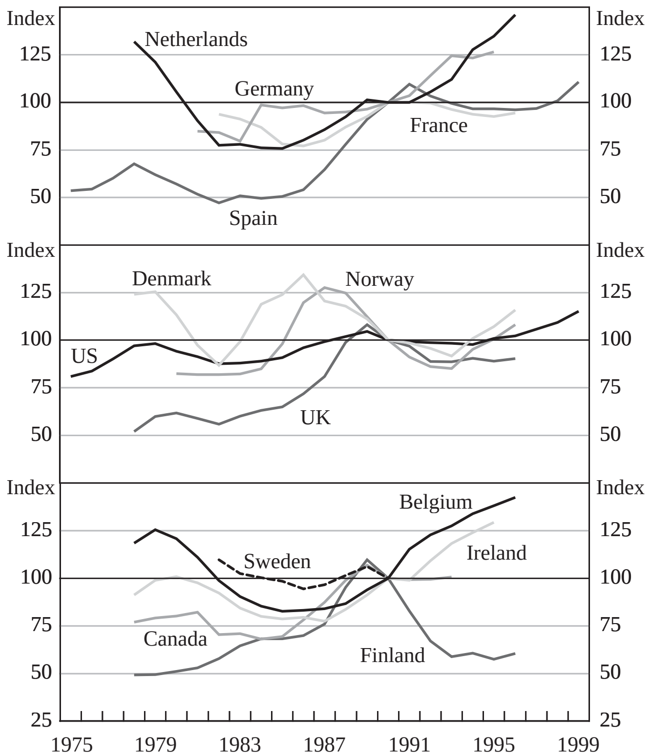
Data on the number of owner-occupied housing units were obtained from various issues of the *Annual Bulletin of Housing and Building Statistics for Europe and North America* published by the United Nations. The series describing the owner-occupied housing stock was not complete for some years in all the countries. More complete data existed for the total housing stock of each country. Where missing, the owner-occupied housing stock was estimated from the total housing stock reported for that year and the ratio of the owner-occupied housing stock to the total housing stock for an adjacent year. Missing data points were estimated by linear interpolation.[6]

5. The countries include: Belgium (1978–1996), Canada (1978–1993), Denmark (1978–1996), Finland (1978–1996), France (1982–1996), Germany (1991–1995), Ireland (1982–1987, 1994–1995), Netherlands (1978–1996), Norway (1980–1996), Spain (1975–1996), Sweden (1975–1996), Switzerland (1991–1996), the UK (1978–1996), and the US (1975–1997).

6. In addition, we are grateful for unpublished estimates of the stock of owner-occupied housing supplied by Taltavull de La Paz (2001) for Spain and the value of owner-occupied housing by Barot and Yang (2002) for Sweden.

Figure 4: Evolution of Real Per Capita Owner-occupied Housing Wealth Across Countries

1990 = 100



Note: Switzerland is not included as data for housing wealth exist only for 1991–1996, and therefore the data could not be normalised to 1990.

Figure 4 reports the evolution of housing market wealth in the 14 countries relative to its aggregate value in 1990. The variations over time in housing market wealth are striking.

Consumption data were collected from the International Financial Statistics database. 'Household Consumption Expenditure including Nonprofit-Institution-Serving Households' is used for the European Union countries that rely upon the *European System of Accounts (ESA1995)*. 'Private Consumption' is used for other countries, according to the *System of National Accounts (SNA93)*. Data on aggregate consumption, housing values and stock market valuations, by country and year, were expressed per capita in real terms using UN population data and the consumer price index.

5. Results from Estimating Wealth Effects on Consumption

Tables 13 through 16 report various econometric specifications of the relationship. All include fixed effects, i.e. a set of dummy variables for each country and state. Model II for each specification also includes state- and country-specific time trends. Model III includes year-specific fixed effects as well as fixed effects for countries and states. For the panel of states, Model III also includes seasonal fixed effects, i.e., one for each quarter. In each of the four tables, the first three columns present regression results for the panel of countries (228 observations on 14 countries), while the next three columns report the results for the panel of states (3 498 observations on 50 states and the District of Columbia).[7] Table 13 presents basic ordinary least

Table 13: Consumption Models Estimated Using Ordinary Least Squares
Dependent variable: consumption per capita

	Country data			**State data**		
	I	II	III	I	II	III
Income	0.660	0.349	0.287	0.567	0.705	0.559
	(9.69)	(5.63)	(3.27)	(31.95)	(28.56)	(22.84)
Stock market wealth	0.019	0.002	–0.010	0.056	0.028	0.063
	(2.05)	(0.25)	(–0.87)	(14.19)	(5.86)	(10.53)
Housing market wealth	0.131	0.110	0.166	0.084	0.047	0.086
	(5.33)	(7.35)	(6.90)	(11.56)	(6.97)	(11.57)
Country/state-specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.9991	0.9998	0.9993	0.9241	0.9587	0.9305
t-ratio	4.664	7.090	6.987	3.919	2.408	2.541
p-value for H_0	0.000	0.000	0.000	0.000	0.016	0.011
p-value for H_1	1.000	1.000	1.000	1.000	0.992	0.994

Notes: The equations all contain country/state fixed effects.

All variables are in real per capita terms (deflated by GDP deflator) and measured in logarithms; *t*-ratios are shown in parentheses. The country data are annual observations for 1975–1999. The state data are quarterly observations for 1982–1999.

H_0 is a test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth.

H_1 is a test of the hypothesis that the coefficient on housing market wealth exceeds that of stock market wealth.

7. The state panel is not quite balanced. The series includes quarterly observations from 1982:Q1 through 1999:Q4 for all states but Arizona. The time series for Arizona begins in 1987:Q1.

squares relationships between per capita consumption, income, and the two measures of wealth. As the table indicates, in the simplest formulation, the estimated effect of housing market wealth on consumption is significant and large. In the international comparison, the elasticity ranges from 0.11 to 0.17. In the cross-state comparison, the estimated elasticity is between 0.05 and 0.09. In contrast, the estimated effects of financial wealth upon consumption are smaller. In the simplest model, the estimate from the country panel is 0.02. In the other two regressions, the estimated coefficient is insignificantly different from zero, perhaps reflecting the more restricted ownership of non-financial wealth in Western European countries. In the cross-state comparisons, the estimated effect of financial wealth is highly significant, but its magnitude is about 60 per cent as large as the estimated effect of housing wealth.

The table also reports the *t*-ratio for the hypothesis that the difference between the coefficient estimates measuring housing and financial market effects is zero. A formal test of the hypothesis that the coefficient on housing market wealth is equal to that of stock market wealth (against the alternative hypothesis that the two coefficients differ) is presented, as well as a test of the hypothesis that the coefficient on housing market wealth exceeds the coefficient on financial wealth. The evidence suggests that housing market wealth has a more important effect on consumption than does financial wealth.

Table 14 reports the results when the effects of first order serial correlation are also estimated.[8] The estimated serial correlation coefficient is highly significant and large in magnitude. The coefficients of housing market wealth change only a little. For the panel of countries, the estimated elasticity ranges from 0.11 to 0.14; for the panel of states, the estimate ranges from 0.04 to 0.06. In five of the six regressions reported, the hypothesis that the effects of housing market wealth are larger than those of financial wealth is accepted by a wide margin.

Table 15 presents results with all variables expressed as first differences. In this formulation, the coefficient on housing market wealth is significant in all specifications, while the coefficient of financial wealth is essentially zero. Consumption changes are highly dependent on changes in income and housing wealth, but not stock market wealth.

Unit root tests suggest that, although we can accept stationarity for most of the series, non-stationarity may be a problem for some series.[9] Therefore, Table 16 presents the model in first differences including the lagged (log) ratio of consumption to income. This is the error-correction model (ECM) often employed in the presence of unit roots. The model represents a co-integrated relation between consumption and income, where income includes income from the stock market and housing.

8. These models rely on sequential estimation using the Prais-Winsten estimator.

9. Augmented Dickey-Fuller tests, both with and without an intercept and a trend, can reject a unit root for most of the series, but not all. This finding is consistent with tests for a common unit root (Maddala and Wu 1999) which can reject the presence of a common unit root for all four variables (and both datasets), suggesting that at least one of the series is stationary.

Table 14: Consumption Models with Serially Correlated Errors Estimated Using Generalised Least Squares
Dependent variable: consumption per capita

	Country data			State data		
	I	II	III	I	II	III
Income	0.679	0.309	0.388	0.647	0.432	0.336
	(12.30)	(4.84)	(5.07)	(40.20)	(18.16)	(13.94)
Stock market wealth	0.007	–0.004	–0.003	0.042	0.007	0.026
	(1.16)	(–0.69)	(–0.33)	(11.87)	(1.53)	(4.87)
Housing market wealth	0.108	0.115	0.136	0.039	0.054	0.062
	(4.62)	(6.52)	(5.92)	(4.14)	(6.25)	(6.96)
Serial correlation coefficient	0.854	0.564	0.817	0.878	0.784	0.866
	(23.77)	(9.57)	(19.49)	(107.43)	(73.55)	(101.44)
Country/state-specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.9998	0.9999	0.9998	0.9839	0.9855	0.9863
t-ratio	4.282	6.525	5.987	–0.311	4.543	3.425
p-value for H_0	0.000	0.000	0.000	0.756	0.000	0.001
p-value for H_1	1.000	1.000	1.000	0.378	1.000	1.000

Notes: See Table 13.

Note that the lagged ratio of consumption to income has a coefficient that is negative and significant in all regressions for both panels. Thus, transitory shocks, arising from changes in other variables in the model or the error term in the regression, will have an immediate effect on consumption but will eventually be offset unless the shocks are ultimately confirmed by income changes. Again, the results support the highly significant immediate effect of housing market wealth upon consumption; the effect is especially large relative to that of financial wealth.[10]

10. Our data measure financial and housing values at the end of each period, rather than their averages throughout each period. Therefore, we estimated each of the 24 regressions reported in Tables 13 through 16 using one- and two-period leads and lags in the measures of housing and financial assets. The character of these results is consistent with those reported in the text: measures of housing wealth were significant; measures of financial wealth were sometimes insignificant; and the magnitude of the coefficient on housing wealth exceeded that of financial wealth. These results are robust.

Table 15: Consumption Models in First Differences Estimated Using Ordinary Least Squares

Dependent variable: consumption per capita

	Country data			State data		
	I	II	III	I	II	III
Income	0.266 (4.06)	0.239 (3.49)	0.254 (3.34)	0.332 (14.12)	0.325 (13.73)	0.274 (11.15)
Stock market wealth	–0.008 (–1.37)	–0.010 (–1.67)	–0.007 (–0.97)	0.001 (0.23)	0.002 (0.36)	0.003 (0.50)
Housing market wealth	0.128 (6.21)	0.147 (6.56)	0.141 (6.37)	0.034 (3.58)	0.030 (3.11)	0.038 (3.94)
Country/state-specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
Regression R^2	0.3943	0.4346	0.4807	0.0729	0.0813	0.1458
Durbin-Watson	1.718	1.847	1.705	2.424	2.445	2.484
t-ratio	6.341	6.725	6.518	2.876	2.437	3.097
p-value for H_0	0.000	0.000	0.000	0.004	0.015	0.002
p-value for H_1	1.000	1.000	1.000	0.998	0.993	0.999

Notes: See Table 13.

Table 16: Error Correction Consumption Models
Dependent variable: change in consumption per capita

	Country data			State data		
	I	II	III	I	II	III
Change in income	0.283 (4.33)	0.297 (4.77)	0.274 (3.64)	0.350 (14.92)	0.388 (16.61)	0.304 (12.57)
Change in stock market wealth	–0.003 (–0.59)	0.001 (0.26)	–0.004 (–0.58)	–0.009 (–2.02)	–0.009 (–2.06)	–0.003 (–0.51)
Change in housing market wealth	0.097 (4.25)	0.100 (4.36)	0.107 (4.35)	0.044 (4.33)	0.047 (4.60)	0.054 (5.23)
Lagged change in consumption	0.131 (2.17)	0.117 (2.01)	0.150 (2.32)	–0.182 (–10.75)	–0.149 (–8.75)	–0.227 (–13.44)
Lagged ratio of consumption to income	–0.077 (–2.65)	–0.333 (–7.04)	–0.071 (–2.45)	–0.049 (–6.87)	–0.151 (–14.00)	–0.051 (–6.77)
Country/state-specific time trends	No	Yes	No	No	Yes	No
Year/quarter fixed effects	No	No	Yes	No	No	Yes
R^2	0.4248	0.5634	0.5044	0.1301	0.1787	0.2169
Durbin-Watson	1.858	1.897	1.898	2.028	2.009	2.055
t-ratio	4.176	4.044	4.369	4.305	4.539	4.727
p-value for H_0	0.000	0.000	0.000	0.000	0.000	0.000
p-value for H_1	1.000	1.000	1.000	1.000	1.000	1.000

Notes: This table shows estimates of the following equation:

$$\Delta C_t = \alpha \Delta C_{t-1} + \beta_1 \Delta Inc_t + \beta_2 \Delta Stock_t + \beta_3 \Delta House_t + \gamma \left[C_{t-1} - Inc_{t-1}\right] + FixedEffects + \varepsilon_t .$$

See notes to Table 13.

6. Conclusion

In previous work we have highlighted the role of the expectations and attitudes of households in determining outcomes in the housing market. This paper has provided additional new evidence on the importance of such factors. The most important result from our survey of home-buyers in four US cities in 2002 is that it suggests that home-buyers' expectations are substantially affected by recent experience. Even after a long boom, home-buyers typically have expectations that prices over the next 10 years will show double-digit annual price growth, apparently only with a modest level of risk. It seems reasonable to conjecture that an expectations formation process such as this could well be a major contributor to the substantial swings seen in housing prices in some US regions.

Given the importance of housing in household wealth, it also seems reasonable to conjecture that the observed swings in housing prices could have substantial macroeconomic impacts. We have examined the wealth effects from both housing and equities with two panels of cross-sectional time-series data that enable more comprehensive tests than in any earlier work. The numerical results vary somewhat with different econometric specifications, and so any quantitative conclusion must be tentative. Nevertheless, the evidence of a stock market wealth effect is weak; the common presumption that there is strong evidence for this form of a wealth effect is not supported in our results. However, we do find strong evidence that variations in housing market wealth have important effects upon consumption. This evidence arises consistently using panels of US states and industrial countries and is robust to differences in model specification. Interestingly, our modeling approach of using a panel of states has recently been applied to Australia by Dvornak and Kohler (2003), who also find a significant effect of housing on consumption.

Looking ahead, the two main findings of this paper suggest that any weakness in the US housing market would have an important impact on the macroeconomy. Our survey (and other evidence) point to some factors that might mitigate these effects. In particular, the reluctance of sellers to lower their asking prices may limit the magnitude of any fall in prices, and if the underlying fundamentals came back quickly enough, it might prevent a bubble from ‘bursting’. On the other hand, there is the danger that when demand drops in housing markets, the volume of sales may drop precipitously, which could do more damage to the US economy today than a modest decline in prices.

References

Barot B and Z Yang (2002), 'House prices and housing investment in Sweden and the United Kingdom: econometric analysis for the period 1970–1998', National Institute of Economic Research Working Paper No 80.

Bhatia K (1987), 'Real estate assets and consumer spending', *Quarterly Journal of Economics*, 102(2), pp 437–444.

Case KE (1983), 'The market for single-family homes in the Boston area', *New England Economic Review*, May/June, pp 38–48.

Case KE (1992), 'The real estate cycle and the economy: consequences of the Massachusetts boom of 1984–87', *Urban Studies*, 29(2), pp 171–183.

Case KE and RJ Shiller (1987), 'Prices of single-family homes since 1970: new indexes for four cities', *New England Economic Review*, Sept/Oct, pp 45–56.

Case KE and RJ Shiller (1988), 'The behavior of home buyers in boom and post-boom markets', *New England Economic Review*, Nov/Dec, pp 29–46.

Case KE and RJ Shiller (1989), 'The efficiency of the market for single-family homes', *American Economic Review*, 79(1), pp 125–137.

Case KE and RJ Shiller (1990),'Forecasting prices and excess returns in the housing market', *American Real Estate and Urban Economics Association Journal,* 18(3), pp 253–273.

Dvornak N and M Kohler (2003), 'Housing wealth, stock market wealth and consumption: a panel analysis for Australia', Reserve Bank of Australia Research Discussion Paper No 2003-07.

Elliott JW (1980), 'Wealth and wealth proxies in a permanent income model', *Quarterly Journal of Economics*, 95(3), pp 509–535.

Engelhardt GV (1994), 'House prices and the decision to save for down payments', *Journal of Urban Economics*, 36(2), pp 209–237.

Engelhardt GV (1996), 'House prices and home owner saving behaviour', *Regional Science and Urban Economics*, 26(3-4), pp 313–336.

Engelhardt GV and CJ Mayer (1994), 'Gifts for home purchase and housing market behaviour', *New England Economic Review*, May/June, pp 47–58.

Engelhardt GV and CJ Mayer (1998), 'Intergenerational transfers, borrowing constraints, and savings behaviour: evidence from the housing market', *Journal of Urban Economics*, 44(1), pp 135–157.

Englund P and YM Ioannides (1997), 'House price dynamics: an international empirical perspective', *Journal of Housing Economics*, 6(2), pp 119–136.

Follain JR and S Malpezzi (1981), 'Are occupants accurate appraisers?', *Review of Public Data Use*, 9(1), pp 47–55.

Gale WG and J Sabelhaus (1999), 'Perspectives on the household saving rate', *Brookings Papers on Economic Activity*, 1, pp 181–214.

Goodman JL and JB Ittner (1992), 'The accuracy of home owners' estimates of house value', *Journal of Housing Economics*, 2(4), pp 339–357.

Greenspan A (1999), 'Mortgage finance', remarks delivered to Mortgage Bankers' Association, Washington DC, 8 March.

Hoynes HW and DL McFadden (1997), 'The impact of demographics on housing and nonhousing wealth in the United States', in MD Hurd and Y Naohiro (eds), *The economic effects of aging in the United States and Japan*, NBER Conference Report Series, University of Chicago Press, Chicago, pp 153–194.

Kain JF and JM Quigley (1972), 'Note on owners' estimates of housing values', *Journal of American Statistical Association*, 67(340), pp 803–806.

Kennedy N and P Andersen (1994), 'Household saving and real housing prices: an international perspective', BIS Working Paper No 20.

Levin L (1998), 'Are assets fungible? Testing the behavioral theory of life-cycle savings', *Journal of Economic Behavior and Organization*, 36(1), pp 59–83.

Maddala GS and S Wu (1999), 'A comparative study of unit root tests with panel data and a new simple test', *Oxford Bulletin of Economics and Statistics*, 61, Special Issue, pp 631–652.

Peek J (1983), 'Capital gains and personal saving behavior', *Journal of Money, Credit, and Banking*, 15(1), pp 1–23.

Pound J and RJ Shiller (1987), 'Are institutional investors speculators?', *Journal of Portfolio Management*, 13(3), pp 46–52.

Shefrin HM and RH Thaler (1988), 'The behavioral life-cycle hypothesis', *Economic Inquiry*, 26(4), pp 609–643.

Sheiner L (1995), 'Housing prices and the savings of renters', *Journal of Urban Economics*, 38(1), pp 94–125.

Shiller RJ (2000), *Irrational exuberance*, Princeton University Press, Princeton.

Skinner J (1989), 'Housing wealth and aggregate saving', *Regional Science and Urban Economics*, 19(2), pp 305–324.

Taltavull de La Paz P (2001), 'Housing and consumption in Spain', paper presented at the 8th Annual ERES Conference, Alicante, 26–29 June.

Thaler RH (1990), 'Anomalies: saving, fungibility and mental accounts', *Journal of Economic Perspectives*, 4(1), pp 193–205.

Yoshikawa H and F Ohtake (1989), 'An analysis of female labor supply, housing demand, and the saving rate in Japan', *European Economic Review*, 33(5), pp 997–1023.

Discussion

1. Malcolm Edey

This paper by Case, Quigley and Shiller provides a wealth of information about housing price dynamics and about how those dynamics might affect the broader economy. Rather than take issue with the conclusions of the paper, which I broadly endorse, I want to use my comments to focus on four questions that arise out of this material.

My first question is: are housing markets bubble-prone?

We have learned from other contributions to this conference that it can be difficult to pin down whether a particular rise in asset prices constitutes a bubble, especially at the time it is happening. It may be easier *ex post* – the definition that says that you know you've had an asset bubble when the price has just fallen by 40 per cent. Despite these uncertainties, I think it makes sense to step back and ask the broader question as to whether certain markets can be classified as bubble-prone. A reasonably clear definition of a bubble-prone market would be one with two characteristics – where the price dynamics are driven to a significant degree by extrapolative expectations, and where this on occasions generates sustained departures of prices from their long-run determinants.

The paper's results are strongly suggestive that housing markets in the US would satisfy that definition; and it seems reasonable to conjecture that the same would be true elsewhere. The paper brings out a number of stylised facts that would support that view. They show, for example:

- A strong investment motive among most home-buyers.
- The perceived attractiveness of housing as an investment is dependant on price expectations and also to some extent on perceptions of returns in alternative markets; thus there is some moderate support for the proposition that housing investment is more attractive in a period of stock market under-performance.
- Expectations of housing prices tend to be extrapolative, so that the degree of short-term optimism depends on perceptions of what is happening now.
- There are considerable inertial forces in the price-setting process, for example, widespread seller resistance to price falls.
- Housing prices in at least some parts of the US market display a pattern of long upswings interspersed with periods of flat or mildly declining prices.
- This latter characteristic is suggestive of periodic overshooting followed by periods of gradual correction.

Currently, Australia (like the US and UK) is in the midst of a housing price boom, and this brings me to my second question: if we accept that housing markets are subject to periodic overshooting and correction (so they might be classified as bubble prone), are they becoming more so over time?

The answer to this question is much less obvious than the first one. Things always look bigger when you're close to them, and there is a natural tendency to think that the latest economic event is more significant than the ones that came before it. To put the current period in some historical context, it is worth noting that housing price booms in Australia have been reasonably regular events. Periods of house price inflation going well into double digits have occurred roughly once a decade, going back at least as far as 1970; and, as John Simon's paper showed, real estate bubbles were not unknown well before that. A look at UK housing prices over this period would show periods of rapid increase occurring with similar frequency to that in Australia.

So the current housing price inflation in Australia is by no means unprecedented. What does mark out the current period is the way it has been associated with rising leverage and more readily available finance, a point that I will return to shortly.

My third question is: what causes housing bubbles?

I will not purport to offer a definitive answer to that question, but I hope I can make some observations that might provoke further discussion. As a starting point, I suggest that it is helpful to distinguish between the *pre-conditions* for bubble-like behaviour in an asset market, and the *triggers* that initiate an actual episode of rising asset prices.

The Case, Quigley and Shiller paper, I think, offers some important insights into the pre-conditions for bubble-like behaviour in housing markets. One obvious pre-condition is the widespread presence of extrapolative expectations, and the paper provides survey-based evidence that this is indeed present in housing markets in the US. A second pre-condition seems to be suggested by the striking differences in price dynamics across the different parts of the US market described in the paper. There appear to be some cities that are readily characterised as bubble-prone (those exhibiting large periodic swings in the housing prices to income ratio) and others that are not (those where that ratio is quite stable).

Why are some housing markets more prone to large swings than others? Why, for example, are Wisconsin housing prices so much more stable than those in California or New York? A plausible explanation is that the more volatile or bubble-prone markets are those where supply constraints on desirable land and desirable locations are the most important, a condition that would exist especially in the large coastal cities. This makes economic sense: it would be hard to have a bubble in an asset where the supply can respond elastically to the higher price. This would also explain why the most volatile markets are also those where the average prices are relatively high.

What about the triggers for a housing price boom?

There are many possible factors that could initiate an upward adjustment in housing prices but, for the sake of the discussion, I will go beyond the content of the paper to mention two that seem to have been important in Australia in the current episode:

- One is the shift to a low-interest-rate environment, which is itself a natural consequence of the transition to low inflation in the 1990s. This interest rate adjustment is estimated to have contributed to an approximate doubling of households borrowing capacity, at least some of which could be expected to be capitalised in housing prices.
- A second has been the increased availability of finance for the housing sector in the aftermath of financial deregulation. Since the early 1990s, housing finance has grown rapidly not only in absolute terms, but has constituted a strongly rising share of credit provided by the financial system as a whole. A rising component of finance for investor housing has been an important element of that. Thus in a little over 10 years, lending for housing has gone from not much more than 20 per cent of credit outstanding of financial institutions, to around 50 per cent. A significant part of that has been accounted for by lending to investors, which went from around 5 to almost 20 per cent of banks' loan portfolios over the same period.

These factors can be thought of as releasing latent demand and hence contributing to an upward adjustment in housing prices in Australia in the past decade. But whatever the initiating factors, there is a broader point that emerges from the paper: that is, that once such an upward adjustment of this type gets under way, the dynamics of extrapolative expectations have the potential to give the process additional momentum of its own.

Finally, I want to touch briefly on the question: what do these housing price dynamics mean for the broader economy?

I think the paper is right to focus attention on the possible effects on consumer spending. It is well documented that housing price increases have been associated with equity withdrawal by households in the US, UK and Australia, thereby contributing to growth of consumer spending in recent years. But this process also has the potential to work in reverse, as was seen in the UK in the early 1990s. Hence, it seems likely that large swings in housing prices, when they occur, can work to amplify the broader macroeconomic cycle.

2. General Discussion

The discussion covered a wide range of topics including the behaviour of house prices, the micro-level evidence about household expectations about housing prices, and the macro-level evidence about the responsiveness of consumption and economic activity to changes in house prices.

One participant commented on the graphs presented by Case, Quigley and Shiller of the ratio of house prices to income in different US states and suggested that it is difficult to discern whether fluctuations in the ratio were evidence of misalignments or rather movements to a new equilibrium. In particular, if house prices reflected expectations of future income, then a ratio using current income might be more volatile. Furthermore, divergent movement in the ratio between states could reflect to some extent differing expectations about future income, for example, driven by differences in recent productivity growth rates.

Another participant suggested that a decline in the average number of people per household could cause a shift in fundamental housing valuations. He recalled the view expressed during the discussion of the paper by John Simon that asset-price misalignments occur when there is a once-off shift in the fundamental value of the asset, which is misinterpreted as a permanent shift in the fundamental growth rate and subsequently becomes built into peoples' expectations. The finding of Case *et al* that people's expectations tend to be backward-looking was seen to support this idea.

The importance of the supply side was also raised. One participant noted that the responsiveness of construction activity to changes in prices may vary between segments in the housing market (e.g., between houses and apartments). If the responsiveness of the supply side is important in determining the propensity of asset-price misalignments developing (as was suggested by Malcolm Edey), this may mean that particular segments of the housing market are more bubble-prone than others.

Turning to the Australian housing market, one participant agreed with Edey that there have been periods in the past where large upswings in house prices have occurred. However, he thought that one distinguishing factor of the present upswing was how prolonged it has been. Another participant noted that the downward rigidities in house prices and rents emphasised by Case *et al* are also present in the Australian housing market. However, it was suggested that such rigidities were probably smaller in magnitude due to the higher proportion of floating-rate (rather than fixed-rate) mortgages in Australia, compared to the US.

The role of investors in the Australian housing market, and the implications for market dynamics, was another topic of considerable focus. One participant suggested that investors are more likely than owner-occupiers to sell in the face of falling house prices. However, another participant expressed the alternative view that housing investors are typically towards the higher end of the income distribution, have often paid off their principal mortgage and therefore are likely to be better able to absorb falls in house prices. On a related topic, Karl Case noted that in the US the relationship between the rental market and the owner-occupier market has altered over time. He cited the role of demographic influences, namely that the proportion of the population in the age groups that typically rent has declined, and contributed to the recent rise in the rate of home ownership.

The estimates of wealth effects in Case *et al*'s paper prompted some discussion of whether housing is an intrinsically different asset compared to equities. One participant argued that this was the case as the household is both a supplier and consumer of housing services. Another participant noted that as a consequence it is the reaction of liquidity-constrained households to changes in house prices that is of macroeconomic importance. It was argued that households that own equities are typically not credit-constrained, whereas increases in house prices would relax the credit constraints for a household at the margin, and that these factors explained why Case *et al* found that the elasticity of consumption with respect to equities is lower than the elasticity of consumption with respect to housing. Another participant thought that the relaxation of credit constraints might cause the effect of changes in house prices on consumption to be asymmetric.

Some of the discussion focused upon the experience of the states of Massachusetts and California in the US in the late 1980s. Case noted that in these episodes of rising house prices, people generally reduced their savings. When the aggregate economy weakened, housing-related sectors initially continued to grow, but then also weakened.

There was also some discussion of implications for financial stability of a fall in house prices. Several participants thought that financial institutions are likely to be able to withstand such a downturn better than previously. This reflected a variety of factors, including improvements in their banking practices, strengthened prudential regulation and supervision, and the move to securitisation of mortgage debt. However, there was some unease as to where the securitisation had redistributed the risk, and concern about the exposure in the US of mortgage insurance companies and the government-sponsored housing enterprises, Fannie Mae (the Federal National Mortgage Association) and Freddie Mac (the Federal Home Loan Mortgage Corporation).

Tulips from Amsterdam

After-dinner address by Trevor Sykes

As you will have gathered from the introduction, I've been a journalist for nearly 50 years. The last 34 of those have been spent covering finance and part of that time has been spent writing as my alter ego, Pierpont, a column which I created 31 years ago.

As Trevor Sykes, I cover all aspects of finance, but Pierpont is more of a scandal-mongerer and tends to focus on follies, fraud and collapses. Indeed, if the Australian corporate world ever turned honest and competent, Pierpont would be out of a job, but I can assure that's never been a worry that has kept him or me awake at night for a single second.[1]

You see, my one simple theme tonight is that in the financial world **no-one** learns from history. And this is nowhere more evident than in the history of booms and busts.

They've been going on for centuries. The causes, the cycle and the end result are always the same and nobody ever learns because they **all** think this time is going to be different.

In 2000, I attended a conference where the main speaker was David Hale, chief apostle of the new-age economies, who scorned Australia because we didn't have a soaring dot com sector like the United States. We were a bunch of hicks who weren't up with the new paradigm. Remember 'paradigm'?

My sympathy with those who were caught when the new paradigm turned into the latest train crash is zero. The lessons have been there to be learned for a long time. They were all there in the very first boom of which we have records. I am here to speak to you tonight about tulips and the boom and bust of 1636–37.

The tulip is a beautiful flower with a fascinating history. The first wild tulips appear to have been natives of the foothills of the high, cold, arid mountains of Tien-Shan, on the borders of Russia and China some 400 kilometres north of Tibet and 400 kilometres east of Tashkent. I've only ever seen those mountains once from 30 000 ft but they appear to be one of the most remote and inhospitable places on earth.

The wild tulips were somewhat different from modern tulips. The flowers were only a few inches above the ground and their only colour was red.

Tulips were admired by the locals, but there weren't many locals. To the north of the Tien-Shan mountains is the barren Russian Taiga. To the east is desert and to the

1. I started the Pierpont website four years ago. On an average day when I open it, the readers have brought one or two new scams to Pierpont's attention. The trouble is that they take a bit of research and Pierpont's lazy and so between us we can only cover one scam a week in the column. Which means we're falling behind rather badly. On my desk as I speak is a pile of A4 which I measured this afternoon at 15 inches. That's nearly 40 centimetres and every millimetre represents at least one scam that Pierpont hasn't got around to investigating yet. So on that backlog, Pierpont's still got plenty of material left.

south is the arid roof of the world stretching down through Tibet to the Himalayas. Approaches from the west are blocked by hostile tribes and the mountains themselves. And they're still remote. Even today, less than one in a million westerners would know more about Tien-Shan than they do about Mars.

Adventurous Turkish nomads pastured their horses in the valleys on the northern side of the mountain range. These nomads were sometimes traders but more often brigands. After holing up in the mountains during the desolate, freezing winter, their first sign of spring must have been the tulips: a break of scarlet in an otherwise hostile landscape. To those hardy horsemen, the flowers must have represented a renewal of life.

The hardy bulbs spread westward towards the Caspian Sea. Who first cultivated them will never be known, but certainly they were prized objects by 1050 in the gardens of Baghdad and in Isfahan, the old Turkish capital.

So Turks came to venerate the tulip. By the 14th century it was the most-prized flower of the Ottoman sultans. The letters which made up its name in Arabic were the same as those that made up the name of Allah, perhaps because when the tulip is in full flower, in modesty before God, it bows its head.

The original wild tulips were a round flower, but the Turks preferred to breed them long and narrow – roughly the difference between a Marie Antoinette champagne glass and a flute.

When Suleyman the Magnificent embarked on his campaigns in the 16th century, his royal armour was embossed with a single glorious tulip, nine inches long.

But for all these centuries, the West knew nothing of the tulip. The tulip was the flower of the east, primarily the Turks, and the only time westerners met the Turks was in battles such as the Field of Blackbirds at Kosovo in 1389, and on days like that you really can't blame the knights of the west much for not being focused on botany.

Sorry to spend so much time on remote botanical history, but I thought it well to explain why the long-delayed emergence of this exotic flower came as such a revelation to Western Europe. Its beauty was combined with exotic origins, connections with royalty and power, a sacred quality … And, for investors, rarity.

Exactly how and where the tulip made the transition from east to west is uncertain, but by 1559 it is recorded as being grown in Bavaria. The bulbs reached England by 1582. The first record of them in Holland is from 1562, where the first merchant to receive them had them roasted and eaten, under the impression they were Turkish onions.

Holland was not the first country to be infected by the craze for tulips. Parisians went mad about the beautiful blooms early in the 17th century, when ladies of the court wore them as a fashion item in their cleavage, doubtless to help display other assets. That practice lasted until about 1615, but in the time it lasted, tulips in Paris at one point were as expensive as diamonds.

The fashion of high-Parisian society was strongly adopted in northern France, where there are anecdotes of a miller exchanging his mill for a single bulb and a proud father whose dowry to his daughter was also a single bulb, which he had bred and named after her.

From northern France, passion for the bulb spread naturally into Holland. So the Dutch were actually late starters in the tulip craze, but this is understandable for two reasons.

The first is that the Dutch were already great traders and prosperous, but up until 1628 they were pre-occupied with their life or death fight for liberation from the Spanish. It was not until 1630 that the threat of invasion had receded far enough for the Dutch to disband their armed forces and concentrate on their main business of making money.

Money, indeed, is a very Dutch obsession. Their neighbours in Belgium say that copper wire was invented by two Dutchmen arguing over a penny.

The second reason the Dutch were slow off the mark was because of the length of time it took for tulips to become available in any volume.

Tulips can be grown from either seed or bulbs. Plants grown from a single seed from one flower can provide considerable variation, so that it is impossible to know exactly what sort of tulip will emerge. It takes six or seven years to produce a flowering bulb from a seed.

However, once a tulip grown from seed has matured and flowered, it can reproduce itself by producing outgrowths, known as offsets, from its bulb. Offsets can be pinched off by hand and in a year or two, become flowering bulbs themselves.

So growing tulips from offsets is faster, but has a disadvantage. Most tulip bulbs will produce only two or three offsets a year, and can do so for only a couple of years before the mother bulb becomes exhausted and dies. So if you strike a terrific new tulip variety, it can only multiply slowly from offsets. With luck, you might get 16 plants after four years.

The natural colour of the tulip is red. But by planned and accidental breeding, they began to develop riotous colours: red with yellow borders, purple with white borders and so on. These patterns excited the Dutch gardeners.

The colours were more intense than anything they had seen before and showed fantastic variety. The most highly prized tulips were almost entirely white or yellow, displaying flames of purple, red or brown running along the centres or edges of the petals.

The great irony of the boom, as is well known, is that this streaking was caused by a virus which is unique to tulips. A bulb which produced a uni-coloured bloom one year might become streaked the next and there was no way of predicting when or how this would happen. This feature was known as ‘breaking’.

Once a mother bulb was infected with the virus, it rarely recovered. So it would continue breaking in dazzling patterns. Dutch breeders tried to induce breaking by binding half a normal bulb with a half-bulb that had broken, which later research proved to be the most effective way of transmitting the virus. However, there was still no way of predicting what the flower from the broken bulb would look like.

Indeed, the mystery of breaking remained unsolved until well into the 20th century, when researchers in London isolated the agent and named it the mosaic virus.

And in a sense, Holland was home to the tulips. By their very origins, tulips flourish in harsh conditions. They were peculiarly suited to the belt of poor, sandy soil which runs up the Dutch coast from Leiden to the city of Haarlem.

So much for history and botany. Let's get down to money.

There are four key foundation blocks for any hysterical boom.

First, a long period of growing prosperity in which the investing classes enjoy a rising tide of disposable income – as Australia enjoyed in the 1960s ahead of the nickel boom. And the deeper this prosperity spreads downward into society, the better the chance of a boom because disposable income is in the hands of people who are inexperienced at investing it.

Second, the arrival of an exciting new commodity or industry, such as railways in the United States in the mid-19th century or Silicon Valley in the late 20th. And, the early investors in that industry should be showing substantial returns, thereby attracting more risk capital. Typically, there is a long groundswell in a commodity price before it goes wild.

Third, within that commodity or industry there should be one or two star performers, such as Poseidon in the nickel boom or Microsoft in Silicon Valley.

Fourth, a marketplace that is liquid and unregulated enough for prices to explode.

By 1636, Holland had all four ingredients.

The merchants were growing rich on the Indies trade. Tulips were a status symbol and – as the years went by – were becoming increasingly accessible by the lower-paid members of society.

And there was a star performer. Rosen tulips were one of the most highly prized varieties, and the most highly prized of them all was the Semper Augustus.

It had a slender stem which carried the flower well clear of the leaves, showing off its colours to best effect. The base of the flower was solid blue, turning quickly to pure white, while slim blood-coloured flares shot up all six petals and around their tips.

By 1624 there were no more than a dozen Semper Augustus in existence. It was so rare that very few were traded, but it became a benchmark which dragged up the prices of all other tulips.

This is another feature of booms. In the diamond boom of the late 1970s, the benchmark was the D flawless diamond. When I interviewed Harry Oppenheimer at de Beers in 1980 he said he'd never seen one and had been asking his agents to find one for him. Nevertheless, D flawless prices set the market for all other stones. I hardly need observe that basing a boom on a leader which hardly ever trades adds an extra degree of instability to prices.

Everyone in Holland agreed that tulips were beautiful. **Now** came the widespread realisation that a fortune could be made from them. The prices of tulips had been rising steadily since their arrival in Holland. The early investors from 1630 were showing rich returns.

By 1633, tulips were becoming widely available in Holland, although the most prized were still scarce and expensive. But in 1633, we have the first recorded instance of tulips being used as money, when a house in the town of Hoorn changed hands for three bulbs.

From then, the prices started rising strongly. The wild peak of this boom lasted just two months, from the end of 1636 to the start of 1637.

Most of us here would have read the tulip chapter in Charles Mackay's classic book, *Extraordinary popular delusions and the madness of crowds*. But if you're really interested in the tulip craze, the best source I know is the inelegantly named *Tulipomania* by Mike Dash. The prices I quote tonight are from Dash.[2]

In the space of those two or three months, a tulip called Admirael de Man was bought for 15 guilders and resold for 175. This at a time when an artisan was earning 300 guilders a year. In the same timespan, a Generalissimo was bought for 95 guilders and resold for 900 – three times an artisan's annual wage. A Gouda priced at 100 guilders when the boom began rose to 750.

The Semper Augustus, priced at 5 500 guilders in 1633, hit 10 000 in January 1637. At that price only a handful of Dutchmen could have afforded it. It was enough to feed, clothe and house a Dutch family for half a lifetime. Or, enough to buy one of the grandest homes on the most fashionable Amsterdam canals for cash, complete with a coach-house and 80ft garden, at a time when Amsterdam property was the most expensive on earth.

At that date, a big-time merchant might have been making 20 000 guilders a year. So a single bulb of Semper Augustus was worth half his income. As a modern equivalent, one tulip bulb was worth half Rene Rivkin's income.

Not only bulbs were traded. The boom also produced a brisk market in the little offsets. As we all know, bulbs prosper best if they are lifted from the soil soon after the season's flowers have died. The buying and selling of bulbs therefore used to occur while they were out of the ground between June and September and could be inspected.

Offsets, however, take several years to mature. As the prices of bulbs began soaring, breeders began selling the offsets separately, and as soon as they appeared.

Buyers of offsets were taking two bets. One was that the flowers from the offset would look like the mother bulb. If the bulb broke unexpectedly, or was broken already, there was no guarantee what the flower would look like in a few years' time.

The second bet, of course, was that the price of tulips would continue rising. So we are now getting into rank speculation.

At first, bulb trading was crammed into four months of the year, as I have noted. But once you had a piece of paper giving you the right to an offset from a bulb, you could trade it all year round. So tulip trading became liberated from the calendar.

2. See C Mackay's *Extraordinary popular delusions and the madness of crowds*, Harmony Books, New York, 1980 and M Dash's *Tulipomania*, Three Pines Press, New York, 2001.

From the autumn of 1635, the bulb trade changed fundamentally. Instead of trading bulbs in season, florists began trading bulbs – and, importantly, offsets – in the ground.

Bulbs had already been used as a unit of exchange. Now they became a promissory note – a scrap of paper listing the variety and weight of the bulb, the name of the owner and the date upon which it would be lifted. Because the lifting date was usually several months away, this encouraged dealing in the piece of paper rather than the bulb.

What we are talking about here is a future.

The futures market was not entirely novel to Holland. The very earliest futures markets had been organised in Amsterdam 30 years earlier by merchants who traded in timber, hemp or spices on the Amsterdam Stock Exchange.

However, the traders in tulip futures were gambling upon an essentially unknown commodity. If I buy a future on BHP shares, I know what I'm getting upon delivery (or at least I hope I do).

But when I buy a future on a broken bulb I don't know what sort of flower I'll have upon delivery. And if it's an offset of a broken bulb, I won't know for two or three years.

But that no longer matters, because the buyer is no longer a botanist or gardener who wants to own a beautiful flower. The buyer is only interested in the bit of paper, which he hopes to trade at a profit.

So yes, the tulip was the underlying commodity that fuelled the boom of 1636–37, but in reality it was leveraged into a derivatives boom. And one of the characteristics of derivatives is that few of the traders are ever interested in final delivery.

So in Holland in 1636, it became perfectly normal for a florist to sell bulbs he could not deliver to buyers who did not have the cash to pay for them and no desire to plant them.

But there were two other important ingredients to this boom. The merchants who traded in timber and spice futures on the Amsterdam Stock Exchange were rich specialists. Investment on the stock exchange or in ships' cargoes required substantial capital.

In contrast, the tulip boom reached down to everyone and was not confined to Amsterdam. Nearly anyone could play.

The second ingredient was leverage. Where bulbs or offsets were not available for instant delivery, it was common to put only 10 per cent of the price down. Also, the buyers quickly worked out that they could build a fortune faster if they borrowed to buy tulips, or futures on tulips. So they began mortgaging their homes to play the bulb market.

I mentioned earlier that weights of bulbs were one indicator given to speculators. A healthy tulip bulb increases in size while in the ground. So if prices on weight stay constant, the bulb will increase in value as it grows.

Bulb weights were quoted by the ace, a measure borrowed from the goldsmith trade which equates to about one-twentieth of a gram. So from late 1634, breeders began selling bulbs by the ace. This was fairer, because previously a speculator might have bought a bulb without knowing whether it weighed 100 aces or 400. But it also inflamed speculation.

A Viceroy bulb grown by an Alkmaar merchant weighed 81 aces when it was planted in the autumn of 1635 and 415 aces when it was lifted in July 1636 – a five-fold increase. That was particularly dramatic, but if bulb prices even stayed constant, the Viceroy's value had increased fivefold also.

Artisans on low wages had been making money slowly. If a weaver scraped together, say, 50 guilders, he might buy a new loom and increment his income slightly. But if he invested the same amount on a bulb he could make a small fortune quickly by speculating on a commodity whose value **had never fallen**.

And if he leveraged by borrowing, he could make a medium to large fortune.

I'm not sure I need to give the rest of this speech, because we can all see where it's heading, can't we?

Understanding the pre-conditions for a boom are more important than understanding the reason for the top-out and bust, but I'll go through the motions anyway. The waiters can serve whatever they like, particularly booze, because we can really all fill in the blanks from here.

Until the summer of 1636, tulip trading had mainly been to connoisseurs or professionals. But in 1636, as far as we can judge, the weight of money seemed to be coming from the florists and artisans and less rich classes who had begun speculating in the trade.

I listed earlier the four requisites for a hysterical boom. We now have three of them. We have a prospering society with surplus investible cash. Not only are the rich investing but the middle classes are getting into the act, so there's volume. We have a prized commodity which has never fallen in price. We have a bunch of star performers, led by Semper Augustus. All we need is a marketplace.

Tulips were never traded on the Amsterdam Stock Exchange, which in any case only traded from noon until 2 pm. Tulips were an unregulated market.

Tulip trading happened in taverns, mostly in Haarlem, where the participants were quite frequently drunk. And sometimes the taverns doubled as brothels, which would seem about the perfect ambience for an unregulated derivatives market.

The taverns were very smoky and the inhabitants drank vast quantities of wine and beer. Each deal struck was followed by a toast. And this was in the days when wine in Dutch taverns was served in pewter pitchers that held anywhere from two pints to more than a gallon. The mania of December 1636 and January 1637 occurred in this drunken, licentious ambience.

The traders here were working class, with at best a second-hand knowledge of tulips. Auctions were held in the taverns. At each table there was a secretary who recorded the deals struck around his table and, of course, by early morning it was entirely possible that the secretary was no longer sober.

As one participant said: 'This trade must be done with an intoxicated head, and the bolder one is, the better'.

These taverns did not deal in the finest quality bulbs. The boom was really in the second and third-raters, right down to the penny dreadfuls of the day or, as they were known, common goods.

Common goods were not sold by the ace but by the half-pound or pound, and a basket of pound-goods might have contained anywhere from 50 to 100 bulbs of the poorest variety.

A parcel of one of the cheapest pound-goods, Gheele Croonen, which could have been had for as little as 20 guilders in September or October of 1636, was 1 200 guilders by January.

Switsers, a common variety, came on market at 60 guilders per pound in the autumn of 1636 but were 1 400 guilders by the end of January.

The deals were usually done on slates. A bidder would write down the price he wanted to pay, a seller would write down the price he would accept. The slates were passed to intermediaries nominated by the principals, who would write down what they considered a fair price, which was not necessarily in the middle.

The slates were passed back to the buyer and seller. If either of them did not agree, they would rub out the price. If the deal was struck, the buyer would pay a commission, usually around 3 guilders, to the seller. The commission was called 'wine money'.

One flaw in this system was that there were no credit checks. Buyers did not have to prove they had the money to pay for the bulbs. Sellers did not have to prove they owned the bulbs they sold. So the taverns combined unbridled speculation, stimulated by alcohol, while providing no safeguards for anyone.

Like most booms, the end came suddenly. On the first Tuesday in February, a group of florists gathered as usual in a Haarlem tavern to offer pound-goods for sale. One member offered a pound of Switsers for 1 250 guilders, a fair price in the market then. He received no bids. Nobody wanted to buy.

From there, panic spread in the market. Nobody wanted to buy tulips any more.

The collapse was so sudden and complete that there is virtually no information on post-boom prices. The only buyers left were a few rich connoisseurs who did not depend on the trade for their wealth.

According to one anecdote a tulip that had been worth 5 000 guilders before the crash was later sold for only 50. A bed which would have fetched 600 to 1 000 guilders in January, changed hands for only 6.

The collapse was total and very fast. Even the great modern computer-aided meltdown of October 1987 did not produce such instant eradication of wealth.

What happened was that the market had been killed from the bottom. The very cheapest tulips had been driven so high in price that there was nothing for new entrants in the market to buy (which looks a lot like the current Sydney real estate boom). With no fresh money coming in from the bottom, the boom lost its foundation.

And, of course, as soon as any over-priced commodity reaches its peak and turns, every trader becomes a seller trying to get out as quickly as possible and destroying prices as he sells down.

The pain of the crash was worst for those who had borrowed to speculate. Men who had pledged their farms and houses suddenly lost them. In the days before social security that meant the workhouse or starvation and probably early death.

A mortgage was an enforceable contract. Were the tavern deals also enforceable?

The courts and authorities of Holland grappled for some time with this question. They obviously did not want to get involved in endless litigation. Eventually they emerged with a compromise. Anyone who had undertaken to buy a bulb could either take it at the agreed price or forfeit for 3.5 per cent.

So an artisan who had agreed to buy bulbs for 1 000 guilders could escape the deal for 35 guilders. Many did so. The pain here was taken by the growers, who had stood to reap large profits and were now brought back to earth with a thud.

The greatest benefit of this ruling was that it unclogged the court system, which was free to go back to murder, theft and other more important phenomena.

So although the compromise doubtless caused great hardship in many cases, it was overall a sensible ruling which enabled the nation to get back to work again and kept the social fabric more or less intact. Modern judges – notably in the High Court – have rarely shown the same pragmatic sense.

We can laugh at the stupidity of the Dutch, but they can be forgiven. The world had never seen a crazy boom before.

Today we have no such excuses. There have been booms of some sort in nearly every decade of the past two centuries.

If the rest of us had properly learned what happened in the tulip boom, I suggest there would have been fewer booms and fewer disastrous busts. But every generation since has thought the tulips were irrelevant, and they're not. Every lesson we need to know about booms, about derivatives, about gearing, is all there, waiting to be learned.

Which brings me back to where I started.

If scientists and engineers didn't learn from history, every generation would be condemned to reinvent the wheel. But scientists and engineers do learn from history, and so we have seen heart transplants and men walking on the Moon. But when it comes to finance, every generation starts off afresh with flint axes.

I thank you for listening to me tonight.

It Takes More Than a Bubble to Become Japan

Adam Posen[1]

Japan's extended economic stagnation since its stock market peaked on December 29, 1989 has prompted a series of investigations, recommendations, and self-examinations both in Japan and abroad. For monetary policy, two aspects of the situation have attracted particular attention. One is the ability or inability of a central bank to successfully raise the price level and inflation expectations when the nominal interest rate is at zero and the banking system is reluctant to lend. The other is the appropriate response of a central bank to an asset-price bubble: whether the central bank can or should try to 'prick' such a bubble when it is expanding, and how the central bank should cope with the economic aftermath of such a bubble bursting. This paper will consider the latter set of issues as raised by the Japanese bubble.[2]

The topic is of more than retrospective or theoretical concern. As Figure 1 plotting the time path of the Japanese Nikkei and US S&P 500 stock averages relative to peak shows, in recent years the American equity market had just about an identical boom, and so far a slightly milder bust, to that of the Japanese market – and the Japanese and American real estate markets both followed similar paths at about a two-year lag to stocks (Figure 2). These are hardly the only examples. A series of applied research studies done at international financial institutions has shown that there have been a great number of asset-price booms and busts, if not definitively bubbles, and these are often associated with negative economic outcomes.[3] Small wonder that, in the wake of the IT and telecoms boom, many countries today are asking themselves 'Who will be the next Japan?'[4]

The main argument of this paper is that it takes more than a bubble to become Japan. While asset-price booms and even busts are not uncommon, Japan's Great Recession is, and it was not the bubble and its burst that produced this outcome. That point may not be especially controversial to those well familiar with Japan's plight.

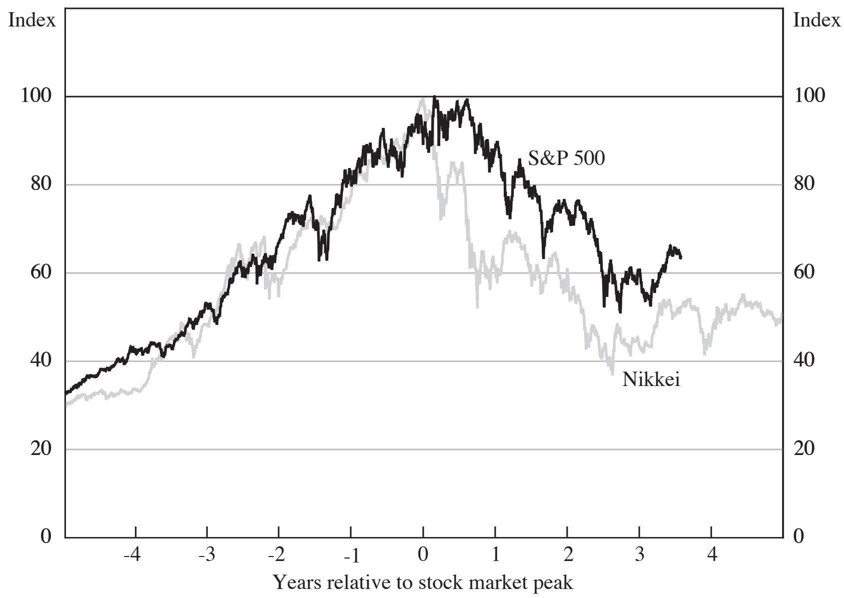
1. Contact: aposen@iie.com. Prepared for the Reserve Bank of Australia 2003 Conference on Asset Prices and Monetary Policy. I am extremely grateful to Samantha Davis for outstanding research assistance, and to Nobuyuki Asai, Kenneth Kuttner, Mikihiro Matsuoka, Tomoyuki Ohta, Stefano Scarpetta, Charles Steindel, Tadao Yanase, Kazuhiko Yano, and especially Arthur Alexander, Tetsuro Sugiura, and Cameron Umetsu, for timely and thoughtful advice. Gordon de Brouwer, my discussant, and participants in the RBA 2003 Conference provided helpful comments. All opinions and errors in this document are solely my own. This research is part of my project on deflation for the Institute for International Economics.

2. My take on the first set of questions, regarding monetary stimulus at the zero-bound in Japan and elsewhere, is given in Posen (2000b), Posen (2003c), and Kuttner and Posen (2001a).

3. See, *inter alia*, Bordo and Jeanne (2002), Borio and Lowe (2001), and IMF (2000).

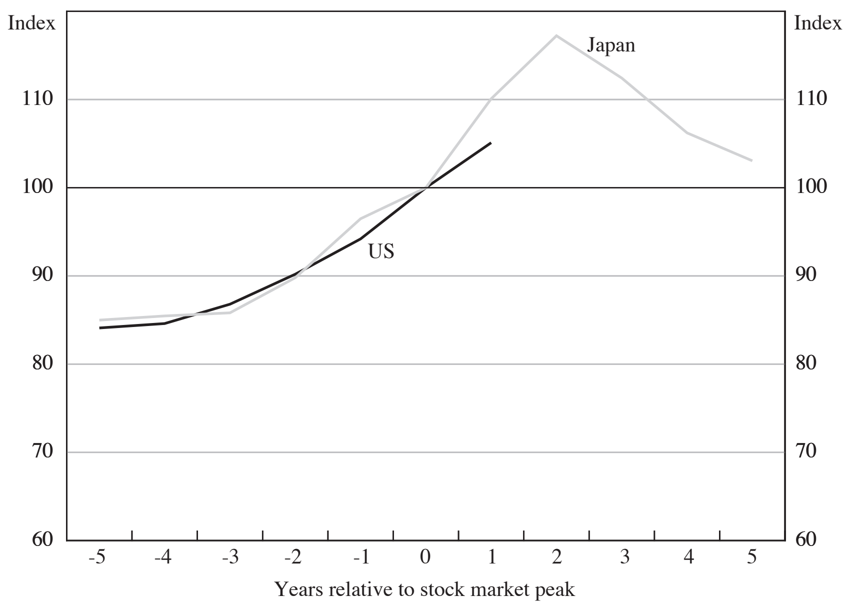
4. As I point out in Posen (2003a, 2003b), this is a particularly pointed question for Germany. A plot of the German DAX index would be much the same except even steeper, and Germany shares many though not all aspects of Japan's political economy.

Figure 1: Stock Market Performance
Stock market peak = 100



Notes: Data are daily. The stock market peak for Japan was December 29, 1989. The stock market peak for the US was March 24, 2000.
Source: Yahoo Finance

Figure 2: Housing Prices
Stock market peak = 100



Notes: See Figure 1 for stock market peaks. Peak is not defined by housing market peak.
Sources: Japan – Japan Real Estate Institute; US – OFHEO

The loud concern expressed in influential parts of both the press and the official sector with regards to the implications of the US asset-price boom (for example, in editorials of *The Economist* and the *Financial Times*), however, seems to say that the destiny of any bubble economy is an extended recession. Some Japanese politicians and pundits have seized upon the post-crash downturn in the US economy to get their own back for the years of unremitting lecturing by their American counterparts about economic policy; they suggest that the criticisms of Japanese policy were, if not unfounded, at least coming home to roost. All these participants in the discussion would lay the responsibility for this destiny of recession at the failure of the central banks involved to take action against the rise of bubbles.

These concerns and comments, while understandable, are not supported by study of the Japanese case. Monetary policy clearly was (and remains) a contributing factor to Japan's stagnation, but it was not disregard of asset prices either on their way up or of their effects on the way down which produced this outcome. Spirited academic debates about whether central banks should directly target asset prices, either as part of an inflation-targeting framework or not, need a different case on which to hook their analyses.[5] As I will argue, the Bank of Japan (BOJ) should have been able to tighten policy more quickly in the late 1980s and loosen policy more quickly in the early 1990s without any particular reference to asset-price movements – and in any event, monetary policy might well have been unable to stop those movements. Negative developments in the Japanese economy after the bubble were hardly driven by the fall in asset values, but rather by other problems in the Japanese economy (including overly tight monetary policy itself). Comparative analysis broadly of other recent cases of asset-price booms and, in more depth, of developments in the US in parallel (relative to its asset-price peak), support my conclusion that a primary concern for monetary policy should be how to encourage restructuring in the aftermath of a boom, not the boom itself.

The paper is comprised of five sections. First, it considers whether monetary ease in the 1980s caused Japan's bubble, as is often suggested. I conclude that the bubble was just as likely to occur whatever monetary policy within reason would have done, drawing on both a new cross-national consideration of the monetary policy asset-price linkage and a re-examination of what actually occurred in Japan 1985–1990. Second, it asks whether the bubble's burst caused Japan's Great Recession. In fact, I argue, Japan's recession of 1990–1994 was far milder than is commonly recognised, and easily explicable by factors outside of the asset-price decline – only a combination of policy mistakes turned this normal recession into the extended stagnation we now fear, and thereby gave time for the asset-price declines to have large real effects. This is borne out by cross-national investigation suggesting the frequency of extended downturns following asset booms is relatively low.

Third, the paper compares the post-bubble response of the US and Japanese economies to ask whether the bubble itself impeded restructuring. The data paint a

5. Examples of this literature include Bernanke (2000) and Greenspan (2002) against targeting asset prices, and Blanchard (2000) and Miller, Weller and Zhang (2002) in favour of central banks directly responding, with many essays in Hunter, Kaufman and Pomerleano (2003) taking one or the other side.

picture of very different responses in the two economies, suggesting that the bubble itself is not a sufficient cause of real-side disruption. Fourth, it looks at whether monetary policy in Japan could have encouraged restructuring. I find some evidence in support of the view that part of the reason for the difference in adjustment between the US and Japan is attributable to differences in monetary response. Finally, I set out what central bankers should learn from Japan's bubble, emphasising the benefits of a more thoughtful approach to assessing potential growth and of easing rapidly in the face of asset-price declines.

1. Did Monetary Laxity in Japan Cause the Bubble?

As noted, the belief is widespread that excessive laxity of Japanese monetary policy in 1986–1989 caused the bubble in Japanese equity and real estate prices.[6] BOJ officials for the last 13 years have bemoaned this fact, vowing not to repeat the mistake (e.g., Hayami (2000a, 2000b); Yamaguchi (1999)). Outside observers of a more monetarist bent have largely agreed with this lesson, thanking their central bankers for being able to resist pressures for undue ease (e.g., Siebert (2000)). And both academics and market pundits have chimed in as well, attributing the bubble to inaction by the Bank of Japan (e.g., Jinushi, Kuroki and Miyao (2000); Nakamae (2000, 2001)). For some the message is a reaffirmation of the importance of central bank independence, since the BOJ is thought to have succumbed to pressure from the Ministry of Finance (MOF) for ease;[7] for others the lesson is that central banks should take asset prices into account when setting policy. Either way, according to this common view, the bubble arose, or at least grew large, because of excessive liquidity.

This claim that monetary policy caused Japan's bubble, however, should not be taken for granted. We need to decide whether excessive monetary ease was a sufficient condition for the Japanese bubble ('if sustained monetary ease, then a bubble occurs'), a necessary condition for the Japanese bubble ('if a bubble occurs, then there must have been prior monetary ease'), or both. The theoretical foundations for such claims turn out to be little more than ones of coincident timing – in Japan in the second half of the 1980s, money supply was growing, velocity was declining, and no increase showed up in wholesale or consumer prices, so the contemporaneous growth in real estate and equity prices must have been the result of this liquidity increase. Yet, this is a rather tenuous link to make. As Japan itself has demonstrated in the last few years, one can have all these conditions present (expanding money supply, declining velocity, no effect on the price level) and still see no increasing trend in asset prices. Without some forward-looking expectations on the part of

6. In general, the academic finance literature dwells on whether bubbles actually can exist, whether any given bubble is rational, and so on. In contrast, the policy and descriptive literature on Japan in the late 1980s refers to the period as 'The Bubble Economy', and even academic treatments claiming the Japanese asset-price booms were bubbles are common. For the purposes of this paper, the Japanese asset-price boom will be referred to as a bubble, but other countries' experiences will be called asset-price booms without claiming to justify characterising them as bubbles.

7. And, in this view, the MOF itself was easing due to pressure from the US government (see discussion below).

investors that returns will be rising relative to base interest rates, that profits will be growing, there will be no buying of real estate or equities.

For monetary policy to be the source of a bubble, the relative price of one part of the economy (here financial and real estate assets) has to be pumped up by a blunt instrument that usually affects all prices in the economy.[8] And it has to do so in such a way that the relative price shift either does not raise expectations of a countervailing shift in monetary policy in the near future (which relies on strange notions of what the imputed future income from increasing land and stock prices will generate), or is expected to only be affected by monetary policy on the upside but not on the down (which there is no reason to believe, if liquidity is the source of the relative price shift in the first place). Either way, this has to take place when we know both analytically and empirically that the relationship between a policy of low interest rates or high money growth and equity or real estate prices is actually indeterminate over time.[9] Of course, one can resolve this logical tension by positing that the investors have unrealistic expectations about monetary policy. Okina and Shiratsuka (2003) and Shiratsuka (1999) do so, for example, by characterising with some justification Japanese investors in the bubble years as believing unduly in low interest rates over a decade or longer horizon. Then, however, it is the expectations of investors which are driving the asset-price process, not the actions of monetary policy. In that case, any monetary policy short of starving the economy of credit could give rise to a boom, and a boom can arise even without excessive ease.

Before evaluating with respect to the Japanese case the merits of this claim versus the more common assumption that monetary laxity causes booms, it is worth pointing out that neither claim has been established with respect to bubbles or asset-price booms in general. If this supposed causal link between monetary laxity and the Japanese bubble is not as apparent in other known cases of asset-price booms, then there clearly is more at work in the Japanese case than just monetary ease. To examine this question, we take a list of asset-price booms in the OECD economies and match them up with a new dataset created to offer simple indicators of loose monetary conditions. Thus, the approach is pseudo-epidemiological, generating a list of cases that satisfy one, both, or neither condition at the same time. First the hypothesis ‘If sustained monetary ease, then an asset-price boom appears’ is examined, then the converse, ‘If a boom appears, then there was prior ease’.

The list of asset-price booms is taken from Bordo and Jeanne (2002), who identify them when the three-year moving average of the growth rate in the asset price under scrutiny falls outside a confidence interval of long-run historical average growth rate plus a multiple of the average volatility of all asset-price growth rates in the sample.[10] Looking at 15 countries (including Japan) over 1970–2000 for industrial

8. This point is made in Kashyap (2000) and Goodfriend (2003), among other places.

9. For example, as Hutchison (1994) points out using Japanese data, a drop in interest rates today might drive up housing prices in the short term by making them more affordable, but in the medium-term tends to drive prices down because it portends a monetary tightening or slower growth. Aggregate supply factors tend to dominate monetary factors as consistent determinants of land prices.

10. The threshold is defined in their paper by 1.3 times the average standard deviation. They choose this threshold to identify the obvious booms without catching too many. See Bordo and Jeanne (2002).

share prices and 1970–1998 for residential property prices, they identify 18 booms in property prices and 24 booms in share prices (Table A1 lists them). For our purposes, this generates a list of booms independent of our markers of monetary ease and, in the next section, of deflation.

Identifying periods of monetary ease would appear to be much harder. As the ample monetary economics literature demonstrates, estimating the effect of monetary policy on the economy at a given moment, or assessing whether or not interest rates should be raised or lowered (given some welfare function) is contentious. It is clearly beyond the scope of this paper to generate country- and period-specific assessments of the relative looseness of monetary policy to go with the list of observed booms. For the purposes of examining the link between monetary ease and booms, however, a simple approach seems justified. In the discussion of monetary policy with respect to perceived bubbles, particularly but not just with regards to Japan, there is usually the sense that it took significant sustained ease to cause the bubble – booms do not seem to pop up frequently enough to be associated with minor mistakes of overly easy monetary policy. In particular, bubbles are usually thought to be associated with long credit booms (Borio and Lowe 2002). If either short periods of monetary ease or small degrees of ease are enough to generate or support booms on their own, that would seem to imply either that booms should be even more frequent than they are, or that the link between ease and booms is indeed rather tenuous.

So for our investigations we utilise two broadly applicable measures of monetary ease: first, whether the central bank's real overnight or instrument interest rate is less than 1 per cent for a sustained period; second, whether growth in a credit aggregate greatly exceeds the aggregate's average growth rate for a sustained period. The second criterion uses a threshold of whether M3 (or appropriate broad money measure by country) year-ended growth exceeds the average rate by one standard deviation of that aggregate's growth rate.[11] The idea is that for any functioning economy with real returns, a 1 per cent or less real interest rate must be considered loose (versus any reasonable estimate of the natural rate of interest), whereas for any given country the baseline for credit growth has to be country-specific reflecting local credit markets, velocity trends, etc. A sustained period of ease is defined as two or more quarters in a row exceeding the M3 growth or below the real overnight rate threshold.[12] Again, the idea is to create a list of periods of monetary ease of sufficient heft to be potential causes for asset-price booms.

We create a list of these periods for the same 15 OECD countries over the same time period as in the Bordo and Jeanne (2002) sample, and find 38 periods of monetary ease by the M3 criterion and 11 periods of monetary ease by the real

11. Details on the data sources and the country-specific monetary aggregates used, including adapting to the advent of the euro as appropriate, are given in Table A1.

12. We include in our list of sustained periods those where one quarter shows tighter policy after the minimum two-in-a-row if that quarter is followed by a least one quarter back to ease, i.e., a run of 3-out-of-4 quarters or 4-out-of-5 quarters of M3 growth above threshold ($r<1\%$) is deemed as one period of sustained ease. No results depend meaningfully on this assumption, but it seems practical.

interest rate criterion. We see whether asset-price booms occurred within 36 months of the end of one of these periods of monetary ease. The three-year time-horizon is chosen both to fit with the outer limit of the usual assumed lag before the effects of monetary policy are fully felt, and with the three-year moving averages that are used to define the boom periods. If the boom begins within the period of monetary ease, that is ‘credited’ to the ease, allowing for the possibility of forward-looking asset markets somehow seeing that monetary ease will be sustained and responding euphorically. This very large window should err on the side of associating many booms with periods of ease, even if the ease had just started, or if the ease was fading into the past.

Table 1 presents the results in response to the question, ‘If ease, then boom?’ The results do not support the popular image of sustained monetary ease being a sufficient condition for a boom. Of 38 periods of ease identified by the M3 criterion, only 12 resulted in share-price booms, and 12 in property booms (the lists are not identical); of 11 periods of sustained ease by the interest rate criterion, no booms followed within 36 months. Of course, some of these periods of monetary ease were in response to contemporaneous or forecast times of slow growth or low inflation, and might not be expected to generate much in the way of asset-price booms during those periods. Yet, run-ups in asset prices often begin well ahead of actual economic recoveries, and here would be counted if they began within 42 months of the monetary ease – a longer period than most recessions. In any event, the absence of any booms in response to low real interest rates would seem to put the focus on credit market conditions more narrowly, but even by that criterion there fewer than one-in-three periods of significantly above average credit expansion are followed by booms.

Table 1: If Monetary Easing, then Boom?

Sustained monetary easing (M3 growth) Total: 38 periods	Industrial share price boom within 36 months 12 booms
Sustained monetary easing (r<1%) Total: 10 periods	0 booms
Sustained monetary easing (M3 growth) Total: 38 periods	Residential property price boom within 36 months 12 booms
Sustained monetary easing (r<1%) Total: 10 periods	0 booms

Note: Monetary easing sustained is defined as a period of two quarters or more (or 3/4, 5/6, etc) during which the real interest rate was less than 1 or M3 (or equivalent broad money measure) growth was greater than the country’s mean plus one standard deviation.

The idea that monetary ease alone is a sufficient condition for asset-price booms might appear to be something of a straw man, though it is one that is often put forward without question in the discussions of the Japanese bubble. Perhaps this confusion is because those speaking about Japan actually subscribe to the idea of sustained monetary ease as a necessary, not a sufficient, condition for a boom to occur – if an asset-price boom, then there must have been prior ease. In other words, on this hypothesis, while there can be periods of ease which do not result in bubbles, there are no bubbles that did not result from monetary ease. This relates closely to the idea of central banks 'pricking' asset-price bubbles, that interest rate increases somehow remove the loose credit conditions on which the bubble is predicated (an idea we examine in the next section).

Utilising the same list of booms and periods of monetary ease we consider this possibility in Table 2. We look at two possibilities, that ease must have preceded the start of the boom, or that at a minimum there must have been ease during the boom.[13] Neither elicits much support from the data – for property and share-price booms, fewer than one-third of them were either preceded by or accompanied by sustained ease in credit growth; none of the share-price booms were preceded or accompanied by sustained ease on these criteria.

Table 2: If Boom, then Prior Monetary Ease?

		Within 36 months prior to start?		**Ease during boom (except last quarter)?**	
	Total number of booms	r<1%	M3 greater than mean plus one SD	r<1%	M3 greater than mean plus one SD
Residential property price booms	18	0	6	0	6
Industrial share price booms	24	0	8	1	6

Note: Monetary easing sustained is defined as a period of two quarters or more (or 3/4, 5/6, etc) during which the real interest rate was less than 1 or M3 (or equivalent broad money measure) growth was greater than the country's mean plus one standard deviation.

The results are therefore far from supportive of monetary laxity as either a necessary or a sufficient condition for asset-price booms, at least with regards to the advanced OECD economies since 1970. The direct association often drawn between the Bank of Japan's monetary policy stance in the late 1980s and the Japanese bubble therefore bears closer scrutiny. In short, there is more to the story than just that the BOJ did not raise rates in time. The (Japanese) textbook version of the story is that international pressure upon Japan from the United States led to too much ease from

13. Excepting the last quarter, to allow for some lag between the start of interest rate increases/monetary tightening and the boom bursting. One could allow more time for tightening at the end of any boom, presumably because it takes a while for monetary tightening to have an effect on asset prices, but that would seem to contradict precisely the second version of the point being tested, that monetary ease is necessary for the bubble to continue.

the BOJ, and that ease led to the bubble.[14] Japan had come out of the second oil shock, carefully closing its public deficits and managing money for price stability. At the time, protectionist pressures were mounting in the US Congress due to the large US trade deficits and the rise of the Reagan-Volcker dollar. First in the Plaza Accord of September 22, 1985, and then (after additional bilateral pressures from the US government) in the Louvre Agreement of February 20, 1987, the Japanese government agreed to stimulate domestic growth and help manage an appreciation of the yen against the dollar.

Under direction from the MOF, the BOJ began to make interest rate cuts in January 1986, starting with an overnight rate of 5.0 per cent. By the time of the last cut three years later, the BOJ had cut its overnight rate to 1.0 per cent. These rate cuts took place against a background of financial liberalisation in the mid 1980s that had the BOJ placing greater reliance on its interest rate instrument in implementing monetary policy, and less on reserve and moral suasion measures upon banks. Meanwhile, the MOF did not wish to imperil its hard-won budgetary consolidation by engaging in expansionary fiscal policy, so the burden of stimulus fell totally on the BOJ. The yen appreciated from a low of 240 per US dollar to 125 per US dollar, inducing the short-lived *Endaka* (high-yen) recession of 1985–1986. The *Heisei* boom that we think of as the bubble years began shortly thereafter. No obvious increases in the CPI or WPI arose for the remainder of the decade, and most private sector forecasts were for continued low inflation (Ahearne *et al* 2002). The 'Black Monday' US stock market crash of October 1987 provided another reason for the BOJ to keep interest rates low. In this version of the story, the issue is whether the BOJ could have raised interest rates some time in 1988, and in so doing have pricked the bubble.

Yet, none of this explains why there should have been a bubble in Japanese equity and real estate markets. Something had to transform the easy monetary policy into asset-price appreciation rather than either more general price pressures or sustainable growth. Again, the sole argument for blaming monetary policy seems to be one of timing. Even that, however, does not hold up well. Land prices were already rising before the Plaza Accord, let alone the full force of the BOJ's rate cuts: one common index shows a 12.7 per cent increase in FY1984 and a 28.9 per cent increase in FY1985. And the run-up in stocks began even when the *Endaka* experience was fresh in people's minds but the only policy commitment of the BOJ, not by choice, was supposedly to keep the yen on an upward trend. If the decision to cut rates in 1986–1989 was truly a political decision in response to US pressures on the MOF, and the MOF on the BOJ – as reported upon in the press and clearly grumbled about by BOJ officials – why was the BOJ's frustrated case for tighter policy not persuasive to the bond markets? Surely, if it were clear that the BOJ were violating its normal policy priorities due to obvious international pressure, the idea that such low rates would be sustainable without any effect on inflation or medium-term growth would have been discounted. The fault for the asset-price increases seems

14. Jinushi *et al* (2000) give a good English-language summary from a Japanese perspective, while complementary recountings are given by Henning (2003) and Siebert (2000), from American and European perspectives respectively. Hoshi and Kashyap (2001, Ch 7) covers the period with an emphasis on financial market developments.

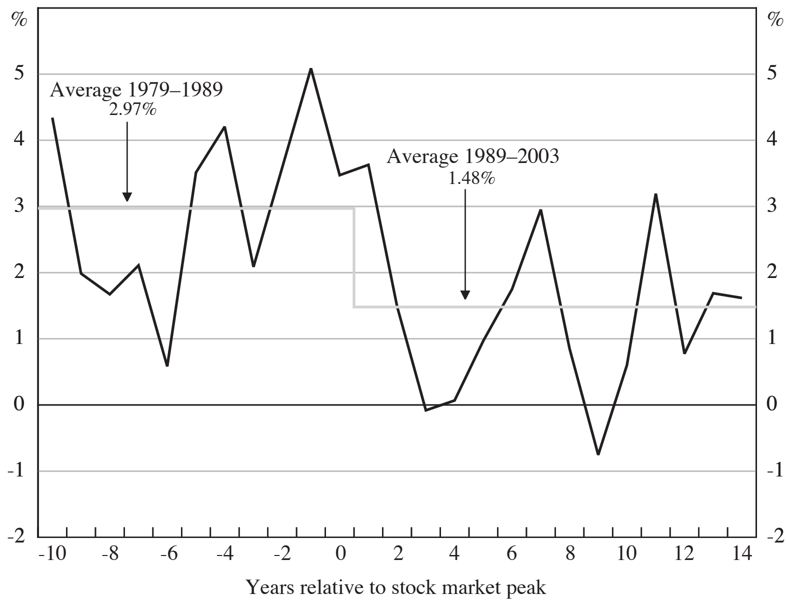
to lie in the unrealistic expectations of participants in a bubble, not in Japanese monetary ease.

Let us turn the question around: should the BOJ have believed in the macroeconomics of the *Heisei* boom in the second half of the 1980s? Or should they have been in a position to discount this story? The debate among monetary economists over this period usually is cast as whether or not a central bank can read asset prices any better than financial markets, and can they assess the evaluation of equities. As the Japanese case of the late 1980s illustrates, this debate is misfocused. Whatever the state of asset prices, central banks have to assess the potential growth rate of the economy they oversee, and this macroeconomic assessment can be done largely independently of any specific relative prices in the economy (Kuttner 1994; de Brouwer 1998). For Japan in 1987–1991, output was 2 per cent a year above trend, and 1988 showed the highest growth rate (7 per cent) seen since the mid 1970s.

Meanwhile, just looking at overall market averages, the stock and bond prices implied either 15 or more years of low interest rates or a massive drop in the risk premium (Ito and Iwaisako 1995). Could a significant drop in the risk premium be held credible for aging Japanese savers, given well-known demographic trends and savings behaviour? Alternatively, how could interest rates be expected to stay low indefinitely if the boom's euphoria was based on a real increase in the potential rate of output – and therefore of the economy's natural rate of interest – over the long run? As Figure 3 shows with regard to Japanese labour productivity, the apparent

Figure 3: Japan – Labour Productivity Growth

Annual percentage change



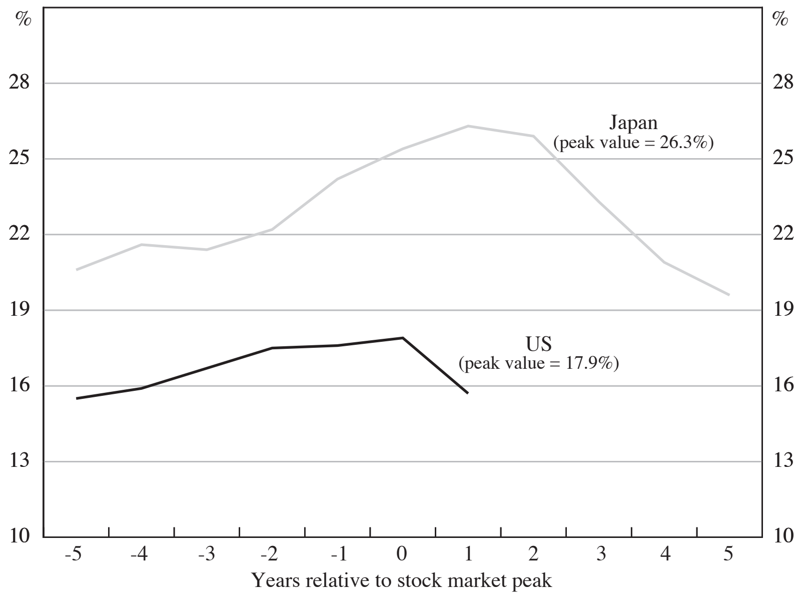
Notes: See Figure 1 for stock market peak. The 2003 figures are an estimate. Labour productivity is for the business sector.

Source: OECD *Economic Outlook* No 73

surge in productivity in the late 1980s was something to be suspicious about. Given limited deregulation, the end of catch-up growth, and the absence of any new technological revolution, what would justify a near-doubling of productivity growth from its around 3 per cent average of 1979–1987?[15] What precedent was there for a 2 per cent jump in trend productivity anywhere except emerging markets making the great leap as Japan already had in the 1950s?[16]

Figure 4 underlines the reason for scepticism by comparing the investment/GDP ratio of the US and Japan against time from stock market peak: where US investment went from 15.1 per cent to 17.9 per cent over the course of the bubble (up about a

Figure 4: Nominal Investment Share
Per cent of nominal GDP



Note: See Figure 1 for stock market peaks.
Source: OECD *National Accounts*, various years

15. Posen (2001b) explains why, using similar reasoning, one would interpret the 1990s as a period of rising potential growth in Japan, not least because of ample deregulation (notably in financial services, energy, retail, and telecommunications) and the IT revolution, as well as changes in female labour force participation.

16. Ueda (2003) actually goes further, suggesting that the bubble's decline was inevitable because there was 'a secular decline in the return on capital [in Japan] starting sometime in the late 1980s'. This is a view echoed by other Japanese officials who, like BOJ Policy Board member Kazuo Ueda, came to power in the mid 1990s and wished to explain, if not excuse, Japanese economic performance. Of course, this would suggest even more strongly that the bubble was irrational and beyond the control of the BOJ, and that the BOJ should have raised rates even earlier or more sharply in the 1980s than Bernanke and Gertler (2000) suggested it should have. Posen (2001b) and Kuttner and Posen (2001a) discuss the tendency for Japanese official estimates to understate the growth potential of Japan in hindsight.

fifth), the Japanese investment/GDP ratio increased by nearly a third (from 20 per cent to over 26 per cent), from a higher initial level, for an economy with an already high capital-output ratio. The law of diminishing marginal returns should not have been expected to be withdrawn.

In short, the BOJ could have decided to tighten policy in the 1980s without any reference to asset prices beyond the most general evaluation of interest rate expectations. It was not lack of explicit attention to rises in asset prices that led monetary policy astray. No expectations based on a reasonable evaluation of monetary policy could have supported these macroeconomic assumptions embodied in the overall asset market. Kuttner and Posen (2003) establish that for any of a wide range of potential output estimates – using real-time available information and varying in method, but never explicitly including asset prices – the BOJ would have normally been expected to raise rates some time in 1987–1988. Of course, even if interest rates had been increased, it is not evident that alone would have 'popped' the bubble.

One could try to restore the link between the Japanese asset-price bubble and monetary policy by asserting that a firm belief in ongoing pressure from the US for yen appreciation in response to the US' endemic trade deficits, rather than actual faith in the potential output measures implied, was what underlay the belief in monetary ease and thus the boom. Perhaps that would have been more rational than belief in the bubble *per se*. As Ronald McKinnon and Kenichi Ohno have shown, however, at least theoretically a long-term expectation of sustained yen appreciation will result in *deflationary* expectations (including of asset prices) in Japan.[17] The point here though is that even if the monetary ease were held to be sustainable due to the US pressure rather than false economic assumptions, that too would require false economic assumptions by the market participants, well beyond those about whatever the BOJ might do, to result in the sustained asset-price rise. So there is no way to square this circle of the bubble somehow logically resting on expectations of future Japanese monetary policy. The bubble was independent of them.

We should turn instead to the obvious non-monetary factors in the creation of the Japanese bubble. These financial developments are both well within the usual remit of a central bank's surveillance, and logical justification for why the unrealistic expectations of bubble participants were fed irrespective of monetary policy. As set out in Hoshi and Kashyap (2000), Cargill, Hutchison and Ito (2000), and Posen and Mikitani (2000), there is a consensus view among economists on how partial financial deregulation in Japan in the 1980s led to a lending boom.[18] Japan's banks lost their best corporate customers after the liberalisation of securities markets allowed large firms to reduce their cost of capital by seeking direct financing. The banks' ability to move into new lines of business was still partially constrained by

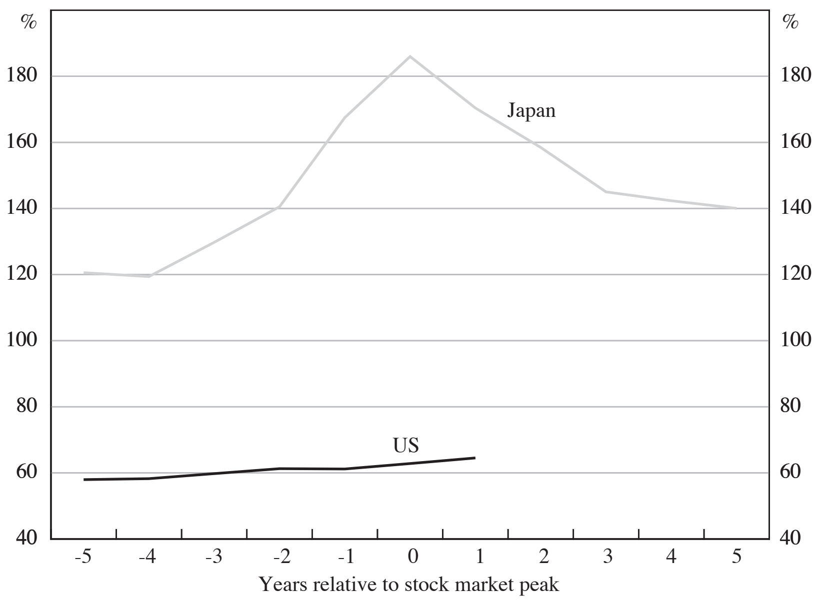
17. Empirically, the McKinnon-Ohno thesis does not hold up – that is, movements in the dollar-yen exchange rate do not one-way Granger-cause movements in the Japanese price level or expectations, even in simple two-variable regressions (see Posen (2003c)). The point here though is that even if the monetary ease were held to be sustainable due to the US pressure rather than false economic assumptions, that too would require false economic assumptions by the market participants.

18. Friedman (2000), among others, points out that this followed the exact same logic as the US Savings and Loan Crisis, complete with accompanying real estate boom/busts.

regulation, and their franchise value was declining, yet they retained the same large amount of loanable funds due to deposit insurance. The 'Convoy' system of financial supervision, which equated banking system stability with no closure of banks, kept overcapacity in the system, leading to low profits and under-capitalisation, increasing the desire to take risks with taxpayer-insured deposits.

As a result, Japanese banks made a huge shift into lending to small- and medium-enterprises (SMEs), increasing that share of their loan portfolios from 42 per cent in 1983 to 57 per cent in 1989, while their loan portfolios expanded by more than half (see Figure 5). The banks nearly doubled their overall lending in selected sectors favourable to the SMEs.[19] Companies hold substantial real estate in Japan, and used this as collateral of rising worth to borrow more; households also took advantage of rising home prices and declining lending standards (mortgage limits rose from 65 per cent of home value on average to 100 per cent on the assumption that land prices would go up).[20] Two additional indicators of this lending/real estate boom arising out of the partial deregulation/ongoing deposits dynamic were the increase in Japanese banks lending directly to firms in the real estate sector, from

Figure 5: Commercial Bank Assets as a Share of GDP



Notes: See Figure 1 for stock market peaks. Return on assets was calculated by dividing profits after taxes by total assets. Total assets include cash and balances with central bank, interbank deposits, loans, securities and other assets.

Sources: OECD *Bank Profitability: Financial Statements of Banks*, 2002, *Economic Outlook* No 73

19. See Figure 21. Hoshi and Kashyap (2000) and Shimizu (2000) present various other measures of this boom in lending to small business.

20. Tax incentives in the inheritance system and elsewhere also encouraged older individuals to borrow against land. See Ito and Iwaisako (1995).

6 per cent of total lending in 1983 to more than 12 per cent in 1989, and the extreme pressure on the long-term credit banks that were most dependent on the borrowing of major corporations (as documented in Shimizu (2000)).

It is easy to draw the chain of causality from improved access to capital for both large and small business, due to rising collateral values as well as deregulation and shifts in lending standards, to rising expectations of profits and stock prices. And in Japan's system of cross-shareholdings and banks owning significant share portfolios in borrower firms, these effects are amplified through increases in bank capital. Some belief in the rising value of land does underlie this dynamic, but once that is given, one can understand the emergence of a bubble in both stock and asset prices with no reference to monetary ease whatsoever. For comparison, remember that the analogous dynamic seen in the US savings and loan industry took place in the early and mid 1980s, hardly a time of monetary ease.

So how did the BOJ monetary policy respond to this structural source of asset-price increases? The evaluation tends to turn on whether the BOJ should have raised rates in 1988 instead of waiting until 1989, and how much they should have raised rates.[21] This is often cast as a dispute over the sufficiency of inflation targeting as a guideline for monetary policy-making, without explicitly taking asset prices into account. This dispute turns on the definition of a policy rule for the inflation-targeting central bank, and the information content of asset prices for inflation and output beyond factors normally considered. As I have argued here and (on an empirical basis) in Kuttner and Posen (2003), however, the proper perspective on potential output in Japan in the second half of the 1980s on its own terms would have led to rate increases in any usual forward-looking policy rule. The issue of whether asset prices should or should not explicitly enter the central bank's target is moot (at least for Japan).[22]

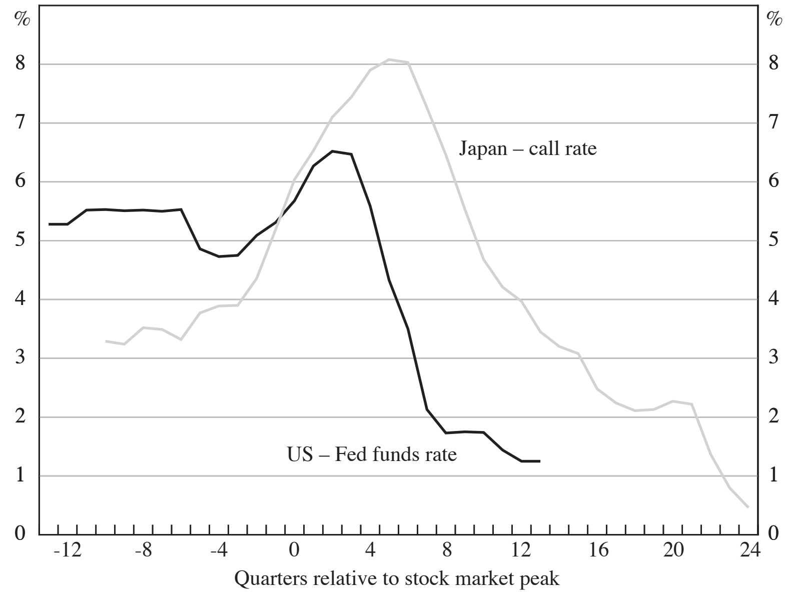
In terms of the practice of monetary policy in the real world, inflation targeting is not about simple policy rules and what data enter them, it is about communication and accountability.[23] And it is with regard to communication and accountability that inflation targeting is indeed relevant for the behaviour of the BOJ in the late 1980s, as well as for other central banks facing asset-price booms. Figure 6 shows the delay, then the more rapid and steep increase in the BOJ's overnight interest rate, followed by relative slowness in cutting its overnight rate, in comparison to the Federal Reserve response (relative to their respective economies' asset-price peaks). The difference in the movements of the two economies' real effective exchange rate (plotted in Figure 7), another determinant of monetary conditions, was not enough to explain this divergence. The BOJ ultimately was slow to raise rates and then

21. See Bernanke and Gertler (2000) versus Okina and Shiratsuka (2003).

22. Of course, there are ways to take asset-price developments into account in monetary policy-making without going all the way to including it in a rule. Bordo and Jeanne (2002) and Mussa (2003) make the case for such discretionary inclusion, saying central banks need to recognise and respond to exceptional circumstances.

23. See Truman (forthcoming), Posen (2000b) and Kuttner and Posen (2001b), and the references therein.

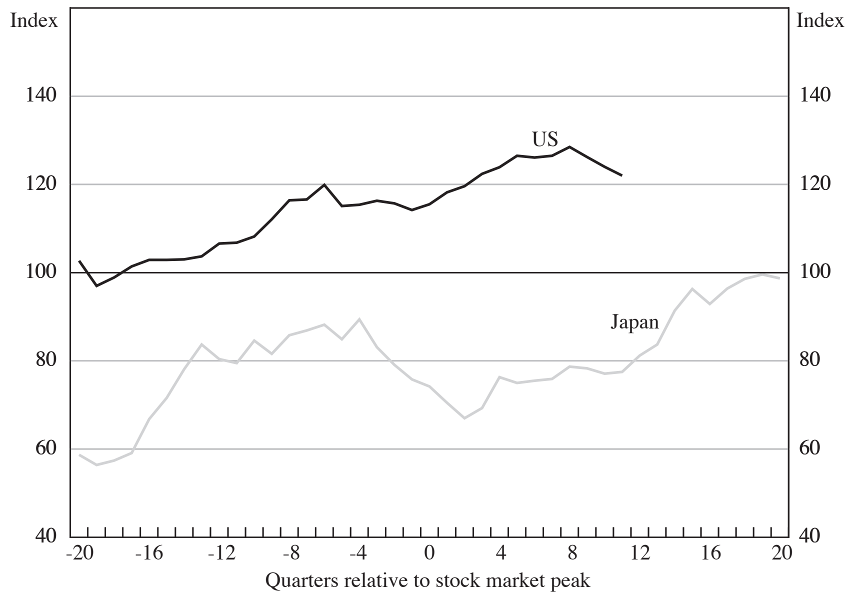
Figure 6: Nominal Overnight Interest Rate



Note: See Figure 1 for stock market peaks.
Source: International Monetary Fund *International Financial Statistics*

Figure 7: Real Effective Exchange Rate

1995 = 100



Note: See Figure 1 for stock market peaks.
Source: OECD *Main Economic Indicators*

raised them high and kept them high, because around 1987 it radically increased its relative weight on inflation versus output goals, and discounted the information from developments in the real economy.[24]

It is ironic that the BOJ began approximating an ‘inflation nutter’, in Mervyn King’s sense of the term, in the late 1980s, in contrast to the frequently told story about the Louvre Agreement and political pressures (not to mention Black Monday) causing monetary laxity. Yamaguchi (1999) indicates as much by saying that it would have been politically impossible to raise rates earlier than when the BOJ did without evidence of inflationary pressures – precisely when information from the potential growth side was offering that evidence. Had the BOJ been under an inflation-targeting regime, the sole focus on inflation would have been revealed to the public and (one hopes) reversed; conversely, had the BOJ had an inflation-targeting communications framework to draw upon, they could have conveyed to the public the inflationary pressures that were evident, even if not showing up yet in the WPI or CPI. In any event, the monetary ease in Japan in 1987–1989 was not the result of the bubble not being taken into account, just as the bubble was not the result of the monetary ease.

2. Did the Bubble Cause Japan’s Deflation or Stagnation?

Just as with monetary ease and the bubble, the idea that the bursting of Japan’s bubble caused the economy’s stagnation through at least the first half of the 1990s is widespread and often taken for granted. Some interested market participants go so far as to say that just about everything bad that has happened to the Japanese economy is due to the decline in asset prices, and that decline’s direct effect on corporate and household balance sheets (e.g., Koo (2003)). Bank of Japan officials make less extreme claims, but do attribute much of the ongoing difficulties in the Japanese economy to the bubble’s burst.[25] And some economic researchers, notably Bayoumi (2001), give pride of place to the balance-sheet effects on the banking system as an explanation for the decline in Japanese output. The only outspoken opposition to this claim is usually from those who argue, from a real business cycle framework (e.g., Hayashi and Prescott (2000)), that Japan’s economy is in a systemic decline.

This claim that the bubble’s burst caused Japan’s stagnation, like the claim about monetary ease and the bubble, is overdue for re-examination. Obviously, no serious macroeconomist who allows balance sheets, let alone credit markets and nominal rigidities, to play a meaningful role in her economic models would deny that significant declines in asset prices can have real effects. That is why macroeconomics was

24. Bernanke and Gertler (1999), Jinushi et al (2000), and Kuttner and Posen (2001a) all find in estimated BOJ reaction functions a similar shift in relative weights, a significant decline in the weight on output information, and date this break to around 1987.

25. Yamaguchi (1999) states: ‘In fact, much of Japan’s difficulties in the 1990s clearly has its origins in the asset market swing in the last 15 years … The damage left on the balance sheet of firms, both financial and non-financial, has been enormous’. See also Hayami (2000b).

born as a field in response to the Great Depression. The economic effects of asset-price declines are likely to be particularly felt in the case when nominal debt and collateral interact with the provision of credit predominantly through a banking system (Bernanke 1983; Kiyotaki and Moore 1997). Overhangs of distressed real estate and a credit crunch for SMEs that are cut out of bank lending are certainly aspects of some of the worst recessions. For Japan, though, the issue is more empirical – when did the bubble's burst have its effect, how large was that effect, and what other factors were going on at the time in Japan. I will argue that observers tend to conflate the post-1999 years of deflation and stagnation in Japan with the bubble of the late 1980s, leaving out the fact that a relatively normal if not mild recession and viable recovery took place in between. Japan, it turns out, is not the poster child for asset-price declines causing recession, we have to look elsewhere.

As recent research has begun to uncover, not all asset-price crashes have significant negative effects on macroeconomic outcomes, despite the availability of plausible channels for transmission of the shock. Mishkin and White (2002), for example, consider 15 US stock market crashes in the last 100 years, and find that 8 generated 'some' or 'severe' financial distress, of which only a few were followed by sharp contractions. We know that asset-price busts are far more common than periods of prolonged stagnation let alone deflation like Japan has seen. If the supposed direct link between the Japanese bubble bursting and persistent sub-potential growth is not as apparent in other known cases of asset-price booms, then there clearly is more at work in the Japanese case than just the bubble's impact itself.

Similarly to the previous section's consideration of the link between ease and bubbles, we begin examining the link between bubbles and deflation by establishing a cross-national benchmark. For the 15 OECD countries in our 1970–2000 sample, we identify periods of sustained deflation, where either the wholesale or consumer price index declined for two or more quarters in succession. Deflation in WPI turns out to be surprisingly common, with 73 cases in our sample (full list of cases is given in the Appendix). Sustained consumer price deflation is significantly less common – only 9 cases counting Japan at the end of the 1990s – but is still more frequent than many people may realise. Following the format of Tables 1 and 2, we use our list of cases of deflation and (from Bordo and Jeanne (2002)) of ends of asset-price booms to see whether such bubble bursts are necessary or sufficient for deflation to arise.[26]

Table 3 reports the results for the question whether an asset-price burst is sufficient to cause deflation. The sample is again split between 18 residential property and 24 industrial share-price bursts, and then between CPI and WPI deflation periods. The cases of bursts are sorted into whether the onset of a sustained deflation (on a given price index) occurred within 36 months of the burst. Of the 9 cases of CPI deflation, only 2 were preceded by equity bursts within 36 months prior. Notably

26. We focus on the date asset-price booms end (i.e., the peak value) rather than dating periods of actual ongoing busts (as Bordo and Jeanne (2002) do) because the point is precisely to find out whether asset-price declines cause busts. Thus, in Tables 3 and 4 we refer to 'bursts' as the time the prices begin falling.

Table 3: If Boom, then Deflation?

		CPI deflation within 36 months	No CPI deflation	WPI deflation within 36 months	No WPI deflation
Residential property price burst	18	0	18	8	10
Industrial share price burst	24	2	22	17	7

Note: Deflation is defined as two quarters or more (or 3/4, 5/6, etc) of negative change in CPI or WPI.

Japan is not one of those (more than 8 years between the burst and the onset of deflation), and none of the deflationary periods were preceded by property bursts. For WPI deflation, there is clearly more of a connection, but interestingly stronger on the share price (17/24 bursts followed by deflation within 36 months) than on residential property (8/18), even though Borio, Furfine and Lowe (2001) and Bordo and Jeanne (2002) both find evidence that residential property bursts tend to have larger effects. Table 4 tackles the converse, whether an asset-price burst is necessary

Table 4: If Deflation, then Prior Boom?

CPI deflation and share booms		
Total periods of CPI deflation	Industrial share price burst within 36 months prior	No industrial share price burst
9	2	7
CPI deflation and property booms		
Total periods of CPI deflation	Residential property price burst within 36 months prior	No residential property price burst
9	0	9
WPI deflation and share booms		
Total periods of WPI deflation	Industrial share price burst within 36 months prior	No industrial share price burst
73	17	56
WPI deflation and property booms		
Total periods of WPI deflation	Residential property price burst within 36 months prior	No residential property price burst
73	9	64

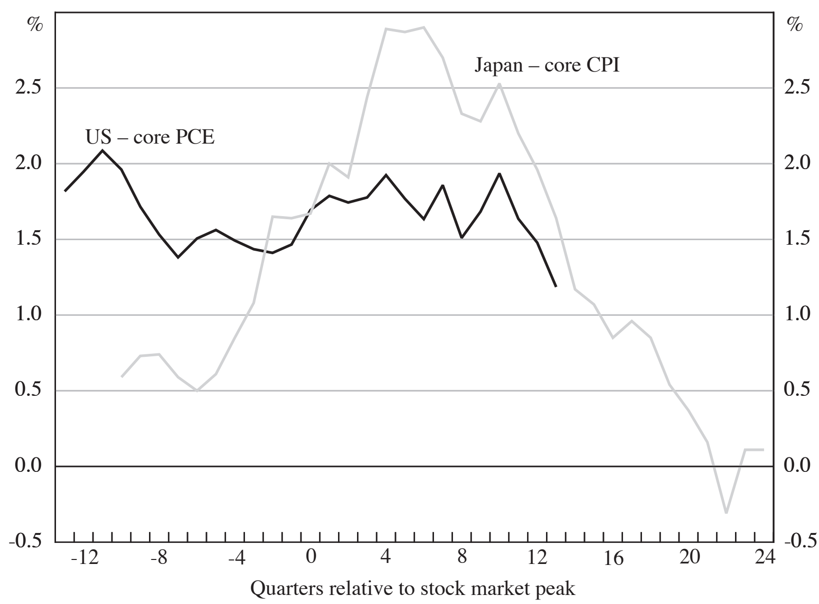
Note: Deflation is defined as two quarters or more (or 3/4, 5/6, etc) of negative change in CPI or WPI.

to cause deflation. The procedure is reversed, first identifying the cases of CPI and WPI inflation, and then seeing how many of them had a burst (either share or property price) within 36 months prior, and gives the same picture.

How tight was the connection between Japan's own asset-price bubble bursting and the performance of the Japanese economy? The first point to notice is that Japanese core CPI inflation continued to rise for five quarters after the stock market peak (Figure 8), and did not drop sharply until mid 1992; for comparison, the US inflation rate remained quite steady for the first two-and-a-half years after the peak and then declined slightly. There must have been a lagged effect from asset prices in Japan. Looking at real GDP growth (Figure 9) also depicts a Japanese economy with quite a bit of momentum: real growth was very strong in 1990 and above 3 per cent even in 1991. Though below 1 per cent for 1992–1994, growth remained positive throughout and came back strongly in 1995–1996 (growth in the US zeroed out in the first year after the bubble burst, and the strength of the current recovery remains to be seen). In both post-bubble economies, this looks like a normal mild recession that follows any monetary tightening. For Japan the underlying data bear this out. As Figure 10 shows, Japanese real consumption growth actually exceeded that of the legendarily retail-minded US in the first two years past the peak – both household and business confidence (Tankan survey measure) bottomed in 1993:Q4, and stock prices grew faster than earnings in 1993 and 1994. Expectations were for

Figure 8: Inflation Rates

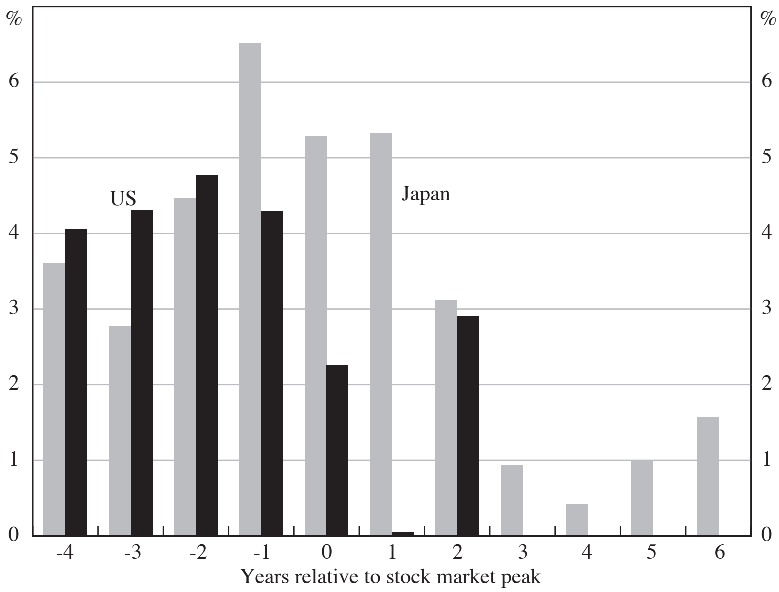
Year-ended



Note: See Figure 1 for stock market peaks.

Sources: Federal Reserve for US; FRBNY estimate for Japan's core CPI

Figure 9: Real GDP Growth
Year-ended



Note: See Figure 1 for stock market peaks.
Source: OECD *National Accounts*, various years

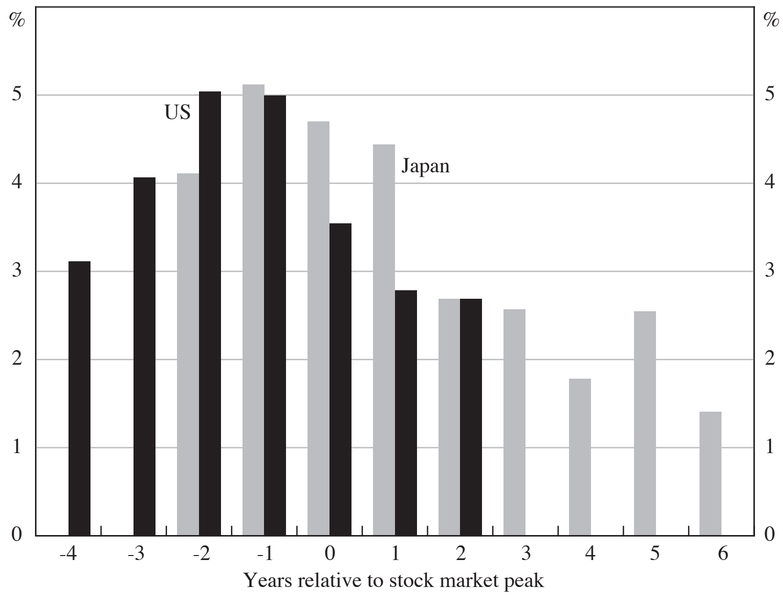
a full return to growth, unimpeded by concerns over asset-price declines or balance sheets. Business investment turned positive in FY1995, and private investment grew by 5.1 per cent in 1996.

So 1990–1994 should be seen as a normal growth recession following monetary tightening. It was perhaps a bit unusual by the standards of Japan before the oil shock, but not all that much different than the 1985–1986 *Endaka* recession which, while shorter, actually saw the Japanese economy contract. And, as I argued in Posen (1998), it took extensive policy mistakes – insufficient monetary easing; contractionary fiscal policy; and forebearance of bank capital erosion and resultant misbehaviour – to kill off the 1995–1996 Japanese recovery. These mistakes, only the last of which has any direct relation to asset-price declines, are sufficient to account for the underperformance of Japan's economy and the onset of deflation from 1997 onwards. Even with regard to the erosion of bank capital, there were numerous regulatory and structural factors at work beyond the decline in stock and real estate prices.

The BOJ did cut its overnight interest rate nine times between July 1991 (from 6.0 per cent to 5.5 per cent) and September 1995 (reaching 0.5 per cent), and argued at the time and thereafter that this should have been ample ease (Ueda 2000; Okina and Shiratsuka 2003). The Federal Reserve Board's unofficial definitive study of

Figure 10: Real Consumption Growth

Year-ended



Note: See Figure 1 for stock market peaks.

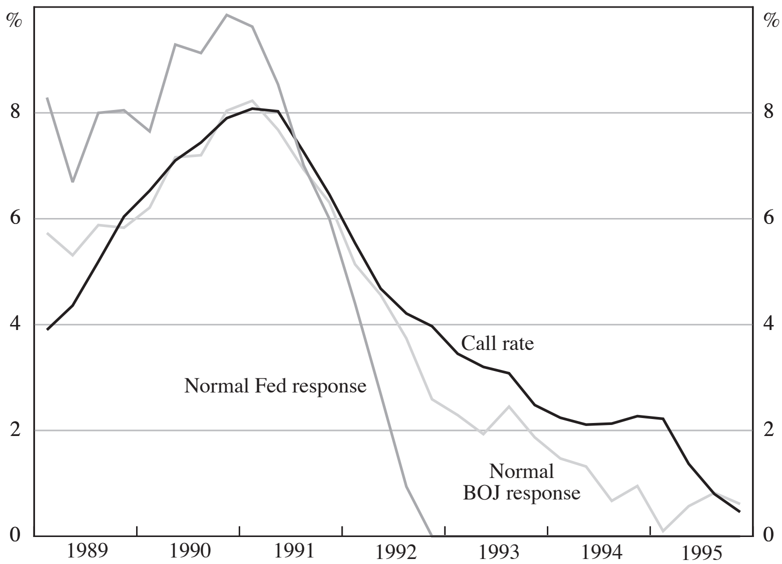
Source: OECD *National Accounts*, various years

the period (Ahearne *et al* 2002) agrees that, given the data and forecasts available in real-time, the BOJ did cut as much as could have been expected – they argue that it was just that deflationary pressures from asset-price declines were not taken into account sufficiently.[27] Had the BOJ cut an additional 200 basis points before end of 1994, it would have been enough to keep Japan on a growth path. Yet, even taking the limitations of contemporary data into account, Ahearne *et al* (2002) are too easy on the BOJ, and as a result give too much weight to the effect of asset-price declines. The aforementioned shift of the BOJ to counter-inflationary conservatism, and the concomitant underweighting of the output gap in decision-making, is embodied in the Taylor rule projection that Ahearne *et al* (2002) use to make their case that the BOJ responses were in line with data. It is true, as Kasa and Popper (1997) establish, that market participants anticipated the severe tightening of 1989–1991 and the slow loosening thereafter. This just emphasises that the course of monetary policy reflected a consistent set of BOJ preferences, not that it was necessarily a reasonable policy response.

27. Then BOJ Deputy Governor Yukata Yamaguchi (2002) picks up that line of argument, that the contractionary effects of insufficient monetary ease were the result of unforseen drag from asset-price deflation, but cuts would have been sufficient for normal circumstances.

Kuttner and Posen (2003) find that what applied in the end of the bubble period also applies in the bubble's aftermath: had the BOJ put a more reasonable weight on intermediate term output versus inflation goals, and therefore paid more attention to the information contained in the output gap, inputting any reasonable forward-looking measure of the output gap would have suggested more rapid interest rate cuts. This result relies solely on data available to the BOJ in real-time, and does not include any information from asset-price movements beyond those embodied in the output gap. The difference with the Ahearne *et al* (2002) result is in the weights. In a related exercise, Harrigan and Kuttner (2003) explicitly compare how the BOJ would have behaved if it had used the available data in a Taylor rule with 'normal' Fed weights versus one with 'normal' BOJ weights as in Ahearne *et al* (2002) (Figures 11 and 12). As shown in Figure 11, the Fed response would have been much more aggressive (again without including any asset price or asymmetric deflation risks explicitly). In fact, the normal Fed response alone would have yielded the earlier 200 bps in cuts that Ahearne *et al* (2002) estimate (using the FRB Global Model) would have been enough to offset deflationary pressures and the post-1996 recession.[28]

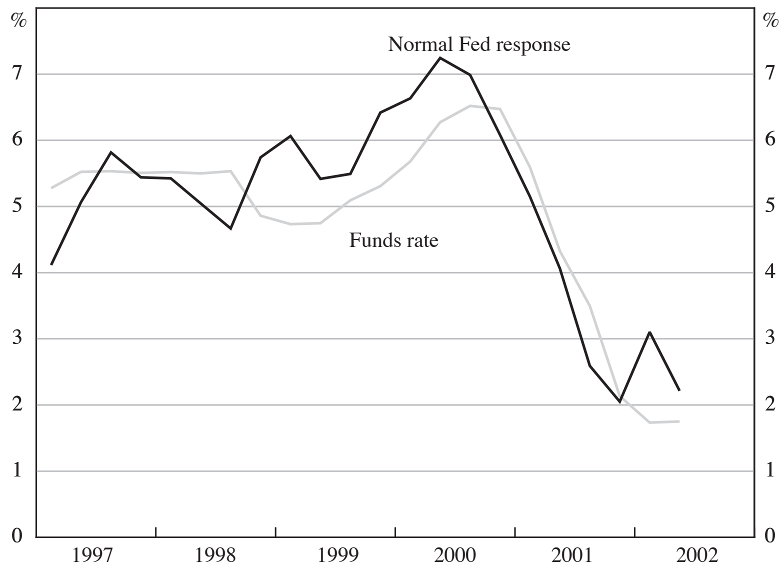
Figure 11: The BOJ's Response to Recession



Note: Data are quarterly.
Source: Harrigan and Kuttner (2003)

28. Similarly, Harrigan and Kuttner (2003) find that the Fed has cut rates since the US bubble burst in line with its 'normal' response, given weights on output and inflation, and given real-time information – without reference to the extreme movements in asset prices (see Figure 12).

Figure 12: The Fed's Response to US Recession

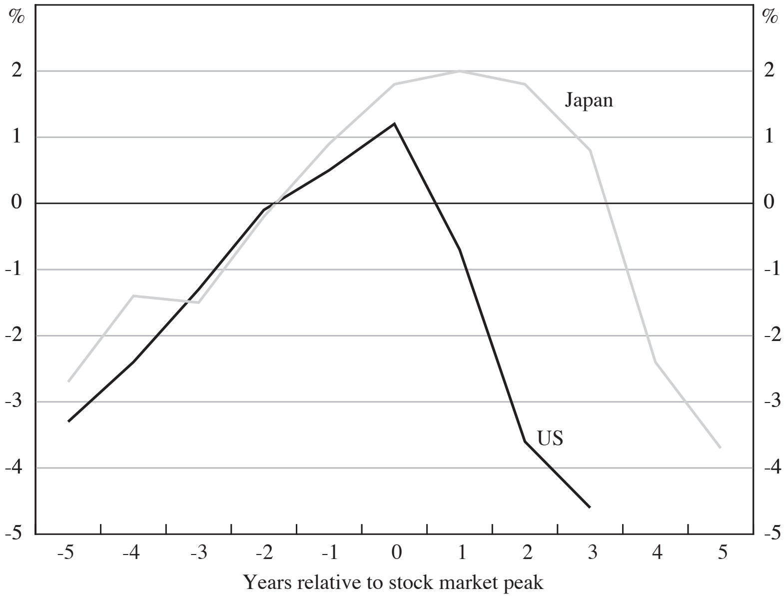


Note: Data are quarterly.
Source: Harrigan and Kuttner (2003)

The cutting-off of the mid 1990s Japanese recovery was in fact overdetermined, because fiscal policy was sufficiently contractionary to have ended it on its own, absent any the monetary policy mistakes, and vice versa (Posen 1998). That is part of why the following recession has been so deep. From 1992–1995, Japanese fiscal policy was mostly stimulative, particularly in 1995, although by comparison with the US after its bubble, fiscal policy was slow to expand (Figure 13). Posen (2003c) shows in a cross-national investigation that Japan was the only OECD economy whose deficit response to business cycle declined over the 1990s, after starting out in the mid-range of responsiveness. While the infamous examples of pork barrel projects and bridges to nowhere certainly represented the nature of much of Japanese public works spending, these were not the main source of fiscal expansion. Rather, increasing social security payments for an aging society and tax cuts provided most of the bang during this period (as can be seen in Figure 14, Japanese government transfers followed a smooth trend, rather than going up as an automatic stabiliser, as they did in the US).

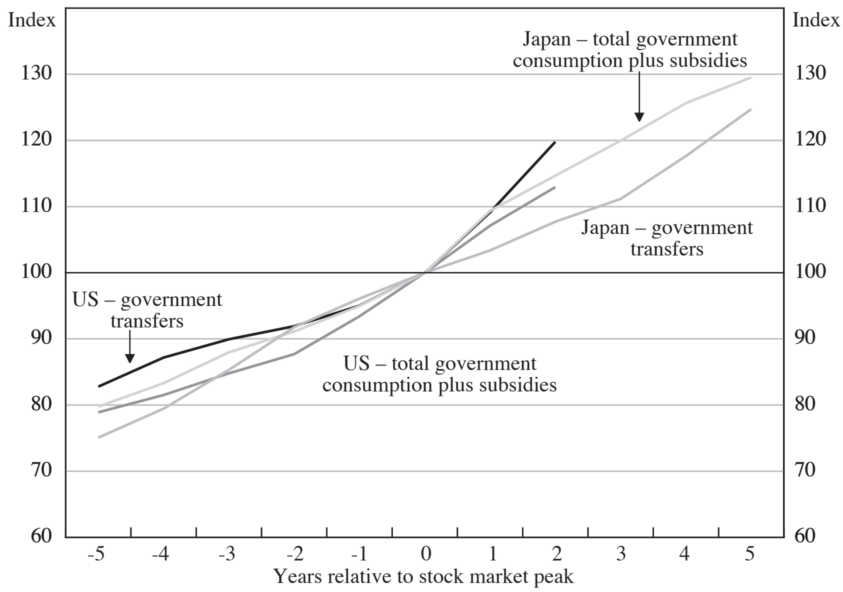
The yield curve was upward-sloping until 1996, consistent with a view that not only was fiscal austerity unexpected, but that recovery and inflation were expected – despite asset-price declines. In April 1997 at the start of the fiscal year, however, multiple tax increases – the implementation of a suspended increase in the consumption tax from 3 to 5 per cent; a rise in the income tax; the addition of co-payments to the national health insurance program – hit the economy, and this took out 2.5 per cent of GDP within three years (Kuttner and Posen 2002). From

Figure 13: General Government Balances as a Per Cent of GDP



Notes: See Figure 1 for stock market peaks. 2002 and 2003 data for the US are estimates.
Source: IMF *World Economic Outlook*, April 2003

Figure 14: Government Consumption and Transfers
Peak = 100



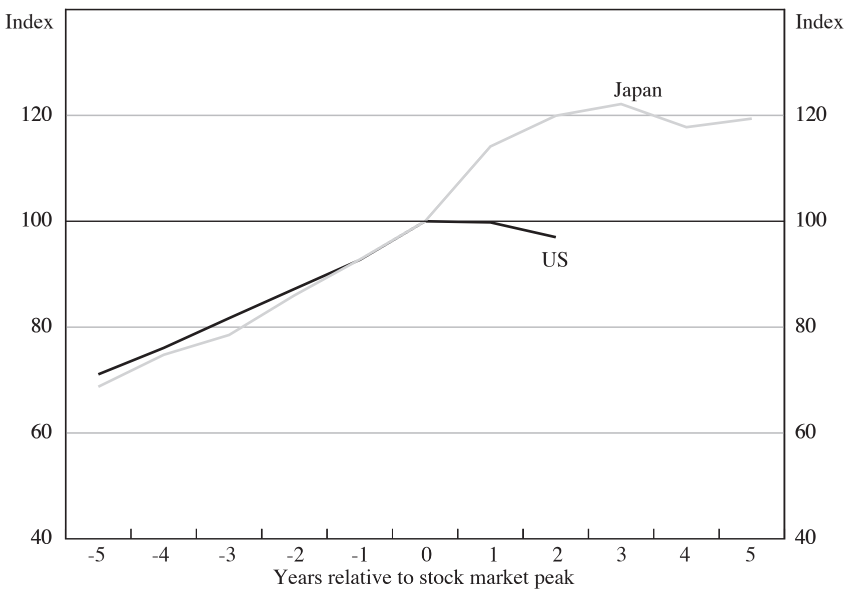
Note: See Figure 1 for stock market peaks.
Source: OECD *Economic Outlook* No 72

that point onwards, fiscal policy tended to be contractionary, and public investment has been declining since 1998. The recession of 1992–1994, the offsetting monetary tightness, and the occasional appreciations of the yen against the dollar had little impact on the revenue-minded Japanese fiscal policy-makers, and tax receipts went up significantly during the first three years after the bubble (see Figure 15). Since the yield curve has flattened and nominal long-term interest rates have declined while the public debt has mounted, there is no reason to think that significant Ricardian offsets for fiscal expansion would have arisen had fiscal policy been tried; econometric assessments of the effectiveness of Japanese fiscal policy support this view (Kuttner and Posen 2001a). Ahearne *et al* (2002) and Posen (1998) concur that had the tax hikes of 1997 been put off, the recovery of 1995–1996 would have continued to gain steam. Of course, a package combining fiscal and monetary stimulus would have been best.

The third major policy mistake was forebearance of bank misbehaviour and capital erosion. This was the natural if unfortunate outcome of the structural shifts in the banking system following partial deregulation discussed above. As in the US Savings and Loan Crisis and other instances of financial fragility around the world, Japanese bank supervisors held off closing banks in hopes that the economy's return to growth and/or a rise in asset prices would restore bank profitability. In Japan, however, this phenomenon was taken to an extreme in duration and breadth, in part because the supervisors retained the Convoy notion that banks should not be allowed to exit

Figure 15: Government Revenue

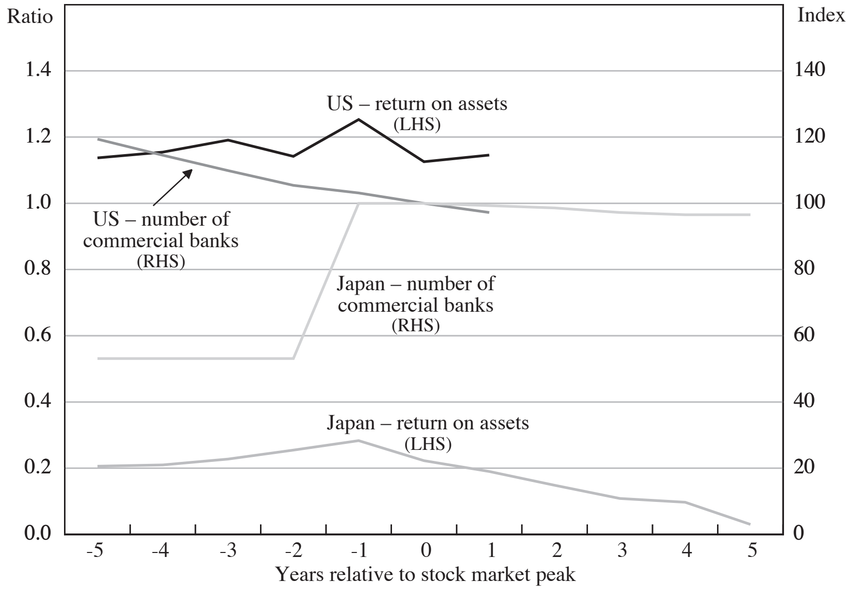
Peak = 100



Note: See Figure 1 for stock market peaks.

Source: OECD *Economic Outlook* No 72

Figure 16: Commercial Banks' Return on Assets and Number of Commercial Banks



Notes: See Figure 1 for stock market peaks. The number of commercial banks has been indexed to 100 in the stock market peak year. Return on assets was calculated by dividing profits after taxes by total assets. Total assets include cash and balances with central bank, interbank deposits, loans and other assets.

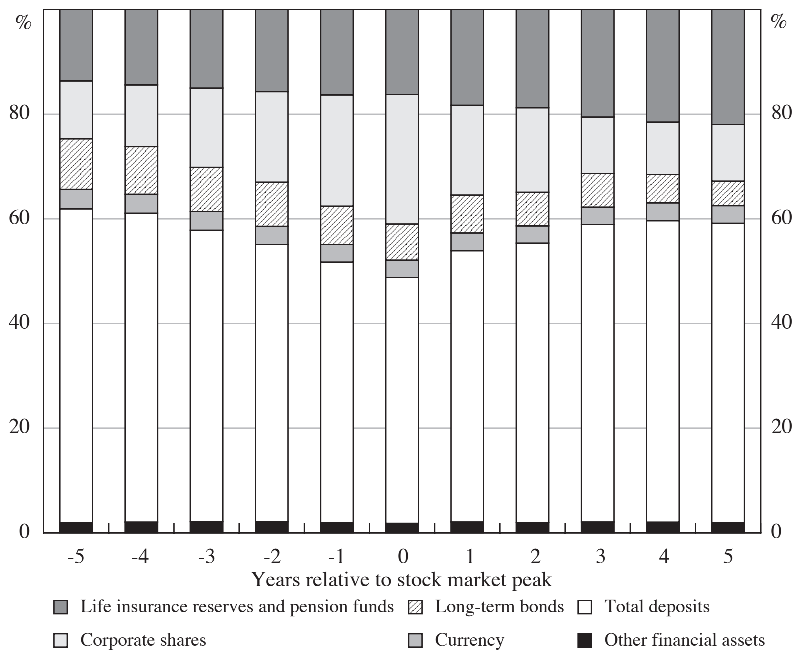
Source: OECD, *Bank Profitability: Financial Statement of Banks*, 2002

the market. Figure 16 juxtaposes commercial banks' return on assets (ROA) with an index of the number of banks for Japan and the US.[29] In Japan, the number of banks five years after the stock market peak was 97 per cent of the number at the peak, and ROA had declined to nearly zero from the already low 0.3 ratio attained during the bubble; in the US, the number of banks was steadily declining through the boom years, and the trend continued into the post-bubble period, keeping bank profitability steady (ROA six-fold or more that of Japan).

During this post-bubble period in Japan (1990–present), banks have been allowed to evergreen loans to distressed borrowers, ration out new borrowers, and exploit those lending relationships which remain viable (Hoshi and Kashyap (2000); Peek and Rosengren (1997)). Japanese households went back to keeping nearly 60 per cent of their savings in bank deposits (including a quarter of that amount in Postal Savings), because the convoy system and deposit insurance gave them no

29. There is a jump in the number of banks listed in 1988 (peak–1) for Japan due to a reclassification of certain institutions. The actual number of core commercial banks was flat and did not increase.

Figure 17: Composition of Household Savings in Japan
Per cent of total household savings



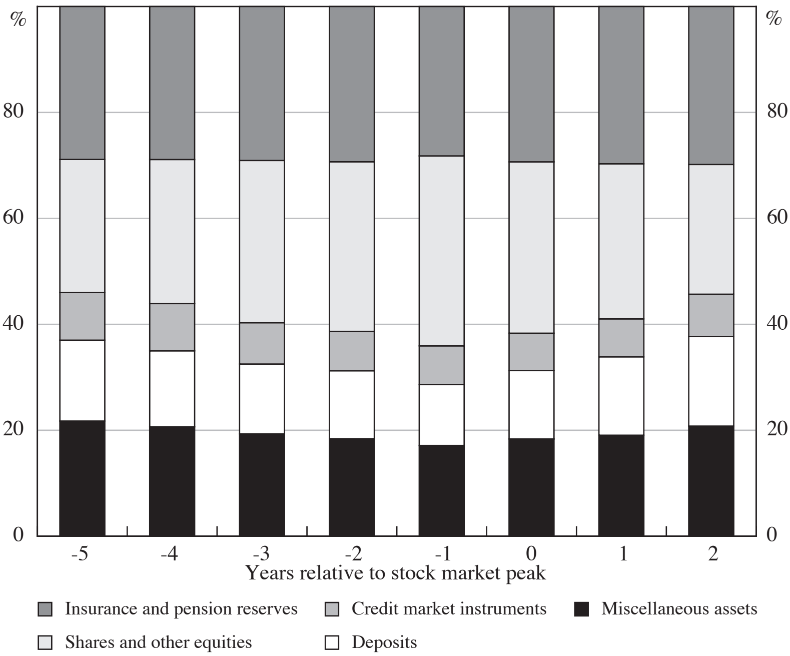
Notes: See Figure 1 for stock market peak. Total deposits includes transferable deposits and other deposits.

Source: Economic and Social Research Institute – Cabinet Office, Government of Japan, SNA (National Accounts)

incentive to move their money out (see Figure 17 for Japan and Figure 18 for the US) – and that kept the banks from having to compete for loanable funds. Adherence to the Basel I Capital Accord meant that Japanese banks had to maintain sufficient Tier II capital to reach 8 per cent by end of FY1992, but the Japanese government had negotiated hard to count latent share gains on banks' non-financial holdings as part of that Tier II capital (Ito and Sasaki 2002). As a result, it took until 1997 for equity prices to decline sufficiently to have an impact on the lending behaviour of Japanese banks.

Had there been sufficient transparency in the Japanese banking system, with sufficient accountability to shareholders and supervisors, though, there either could have been enough Tier I capital issuance or banking sector consolidation – or even sales of long-held industrial shares – in the intervening seven years to offset the declines in Tier II capital due to cross-shareholdings. In fall 1997, however, abetted by the downturn of the economy and the fiscal tightening, financial failures shocked the Japanese public. Within a year, Hokkaido Takushoku Bank, Sanyo Securities, Yamaichi Securities, Long-Term Credit Bank, Nippon Credit Bank,

Figure 18: Composition of Household Savings in the US
Per cent of total household savings



Notes: See Figure 1 for stock market peak. Credit market instruments include open market paper, US government securities, municipal securities, corporate & foreign bonds, and mortgages. Shares and other equities include corporate equities, mutual fund shares and security credit. Miscellaneous assets include investment in bank personal trusts, equity in non-corporate business and miscellaneous assets.

Source: Federal Reserve Board, *Flow of Funds Accounts of the United States: Annual Flows and Outstandings, 1995-2002*, Table L.100 Households and Nonprofit Organizations (1)

and a number of minor firms failed despite government efforts to prop them up.[30] At this point the effects of a bank credit crunch did add to the contraction of the Japanese economy.[31]

So did the asset-price bubble cause Japan's Great Recession? Even the oft-used analogy of the balance sheet effects being the match which lit the fuse seems to exaggerate the bubble's direct impact. The 1991–1994 recession was well within normal bounds of a usual recession post-monetary tightening, nothing too arduous. Japanese monetary and fiscal policy austerity is sufficient to account for the abortion of the 1995–1996 recovery, a recovery that on all forward-looking indicators (including

30. Hoshi and Kashyap (2001, Ch 8) gives a good history of this period.

31. Bayoumi (2001), Cargill *et al* (2000), Ito and Sasaki (2002), Ogawa (2003), Peek and Rosengren (1997, 2003), and Shimizu (2000) all offer evidence to this effect.

rising stock prices) looked to be sustainable. Neglect of basic financial supervision allowed balance sheet problems for banks to finally accumulate to where they impeded lending, after macroeconomic policy had already put the economy back into recession. If these extensive policy mistakes had not killed the 1995–1996 recovery off, and if the Japanese bank supervisors had taken only 10 years after partial deregulation to engage with the structural under-capitalisation of their banking sector, we would not be discussing the Japanese economy the way we do today (Posen 1998). With that proper perspective on the course of Japan's economy after the bubble in mind, we might not now be so concerned with the impact of bubbles on major economies in general, without the Japanese example to cite.

3. Did the Bubble Impede Restructuring?

No matter what the demand shock to an economy, it is never without sectoral impact. An economy undergoing adjustment has to reallocate workers and capital from less to more rewarding uses. With well-functioning markets, distressed assets are fairly and quickly repriced and re-employed. The question here is whether a bubble bursting is in and of itself sufficient to impede this process of restructuring. Given the recognition that some bubbles have significant macroeconomic costs and some do not, it is possible that the difference in costliness between bubbles accords with how well the economy reallocates capital afterwards. Obviously, financial systems that are dysfunctional impede this process of reallocation. Pomerleano (2003) establishes with cross-national data that specialised human capital, such as workout specialists and property appraisers, also is needed. In the end, many of the factors usually cited as good for economic growth are good for restructuring, which makes sense because the ongoing process of restructuring can be seen as the Schumpeterian engine of growth. As with the previous two sections, my argument is that we should shift attention away from the bubble as a causal force in its own right, and stress the response of Japanese authorities, businesses, and households.

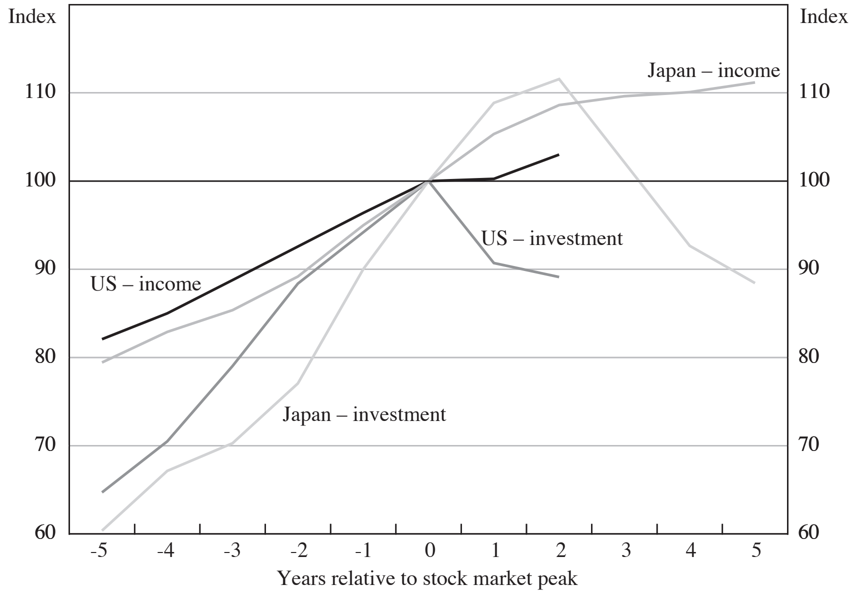
The previous two sections addressed essentially retrospective questions: did monetary ease cause the Japanese bubble?; did the bubble cause Japan's recession? The restructuring issue requires something more of a counter-factual approach – tracing out the bubble's impact on restructuring needs a benchmark against which to measure progress. Therefore, insofar as data allow, we will compare the response of the US economy (known for its arms-length markets and corporate governance) to a given asset-price bubble, with the response of the Japanese economy (known for its web of corporate and financial relationships) to an almost identical asset-price bubble. Even where data limitations preclude us from making the comparison directly, it will be evident that the Japanese corporate sector responded to the bubble's burst by resisting restructuring for a multi-year period.[32]

The simplest point to be made is clear in Figure 19 showing the path of investment and national income in the two countries relative to peak in equity prices. In the

32. For no doubt historical and institutional reasons, the US government collects less data on the micro-level about the activities of specific firms and workers than the Japanese government does.

Figure 19: Investment and Income

Peak = 100



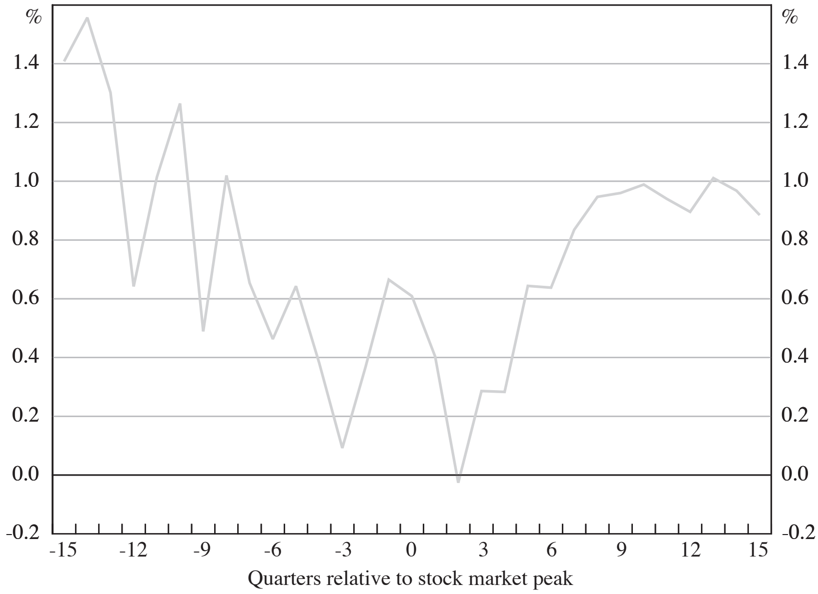
Note: See Figure 1 for stock market peaks.
Source: OECD *National Accounts*, various years

US, income flattened out almost immediately upon the bubble's bursting, and investment declined – in Japan, however, investment continued to climb for two years after the bubble and so (at a slower rate) did income. The Japanese investor simply did not respond to the market signal. This could be because of the relationship banking system that encourages banks to carry clients through harder times while the securitised US system results in rapid financial cutbacks; this also could be because of evergreening and poor bank supervision in Japan. Figure 20 plots the quality spread between benchmark 10-year AA-class industrial bonds and Japanese government bonds, which began to rise in the year after the bubble's burst, but stayed well below pre-bubble levels (and at a relatively low differential compared to US spreads) – the bond market was insufficiently responsive.

A more important fact is shown in Figure 21 which presents the bank loans outstanding to the sectors in the Japanese economy which were at the heart of the bubble: finance, insurance and real estate (FIRE); services (in Japan, dominated by inefficient SMEs); and construction. Each one of these sectors saw loans outstanding to it continue to rise rather than shrink following the bubble years. In the case of construction, the trend in loan growth to the sector actually rose after the bubble.[33]

33. This is probably in part due to the use by Japanese governments of public works construction projects as employment programs, making the loans seem to be implicitly government backed. See Posen (1998, pp 29–54) and Kuttner and Posen (2001a) for discussions of the growth in construction employment.

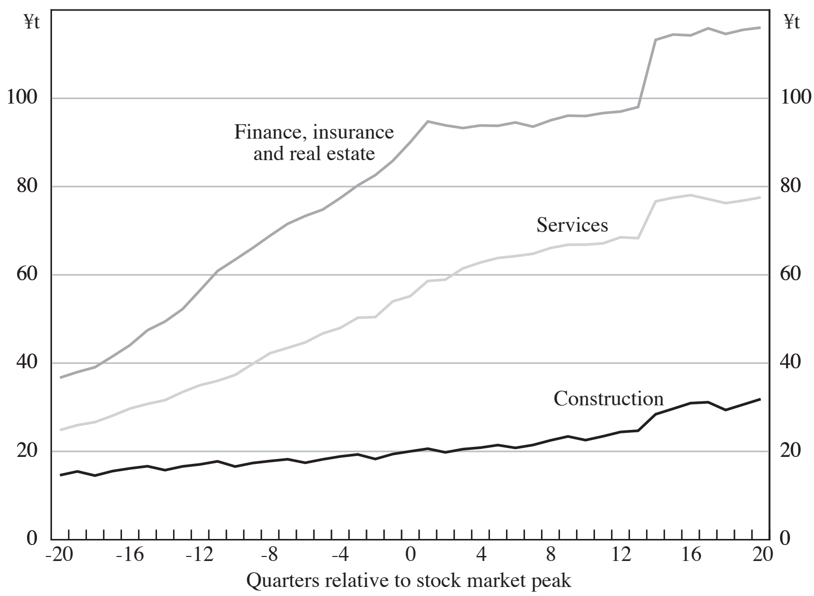
Figure 20: Japan – Quality Spread



Notes: See Figure 1 for stock market peak. The quality spread is defined as the difference between the end-of-quarter interest yield on benchmark 10-year AA-class industrial bonds and Japanese government bonds.

Source: Japan Securities Dealers Association

Figure 21: Japan – Loans and Discounts Outstanding by Sector



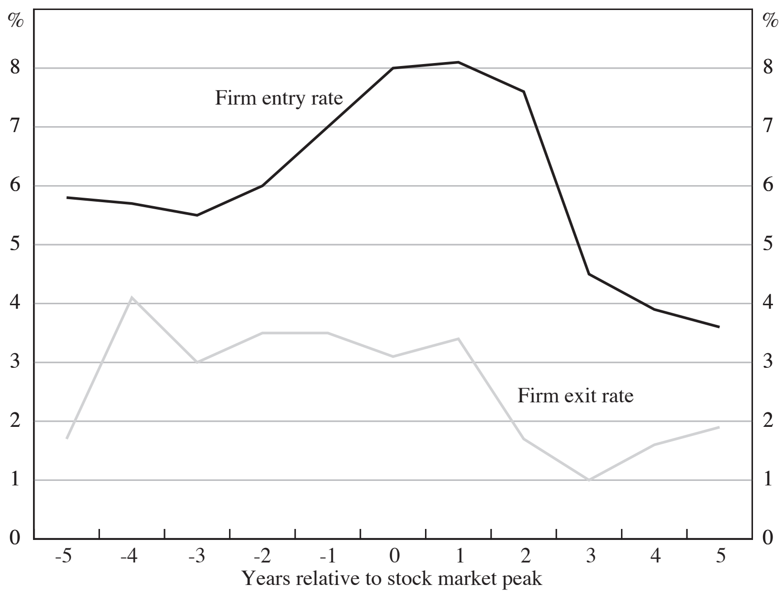
Note: See Figure 1 for stock market peak.

Source: BOJ

The US does not break down lending data in flow of funds by sector, probably because of the lesser importance of banks in corporate finance. As Friedman (2000) notes, lending to real estate continued to rise in the US after the Savings and Loan Crisis, so this is not entirely atypical. Nonetheless, the expansion of lending on this scale in all these sectors is clearly an indicator of lack of adjustment of which sectors were favoured by lenders. Figure 22 further reflects adverse selection in Japanese credit markets post-bubble: the rate of firms going under in Japan (exiting business) actually declined starting in 1991, and stayed below pre-bubble levels, while the rate of new firm entry dropped markedly.

Overall, Japanese labour markets have engaged in a form of adverse selection analogous to that in bank lending. As is often anecdotally observed, Japanese firms that have stayed open have generally sought to maintain employment rather than restore profitability during the 1990s, even though this came at a cost of offering few opportunities to younger workers and school leavers. Figure 23 documents that the job separation rate rose only slightly in the immediate aftermath of the bubble before declining, while over time the decline in job entry rate accelerated. Lacking US job entry/exit data for the period, we can show how employment in various industries responded as an indicator of restructuring. In Figure 24 it can be seen that the same three sectors – construction, FIRE, and services – in Japan that have

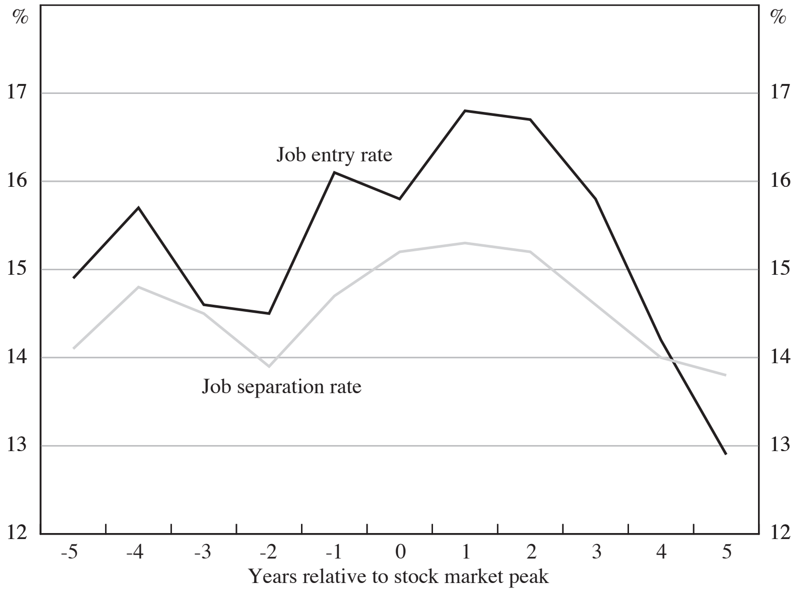
Figure 22: Japan – Firm Entry and Exit Rate



Notes: See Figure 1 for stock market peak. Firm entry rate = number of registrations/the number of companies in previous year; firm exit rate = firm entry rate – increasing rate of the number of companies. Comparable data were not available for the US for the years after the US stock market peak. The US Census Bureau provides establishment ‘birth’ and ‘death’ rates only up through 1999–2000.

Source: Teikoku Databank

Figure 23: Japan – Job Entry and Separation Rate



Notes: See Figure 1 for stock market peak. Comparable data for the US were only available from the Bureau of Labor Statistics' Job openings and labor turnover survey from December 2000, which was after the US stock market peak.

Source: Ministry of Health, Labour and Welfare, 'Survey on employment trends'

continued to get funding from their banks have increased their employment;[34] in the US, the information and communications technology (ICT) sector that was the darling of the American bubble saw employment contract immediately.

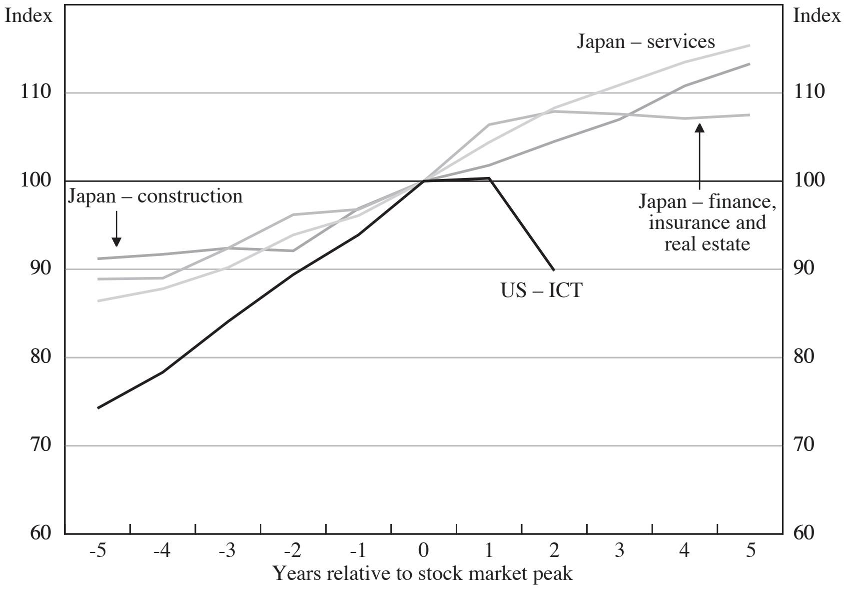
In keeping with the relative extent of re-allocation, labour productivity declined in Japan steadily over the years after the Nikkei peak (even discounting the artificial high of the 1988 productivity number), while US productivity has continued to grow in the three years since the S&P 500 peak, and the latest numbers released promise a continuation of the trend (Figure 25). As a result, real corporate profits computed from the national accounts (Figure 26), not accounting profits, have rebounded from a short post-bubble decline in the US, and were generally a steady number; in Japan, corporate profits traced the boom upwards, and declined for five straight years after the peak.

Two analogous bubbles produced very different degrees of restructuring, so it is not about the bubble.[35] Given that Japan does have the basic institutions, property

34. Ogawa (2003) using firm-level data shows a clear link between availability of credit and employment at Japanese SMEs.

35. Rosengren (2003) suggests that post-bubble reaction may be more important for macroeconomic performance than pre-bubble pre-emption.

Figure 24: Sectoral Employment Data
Peak = 100



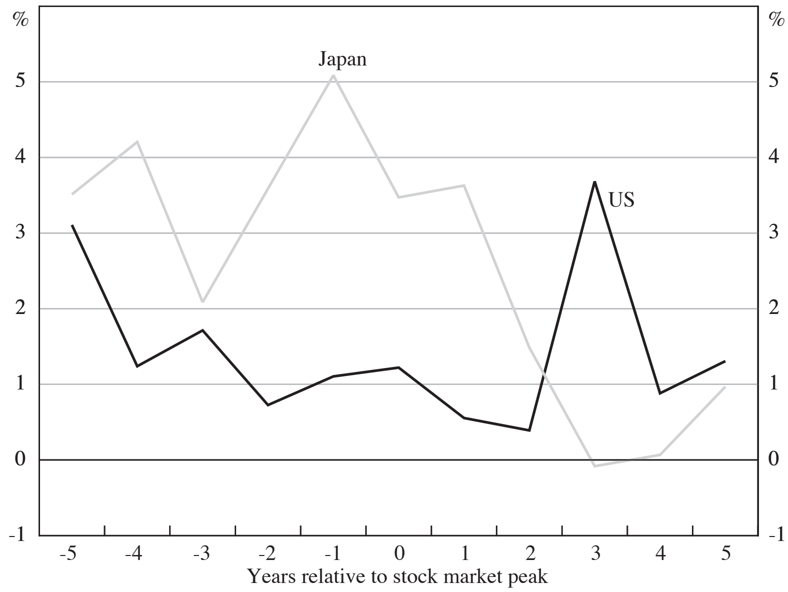
Notes: See Figure 1 for stock market peaks. For the US, ICT includes software publishers, Internet publishing & broadcasting, telecommunications, computer systems design & related services, and computer & electronic products.

Sources: Japan – Nomura; US – Bureau of Labor Statistics

rights, and to a large degree financial expertise necessary for a successful restructuring (or can easily import it from eager providers), why did restructuring not occur? A large measure of the blame must go to the management of the Japanese banks who not only have the usual undercapitalised lenders' incentives to misallocate credit, but who also have been accustomed to extracting rents from corporate clients, depositors, and even government officials, and therefore have every incentive to keep current relationships going.[36] Yet their lack of accountability to shareholders or public officials, and their ability to tie up so much of Japanese savings requires more to be successful. Posen (2003a, 2003b) argues that four factors create the Japan syndrome leading to sustained deflation: undercapitalised banks with incomplete deregulation; passive savers and voters; a lack of openness to international pressures (or exits by savers and firms); and contractionary macroeconomic policies. The question remains open, but the role of macroeconomic policy in restructuring merits further consideration.

36. Among those empirical studies documenting the successful though destructive rent-seeking behaviour of Japanese banks are McGuire (2002, 2003); Morck, Nakamura and Shivdasani (2000); Peek and Rosengren (2003); Petersen and Rajan (1995); Smith (2003); Van Rixtel and Hassink (2002); and Weinstein and Yafeh (1998).

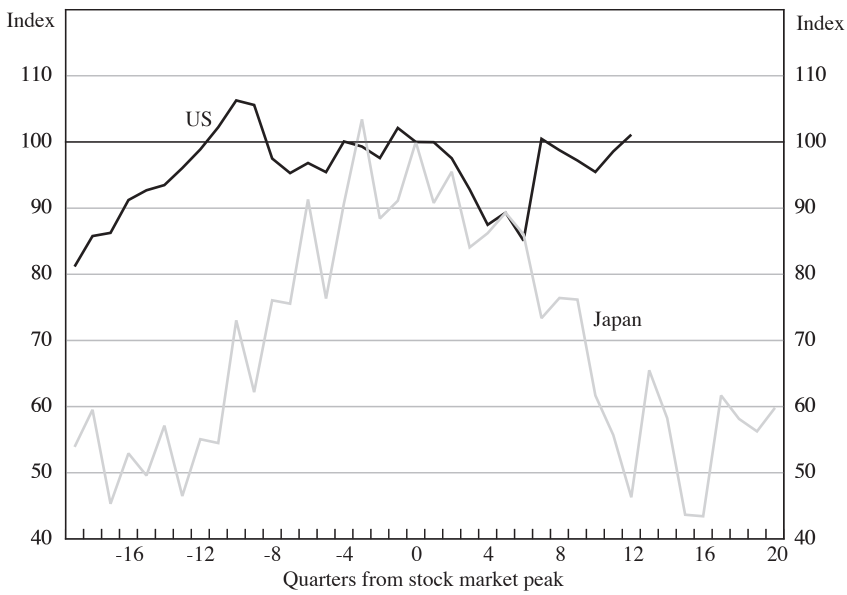
Figure 25: Labour Productivity Growth
Annualised



Notes: See Figure 1 for stock market peaks. The 2003 figures are an estimate. Labour productivity is for the business sector.

Source: OECD *Economic Outlook* No 73

Figure 26: Corporate Profitability
Peak = 100



Note: See Figure 1 for stock market peaks.

Sources: Japan – Ministry of Finance, Financial Statements Statistics on Corporations by Industry; US – Bureau of Economic Analysis, National Income and Product Accounts Table 6.16C

4. Could Monetary Policy Have Encouraged Restructuring?

After an asset-price boom has ended, and the need for restructuring becomes apparent, the central bank has a choice to make. Inflation is unlikely to be a threat for an extended period, giving some room to focus on growth. The central bank therefore can either tighten monetary conditions in hopes of inducing faster or more complete restructuring, or it can loosen monetary conditions in hopes of easing the restructuring process. This is the old debate between liquidationists and expansionists, seen around the world during the early 1930s. Then US Treasury Secretary Andrew Mellon was seen as the exemplar of the liquidationist view urging policies to 'get the rot out'; Keynes would be the embodiment, if not the creator, of the expansionist alternative. In Japan since the bubble burst, but particularly since the 1997 recession and the emergence of steady deflation, the debate has been revived, and both points of view have been heard. What are the economic and political assumptions underlying the respective positions?

The view that creative destruction requires liquidations has often been espoused by top BOJ officials. In summer 2000, in anticipation of the interest rate increase to be undertaken that August, BOJ Governor Masaru Hayami gave a series of press interviews and speeches advocating this view.[37] Fundamentally, low or zero interest rates are said to impede restructuring because they allow inefficient firms to make their loan payments and remain open. Those sharing this view, such as the Japanese business pundit Tadashi Nakamae (2000, 2003), advocate raising interest rates to increase bankruptcies and raise efficiency in the economy. Efforts by monetary policy-makers to ease the pain of adjustment will likely decrease the incentive of businesses, interest groups, and government to undertake necessary restructuring (shades of the European Central Bank can be seen here). In fact, low or zero interest rates have the political effect of inviting wasteful government spending in place of reform. In all, the idea is to impose greater market discipline by making credit markets tighter.

The opposing view holds that restructuring goes best in a supportive environment, and that efforts to increase destruction of firms and jobs are often uncreative. Most of today's mainstream macroeconomic models that include imperfect information and financial intermediation support this view, and the existence of nominal rigidities adds to the argument for expansionist policies.[38] Low or negative real interest rates aid restructuring because they improve the investment incentives of borrowers. As Bernanke and Gertler (1990) argue, the appropriate response to financial fragility is to restore the net worth of borrowers so they have something at stake in their economic activity and pursue the proper projects. Obviously, inflation and liquidity are one means by which to do this. Sorting out firms for life or bankruptcy based

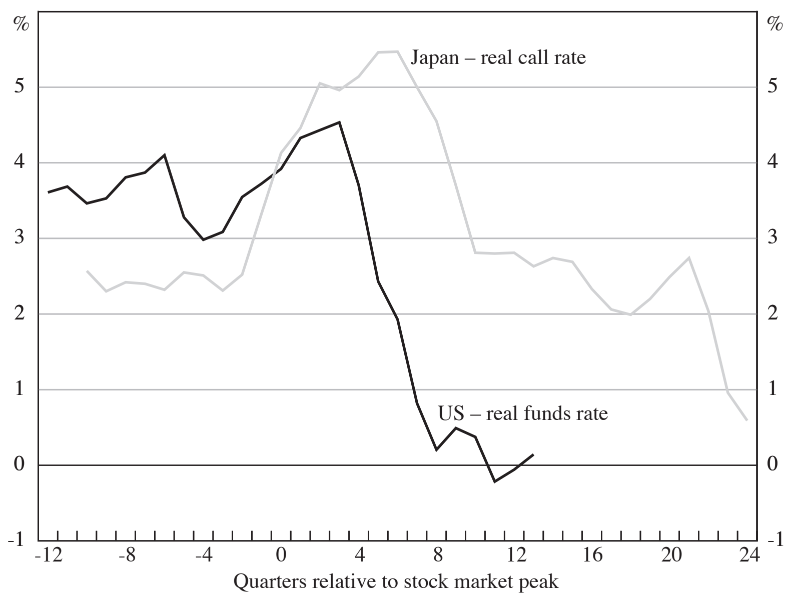
37. See, for example, Bremmer (2000a, 2000b, 2000c), Hayami (2000a), Spindle (2000a, 2000b), and Tett and Abrahams (1999), as well as the references in Posen (2003c).

38. Posen (1998, pp 143–157) summarises the relevant literature, drawing on the work of Akerlof, Bernanke, Stiglitz, and others.

upon which ones happen to hit a liquidity constraint when interest rates rise is a very poor screen for investment or management quality, making monetary policy too blunt an instrument (Mussa 2003; Posen 2000a). Politically, the assumption is that governments will pander to interest groups almost inevitably, but governments with additional resources are better able to buy off entrenched interest groups into lasting change. A more buoyant economic environment may also reduce the incentive for interest groups to dig in their protections.

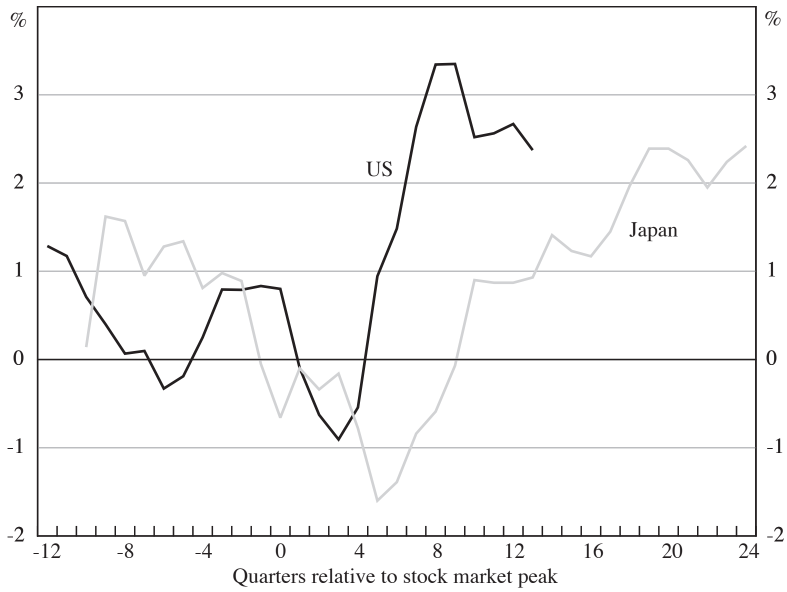
Looking at the one case of Japan will not settle this debate, but it does give us strong indications of where the truth lies. In fact, given that many thought the debate settled against the liquidationists by the Great Depression, only to have the old arguments resurface in the fact of Japan's Great Recession, there may be no hope of settling it. Yet, the comparison of US and Japanese experiences post-bubble does provide a useful if not compelling heuristic – and it is one in favour of the expansionist view. Short-term real interest rates declined much further much faster in the US than in Japan in the aftermath of the bubble (Figure 27), with a differential of nearly 300 basis points three years out. Leaving aside the concerns from Sections 1 and 2 about whether the decline was commensurate with the surrounding economic conditions, what effect did this have on the restructuring?

Figure 27: Real Interest Rates



Note: See Figure 1 for stock market peaks.
Sources: BOJ; Federal Reserve

Figure 28: Term-yield Spreads

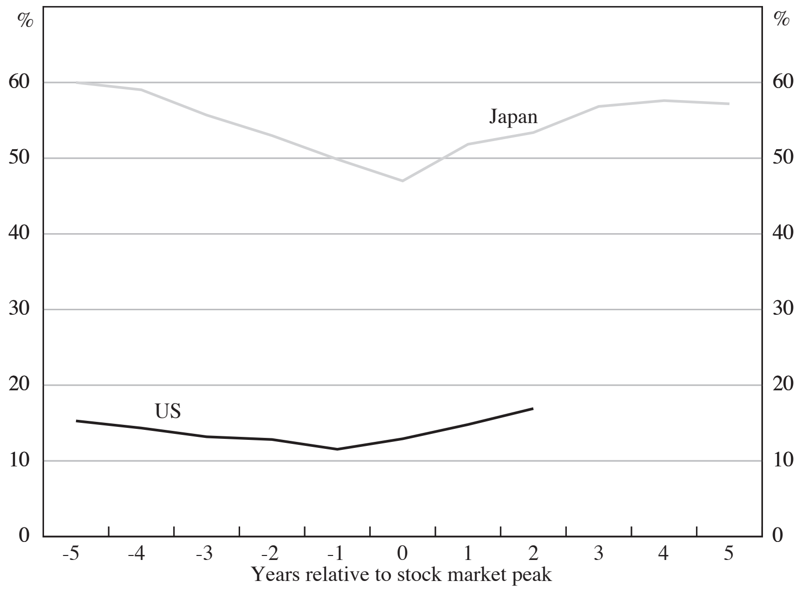


Notes: See Figure 1 for stock market peaks. Spread is defined as 10-year government bond rate minus overnight central bank rate.

Source: Japan – BOJ; US – Federal Reserve Board

Section 3 has already given us our answer: the US economy changed lending and employment patterns more in those three post-equity peak years than the Japanese economy has in the 13 years since its stock market peak. This may not have been the only determinant, but loosening monetary policy did not impede restructuring. In fact, as shown in Figure 28, the yield curve on government bonds (10-year minus 3-month) steepened far more in the US than in Japan over the same immediate post-bubble period, even though the Japanese yield curve did steepen some. And the economy which had the steeper yield curve had sounder bank behaviour, as one would expect via the profitability channel. Finally, the ongoing willingness of Japanese households to keep just below 60 per cent of their savings in bank deposits (in comparison to the US share of below 20 per cent – see Figure 29) reflects in part the high risk-free real interest rates and distortions of investment, but in turn feeds those structural problems.

Figure 29: Household Deposits
Per cent of total household savings



Notes: See Figure 1 for stock market peaks. The US data include households and non-profit organisations, and the Japanese data include households and private unincorporated non-financial enterprises. For Japan, total deposits includes transferable deposits and other deposits.

Sources: Japan – Economic and Social Research Institute – Cabinet Office, Government of Japan, SNA (National Accounts); US – Federal Reserve Board, *Flow of Funds Accounts of the United States: Annual Flows and Outstandings, 1995-2002*, Table L.100 Households and Nonprofit Organizations (1).

5. What Central Bankers Should Learn from Japan's Bubble

So did the asset-price bubble cause Japan's Great Recession? Even the oft-used analogy of the bubble's balance-sheet effects being the match which lit the fuse seems to exaggerate the Japanese bubble's direct impact. The 1991–1994 recession was well within normal bounds of a usual recession post-monetary tightening, nothing too destructive or persistent. Japanese monetary and fiscal policy austerity is sufficient, without any reference to balance-sheet effects, to account for the abortion of the 1995–96 recovery, a recovery that on all forward-looking indicators (including rising stock prices) looked to be sustainable. Neglect of basic financial supervision allowed balance-sheet problems for banks to finally accumulate to where they impeded lending starting in 1997, *after* macroeconomic policy had already put the economy back into recession. If these extensive policy mistakes had not killed the 1995–1996 recovery off, and if the Japanese bank supervisors had taken only 10 years after partial deregulation to engage with the structural undercapitalisation of their banking sector, we would not be discussing the Japanese economy the way we do today (Posen 1998).

With an accurate understanding of the sources of Japan's economic underperformance after the bubble – one that, as argued here, does not include the bubble itself as a direct cause of that underperformance – monetary policy-makers and pundits might not be giving as much attention to the debate over whether policy should respond to bubbles as they currently do. Monetary policy clearly was (and remains) a contributing factor to Japan's stagnation, but it was not disregard of asset prices either on their way up or of their effects on the way down which led to the monetary policy decisions made by the BOJ. The BOJ should have been able to tighten policy more quickly in the late 1980s and loosen policy more quickly in the early 1990s without any particular reference to asset-price movements – and in any event, monetary policy might well have been unable to stop those movements. Negative developments in the Japanese economy after the bubble were hardly driven by the fall in asset values, but rather by other problems in the Japanese economy (including overly tight monetary policy itself). Comparative analysis broadly of other recent cases of asset-price booms and, in more depth, of developments in the US in parallel (relative to its asset-price peak) with developments in Japan, support my conclusion that a primary concern for monetary policy should be how to encourage restructuring in the aftermath of a boom, not the boom itself.

Thus, I take away four lessons for central bankers about asset prices and monetary policy from Japan's bubble and response to it.

First, *bubbles will come, bubbles will go, but monetary policy remains the same*. The highly charged discussions in the last few years whether or not central banks should include asset prices in their decision-making seem unnecessary. If central bankers worry sufficiently about assessing potential output – using real-time data but also benchmarking appropriately with international comparisons and historical trends – and check credit aggregates for consistency with their assessment, they do not need to get into the game of evaluating equity prices. This perhaps seems to be a sleight of hand, where assessing potential output is really no easier than looking at appropriate P/E ratios, but that is mistaken. Given the huge difference in volatility between potential and equity prices, as well as the statistical techniques available for estimating potential without much in the way of assumptions, and the relatively sensible benchmarks for what potential can be, this is a much more tractable task. And in any event, central banks have to estimate potential output no matter what.

Thus, it is surges in lending rather than in real estate or stock prices *per se* that should attract the attention of the central bank. Issing (2002) makes a case that this is a good reason for central banks to track broad money supply growth measures as well as inflation, as the European Central Bank does. While that may be a bit too pat, it certainly reminds us that the point of the exercise is not simple policy rules, with a yes/no on targeting asset prices, but rather to pursue an information-inclusive strategy. It is in this sense that central banks should worry more about communicating with markets and the broader public about the contingent nature of their assessments than sticking with a foolish consistency. In all these regards, inflation targeting (in the flexible manner practiced by all major central banks with inflation targets) will help, even though it will not solve everything. Flexible inflation targeting will prevent undue emphasis on inflation goals without reference to output gaps; flexible inflation targeting will be information inclusive rather than strictly rule based; and flexible inflation targeting will provide a framework for communicating with the public.

Second, *it is what happens after the bubble bursts that is truly important for macroeconomic outcomes*. Since bubbles do not always result in deflation or even in unusually deep recessions, there should be more emphasis on financial stability and reactive policy (as many in Hunter *et al* (2003) also argued). As I stated in Tokyo in January 2001: 'The [US] stock market probably was a bubble, at least in tech stocks, that has burst. What the much softer landing in the US than it was in Japan demonstrates is how financial regulation and supervision and monetary policy, rather than the stock market itself, determine the impact of a bubble' (Posen 2001a). Meanwhile, the impact of monetary policy movements on the generation and inflation of bubbles is unclear, even if one took them into account for pre-emptive purposes, whereas we know monetary policy can affect the output gap and distressed financial systems beneficially in the short-run. Central banks should also not hide behind bubbles, claiming they cannot do anything after a bubble has burst or that the bubble confused them – they have to take responsibility for their part in the aftermath.

Third, *fewer banks, fewer crises*.[39] I mean this in three senses. One, if an economy has a smaller share of corporate financing running through banks, and there are more developed alternative forms of financing, adjustment will be smoother and the impact of collateral declines will be smaller. Two, if an economy keeps a smaller share of household savings in bank accounts, there will be stronger checks upon the banking system from households both economically (as savers) and politically (as voters) than when they passively accept what the banks do to them. Three, fewer banks within a given nation's banking sector, that is higher concentration, improves profitability and therefore capital and behaviour. Bank dependent systems will do worse with the aftermath of bubbles.

Fourth and finally, *monetary ease is the appropriate reaction to the burst of bubbles*. Japan has proven the liquidationists wrong again. When an economy has a serious deficit of demand, a broken financial system, and/or approaches the zero interest rate bound, fiscal and monetary policy should work in tandem. Relying on two tools rather than one exclusively will increase credibility as well as decrease distortions for a given combined stimulative effect. Claims that such post-burst expansions induce moral hazard among the investors writ large (e.g. Miller *et al* (2002)) would be the one plausible argument against such ease. These claims, however, do not appear to be borne out empirically. Looking at the list of asset-price booms from Bordo and Jeanne (2002) (see Table A1) finds few if any repeat offenders in booms. This moral hazard concern relies too much on a macroeconomist's representative agent view, and ignores both the fears of the individual investor and the real moral hazards of the financial intermediaries. Those micro-level people's micro-level incentives regarding willingness to invest swamp any effect from an expansionary monetary policy.

39. In Posen (2002, 2003d) I made this case in detail, drawing lessons from Japan's experience for emerging markets.

Appendix

Table A1: List of OECD Booms

Country	Boom in residential property prices 1970–1998	Boom in industrial share prices 1970–2001
Australia	1987–1990	1985–1987
Canada	1986–1989	
Denmark	1983–1986	1981–1984
Finland	1986–1989 and 1996–1998	1982–1984; 1986–1988; 1993–1995 and 1997–2001
France		1984–1986 and 1996–2000
Germany		1983–1986 and 1996–2000
Ireland	1977–1979 and 1996–1998	1985–1988 and 1996–1998
Italy	1973–1976; 1979–1981 and 1988–1991	1979–1981; 1984–1987 and 1996–2000
Japan	1973 and 1985–1990	1984–1989
Netherlands	1974–1977	1983–1985 and 1995–2000
Norway	1973–1974 and 1984–1987	1983–1985
Spain	1985–1991	1984–1988 and 1996–2001
Sweden	1987–1989	1981–1984 and 1996–2000
UK	1973 and 1986–1989	
US		1996–2000

Source: Bordo and Jeanne (2002), pp 147–148

References

Ahearne A, J Gagnon, J Haltmaier and S Kamin, C Erceg, J Faust, Luca Guerrieri, C Hemphill, L Kole, J Ruosh, J Rogers, N Sheets and J Wright (2002), 'Preventing deflation: lessons from Japan's experience in the 1990s', Board of Governors of the Federal Reserve International Finance Discussion Paper No 729.

Bayoumi T (2001), 'The morning after: explaining the slowdown in Japanese growth in the 1990s', *Journal of International Economics*, 53(2), pp 241–259.

Bernanke BS (1983), 'Nonmonetary effects of the financial crisis in the propagation of the Great Depression', *American Economic Review*, 73(3), pp 257–276.

Bernanke BS (2000), 'Japanese monetary policy: a case of self-induced paralysis?', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 149–166.

Bernanke BS and M Gertler (1990), 'Financial fragility and economic performance', *Quarterly Journal of Economic*s, 105(1), pp 87–114.

Bernanke BS and M Gertler (2000), 'Monetary policy and asset price volatility', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, Kansas City, pp 77–128.

Blanchard O (2000), 'Bubbles, liquidity traps, and monetary policy', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 185–193.

Bordo M and O Jeanne (2002), 'Monetary policy and asset prices: does "benign neglect" make sense?', *International Finance*, 5(2), pp 139–164.

Borio C, C Furfine and P Lowe (2001), 'Procyclicality of the financial system and financial stability: issues and policy options', in *Marrying the macro- and micro-prudential dimensions of financial stability*, BIS Papers No 1, Basel, pp 1–57.

Borio C and P Lowe (2002), 'Asset prices, financial and monetary stability: exploring the nexus', BIS Working Papers No 114.

Bremmer B (2000a), 'Inside the Bank of Japan (int'l edition)', *BusinessWeek Online*, International – Asian cover story, 12 June, available at <http://www.businessweek.com/2000/00_24/b3685012.htm>.

Bremmer B (2000b), 'Interview with the taskmaster (int'l edition)', *BusinessWeek Online*, 12 June, available at <http://www.businessweek.com/2000/00_24/b3685012.htm>.

Bremmer B (2000c), 'No...to a stop-and-go policy: a talk with Japan's Yutaka Yamaguchi', *BusinessWeek Online*, 12 June, available at <http://www.businessweek.com/2000/00_24/b3685012.htm>.

Cargill T, M Hutchison, and T Ito (2000), *Financial policy and central banking in Japan*, MIT Press, Cambridge, Mass.

de Brouwer (1998), 'Estimating output gaps', Reserve Bank of Australia Research Discussion Paper No 9809.

Friedman B (2000), 'Japan now and the United States then: lessons from the parallels', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 37–56.

Goodfriend M (2003), 'Interest rate policy should not react directly to asset prices', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 445–457.

Greenspan A (2002), 'Economic volatility', remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–30 August.

Harrigan J and K Kuttner (2003), 'Is the U.S. going the way of Japan?', Solutions for the Japanese Economy Project, Columbia University and Federal Reserve Bank of New York, mimeo.

Hayami M (2000a), 'Opening speech', address delivered at the 9th International Conference held by the Institute for Monetary and Economic Studies on 'The role of monetary policy under low inflation', Tokyo, 3 July.

Hayami M (2000b), 'The US and Japanese economies: reflections of a central banker', address delivered at the 32nd Annual Joint Meeting of Japan-Midwest U.S. Association, Tokyo, 11 September.

Hayashi F and E Prescott (2000), 'The 1990s in Japan: a lost decade', Federal Reserve Bank of Minneapolis Working Paper 607.

Henning CR (2003), 'Japan's resistance to macroeconomic *gaiatsu*', Institute for International Economics, mimeo.

Hoshi T and A Kashyap (2000), 'The Japanese banking crisis: where did it come from and how will it end', in BS Bernanke and J Rotemberg (eds), *NBER Macroeconomics Annual 1999*, 14, MIT Press, Cambridge, Mass, pp 129–201.

Hoshi T and A Kashyap (2001), *Corporate financing and governance in Japan: the road to the future*, MIT Press, Cambridge, Mass.

Hunter WC, GG Kaufman and M Pomerleano (eds) (2003), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass.

Hutchison M (1994), 'Asset price fluctuation in Japan: what role for monetary policy?', *Bank of Japan Monetary and Economic Studies*, 12(2), pp 61–83.

IMF (International Monetary Fund) (2000), 'Chapter III: Asset prices and the business cycle', *World economic outlook: asset prices and the business cycle*, May, pp 77–112.

Issing O (2002), 'Why stable prices and stable markets are important and how they fit together', European Central Bank, mimeo.

Ito T and T Iwaisako (1995), 'Explaining asset bubbles in Japan', NBER Working Paper No 5358.

Ito T and YN Sasaki (2002), 'Impacts of the Basel capital standard on Japanese banks' behavior', *Journal of the Japanese and International Economies*, 16(3), pp 372–397.

Jinushi T, Y Kuroki and R Miyao (2000), 'Monetary policy in Japan since the late 1980s: delayed policy actions and some explanations', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 115–148.

Kasa K and H Popper (1997), 'Monetary policy in Japan: a structural VAR analysis', *Journal of Japanese and International Economics*, 11(3), pp 275–295.

Kashyap A (2000), 'Discussion of the financial crisis', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 106–114.

Kiyotaki N and J Moore (1997), 'Credit cycles', *Journal of Political Economy*, 105(2), pp 211–248.

Koo RC (2003), *Balance sheet recession: Japan's struggle with uncharted economics and its global implications*, John Wiley & Sons (Asia), Singapore.

Kuttner KN (1994), 'Estimating potential ouput as a latent variable', *Journal of Business and Economic Statistics*, 12(3), pp 361–368.

Kuttner KN and AS Posen (2001a), 'The great recession: lessons for macroeconomic policy from Japan', *Brookings Papers on Economic Activity*, 2, pp 93–185.

Kuttner KN and AS Posen (2001b), 'Inflation, monetary transparency, and G3 exchange rate volatility', in M Balling, E Hochreiter and E Hennessy (eds), *Adapting to financial globalization*, International Studies in Money and Banking Vol 14, Routledge, London, pp 229–258.

Kuttner KN and AS Posen (2002), 'Fiscal policy effectiveness in Japan', *Journal of the Japanese and International Economies*, 16(4), pp 536–558.

Kuttner KN and AS Posen (2003), 'The difficulty of discerning what's too tight: Taylor rules and Japanese monetary policy', Institute for International Economics, mimeo.

McGuire P (2002), 'Japanese firm performance and bank affiliation: evidence of rent extraction', BIS, mimeo.

McGuire P (2003), 'Bank ties and bond market access: evidence on investment-cash flow sensitivity in Japan', NBER Working Paper No 9644.

Miller M, P Weller and L Zhang (2002), 'Moral hazard and the US stock market: analysing the "Greenspan put"', *Economic Journal*, 112(478), pp C171–C186.

Mishkin FS and EN White (2002), 'U.S. stock market crashes and their aftermath: implications for monetary policy', NBER Working Paper No 8992.

Morck R, M Nakamura and A Shivdasani (2000), 'Banks, ownership structure, and firm value in Japan', *Journal of Business*, 73(4), pp 539–567.

Mussa M (2003), 'Asset prices and monetary policy', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 41–50.

Nakamae T (2000), 'Why reform?', *Nihon Keizai Shimbun*, 4 January.

Nakamae T (2001), 'As the Japanese economy withers once again, the world wonders whether the U.S. will have its own "Japan problems"', *NIER Quarterly Report*, March.

Nakamae T (2003), 'Fukui's mission impossible', *The International Economy*, 42(3), pp 87–90.

Ogawa K (2003), 'Financial distress and employment: the Japanese case in the 90s', NBER Working Paper No 9646.

Okina, K and S Shiratsuka (2003), 'Japan's experience with asset price bubbles: is it a case for inflation targeting?', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 81–99.

Peek J and E Rosengren (1997), 'The international transmission of financial shocks: the case of Japan', *American Economic Review*, 87(4), pp 495–505.

Peek J and E Rosengren (2003), 'Unnatural selection: perverse incentives and the misallocation of credit in Japan', NBER Working Paper No 9643.

Petersen M and R Rajan (1995), 'The effect of credit market competition on lending relationships', *Quarterly Journal of Economics*, 110(2), pp 407–443.

Pomerleano M (2003), 'The morning after: restructing in the aftermath of an asset bubble', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 503–516.

Posen AS (1998), *Restoring Japan's economic growth*, Institute for International Economics, Washington DC.

Posen AS (2000a), 'Little creative benefit in recession', *Financial Times*, 2 August, p 11.

Posen AS (2000b), 'The political economy of deflationary monetary policy', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 194–208.

Posen AS (2001a), 'Beware of policy overreactions: managing changing macroeconomic conditions in Japan and the United States', delivered at Keidanren Think Tankers' Reunion Symposium, Tokyo, 17 January.

Posen AS (2001b), 'Recognizing Japan's rising potential growth', *NIRA Review*, 8(1), pp 48–53.

Posen AS (2002), 'Fewer banks, fewer crises', Central Bank of the Republic of Turkey Lecture given at the 'International Conference in Economics VI', held by Middle East Technical University, Ankara, 11 September.

Posen AS (2003a), 'Frog in the pot: Germany's path to the Japan syndrome', *The National Interest*, 71, pp 105–117.

Posen AS (2003b), 'Is Germany turning Japanese?', Institute for International Economics Working paper No 03-2.

Posen AS (2003c), 'Japanese macroeconomic policy: unusual?', Institute for International Economics, mimeo.

Posen AS (2003d), 'A strategy to prevent future crises: safely shrink the banking sector', in E Demaestri and P Masci (eds), *Financial crises in Japan and Latin America*, Inter-American Development Bank, Washington DC, pp 259–272.

Posen AS and Mikitani R (eds) (2000), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC.

Rosengren E (2003), 'Comments on "the morning after"', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 529–533.

Shimizu Y (2000), 'Convoy regulation, bank management, and the financial crisis in Japan', in AS Posen and R Mikitani (eds), *Japan's financial crisis and its parallels to U.S. experience*, Special Report 13, Institute for International Economics, Washington DC, pp 57–99.

Shiratsuka S (1999), 'Asset price fluctuation and price indices', IMES Discussion Paper Series No 99-E-21.

Siebert H (2000), 'The Japanese bubble: some lessons for international macroeconomic policy coordination', *Aussenwirtschaft*, 55(2), pp 233–250.

Smith DC (2003), 'Loans to Japanese borrowers', Federal Reserve System International Finance Discussion Paper No 769.

Spindle B (2000a), 'Hayami sees role as enforcer – BOJ chief makes case for rate rise to force firms to restructure', *Asian Wall Street Journal*, 5 June, p 1.

Spindle B (2000b), 'Heard in Asia: rate rise alone is unlikely to spoil Japan's recovery', *Asian Wall Street Journal*, 14 August, p 13.

Tett G and P Abrahams (1999), 'Japan's big issue', *Financial Times*, 12 February, p 19.

Truman E (forthcoming), *Inflation targeting in the world economy*, Institute for International Economics, Washington DC.

Ueda K (2000), 'Remarks', delivered at a Conference held by the International Center for Monetary and Banking Studies and CEPR on 'Asset price inflation: what to do about it?', Geneva, 5 May.

Ueda K (2003), 'Deflation and monetary policy in Japan', Center on Japanese Economy and Business, Columbia University, mimeo.

Van Rixtel A and W Hassink (2002), 'Monitoring the monitors: are old boys networks being used to monitor Japanese private banks?', *Journal of the Japanese and International Economies*, 16(1), pp 1–30.

Weinstein DE and Y Yafeh (1998), 'On the costs of a bank-centered financial system: evidence from the changing main bank relations in Japan', *Journal of Finance*, 53(2), pp 635–672.

Yamaguchi Y (1999), 'Asset prices and monetary policy: Japan's experience', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, Kansas City, pp 77–128.

Yamaguchi Y (2002), 'Monetary policy in a changing economic environment', remarks at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, 28–30 August.

Discussion

1. Gordon de Brouwer[1]

Adam Posen raises some big questions about the interaction of asset-price bubbles, economic growth and deflation, and the scope for monetary policy to respond. He has some answers and I broadly agree with his diagnosis and assessment.

Certainly there are few more interesting case studies than Japan on the interaction of asset prices, the macroeconomy, and policy. Japan stands out as the most serious example in the past two decades of how rises and collapses in asset prices can have a devastating impact on the economy. As Adam shows, it is a complex story. This complexity means that many, not just one, factors are at play and that the resolution of the problems requires a set of policy responses.

The focus on Japan in this conference serves two purposes. The first is to highlight the cost of bubbles and examine the place for policy action to limit the worst of excesses in asset-price bubbles. This is obviously important to the debate now occurring in Australia. The second purpose is to focus on the problems of a sustained collapse in asset prices and how to deal with them. Japan matters to the global economy and the sooner it gets its economic act together the better for us all. Adam's paper serves both these purposes.

But discussants are not invited just to say how great a paper is. They are there for debate and testing ideas. To this end, I will revisit the question of the lessons of Japan's experience for other countries, and focus especially on the place of targeted interventions in asset markets. Before I get to this, I would like to look at two structural issues in Japan that may be useful in addressing the lessons from Japan's experience. The first issue is the interplay and connections between the prices of various asset classes. If asset market spillovers exist, policies specifically directed to one asset class may have unintended spillover effects to other asset classes. The second issue is the degree to which asset prices matter to economic activity. If asset prices are particularly important to private decision-makers, then the argument may be stronger for policy actions which address directly the disequilibrium in asset prices.

Structural issue #1: the twin-peaks phenomenon in Japan

It is very well known that asset prices share many common characteristics, including speculative dynamics and herding,[2] and that there are spillovers between assets, both contemporaneously and over time.[3]

---

1. Professor of Economics and Executive Director Australia-Japan Research Centre, Asia Pacific School of Economics and Government, Australian National University. Comments welcome to gordon.debrouwer@anu.edu.au.

2. See, for example, Cutler, Poterba and Summers (1990) and Devenow and Welch (1996).

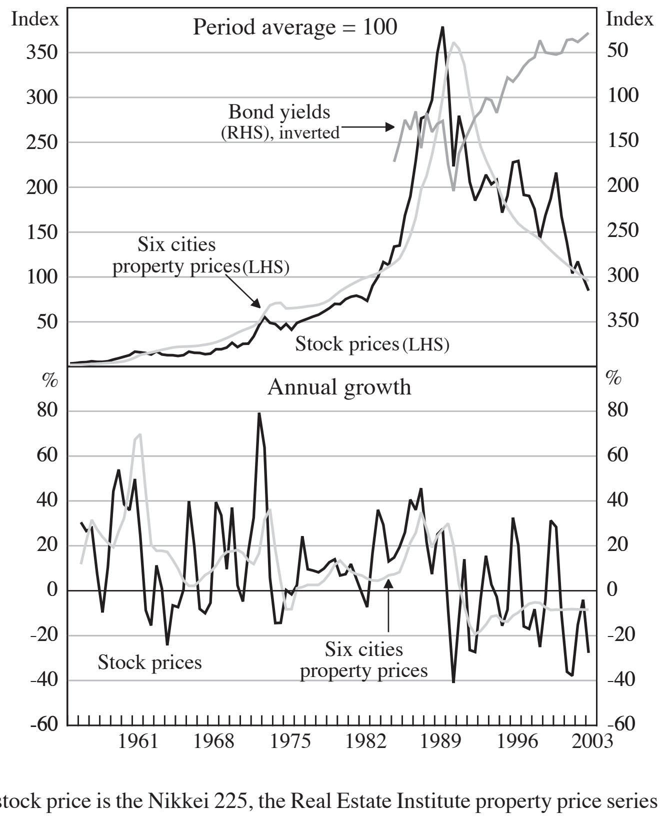
3. See, for example, Rigobon and Sack (2003).

One of these spillovers is the passing of speculative activity from one asset class to another, leading to twin or multiple peaks in the various asset prices. Speculative pressures based on herding behaviour, for example, can build up in one asset class. The collapse of the bubble in that market may lead investors to shift to another asset class, effectively passing bubbles on to the range of different asset classes. A common example is the shift of investment (and speculative dynamics) between stock markets and property markets. A familiar phenomenon in a number of industrial countries in the late 1980s, late 1990s, and early 2000s has been for investors to shift from a falling stock market to property or fixed-interest investments, causing prices in these markets to rise as a result.

Are there twin or multiple peaks in Japanese asset prices? Figure 1 shows measures of stock, property, and bond prices for Japan on a six-month frequency over the past 50 years or so. This is a fairly low frequency over a long period of time.

Figure 1: Classes of Asset Prices in Japan

Six-month frequency



Notes: The stock price is the Nikkei 225, the Real Estate Institute property price series is the six cities average property price (average of residential, commercial and industrial), and 10-year future bond yield. The data are from CEIC, codes JZIA, JELBAA and JZCA respectively. They are indexed in Figure 1 with the base equal to the period average. Bond yields are shown in reverse scale to proxy bond prices.

Source: CEIC

The first point to note is that bubbles (defined as a 'substantial' rise followed by a 'substantial' fall) are not coincident in Japan although they are correlated. The rise (and fall) in stock prices in the early 1960s, mid 1970s and the late 1980s preceded the rise (and fall) in property prices. Both series experienced substantial falls in the 1990s and it is hard, at least by eyeballing the data, to discern which series has led since then. Overall asset-price deflation appears to have dominated price movements in the past decade or so.

The spillover effects at low frequency suggest that the interaction of asset prices over time may be predictable, at least to a limited degree. Table 1 presents a simple probit model to estimate influences on the probability of a price rise in one market. These influences are the recent economic cycle, past price movements in the asset class under consideration, and past price movements in other asset classes.[4]

Not surprisingly, the model for stock prices is particularly weak. But it suggests that past price rises in property prices raise the probability of a rise in stock prices in Japan. The results for modelling property prices are much more robust: past price rises in both property and stocks raise the probability that property prices will rise over a six-month period.

The potential for low-frequency spillover of price changes between different asset classes has an important implication for how and whether policy-makers should try to respond to asset-price movements. If policy-makers choose to respond to what they perceive to be an asset-price bubble, they can do so by using a general instrument – interest rates, or a specific instrument, like tax arrangements or margining

Table 1: Estimated Probabilities of Rising Asset Prices
Probit model of the rise in asset prices

	Tendency for property prices to rise		Tendency for stock prices to rise	
Constant	0.22	[0.52]	0.47	
Δ private final demand (*t*-1)	0.07	[0.60]	–0.11	[0.13]
Δ property prices (*t*-1)	**0.36**	**[0.00]**	**0.08**	**[0.05]**
Δ property prices (*t*-2)			–0.06	[0.10]
Δ stock prices (*t*-1)	**0.06**	**[0.01]**	0.01	[0.54]
McFadden R^2	0.76		0.05	
No of observations	94		93	

Notes: Marginal significance shown in square brackets; bold indicates significant at the 5 per cent level.

4. The probit model assumes a normal distribution. This is satisfied for six-monthly changes in equity prices but not six-monthly changes in average property prices (although it is not an egregious failure).

requirements. There is a risk in using either of these sets of instruments to 'prick' a bubble in that it may just end up shifting the bubble from one asset class to another. The risk of this happening is higher if policy-makers use a market-specific instrument when the initial bubble is the result of easy financial conditions. But Japan is dealing with damaging asset-price deflation. If the correlation between asset markets is structural in nature, say because of arbitrage, then intervention to shift prices up in one market may spill over, happily, to other asset markets.

Structural issue #2: asset prices, the economy and the business cycle

There is a solid ground for thinking that asset prices are important in explaining economic activity. There are obvious mechanisms through which this occurs. Wealth is important in explaining consumption in permanent-income and life-cycle models, and in reducing the bind of liquidity constraints. Higher stock values make it easier for firms to fund investment, all else given. Damaging negative wealth effects occur when the prices of goods, labour and assets are falling but the price of liabilities (like intermediated debt) is fixed in nominal terms.

Asset prices are also important in predicting the economic cycle. Contemporary economics has long analysed asset prices as forward-looking 'jumping' variables driven by expectations about the future. These expectations about the future can extend to the economic cycle. For example, if stock prices are characterised as the present discounted value of future dividends, then the current stock price will be sensitive to expectations about the business cycle, since this affects both the future dividend stream and the discount rate. If expectations are not systematically wrong, it is natural to examine whether asset prices have predictive value in forecasting the economic cycle.

We need to know the evidence for Japan. Do asset prices in Japan help predict Japan's economy and economic cycle? Has this changed over time, especially in the 1990s and early 2000s? We need structural models to address this properly, but a quick and dirty way to assess this is simply to see if changes in stock prices and property prices help predict economic activity. Table 2 sets out Granger causality results for interactions between these asset prices and economic activity. Economic activity is defined as GDP, private final demand, private consumption, private residential investment, private non-residential investment, the Tankan survey measure of actual business conditions, and CPI inflation.

The results are striking. Over the past four and a half decades, domestic property prices and stock prices have been a strong and systematic predictor of Japan's economic cycle. This is most apparent in investment, with stock prices a notably strong predictor of private non-residential investment and property prices a notably strong predictor of private residential investment. While the coefficients are not reported in Table 2, the sum of coefficients is always positive, so rises (falls) in asset

Table 2: Using Asset Prices to Predict Economic Activity
Granger causality tests, six-monthly

Variable doing the predicting	Variable being predicted	Marginal significance 1955:Q2–2003:Q1	Marginal significance 1990:Q1–2003:Q1
Property prices	GDP	0.10	0.27
	Private final demand	**0.04**	0.37
	Private consumption	0.42	0.40
	Private residential investment	**0.05**	0.55
	Private non-residential investment	**0.00**	0.38
	Tankan business conditions	**0.00**	0.18
	CPI inflation	**0.00**	0.08
Stock prices	GDP	**0.00**	0.91
	Private final demand	**0.00**	0.59
	Private consumption	0.16	0.91
	Private residential investment	0.06	**0.02**
	Private non-residential investment	**0.00**	0.12
	Tankan business conditions	**0.00**	0.22
	CPI inflation	**0.00**	0.58

Notes: National accounts data are in constant 1995 prices from 1980–2003 and 1990 prices before then; all variables are percentage change except the Tankan survey of actual business conditions; Granger causality tests conducted in a VAR model with three lags of each variable; bold indicates significant at the 5 per cent level. Tankan is only available from 1974:Q2. The CPI is only available from 1970:Q1.

Source: Author's calculations using data from the CEIC database.

prices are associated with stronger (weaker) economic activity.[5] The implication of this is that an effective policy response to Japan's crisis should aim at breaking the ongoing decline in asset prices.

But there is a big change in these relationships when it comes to the 1990s and early 2000s. As shown in the last column of Table 2, in this case, asset prices no longer have general predictive value in non-structural models. There is one exception: the effect of stock prices on private residential investment and, more marginally, private non-residential investment. Horioka (2003) points out that these are the components of private expenditure in Japan that have performed the worst in the past decade.

5. Oddly enough neither stock prices nor property prices (either average or residential property prices) help predict personal consumption. This does not fit with structural modelling in standard life-cycle representations of consumption in Japan which finds a positive wealth effect on consumption, including from real estate wealth; see, for example, Horioka (2003).

Lessons for other countries from Japan's experience

The depth and breadth of Japan's asset-price collapse are full of lessons for other countries, including those facing bubbles of their own. There are four key points from Japan's experience.

1. The scale of asset-price swings is so great that monetary policy cannot respond directly to them without destabilising output and general prices

As shown in Figure 1, there are huge swings in asset prices over the cycle, by as much as 80 per cent in a half year. The magnitude of these swings is such that they are not something that monetary policy can directly address without causing severe instability in output and general prices.

2. Like the poor, asset-price swings are with us always

Asset-price swings are a permanent feature of the landscape: cycles and bubbles in asset prices in Japan have not diminished or accelerated in the post-war period. Generally speaking, it is hard to accept that policy-makers under a new (enlightened) regime would be able to dampen or eliminate asset-price cycles. If this is right, the key is to minimise the damage from the big swings in asset prices on the balance sheets of households, firms, financial institutions and governments, and, when they do cause harm, dealing with the problems as quickly as is practicable.

3. Targeted interventions to limit asset-price rises or falls may or may not work …

A valuable insight of economics is the importance of assigning the right instrument to the problem at hand. If there is a problem in a specific asset market, the ideal approach is to use the specific instrument that most effectively deals with the problem.

If, for example, policy-makers are concerned that rising asset prices are unsustainable and are artificially and temporarily boosting collateral and borrowing (with the threat of creating debt overhang and weak balance sheets when the bubble bursts), then there is some (at least initial) appeal in the argument that they should raise capital or margin charges on, or otherwise limit, particular forms of borrowing. As Adam says, policy should focus on ensuring the stability of the lending channel.

Similarly, targeted interventions in markets after an asset-price collapse may be appropriate. Consider the arguments in Japan for dealing with deflation. The approach favoured by the economic ministries in Kasumigaseki (and so far resisted by Nihonbashi) is for more aggressive monetisation of central government debt and fiscal deficits. An alternative, and possibly complementary, approach is for official purchases of other assets, including shares and property. The appeal of this latter argument is that if the profound collapse of asset prices has forced households and firms to cut spending to reduce debt and stabilise their balance sheets, then breaking and reversing the downward spiral in asset prices may help stimulate private spending in the economy. The partial evidence presented above may support such a targeted intervention.

If current asset prices are too low, this intervention will be stabilising and will end up being profitable for the authorities. And if the correlations between asset markets reflect structural links, then interventions in one market will spread to others.

4. … but institutions and credibility matter to the effectiveness of policy interventions, be they targeted or general

The success of interventions depends directly on the capacity of institutions to deliver them effectively and the credibility of the policy regime and policy-makers. Having just said that there are arguments for targeted intervention in principle, let me use Japan's experience to outline the practical limitations to such interventions.

Consider, first, targeted interventions to slow down the rise of asset prices. There are two reasons to be cautious about targeted interventions in the upward phase of the asset-price bubble. In the first place, as shown above, the prospect of generating twin or multiple bubble peaks in asset prices is a real one. Dumping on one asset market may just result in shifting speculative activity to another market.

Furthermore, Japan's experience shows just how hard it is to contain a rise in a particular market in practice. The Japanese monetary authorities were deeply concerned in the late 1980s with the sharp rise in speculative activity in property and stock markets. They sought to limit access to finance by imposing lending limits on banks. This was largely unsuccessful because funding was fungible and led to disintermediation from the domestic banking sector. Borrowers were directed to non-bank financial intermediaries, notably the housing loan financial institutions (jusen), and to foreign banks which the authorities were reluctant to control for fear of inducing foreign, especially US, criticism. There were also big gaps in the regulatory net, with different institutions regulated and supervised by different government agencies; the Ministry of Agriculture, Forestry and Fisheries (MAFF) in particular was reluctant to impede the activities of agricultural cooperatives.[6] The upshot was the failure of the regulatory system to deliver. This does not necessarily mean that prudential mechanisms cannot be used to try to limit the impact of asset-price shocks. But it does mean that if targeted policies are to be effective, the regulatory processes need to be well-structured, in the sense of being consistent, coordinated, and flexible. This is a lesson for Australia and other countries facing asset-price bubbles.

The success of targeted interventions when asset prices have fallen too much also depends on the institutional framework and credibility of policy-makers. There are substantial practical problems with targeted intervention to boost the stock or property markets in Japan. The biggest is the credibility of the regime itself. A long history of political and official intervention and manipulation in stock and fixed-interest markets and the importance of money politics in Japan mean that

6. See Ito and Hamada (2003) for an account of this.

official interventions in asset markets are unlikely to be credible unless they are done through blind trusts operated by an independent agency such as the Bank of Japan. There is deep institutional resistance to this. There is also a problem of which assets to buy. It is cleaner to buy property through securitised pooled investments such as property trusts but these are not well developed in Japan. Having a broad and well-developed set of financial markets, including markets in securities over real assets, makes interventions in asset markets easier.

End-piece

There is no shortage of expert advice about whether and how economic policy-makers should respond to asset-price movements. Many of the 'names' of macroeconomics have written on this and they pretty much make every recommendation possible, ranging from not using monetary policy to respond to asset prices (Bernanke and Gertler 2000), using monetary policy to respond to asset prices (Cecchetti *et al* 2000; Bordo and Jeanne 2002), or using alternative market-specific instruments to deal with the bubble (Schwartz 2002). There is a serious proponent for every course of action. This is both distressing to policy-makers, since the economics discipline cannot provide them with clear advice, as well as comforting to policy-makers, since they can say that they have 'right' on their side no matter what they do. In deciding on policy action, these arguments need to be evaluated against the practicalities of the institutional framework and credibility of policy-makers. Whether a particular policy approach is to be taken or not depends not just on whether it is analytically persuasive but also on whether it will work in practice given the grimy reality and credibility of each country's institutional structure.

References

Bernanke B and M Gertler (2000), 'Monetary policy and asset price volatility', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, pp 77–128.

Bordo MD and O Jeanne (2002), 'Boom-busts in asset prices, economic instability, and monetary policy', NBER Working Paper No 8966.

Cecchetti SG, H Genberg, J Lipsky and S Wadhwami (2000), *Asset prices and central bank policy*, Geneva Reports on the World Economy No 2, International Center for Monetary and Banking Studies and Centre for Economic Policy Research, Geneva.

Cutler DM, JM Poterba and LH Summers (1990), 'Speculative dynamics', NBER Working Paper No 3242.

Devenow A and I Welch (1996), 'Rational herding in financial economics', *European Economic Review*, 40(3-5), pp 603–615.

Horioka CY (2003), 'The stagnation of household consumption in Japan', paper presented at the Venice Summer Institute, Venice International University, San Servolo, 25–26 July.

Ito T and K Hamada (2003), 'Bank fragility in Japan 1995–2003', paper presented at the Venice Summer Institute, Venice International University, San Servolo, 25–26 July.

Rigobon R and B Sack (2003), 'Spillovers across US financial markets', NBER Working Paper No 9640.

Schwartz AJ (2002), 'Asset price inflation and monetary policy', NBER Working Paper No 9321.

2. General Discussion

One participant noted that discussion in earlier sessions appeared to have come to a consensus that asset-price misalignments in property markets tend to have a greater impact on the real economy than those in equity markets. If this is the case, the larger role of commercial property in the Japanese bubble, relative to the US experience of the late 1990s, might be one reason why the fall-out from the Japanese crash had been much greater. The participant also emphasised that the de-leveraging that occurred in the Japanese corporate sector after the bubble had significant effects on the real economy as it held down investment growth.

The discussion of Japanese policies touched on Posen's suggestion that the Bank of Japan should have run tighter monetary policy in 1988. One participant suggested that this would have been politically difficult. In his opinion, people at the time appeared to be willing to accept rises in commercial property prices as they were accompanied by strong investment growth, which was thought to be sustainable as people believed that the growth rate of potential output had increased. He also noted that changes in the financial intermediation process made interpreting monetary aggregates difficult at this time. Another participant discussed the conduct of fiscal policy in Japan, and suggested that announcements of expansionary fiscal policy during the 1990s were not always subsequently implemented. He argued that these unfulfilled announcements had resulted in rises in long-term interest rates and crowding-out of real activity.

One participant thought that the Japanese experience highlighted the difficulty in preventing feedbacks from asset-price misalignments to the value of financial institutions' capital, and therefore their ability to lend. More generally, a number of participants were of the view that the reform of the Japanese financial sector to date had occurred at a very slow pace, and that this was impeding necessary structural reforms of the real economy. There also appeared to be broad agreement with the view presented in the paper that this lack of financial sector reform, and to a lesser extent the stance of monetary policy in the middle of the decade, were the main factors behind Japan's poor economic performance over the second half of the 1990s.

There was some discussion of the measure of productivity used in Posen's paper. It was argued that an alternative measure, namely output per hour worked, may have been more appropriate, since it would take into account demographic factors when explaining movements in the level of Japan's productivity. Adam Posen responded that he thought that movements in Japan's productivity over the second half of the 1990s could largely be explained by macroeconomic developments and the deregulation which was undertaken in sectors such as retailing and telecommunications, without recourse to explanations involving demographic factors.

How Should Monetary Policy Respond to Asset-price Bubbles?

David Gruen, Michael Plumb and Andrew Stone[1]

Abstract

We present a simple model of the macroeconomy that includes a role for an asset-price bubble, and derive optimal monetary policy settings for two policy-makers. The first policy-maker, a sceptic, does not attempt to forecast the future possible paths for the asset-price bubble when setting policy. The second policy-maker, an activist, takes into account the complete stochastic implications of the bubble when setting policy.

We examine the optimal policy recommendations of these two policy-makers across a range of plausible assumptions about the bubble. We show that the optimal monetary policy recommendations of the activist depend on the detailed stochastic properties of the bubble. There are some circumstances in which the activist clearly recommends tighter policy than that of the sceptic, while in other cases, the appropriate recommendation is to be looser than the sceptic. Other things equal, the case for 'leaning against' a bubble with monetary policy is stronger the lower the probability of the bubble bursting of its own accord, the larger the efficiency losses associated with big bubbles, and the higher the assumed impact of monetary policy on the bubble process.

1. Introduction

Asset-price bubbles pose difficult problems for monetary policy, and despite considerable debate no consensus has yet emerged on the appropriate strategy for monetary policy-makers in the presence of such bubbles.

Different views about the appropriate role of monetary policy in the presence of asset-price bubbles do not arise primarily because of differences about the objectives of monetary policy. These objectives, it is usually agreed, are to maintain low inflation and to limit the volatility of inflation and output, thereby contributing to stability in both the macroeconomy and the financial system. Rather, the different views are about how best to achieve these objectives.

One view is that monetary policy should do no more than follow the standard precepts of inflation targeting. Proponents of this view would acknowledge that

1. Macroeconomic Group, Australian Treasury (D Gruen) and Economic Group, Reserve Bank of Australia (M Plumb and A Stone). We are grateful to Glenn Stevens for a conversation that initiated this work, and to Guy Debelle, Malcolm Edey, Philip Lowe, Andrew Rose and Dave Stockton for helpful suggestions. The views expressed in this paper are those of the authors and should not be attributed to their employers.

rising asset prices often have expansionary effects on the economy, and might sometimes also provide a signal for incipient inflationary pressures, so that some tightening of monetary policy might be appropriate. According to this view, however, policy should only respond to observed changes in asset prices to the extent that they signal current or future changes to inflation or the output gap. There should be no attempt to use policy either to gently lean against a suspected asset-price bubble while it is growing or, more aggressively, to try to burst it. This view of the appropriate monetary policy response to asset-price bubbles has been put recently by Bernanke (2002).

An alternative view is that monetary policy should aim to do more than respond to actual and expected developments in inflation and the output gap. Cecchetti, Genberg and Wadhwani (2003), prominent proponents of this alternative view, put the argument in these terms:

> … central banks seeking to smooth output and inflation fluctuations can improve... macroeconomic outcomes by setting interest rates with an eye toward asset prices in general, and misalignments in particular ... *Raising interest rates modestly as asset prices rise above what are estimated to be warranted levels, and lowering interest rates modestly when asset prices fall below warranted levels, will tend to offset the impact on output and inflation of [asset-price] bubbles, thereby enhancing overall macroeconomic stability.* In addition, if it were known that monetary policy would act to 'lean against the wind' in this way, it might reduce the probability of bubbles arising at all, which would also be a contribution to greater macroeconomic stability. (p 429, italics added)[2]

We argue here that it is not clear that central banks should follow this advice. There is no universally optimal response to bubbles, and the case for responding to a particular asset-price bubble depends on the specific characteristics of the bubble process.

We present a simple model of the macroeconomy that includes a role for an asset-price bubble, and derive optimal monetary policy settings for two policy-makers. The first policy-maker, a sceptic, makes no attempt to forecast future movements in asset prices when setting policy, perhaps because she does not believe in the existence of the bubble or, alternatively, does not believe that monetary policy should actively respond to it. Her policy settings define the standard inflation-targeting benchmark in our model. The second policy-maker, an activist, takes into account the complete stochastic implications of the bubble when setting policy.

Once the bubble has formed, it is assumed to either grow each year with some probability, or to collapse and disappear. Crucially, and realistically, monetary policy in the model affects the economy with a lag, so that policy set today has its initial impact on the economy next year, by which time the bubble will have either grown further or collapsed.

---

2. Cecchetti *et al* are careful to argue that monetary policy should not target asset prices. To quote them again, 'we are *not* advocating that asset prices should be *targets* for monetary policy, neither in the conventional sense that they belong in the objective function of the central bank, nor in the sense that they should be included in the inflation measure targeted by monetary authorities' (p 429, italics in the original).

For an activist policy-maker, it follows that there are two countervailing influences on monetary policy in the presence of the bubble. On the one hand, policy should be tighter than the standard inflation-targeting benchmark to counter the expansionary effects of future expected growth in the bubble and, in some formulations, to raise the probability that the bubble will burst. On the other hand, policy should be looser to prepare the economy for the possibility that the bubble may have burst by the time policy is having its impact on the economy.

Which of these two influences dominates? For intermediate and larger bubbles – which are of most importance to policy-makers – we argue that it depends on the characteristics of the bubble process. There are circumstances in which the activist should recommend tighter policy than the sceptic. This is likely to be the appropriate activist advice when one or more of the following conditions applies: the probability that the bubble will burst of its own accord over the next year is assessed to be small; the bubble's probability of bursting is quite interest-sensitive; efficiency losses associated with the bubble rise strongly with the bubble's size; or, the bubble's demise is expected to occur gradually over an extended period, rather than in a sudden bust.

Alternatively, however, when these conditions do not apply, it is more likely that the activist should recommend looser policy than the sceptic. This result makes clear that there is no single optimal rule for responding to all bubbles, and also illustrates the quite high level of knowledge of the future stochastic properties of the bubble that is required to set appropriate activist policy.

2. Model

Our model is an extension of the Ball (1999) model for a closed economy. In the Ball model, the economy is described by two equations:

$$y_t = -\beta r_{t-1} + \lambda y_{t-1} \tag{1}$$

$$\pi_t = \pi_{t-1} + \alpha y_{t-1} \tag{2}$$

where y is the output gap, r is the difference between the real interest rate and its neutral level, π is the difference between consumer-price inflation and its targeted rate, and α, β, and λ are positive constants (with $\lambda < 1$ so that output gaps gradually return to zero).

The Ball model has the advantage of simplicity and intuitive appeal. It makes the simplifying assumption that policy-makers control the real interest rate, rather than the nominal one. It assumes, realistically, that monetary policy affects real output, and hence the output gap, with a lag, and that the output gap affects inflation with a further lag. The values for the parameters α, β, and λ that Ball chooses for the model, and that we will also use here, imply that each period in the model is a year in length.[3]

3. Ball's parameter values are $\alpha = 0.4$, $\beta = 1$ and $\lambda = 0.8$. Ball also adds white-noise shocks to each of his equations, which we have suppressed for simplicity.

We augment the model with an asset-price bubble. We assume that in year *0*, the economy is in equilibrium, with both output and inflation at their target values, $y_0 = \pi_0 = 0$, and that the bubble has zero size, $a_0 = 0$. In subsequent years, we assume that the bubble evolves as follows:

$$a_t = \begin{cases} a_{t-1} + \gamma_t & \text{with probability } 1 - p_t, \\ 0 & \text{with probability } p_t. \end{cases} \tag{3}$$

Thus, in each year, the bubble either grows by an amount, $\gamma_t > 0$, or bursts and collapses back to zero. For ease of exposition, in the rest of this section we will assume that γ_t is constant, $\gamma_t = \gamma$, but we will allow for a range of alternative possibilities in the results we report in the next section. We also assume that once the bubble has burst, it does not re-form. To allow for the effect of the bubble on the economy, we modify Ball's two-equation model to read:

$$y_t = -\beta r_{t-1} + \lambda y_{t-1} + \Delta a_t \tag{4}$$

$$\pi_t = \pi_{t-1} + \alpha y_{t-1}\,. \tag{5}$$

In each year that the bubble is growing it has an expansionary effect on the economy, increasing the level of output, and the output gap, by γ. The bubble is, however, assumed to have no direct effect on consumer price inflation, although there will be consequences for inflation to the extent that the bubble leads the economy to operate with excess demand as it expands, and with excess supply when it bursts.

When the bubble bursts, the effect on the economy is of course contractionary – if the bubble bursts in year *t*, the direct effect on output, and the output gap, in that year will be $\Delta a_t = -(t-1)\gamma$. Thus, the longer the bubble survives, the greater will be the contractionary effect on the economy when it bursts.

We will assume that the evolution of the economy can be described by this simple three-equation system (Equations (3), (4) and (5)). But we distinguish between two policy-makers: a sceptic who doesn't try to second-guess asset-price developments, and an activist who believes that she understands enough about asset-price bubbles to set policy actively in response to them.[4]

We assume that the policy-makers observe in each year whether the bubble has grown further, or collapsed, before setting the interest rate for that year. Given the nature of the lags in the model, this year's interest rate will have no impact on real activity until next year, and on inflation until the year after that.

We also assume that the two policy-makers have the same preferences, and that they care about the volatility of both inflation and output. Thus we assume that in each year *t*, policy-maker *p* (activist or sceptic) sets the real interest rate, r_t, to

4. To draw the distinction more precisely, both policy-makers understand how the output gap and inflation evolve over time, as summarised by Equations (4) and (5). The activist also understands, and responds optimally to, the stochastic behaviour of the bubble, as summarised by Equation (3). The sceptic, by contrast, responds to asset-bubble shocks, Δa_t, when they arrive, but assumes that the expected value of future shocks is zero.

minimise the weighted sum of the expected future squared deviations of inflation and output from their target levels, or in symbols, sets r_t to minimise

$$\sum_{\tau=t+1}^{\infty}\left[E_t^p(y_\tau^2)+\mu E_t^p(\pi_\tau^2)\right] \tag{6}$$

where μ is the relative weight on the deviations of inflation and E_t^p is the year t expectation of policy-maker p. In the results we show in the paper, we set $\mu = 1$, so that policy-makers are assumed to care equally about deviations of inflation from target and output from potential.

In setting policy each year, the sceptical policy-maker ignores the future stochastic behaviour of the bubble. Since certainty equivalence holds in the model in this setting, Ball shows that, for the assumed parameter values, optimal policy takes the form

$$r_t = 1.1y_t + 0.8\pi_t \tag{7}$$

which is a more aggressive Taylor rule than the 'standard' Taylor rule introduced by Taylor (1993), $r_t = 0.5y_t + 0.5\pi_t$.

As the bubble grows, the sceptical policy-maker raises the real interest rate to offset the bubble's expansionary effects on the economy. But she does so in an entirely reactive manner, ignoring any details about the bubble's future evolution. Once the bubble bursts, output falls precipitously and the sceptical policy-maker eases aggressively, again in line with the dictates of the optimal policy rule, Equation (7).[5]

We assume that the activist policy-maker learns about the bubble in year *0*, and hence takes the full stochastic nature of the bubble into account when setting the policy rate, r_t, from year *0* onwards. Once the bubble bursts, however, there is no further uncertainty in the model, and the activist policy-maker simply follows the modified Taylor rule, Equation (7), just like the sceptical policy-maker.

3. Results

In this section, we present optimal policy recommendations through time, assuming that the bubble survives and grows. We focus on the growth phase of the bubble's life because it is of most policy interest, as it generates the most disagreement about which policy approach is preferable. Once the bubble bursts, by contrast, there is general agreement that it is appropriate to ease aggressively to offset the contractionary effects of the bust.[6]

Our main aim is to compare the optimal policy recommendations of the sceptic with those of an activist, over a range of plausible alternative assumptions about

5. We implicitly assume that the zero lower bound on *nominal* interest rates is not breached when policy is eased after the bubble bursts, so that the real interest rate can be set as low as required by Equation (7).

6. For completeness, Appendix A shows optimal interest rate recommendations both before and after the bursting of the bubble.

the stochastic nature of the bubble. To do so in a meaningful way, it is necessary that the two policy-makers face an economy in the same state in each year. Since the current state of the economy depends on previous policy settings (as well as on the evolution of the bubble) we will assume throughout that the policy settings that are actually implemented each year are those chosen by the sceptic.

We can then meaningfully ask each year: given the state of the economy, what are the current optimal policy recommendations made by the different policy-makers? The activist's recommendations will depend on the assumptions she makes about the future possible paths of the bubble, while the sceptic's will not, since she assumes that future asset-price shocks have no expected effects.

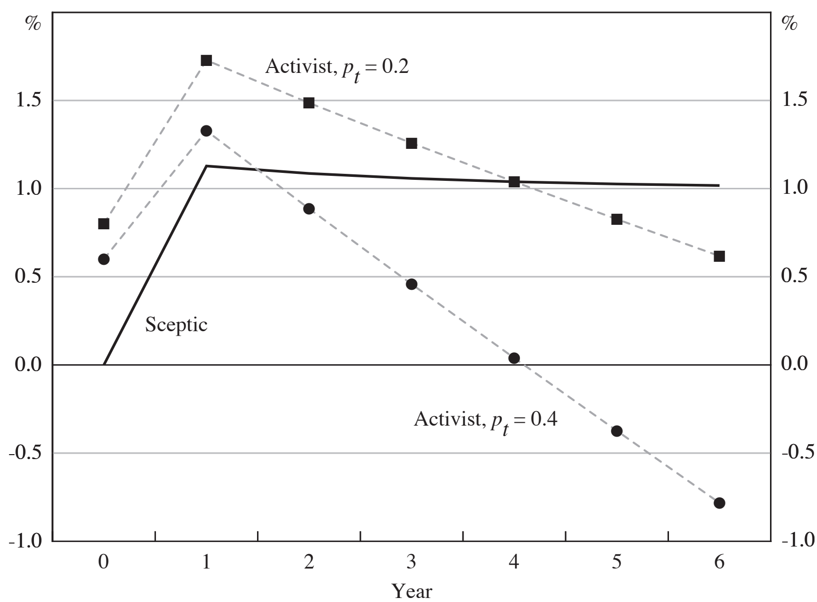
3.1 Baseline results: policy cannot affect the bubble

We begin with some simple baseline results. For these results, we assume that the bubble's direct expansionary effect on output in each year of its growth is a constant 1 per cent (i.e., $\gamma_t = 1$). Figure 1 shows the optimal policy choices made by the sceptic and two activists. We focus first on the sceptic, and then on the activists.

Since the sceptic assumes that future asset-price shocks have no expected effects, she responds to the bubble only when its initial expansionary effects are manifest

Figure 1: Real Interest Rate Recommendations While the Bubble Survives

Policy has no effect on the bubble



Notes: The sceptic implements policy in each year. Real interest rates are deviations from neutral.

in year *1*. As time proceeds and the bubble grows, she sets the policy interest rate in line with Equation (7), which is optimal given her beliefs about future asset-price shocks. Of course, were the bubble to burst, she would ease immediately (see Appendix A for further details).

An activist, deciding on optimal policy in year *t*, understands that if the bubble continues to grow, its direct effect on output next year will be +1 per cent, while if it bursts, the direct effect next year will be $-a_t$ per cent. If the probability of bursting each year is a constant, p^*, the bubble's expected direct effect on output next year is $(1-p^*)-p^*a_t$.

Certainty equivalence applies to this baseline version of the model.[7] It follows that the difference between the policy interest rates recommended by the activist, r_t^a, and the sceptic, r_t^s, depends only on their different assessments of the expected effect of the bubble on output next year. With the sceptic assuming that the bubble will have no expected effect on output next year, it follows that

$$r_t^a - r_t^s = (1-p^*) - p^*a_t \quad . \tag{8}$$

Equation (8) implies that the activist will recommend tighter (easier) policy than the sceptic whenever, in probability-weighted terms, the expansionary effect on real activity from the bubble surviving is greater (less) than the contractionary effect from the bubble collapsing.

For the results shown in Figure 1, we assume that the only difference between the two activists is that one assesses the probability that the bubble will burst each year as $p_t = p^* = 0.2$ (the 'durable-bubble activist'), while the other assesses it as $p_t = p^* = 0.4$ (the 'transient-bubble activist').[8]

In terms of their optimal policy recommendations, the two activists agree that policy should be tighter than the settings chosen by the sceptic for the first couple of years of the bubble's growth (including year *0*, since that is when they learn about the bubble). Although they disagree about the details, they share the assessment that the continued probable growth of the bubble is a more important consideration for policy than the bubble's possible collapse.

The activists both understand, however, that as time proceeds, the bubble is getting bigger and the size of the prospective bust is also getting bigger. As a consequence, if the bubble survives for more than a year or two, the two activists no longer agree

7. The model set-up is more complex than the standard set-up in which certainty equivalence applies. This is because, once the bubble bursts, there are no further asset-bubble shocks and hence, *ex ante*, the distribution of shocks is not independent through time. It is therefore not straightforward to demonstrate certainty equivalence. Nevertheless, Equation (8) in the text does follow and can be generalised to allow for alternative parameter values, time-varying bubble growth and/or probabilities of bubble collapse, provided that the evolution of the bubble remains independent of the actions of the policy-makers. The generalised equation is $r_t^a - r_t^s = \beta^{-1}[(1-p_{t+1})\gamma_{t+1} - p_{t+1}a_t]$ which, in particular, implies that $(r_t^a - r_t^s)$ does not depend on α, λ or μ. A proof of this equation is available from the authors on request.

8. Assuming $p_t = 0.2$ implies an average remaining life for the bubble of five years, while $p_t = 0.4$ implies an average remaining life of two and a half years.

about whether policy should be tighter or looser than the modified Taylor-rule settings chosen by the sceptic. The durable-bubble activist recommends tighter policy because she assesses the probability of the bubble bursting to be small, but the transient-bubble activist recommends looser policy because her assessment is that this probability is larger.

If the bubble survives for long enough the two activists will again concur at least in the direction of their policy advice – they will both recommend looser policy than the sceptic because the possibility of the by-now-bigger bubble collapsing eventually dominates for them both.

In this case, then, the policy recommendations of an activist — and even whether she recommends tighter or looser policy than the benchmark settings chosen by the sceptic — depend crucially on her assessment of the probability that the bubble will collapse of its own accord. This is an important example of the general point that the activist's policy advice will depend critically on the detailed assumptions she makes about the stochastic properties of the bubble. This is the central insight of the paper. We now show the relevance of this insight across a wide range of alternative assumptions about the bubble's stochastic behaviour.

3.2 Sensitivity analysis[9]

3.2.1 Policy affects the probability that the bubble will burst

An obvious extension to the model is to assume that by setting tighter policy *this year*, the policy-maker can raise the probability that the bubble will burst *next year*. For simplicity, we initially assume a linear relationship between the interest rate and the probability of the bubble bursting:

$$p_t = p^* + \delta(r_{t-1} - r^*_{t-1}). \tag{9}$$

We assume that $\delta = 0.1$, so that a 1 percentage point rise in the real interest rate this year raises the probability of the bubble bursting next year by 0.1, subject to the constraint that $0 \le p_t \le 1$. The path of interest rates, r^*_t, $t \ge 0$, is the optimal path chosen by the sceptical policy-maker.[10]

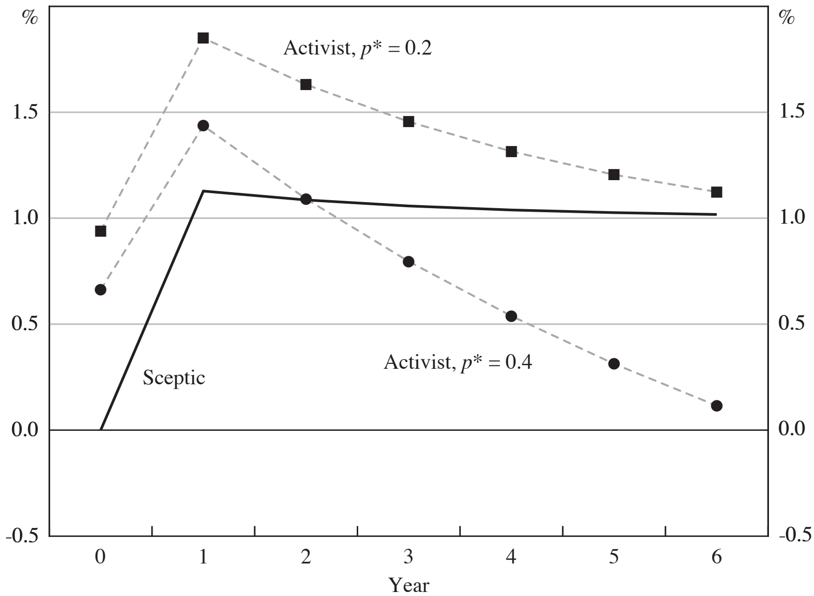
As before, we assume that the bubble's direct expansionary effect on output in each year of its growth is a constant 1 per cent (i.e., $\gamma_t = 1$). Figure 2 shows the optimal

9. Most of the extensions we examine in this section imply that certainty equivalence no longer applies to the model (the exceptions are the bubble that collapses over two or more years and the rational bubble), in which case the results must be derived by numerical optimisation. To simplify the numerical problems, we assume that if the bubble survives until year *14* (which is a very unlikely event for all the parameter values we consider) then it bursts with certainty in that year. For earlier years, this assumption is only relevant for the policy choices of the activist policy-maker.

10. We choose the functional form in Equation (9) so that, for the benchmark policy settings chosen by the sceptic, $p_t = p^*$ for all t. The results generated using an alternative functional form, $p_t = p^* + \delta\, r_{t-1}$, are qualitatively very similar to those shown.

Figure 2: Real Interest Rate Recommendations While the Bubble Survives

Policy affects the bubble's probability of bursting



Notes: The probability of the bubble bursting is given by Equation (9) with $\delta = 0.1$. The sceptic implements policy in each year. Real interest rates are deviations from neutral.

policy recommendations made by the sceptic and two activists. The two activists again differ only in their assessment of the bubble's probability of collapse. Both believe that this probability is given by Equation (9), but the durable-bubble activist believes that $p^* = 0.2$, while the transient-bubble activist believes that $p^* = 0.4$.

The sceptic's optimal policy profile is the same as in Figure 1, because she ignores the future stochastic details of the bubble. By contrast, it is optimal for the activists to recommend tighter policy than they would recommend if they had no influence on the bubble, as can be seen by comparing the activist profiles in Figures 1 and 2. By tightening somewhat, the activists reduce the probability that the bubble will grow further and be more disruptive to the economy when it ultimately bursts. Nevertheless, the optimal policy continues to depend, sensitively, on the activist's assessment of the bubble's probability of collapse, just as it did when the activists could not affect the bubble.

It is also of interest to see how the results change when we vary the sensitivity to interest rates of the bubble's probability of collapse. For this exercise, we assume a monotonically increasing, but non-linear, relationship between interest rates and this probability, to avoid a corner-solution problem with the linear form (explained shortly). The relationship we assume is:

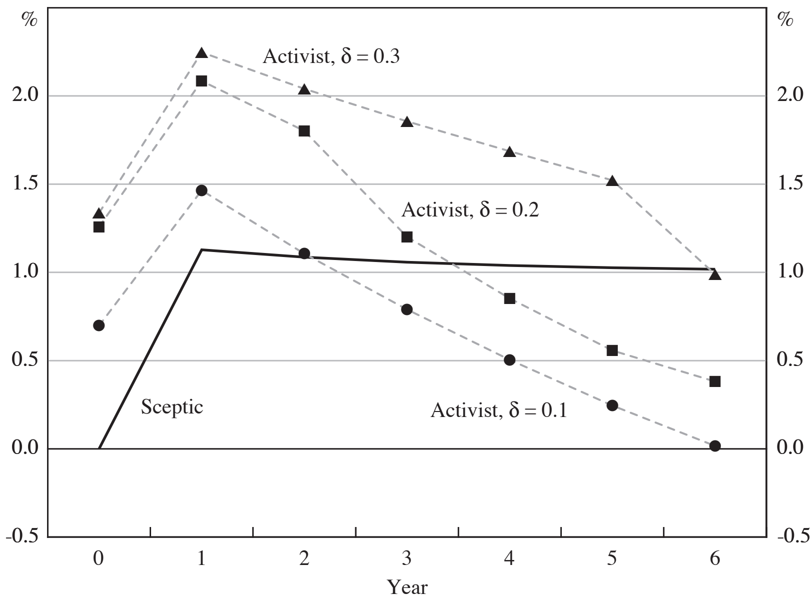
$$p_t = [exp(a(r_{t-1} - r^*_{t-1}) + b) + 1]^{-1} \tag{10}$$

where $a = -\delta/[p^*(1-p^*)]$ and $b = ln[(1-p^*)/p^*]$. For this functional form, $p_t = p^*$ when $r_{t-1} = r^*_{t-1}$ and $\frac{\partial p_t}{\partial(r_{t-1} - r^*_{t-1})} = \delta$ when this derivative is evaluated at $r_{t-1} = r^*_{t-1}$. These two features are also features of the linear form, Equation (9). The advantage of the non-linear form, Equation (10), is that, while raising last year's interest rate, r_{t-1}, raises the probability that the bubble will burst this year, p_t, it cannot drive that probability to 1, as can occur with the linear form.[11]

Figure 3 shows a comparison of optimal interest rate recommendations for the sceptic and three activists. The activists assume that the bubble's probability of

Figure 3: Real Interest Rate Recommendations While the Bubble Survives

Varying the interest sensitivity of the probability of bursting



Notes: The probability of the bubble bursting is given by Equation (10) with p* = 0.4. The sceptic implements policy in each year. Real interest rates are deviations from neutral.

11. It seems implausible that moderate rises in the real interest rate would burst the bubble with certainty; yet that is an implication of the linear form, Equation (9). Simulations of the linear model with $\delta > 0.1$ do indeed generate this outcome (results not shown). It is for this reason that we use the non-linear form for simulations with $\delta > 0.1$. As argued by Dave Stockton in his comments on this paper, one could also imagine that the relationship between the bubble's probability of collapse and the policy interest rate might be non-monotonic, with small interest-rate rises *lowering* the subsequent probability of collapse. This would undoubtedly further complicate the optimal policy recommendations of an activist.

bursting is given by Equation (10) with $p^* = 0.4$ (except $p_{14} = 1$), but they assume three different degrees of interest-rate sensitivity: $\delta = 0.1$, $\delta = 0.2$ or $\delta = 0.3$.

The pattern of optimal interest rate recommendations is somewhat similar to those in Figures 1 and 2. When the bubble is very small, the activists all agree that policy should be tighter than the setting chosen by the sceptic. But this consensus among the activists evaporates as the bubble gets bigger, and from year *2* onward, first one and then two of the three activists recommend looser policy than the sceptic, while the activist who believes that the bubble is highly interest-sensitive ($\delta = 0.3$) continues to recommend tighter policy, at least until year *6*.

3.2.2 Allowing for efficiency losses

A second natural extension is to allow for efficiency losses associated with the bubble. There are two broad ways to motivate the idea of efficiency losses. They can be motivated in terms of the economically inefficient physical over-investment that is put in place in response to asset-price rises that are not based on fundamentals, or in terms of the damage done to the financial system when the bubble bursts.

Either way, it seems plausible that the efficiency losses rise with the size of the bubble. To account for these losses, we re-formulate the policy problem as setting r_t to minimise

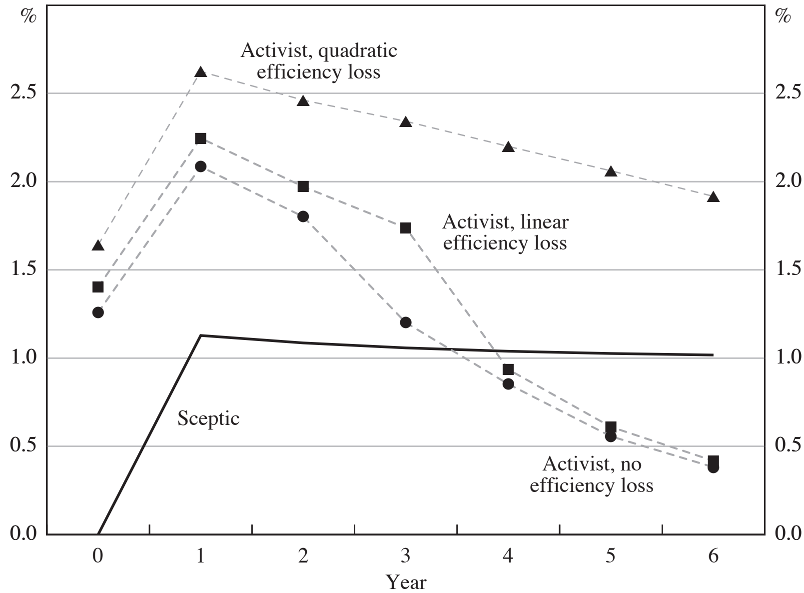
$$E_t^p[\max(a_\tau)]^\kappa + \sum_{\tau=t+1}^{\infty}\left[E_t^p(y_\tau^2) + E_t^p(\pi_\tau^2)\right] \tag{11}$$

where we assume that the efficiency losses rise either linearly with the maximum size of the bubble ($\kappa = 1$) or with the square of this maximum size (quadratic case, $\kappa = 2$). We also assume, as before, that the relative weight on inflation deviations, μ, takes a value of one. Since the sceptic ignores the bubble, we assume for her that $E_t^s[\max(a_\tau)]^\kappa \equiv 0$.

Figure 4 shows a comparison of optimal interest rate recommendations for the sceptic and three activists. The activists all assume that the bubble's probability of bursting is given by Equation (10) with $p^* = 0.4$, and with interest-rate sensitivity, $\delta = 0.2$. The first activist, however, makes no allowance for efficiency losses, and hence minimises the standard loss function, Equation (6). The second activist assumes linear efficiency losses, while the third assumes quadratic losses, and so they minimise the loss function, Equation (11), assuming appropriate values for κ.

As previous figures have shown, being able to raise the probability of the bubble bursting gives an incentive to the activist policy-maker to tighten policy somewhat. Figure 4 shows that taking account of efficiency losses associated with an asset-price bubble raises this incentive further, and therefore further raises the optimal interest rate recommendations of the activist. Moreover, if efficiency losses associated with the bubble are assumed to rise sufficiently rapidly with the maximum size of the bubble, then the incentive for the activist to recommend tighter policy than the sceptic is a strong one.

Figure 4: Real Interest Rate Recommendations While the Bubble Survives
Allowing for efficiency losses associated with the bubble



Notes: The probability of the bubble bursting is given by Equation (10) with $p^* = 0.4$ and $\delta = 0.2$. The sceptic implements policy in each year. Real interest rates are deviations from neutral.

3.2.3 Policy affects the bubble's growth

A further natural extension to the simple version of the model involves assuming that, rather than affecting the probability of the bubble bursting, the activist policy-maker can, by setting tighter policy this year, reduce the extent of the bubble's growth next year if it survives. For the simulations we show for this case, we assume that $p_t = p^* = 0.4$ (except $p_{14} = 1$) and that

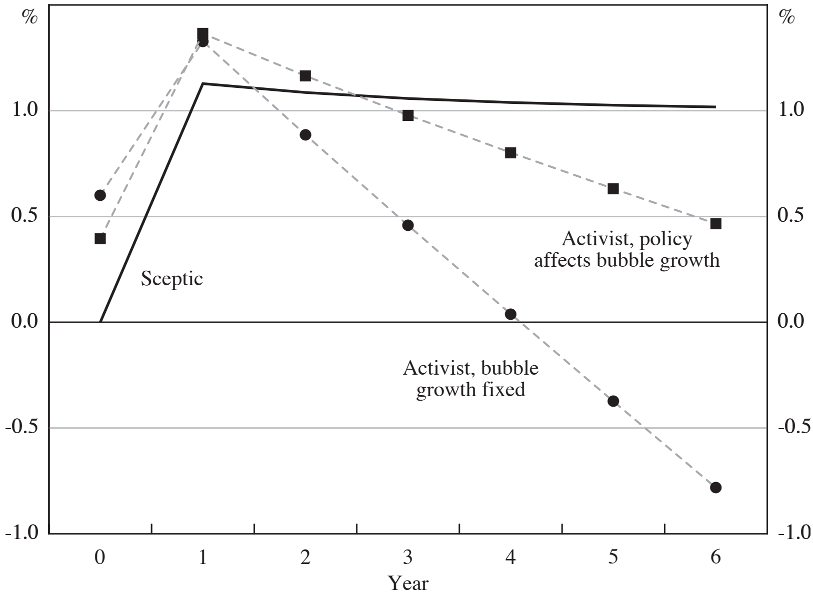
$$\gamma_t = 1 - \phi(r_{t-1} - r^*_{t-1}). \qquad (12)$$

For reasons we discuss shortly, only large values of the parameter ϕ generate significantly changed behaviour by the activist policy-maker. We therefore assume that $\phi = 1$, so that by setting policy 1 percentage point higher than the sceptic this year, the bubble's growth next year is reduced from 1 per cent to nothing.[12] As

12. If the bubble survives, it would again be necessary to set policy 1 percentage point higher than the sceptic to ensure that the bubble did not grow in the subsequent year. Given the effects of continually tight policy on the rest of the economy, it is perhaps not surprising that being able to raise the probability that the bubble will burst has more influence on optimal policy than simply being able to reduce its growth each year by setting tighter policy in each previous year.

Figure 5: Real Interest Rate Recommendations While the Bubble Survives

Policy affects the bubble's growth



Notes: The probability of the bubble bursting is $p_t = 0.4$. The sceptic implements policy in each year. Real interest rates are deviations from neutral.

above, the path of interest rates defined by $r_t^*, t \geq 0$, is the optimal path chosen by the sceptical policy-maker assuming $\gamma_t = 1$.

Figure 5 shows a comparison of optimal interest rate recommendations for the sceptic and two activists. Both activists assume that the bubble's growth is given by Equation (12), but one assumes no interest-rate sensitivity, $\phi = 0$, while the other assumes high sensitivity, $\phi = 1$.[13]

For every year apart from year *0*, being able to reduce the bubble's growth induces the activist policy-maker to recommend tighter policy than she otherwise would. The differences in the policy recommendations induced by this expectation are, however, less pronounced than the differences that arise when an activist policy-maker assesses the probability that the bubble will burst each year at $p_t = 0.2$ rather than $p_t = 0.4$, as can be seen by comparing Figures 1 and 5.

13. The results assuming no interest-rate sensitivity are equivalent to the baseline results shown in Figure 1 for the activist assuming $p_t = 0.4$.

3.2.4 Bubbles that take two or more years to collapse

Another extension to the basic model involves assuming that, when the bubble collapses, it does so evenly over two or more years, rather than suddenly in one. In the examples we have examined until now, the activist must always confront the problem that, owing to the lag structure of the Ball model, policy can only respond to a collapsing bubble after the collapse is complete. This problem is reduced by assuming that the collapse occurs over two or more years rather than one.

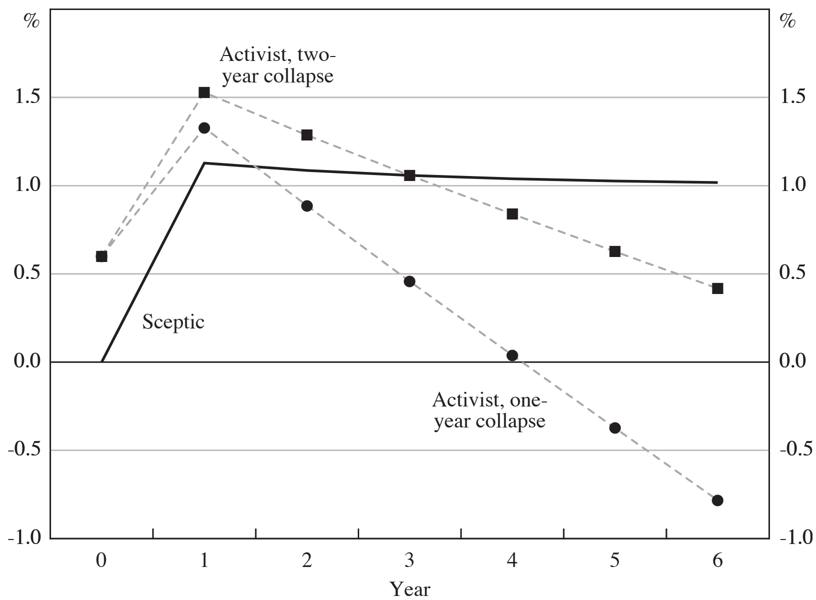
Figure 6 shows results for the sceptic and two activists (one who assumes gradual, even, two-year collapse; the other, sudden), assuming that $p_t = p^* = 0.4$ (except $p_{14} = 1$) and that $\gamma_t = 1$. The activist who assumes that the bubble will collapse only gradually recommends tighter policy than the one who assumes that it will be sudden, because of their different assessments of the bubble's expected effect on next year's output.

Nevertheless, the overall pattern of policy recommendations remains similar to earlier cases. As the size of the bubble grows, the 'gradually-bursting' activist eventually recommends looser policy than the sceptic does, for reasons that are by now familiar.

In cases in which the bubble is expected to collapse evenly over three or more years, the activist would recommend tighter policy than the sceptic for longer,

Figure 6: Real Interest Rate Recommendations While the Bubble Survives

Bubble takes two years to collapse



Notes: The probability of the bubble bursting is $p_t = 0.4$. The sceptic implements policy in each year. Real interest rates are deviations from neutral.

while the bubble is growing, a result that follows from a straightforward extension to Equation (8).

3.2.5 A rational bubble

In the baseline results presented at the beginning of the section, we assumed that the asset-price bubble grew at a uniform rate, $\gamma_t = 1$, and that the probability of the bubble's collapse was constant through time. This seems to us a simple and intuitively appealing baseline case.

In this case, however, there is no arbitrage condition ruling out unexploited profit opportunities in the assets whose price rises constitute the bubble. Our baseline case is therefore not a 'rational' bubble. We do not see this as a shortcoming — to our minds, there is much evidence that the asset-price bubbles we see in modern industrial economies are not rational in this sense (see, for example, Shiller (2000)). Nevertheless, it is of interest to derive results for the case of a rational bubble.

Such a bubble arises from the actions of a rational investor who buys the relevant assets up to the point at which expected profits are driven to zero.[14] If the probability of collapse is constant, p^*, and the capital gain to the investor in year $t+1$ if the bubble collapses is $-a_t$, then a rational risk-neutral investor will be indifferent to holding the asset when the expected growth of the bubble, if it survives, is $\Delta a_{t+1} = a_t p^*/(1-p^*)$. This is a geometrically growing bubble, rather than the constant-growth bubble that constituted our baseline case.[15]

The arbitrage condition that defines this rational bubble implies that the bubble's expected growth over the next year, $E_t^a \Delta a_{t+1}$, is zero. In this case, however, the activist and the sceptic are making identical assumptions about the bubble's expected effect on next year's output. It follows that the activist will always recommend the same policy interest rate as the sceptic for a rational bubble, provided she believes that the stochastic properties of the bubble are not affected by the actions of policy-makers, so that certainty equivalence holds.[16]

---

14. We assume that the assets yield an annual return equal to the real interest rate, so that the expected profit relative to holding 1-year government bonds is determined by the expected capital gain on the assets.

15 Note that, if the probability of collapse is not constant, a rational bubble need not grow at a constant geometrical rate.

16. This result relies on a number of implicit, simplifying assumptions about the economy. In particular, it relies on the assumptions that the effect on the output gap of changes in asset prices is proportional to the size of those changes, and that rational investors and the activist policy-maker agree on the exact stochastic details of the bubble. Relaxing either of these assumptions could generate different policy recommendations by the activist. For example, for a geometrically growing bubble, it could account for an activist policy-maker assessing the bubble's growth rate to be faster (slower) than 'rational' — say, $\Delta a_{t+1} = \chi a_t p^*/(1-p^*)$, with $\chi > 1$ ($\chi < 1$) — in which case the activist's policy recommendations would always be tighter (looser) than the sceptic's, for as long as the bubble survived.

4. Discussion and Conclusions

Table 1 provides a summary of the results. For each set of assumptions, it shows, as time proceeds and the bubble grows, whether the activist would recommend tighter (+), looser (–) or the same (=) policy settings as the sceptic.

There are several broad lessons worth highlighting from this summary. When the asset-price bubble is small enough, the activist policy-maker always (except in the case of the rational bubble) recommends tighter policy than the sceptic who ignores the future possible paths of the bubble. However, this result is of limited practical relevance. Although we have assumed that activist policy-makers learn about the nature of the bubble at its inception, in reality there is likely to be much doubt in the early stages about whether rising asset prices constitute a bubble. Asset-price bubbles rarely arise out of thin air — instead, they usually occur when the evolving economic fundamentals are consistent with some rise in asset prices. While there will always be some doubt about whether rising asset prices constitute a bubble, these doubts would seem particularly acute when the suspected deviation of asset prices from fundamentals remains small and has been short-lived. For these reasons, there would seem to be no strong case for central banks to respond to small asset-price misalignments.[17]

Table 1: Activist's Policy Recommendations While the Bubble Survives
Tighter (+), looser (–), or the same as (=) the sceptic's recommendation

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Policy can't affect bubble						
$p_t = 0.2$	+	+	+	=	–	–
$p_t = 0.4$	+	–	–	–	–	–
Policy affects probability of bursting						
$p^* = 0.2, \delta = 0.1$	+	+	+	+	+	+
$p^* = 0.4, \delta = 0.1$	+	+	–	–	–	–
$p^* = 0.4, \delta = 0.2$	+	+	+	–	–	–
$p^* = 0.4, \delta = 0.3$	+	+	+	+	+	–
Linear efficiency losses	+	+	+	–	–	–
Quadratic efficiency losses	+	+	+	+	+	+
Policy affects bubble growth	+	+	–	–	–	–
Bubble bursts over two periods	+	+	+	–	–	–
Rational bubble	=	=	=	=	=	=

17. Cecchetti *et al* (2003, p 440) also make this point when they say 'our proposal [to raise interest rates modestly as asset prices rise above what are estimated to be warranted levels] does not call for central banks to respond to small misalignments. We agree that these are difficult to detect and are unlikely to have very strong destabilising effects in any case'.

As the bubble grows, however, there are two developments with potentially conflicting implications for appropriate activist policy. On the one hand, an activist policy-maker should become increasingly confident that the observed asset-price rises *do* constitute a bubble, which should strengthen the case for responding actively to them. On the other hand, as the bubble grows, the potential negative effects from its eventual bursting will increase. Whether this constitutes an argument for tighter or looser policy will depend on the nature of the bubble.

The case for tightening is to offset the expansionary effects of future expected growth of the bubble and, in some formulations, to reduce the bubble's growth or help to burst it. As we have seen, there are circumstances in which this case is particularly compelling, in particular when: the probability that the bubble will burst of its own accord over the next year is assessed to be small; the bubble's probability of bursting is quite interest sensitive; efficiency losses associated with the bubble rise strongly with the bubble's size; or, the bubble's demise is expected to occur gradually over an extended period, rather than in a sudden bust. Conversely, the case for loosening is strongest when these conditions are reversed, since in those circumstances it becomes increasingly important to allow for the contractionary impact that arises when the bubble bursts.[18] The stochastic process driving the bubble is thus crucial to determining which of these considerations predominates.[19]

Ultimately, the appropriate policy strategy is a matter for judgement. Since the optimal policy response at any point depends on the stochastic properties of the bubble, our results highlight the information requirements inherent in an activist approach. Where sufficient information about the bubble process is not available to the policy-maker, a robust approach, something along the lines of the one used by our sceptic, may be the best that can be achieved. Given sufficient information about the bubble process an activist approach may be feasible, but our results suggest that the appropriate response to bubbles is not uniform. In particular, it may be optimal to 'lean against' some bubbles but not others, and hence the formulation of an activist strategy requires judgments to be made about the process driving the bubble and its likely sensitivity to monetary policy.

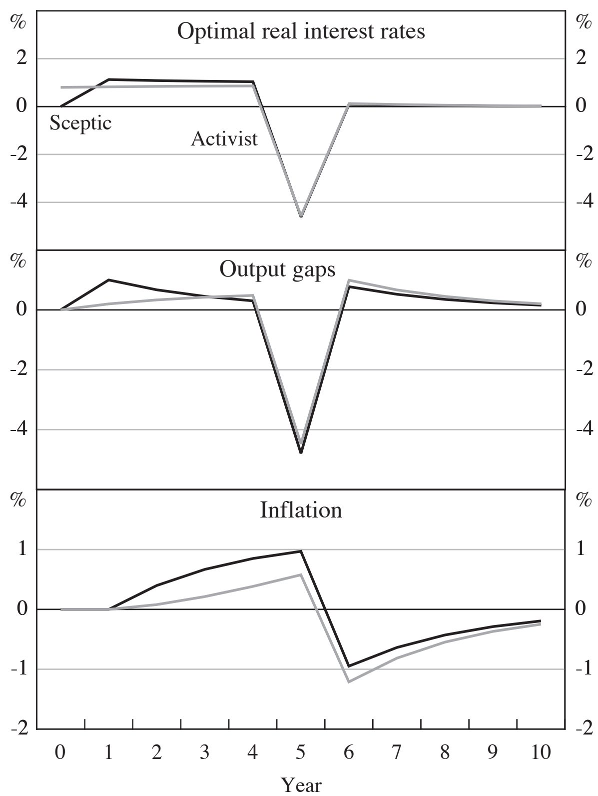
18. In a passage immediately following the one quoted in the previous footnote, Cecchetti *et al* say '... there are clearly times when egregious misalignments exist. Recent examples include Japanese stock and land prices in 1989, and the NASDAQ in late 1999 and early 2000. While some portion of these high price levels may have been justifiable based on fundamentals, few people would deny that a significant component was due to asset market disturbances. Ultimately, in terms of reducing inflation and output volatility, *it is important that central bankers respond to these large relatively "obvious" misalignments*'. (2003, p 440, italics added) When misalignments are large and relatively obvious, however, our results suggest that it may be unclear whether the appropriate policy response should be to raise interest rates modestly or to lower them, unless the policy-maker is able to make use of specific knowledge about the stochastic process driving the bubble.

19. It is also possible that the probability of the bubble bursting of its own accord over the next year might rise as the bubble gets larger. If so, the case for looser, rather than tighter, policy by the activist is further strengthened, a point also made by Kent and Lowe (1997) (see Appendix B). For most of our simulations, we have assumed $p^* = 0.4$, implying an average remaining life for the bubble of two and a half years, which may be a more plausible assumption for intermediate and larger bubbles than $p^* = 0.2$, which implies an average remaining life of five years.

Appendix A: Policy Settings for a Bubble that Bursts in the Fifth Year

We assume a constant probability $p_t = 0.2$ that the bubble bursts in each year. In contrast to the simulations reported in the text, we allow both the sceptic and the activist to implement policy through time — so that the state of the economy depends on the identity of the policy-maker. Figure A1 shows results assuming that, as events turn out, the bubble grows for four years, during which time it has a direct expansionary effect on output of $\gamma = 1$ per cent in each year, and then bursts in the fifth year, with a direct contractionary effect on output of 4 per cent in that year.[20] The top panel shows the real interest rate profiles, r_t, set by the two policy-makers; the second and third panels show the outcomes for the output gap, y_t, and the inflation rate, π_t.

Figure A1: Results for Bubble that Happens to Burst in the Fifth Year



Notes: The bubble's *ex ante* probability of bursting in each year is $p_t = 0.2$. Real interest rates are deviations from neutral; inflation rates are deviations from target.

20. A bubble with a probability of bursting each year of $p_t = 0.2$ bursts on average in the fifth year.

While the bubble is growing, the paths for output and inflation generated by the sceptic's policy settings reflect the continued expansionary effects of the bubble. The activist responds more aggressively to these expansionary effects because she anticipates them, but nevertheless she does not offset them completely because of the possibility that the bubble may be about to burst. Therefore, even with the activist's optimal policy settings, output and inflation remain above target while the bubble survives.

The bursting of the bubble in year *5* generates a severe recession. Output falls by more than the direct contractionary effect of the bubble bursting, because policy in the previous year has been tighter than neutral to offset the bubble's expansionary effects. In response to the bubble's collapse, policy is eased aggressively. Despite using the same policy rule after the bubble bursts, the modified Taylor rule, Equation (7), the paths for the policy interest rate, output, and inflation are somewhat different for the two policy-makers because they have set different policy interest rates in earlier years.

Appendix B: Comparison with Kent and Lowe (1997)

Kent and Lowe (1997) present a simple model of an asset-price bubble that has similarities with ours. They derive optimal activist policy in their model for two of the cases we have examined: when the probability of the bubble collapsing is exogenous, and when this probability rises with the previous period's policy interest rate.[21]

Kent and Lowe show that, when policy cannot affect the bubble's probability of collapse, optimal activist policy generates average inflation in their period *2* equal to the central bank's target rate of inflation. When policy can affect the bubble's probability of collapse, however, optimal activist policy generates average inflation in period *2 less than* the central bank's target rate of inflation (where the averages are calculated over all possible outcomes for the bubble).

The qualitative nature of these results carries over to our model set-up. When policy cannot affect the bubble, average inflation in every year of our model is also equal to the central bank's target. When policy can affect the bubble, however, either by affecting its probability of bursting or its rate of growth, average inflation from year *2* onward is always less than the central bank's target when activist policy is implemented.[22]

Kent and Lowe use their model to make the case that, when policy can affect the bubble's probability of collapse, it may make sense for the policy-maker to raise interest rates early in the life of the bubble, even though this will increase the likelihood of inflation being below target in the near term. As we have seen, this general case — for tightening policy early in the life of the bubble — survives in our model. What our model adds to this story is that 'early in the life of the bubble' may not last very long. For many of our simulations, within a couple of years or so of the bubble's inception, it is no longer clear whether optimal activist policy should be tighter or looser than the policy chosen by a sceptic.

21. Theirs is a three-period model in which the bubble, which has formed in period *1*, can either grow or collapse back to zero in period *2*, and if it has grown, can grow further or collapse in period *3*. Their periods should therefore probably be thought of as spanning more than one year.

22. Recall that it takes two years for policy changes to affect inflation in our model. As for the Kent and Lowe model, in each year the averages must be calculated over all possible outcomes for the bubble, weighted by their appropriate probabilities. Calculated in this way, the averages are therefore equivalent to period-*0* expectations.

References

Ball L (1999), 'Efficient rules for monetary policy', *International Finance*, 2(1), pp 63–83.

Bernanke BS (2002), 'Asset-price "bubbles" and monetary policy', remarks before the New York Chapter of the National Association for Business Economics, New York, 15 October. Available at <http://www.federalreserve.gov/boarddocs/speeches/2002/20021015/default.htm>.

Cecchetti SG, H Genberg and S Wadhwani (2003), 'Asset prices in a flexible inflation targeting framework', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 427–444.

Kent C and P Lowe (1997), 'Asset-price bubbles and monetary policy', Reserve Bank of Australia Research Discussion Paper No 9709.

Shiller RJ (2000), *Irrational exuberance*, Princeton University Press, Princeton.

Taylor J (1993), 'Discretion versus policy rules in practice', *Carnegie-Rochester Conference Series on Public Policy*, 39, pp 195–214.

Discussion

1. David Stockton[1]

The subject of the paper by David Gruen, Michael Plumb and Andrew Stone — how monetary policy should respond to asset prices — is obviously an important one. The formation of bubbles in asset prices and the eventual demise of those bubbles have the potential to cause damage to our economic and financial systems. Macroeconomic instability in the form of unwelcome variability of output and inflation can be one consequence of bubbles. Moreover, to the extent that private and public economic agents act on distorted signals provided by asset markets, resources can be misallocated — and those misallocations can involve more persistent costs when transmitted through capital spending decisions. And, asset-price bubbles carry with them the potential for heightened financial fragility and the possible feedback of that fragility on economic performance. So limiting the damage associated with asset-price bubbles, if possible, is certainly a worthy objective.

The paper by Gruen *et al* is a very refreshing contribution to the growing literature on the subject of the appropriate response of monetary policy to asset-price bubbles. It is a powerful paper largely because it is modest in its ambitions. Ultimately, policy-makers and those advising them need to be able to answer three questions before implementing policies to counter or lean against the emergence and perpetuation of asset bubbles. Can we with reasonable assurance detect the existence of an asset bubble? Once detected, can we calibrate monetary policy in a manner that with reasonable assurance will reduce the volatility of output and inflation? And finally, can we demonstrate and communicate clearly the effectiveness of that policy in a way that garners the support of the public on whose behalf we take these actions?

In this paper, the authors confine their attention to the question of calibrating monetary policy in the known presence of an asset bubble. Their principal contribution is to demonstrate that the optimal policy depends on the specific stochastic properties of the bubble. That might sound like a rather obvious finding, and it is. But the authors have given at least theoretical life to some of the real-world concerns that monetary policy-makers have about formulating policy in the face of an asset bubble; specifically, in response to a bubble that might continue growing or that might burst, they address the question of whether and when policy should be tighter than might otherwise be recommended and whether and when policy should be looser than would otherwise be recommended. Their work is not entirely unique in that regard (see Kent and Lowe (1997)), but this paper is a clear step forward.

1. Director, Division of Research and Statistics, Board of Governors of the Federal Reserve System. I have benefited from conversations on this subject with Robert Tetlow and David Reifschneider. The views are those of the author and not necessarily those of the Board of Governors, the Federal Reserve System, or other members of the staff.

To appreciate the paper, it needs to be placed in the existing literature. Much of the earlier work in this area adopted a framework that employed a linear, or at least linearised, rational expectations model of the economy and sometimes assumed rationality, or near-rationality, of the bubble (see Bernanke and Gertler (2000, 2001), Cecchetti *et al* (2000), and Cecchetti, Genberg and Wadhwani (2003)). In addition most work employed a quadratic loss function in the central bank's objectives, and assumed no preference for asset-price stabilisation *per se*. The assumptions of a quadratic loss function and no specific preferences about asset prices are retained in this paper. But much of the mileage gained by the paper comes from dropping rational expectations. Instead, the authors employ a very simple linear backward-looking model of the economy and, for most of the paper, abandon the assumption of a rational bubble. The authors employ some of the freedom that they have allowed themselves to add the possibility of a bubble process that is endogenous to monetary policy.

The framework employed by previous researchers was chosen for understandable reasons. There was a desire to stick with the tractable linear-quadratic modelling framework. Moreover, there is no generally accepted theory about how policy affects bubbles. And when employed, the assumption of rational bubbles, or nearly rational bubbles, imposed restrictions on the stochastic process for asset prices.

But in some circumstances, there are costs to confining one's attention to tightly parameterised rational expectations models. One is that the world usually works out fairly well for a reasonably competent policy-maker because the expectations formation process of a very well-informed public facilitates the effectiveness of policy in these models. Central bankers do not face especially difficult problems when there are strong self-correcting mechanisms at work in the economy (Mussa 2002). While the assumption of strong self-correcting mechanisms may not be a bad one in most states of the world, it can come close to defining away the problem when considering asset-price bubbles. In the world of a bubble, the normally well-informed rational public may at least temporarily be suffering from a bout of delusion. Central bankers face more daunting challenges when the behaviour of private agents is driving the economy away from equilibrium. For that reason, the authors have taken a useful step by considering the implications of handing back the informational advantage to the policy-makers.

The informational advantage of the policy-makers is shifted to an extreme in the model; the results illustrate the gains that would be available to policy-makers if they could **fully** characterise the stochastic process for the bubble. As noted in the paper, the basic insight is that, using this information, policy should be kept tighter than otherwise when the size of the bubble is known to be small in order to counteract its unwarranted expansionary effect, but should be kept looser than otherwise when the bubble is known to be large in order to cushion the potential sizable negative effects should the bubble collapse.

But perhaps more important than this result is the demonstration in the paper of the information required to implement this policy. In addition to knowing the complete structure of the economy, our policy-maker is assumed to know the following:

(i) the size of the prospective increment to the bubble should it continue (γ); (ii) the probability that the bubble will burst the next period (p); (iii) the sensitivity of the probability of the bubble bursting to changes in the policy interest rate (δ); (iv) the sensitivity of the size of the bubble increment to the policy interest rate (ϕ); and (v) the characteristics of the bubble collapse, when it occurs, in terms of size and duration.

This is one very smart policy-maker. We central bank economists, and our academic colleagues, are indeed a very clever lot. But I am sceptical that we are clever enough to fill in those parameters and solve that model with enough conviction to implement policy. In January 2000, tightening policy in the United States to lean against the bubble, in the end, would have only exacerbated the effects of its impending demise. But, it would have required enormous confidence on the part of monetary policy-makers to have begun an easing of monetary policy at that time to cushion, in expected value terms, the deflation of the then-mounting asset-price bubble. In terms of illustrating the information requirements of implementing an optimal policy in the face of a bubble, the model developed by Gruen *et al* delivers the goods.

Let me note a few aspects of the paper that I found less than fully satisfying. For one, I did not especially care for the distinction made between the sceptical policy-maker and the activist policy-maker. The authors are actually comparing the actions of an ignorant policy-maker and a knowledgeable policy-maker. The differences in the model are not about how these policy-makers confront and respond to uncertainty but rather are about how better information concerning the stochastic process governing the bubble affects the formulation of monetary policy. It should not be surprising that better information leads to better policy — though even here the authors do not provide a sense of the dimensions of the resulting welfare gains. It would perhaps be more illuminating to consider a sceptic to be a policy-maker with diffuse priors about the key parameters of the stochastic process of the bubble and an activist to be a policy-maker more confident of those parameter estimates.

More generally, I would recommend that when extending this work the authors turn their attention to incorporating uncertainty more completely into this framework. After all, coping with risks and uncertainties is the central preoccupation of policy-makers; policy-makers live in a stochastic environment with poorly identified models and many sources of shocks. Hence, it would be helpful to know how optimal monetary policy would be formulated when the policy-maker is concerned both with the consequences of not taking action when there is the possibility that a bubble has formed and with the consequences of taking action in the belief that a bubble has formed when in fact it has not. Those considerations are almost always in play because, as is widely recognised, bubbles often have their origins in unobservable changes in fundamentals. In the United States, the interaction of productivity and asset prices was, and remains, a key feature of the events of the past decade. Adding in uncertainty more explicitly would provide important texture to the policy-setting process that is absent from this model.

Although even the simple model examined in the paper involves considerable informational complexity, a few elaborations should be considered. For one, the endogeneity of the bubble with respect to policy could be more complicated than the simple linear formulations examined in the paper. In particular, non-monotonic responses are possible. Over some plausible ranges, small increases in short-term interest rates could increase, not decrease, the subsequent size of the bubble increment, or similarly lower, not raise, the probability of a subsequent burst of the bubble. This could occur if investors came to view potential market gains as larger or more durable when the bubble survives a modest policy tightening. At some point, the increases would be large enough to depress the asset-price increment or raise the probability of a bubble bust. That type of nonlinearity complicates an incremental strategy for responding to bubbles.

I found the characterisation of the bubble collapse to be another oversimplification that warrants greater attention. The bursting of a bubble could cause asset prices to overshoot on the downside. The volatility that accompanies both the build-up of the bubble and its collapse may lead equity premiums to become elevated for a meaningful period of time. Presumably such a concern would increase the expected contraction associated with the bursting of a bubble, reducing the propensity to lean against a bubble and making policy-makers more anxious to cushion its potential demise. Moreover, this is another area of prominent uncertainty for policy-makers. As equity prices came down over the past few years in the United States, it was at any given point in time hard to tell where we were in the process. It still is. Are equity markets in the United States still overvalued? Or, has there been an overshooting on the downside? One can find respectable adherents to both these positions. So a bit more attention to the stochastic characteristics of bubble collapse would be a useful supplement to this line of analysis.

Of course policy-makers are uncertain not only about the stochastic process generating the bubble, but also about the influence of the bubble on real economic decisions. In a world characterised by uncertainty, economic agents may not respond in a linear fashion to the signals provided by asset prices as suspicions arise that these prices are deviating from fundamentals. Household and business spending might well respond less to changes in asset prices as those prices are perceived to deviate farther from fundamentals.

Some of these suggestions are relatively straightforward extensions of the model that Gruen *et al* have developed in their paper. Others, such as a more careful analysis of the effects of uncertainty on optimal policy, would require more fundamental adjustment of their modeling framework. But none of these comments should be read as calling into question the contribution made by this paper. The complicated information requirements that flow from this simple model of the economy and the simple descriptions of the stochastic processes for bubbles demonstrate just how far we still have to go before addressing the first-order issues surrounding the appropriate policy response to asset-price bubbles.

Indeed, much of the work in this area brings to mind occasional reports from experimental medical science. Those reports often demonstrate the enormous advances in diagnosis and treatment that will be possible as various technologies are refined, tested, and implemented. But before submitting to these experimental treatments, most of us would probably like some reasonable assurance that these treatments will transfer successfully from the lab to the operating theatre. Similarly, our principals — the publics that we serve — expect from us a reasonable assurance that by acting we can make a situation better, not worse. I believe in recent years, we have just begun to make the case — and not always convincingly — for our ability to conduct macroeconomic stabilisation policy in response to more garden-variety disturbances. I am less confident that central banks can provide the public with an assurance that they can both identify circumstances in which asset prices have deviated from fundamentals and then act in a welfare-improving manner. Gruen *et al* have made a contribution by highlighting some of the information that will be required before those actions can be taken with necessary confidence.

References

Bernanke BS and M Gertler (2000), 'Monetary policy and asset price volatility', in *New challenges for monetary policy: a symposium sponsored by the Federal Reserve Bank of Kansas City*, Federal Reserve Bank of Kansas City, Kansas City, pp 77–128.

Bernanke BS and M Gertler (2001), 'Should central banks respond to movements in asset prices?', *American Economic Review*, 91(2), pp 253–257.

Cecchetti SG, H Genberg, J Lipsky and SB Wadhwani (2000), *Asset prices and central bank policy*, Geneva Reports on the World Economy No 2, International Center for Monetary and Banking Studies and Centre for Economic Policy Research, Geneva.

Cecchetti SG, H Genberg and SB Wadhwani (2003), 'Asset prices in a flexible inflation targeting framework', in WC Hunter, GG Kaufman and M Pomerleano (eds), *Asset price bubbles: the implications for monetary, regulatory, and international policies*, MIT Press, Cambridge, Mass, pp 427–444.

Kent C and P Lowe (1997), 'Asset-price bubbles and monetary policy', Reserve Bank of Australia Research Discussion Paper No 9709.

Mussa M (2002), 'Remarks to the Conference on Asset Price Bubbles: Implications for Monetary, Regulatory and International Policies', sponsored by the Federal Reserve Bank of Chicago and the World Bank Group, 22–24 April.

---

2. General Discussion

The main theme to emerge in the discussion of the paper was whether the Gruen, Plumb and Stone model accurately characterised the supply-side consequences of an asset-price bubble. Some participants reiterated views (also expressed in previous sessions) that the primary effect of an asset-price misalignment on the real economy was the misallocation of capital, which may manifest itself as a capital overhang after the bubble bursts. The concerns raised were whether simply augmenting an output gap equation with an asset-price bubble, as was done in the paper, properly captures these supply-side effects. David Gruen noted, however, that the paper addressed some of these concerns in Section 3.2.2.

Some participants wondered whether the results were substantially influenced by the assumed lag with which policy affects the economy in the model. Under this lag structure, changes in the real cash rate only affect the output gap after one year, so that the policy-maker is assumed to be unable to respond to the bursting of a bubble until the negative effects on output have already fully taken place. David Gruen responded that it would probably be possible to allow policy to have some contemporaneous effect on output, but he did not expect that it would significantly alter the core findings of the paper.

Another related issue that was discussed was the assumption, in the paper's baseline results, that all of the negative effects of the bursting of the bubble are concentrated in one year. It was noted that Warwick McKibbin's simulations suggest that the effects of an asset-price correction may be protracted in nature. Sensitivity analysis in the paper does, however, at least partially address this issue: Section 3.2.4 considers the situation where the negative impact of the bubble's bursting is spread out evenly over two or more years, rather than occurring in a single year.

One participant suggested that the 'sceptical' policy-maker in the Gruen *et al* model could be better characterised as an ignorant policy-maker, and so represented something of a straw man for the comparisons presented in the paper. Another participant disagreed, stating that he considered the sceptical policy-maker construct to provide a useful baseline for the analysis. He noted that a sceptic does not ignore bubbles, in the sense of disregarding the impact which they may already have had on output and inflation. Rather, in each period the sceptic simply operates on the efficient markets assumption that asset prices are now in line with fundamentals, and so would not be expected to change in coming periods.

In all, there appeared to be agreement with the paper's theme that reacting to asset-price bubbles in an activist manner requires a great deal of information about the misalignment, which the policy-makers are often unlikely to have. As a consequence, most participants thought that any 'leaning against' a perceived bubble by policy-makers should typically be only marginal in nature, and certainly not directed towards actively attempting to burst the bubble.

Round-table/Wrap-up Discussion

1. Jeffrey Carmichael

I would like to sum up my thoughts on the conference by reflecting on what I have learned over the past day and a half.

First, I have learned that bubbles occur when asset prices rise sharply then fall sharply – without any apparent change in underlying market fundamentals. I should underline two aspects of that seemingly innocuous definition:

- The first interesting aspect is its direction – up then down; importantly, not the reverse. Despite the impassioned pleas from Steve Cecchetti for symmetry, no-one (including myself) was able to think of an example of an inverted bubble. Note that I rule out exchange rate examples, since inversion there is a trivial case of swapping the numeraire.
- The second aspect I want to underline is the reference to 'without any apparent change in the underlying market fundamentals'. This was a point made well and repeatedly by Warwick McKibbin and others. We need to be careful about calling every sharp price swing a bubble. We must first establish whether or not something fundamental has actually changed.

Second, I learned that bubbles have certain characteristics in common. From a number of presentations, most notably from John Simon and Karl Case, I learned that bubbles are typically characterised by some or all of the following:

- speculation rather than fundamentals as the primary driver of price movements;
- strong credit growth;
- fraud or other forms of market misconduct;
- the failure of financial institutions; and
- significant economic costs.

However, as the discussion of these characteristics progressed, I came to my third insight and perhaps the main message of the conference – not all bubbles are born equal. In particular, I learned that there appear to be major differences between stock-price bubbles and property-price bubbles:

- Stock-price bubbles are typically much sharper and shorter in duration.
- Fraud and market misconduct are more often associated with stock-price bubbles (although confidence tricksters are not unknown in the real estate market).
- Institutional failure is much more likely following a property bubble – largely because of the institutional leverage in property financing.
- The economic impact is typically greater following the bursting of a property-price bubble – not only because of the greater potential for institutional failure, but also

because property booms seem more likely to feed into consumption behaviour through wealth effects. I refer here particularly to Karl Case's results.

Fourth, I learned that bubbles are bad. But I have to confess that at this point I started to have some doubts. The papers all said bubbles were bad. My starting prejudice was that bubbles were bad. But that bane of all good economics raised its ugly head – the evidence started to get in the way of a good theory. David Merrett made the point that only one of the three bubbles considered by John Simon could actually be considered as having had a major impact on the real economy. Karl Case convinced me that the last property bubble in Massachusetts had a major impact. But he, and others, were much less convinced that the next bubble will have as much impact, given the structural changes that have occurred in financial markets and in financial regulation.

Again I was drawn to the idea that perhaps not all bubbles are born equal. A 400 per cent rise and fall in the mining sector share price index in the space of three months is unlikely to carry the same systemic threats as a five-year imbalance in national housing prices, coupled with a vulnerable banking system.

So what did I learn from all of this for the implementation of monetary policy?

I learned from a number of speakers, including Charlie Bean and Phil Lowe, that bubbles are hard to identify. But I can still hear Steve Cecchetti crying from the background – 'hard yes, but don't give up just because it is hard'. Then David Gruen added weight to Charlie and Phil's position with his observation that, not only are bubbles hard to identify, the central bank needs a lot of additional information in order to calibrate the optimal monetary response. Again I can hear Steve imploring us not to give up.

What then can a central bank reasonably do? Here Steve came into his own. Asset prices should not be targeted by monetary policy. At best, asset prices convey information about expected inflation and economic activity. That information has value and should be taken into account in calibrating monetary policy. On this basic proposition there seemed to be a high degree of consensus – although there would undoubtedly have been less consensus about exactly how the information should be used.

Then, just as I was starting to feel that we had the topic under control, Martin Parkinson noted that we should not forget the cost-benefit aspect of using monetary policy to influence bubbles – however minor that use of monetary policy might be.

Unfortunately, we did not explore the costs very far and so I was left to speculate.

As I grappled with what these costs might be, Adam Posen reminded me that the one thing I should remember from my 20 years as a central banker (in a previous incarnation) is that monetary policy is a blunt instrument. Its impact tends to fall without fear or favour. The central bank does not face a situation of one monetary policy instrument and one asset price subject to a bubble. In reality, it has one monetary policy instrument and hundreds of asset prices – some subset of which may or may not be subject to bubbles.

So I asked myself the following questions:

- Could monetary policy stop fraud and market misconduct? No – the result of such an attempt would be all cost and no benefit.
- Could monetary policy stop a local property price bubble in Oodnadatta? Maybe – but at the likely cost of plunging the rest of the economy into a decade of recession.
- Could monetary policy have stopped the Poseidon price boom in the early 1970s? Again maybe – but again at extreme cost to the rest of the economy.
- Could monetary policy stop bank failures by preventing a property boom from collapsing? In the short term probably yes – by creating excessive liquidity – but, in the longer term the problems are likely to be compounded.
- Could monetary policy help correct a potentially overheating economy that was being fuelled by a widespread property bubble? Finally we appear to have a situation where the benefits of monetary intervention might outweigh the costs – though even here, Adam Posen would be quick to point out that the main role for monetary policy is more likely to be in dealing with the aftermath of the asset-price collapse, than in stemming the rise.

But if the role of monetary policy in containing bubbles is really so limited, the question naturally follows – is there anything else we can do?

The answer seemed to lie in comparative advantage. Steve Cecchetti and Phil Lowe both pointed out that the primary damage from bubbles often lies in institutional failure – and institutional soundness is more a matter for regulators than for monetary policy. Indeed the discussion went further to suggest that prudential regulation could even play a role in dampening bubbles. Again the discussion implied that the task was not easy (in part because it required regulators to make judgements about the same bubbles that we agreed central bankers had trouble identifying). At the same time, it was agreed that regulation offers the prospect of targeted intervention and has the advantage that the intervention can be viewed as falling within the regulator's mandate of risk management and financial sector stability – though any regulator heading down this path would be well-advised to heed Gordon de Brouwer's warning against trying to be too cute with targeted intervention.

While no one actually pointed it out, I believe all would have been aware of the obvious parallel with market conduct regulation. If prudential regulation can be used to reduce the economic impact of institutional failure following property bubbles, maybe market conduct regulation could similarly be used to reduce the economic and social impact of fraud and misconduct that appear to accompany stock-price bubbles. While conduct regulation arguably still has a long way to go before it effectively combats the dangers present in stock-price booms, they have unquestionably come a long way since the South Sea bubble.

Following comparative advantage, a case could be made that the more active roles in combating bubbles – at least in minimising the damage that they might otherwise do – lie more with the regulators than with monetary policy. If the regulators manage their part successfully, monetary policy would be left largely with the responsibility of dealing with the aftermath – which, in an effective regulatory world with no fraud and no institutional failure, should be relatively minor.

Again I began to think we had it all under control. Then I heard Trevor Sykes, through the after-dinner haze, warning us that we are all doomed to re-learn history in financial markets, locked in a repeating 'Groundhog Day' bubble.

Maybe we still have some more work to go after all.

2. John Plender

The question at the back of my mind at the start of this conference was whether something new and different was happening in the operation of bubbles. If you think about it, we have just lived through the biggest stock market bubble in history. Yet it has not been followed by a financial crisis. This contrasts markedly with circumstances after the 1929 Crash. And from a broader historical perspective it remains unusual for bubbles not to be followed by trouble in banking. So what is going on?

If we try to identify what has been different in the recent stock market bubble that emanated from the US, the first thing that seems clear is that the American population was more heavily exposed to equity than at any time in history. The same is broadly true of most of the economies in the English-speaking countries. The striking point is that this exposure was largely unleveraged. In the US, for example, it came through such vehicles as mutual funds and Section 401k pension plans. Much the same was true elsewhere.

From a central banker's perspective this has one specific advantage. It reduces the risk of systemic trouble in banking. But there is also an important potential cost. The increased exposure of the household sector to equities means that the economy is hostage to the fluctuations of equity prices as never before, thanks to wealth effects. We all know the consequence for savings, consumption and the household sector balance sheet. Because people think that the stock market is doing their saving for them, household savings decline in relation to disposable income. Debt accumulates. The unwinding of the resulting imbalance may cause a fall in demand as asset prices decline and people become more pessimistic about their economic prospects. And in a period of low inflation the ability to offset this kind of shock may be limited if there is little or no scope to reduce nominal interest rates.

I am surprised at the earlier suggestions that bubbles are not such a terribly bad thing. Quite apart from this problem of dealing with imbalances, there are serious implications for the supply side of the economy. To name just one, in a securities bubble stock prices that rise out of line with fundamentals lead to an artificially low cost of capital. That in turn leads to excessive investment in sub-optimal projects. The result in the present economic cycle has been a grotesque misallocation of resources. The whole process leads to economic inefficiency. So even without leverage and without a subsequent financial crisis, a bubble can do considerable economic damage.

It is worth saying, in passing, that there was leverage in the recent bubble, but that it had moved outside the financial system. It came with the growth of stock options, where the leverage is inherent in the structure of the instrument rather than a function of borrowing. This meant that in the 1990s you had a micro-wealth effect in the boardroom. And this in turn spawned leverage in company balance sheets as corporations borrowed to buy back shares to offset the dilution that resulted from issuing stock options. More recently, as many of these stock options lost value in the stock market decline, there was a negative boardroom wealth effect which in the post-Enron climate contributed to a serious dampening of 'animal spirits'. Note, too, that the greater transparency that now prevails in relation to pension costs has made the corporate sector even further hostage to the gyrations of the stock market.

So to return to my opening question, are we now in a world where imbalances are the big worry for policy-makers after a bubble and that leverage is no longer the threat it used to be? Surely not. Throughout the conference I have been fishing for a taxonomy of asset-price bubbles and asking myself whether there is a hierarchy, in terms of which kind of bubble delivers the most economic and financial damage. I think the tentative answer is that there cannot be a simple and straightforward hierarchical categorisation because a firm distinction between unleveraged and leveraged bubbles has to be acknowledged at the outset. But within these two individual categories I think it is worth hazarding an attempt to distinguish the bad from the less bad, while acknowledging that a leveraged bubble is simply one which gives an additional complex twist to the instabilities latent in an unleveraged bubble.

If we consider, first, the equity-financed bubbles, the benign or less troublesome end of the spectrum would feature Poseidon and the nickel boom. This was not large in relation to Australia's GDP and the banking system was not heavily exposed to the weaker exploration companies. By definition there could be no dangerous global spillover. There were undoubtedly corporate governance failures, which impaired confidence for a time in the stock market, but that is another story.

The more troublesome end of the spectrum contains the recent US bubble, which was very large in relation to GDP. The globalisation of capital flows since the 1970s means that the bubble was contagious, with striking consequences for those economies where the stock market was large in relation to national output. Because the imbalances have yet to be unwound, the extent of the damage cannot be quantified. But the key danger signal is simply size of the asset-price misalignment in relation to GDP.

A point worth making for the future is that many economies where financial intermediation has been dominated by relationship banking rather than capital markets are now moving closer to the model that prevails in the English-speaking economies. As more of their populations are exposed to equity, there will be a growing risk of heavily synchronised economic cycles if the correlation between US equity prices and those in the rest of the developed world remains close.

Now consider the second category. With leveraged bubbles we are back to eternal verities. They combine the problem of imbalance with the threat of systemic trouble in banking, which in turn implies even greater macroeconomic instability along with moral hazard and other problems associated with last-resort lending. In the current economic cycle, commercial property is a sleeper. But it remains a considerable danger. The worry is that it is one of the few assets that is sufficiently lumpy to absorb large sums when bankers are under heavy pressure to lend. We should never underestimate the bankers' capacity for collective memory loss.

Residential property, which is more the focus of concern in the present cycle, especially in the UK and Australia, is a less dangerous threat. We have heard from Karl Case about bank failures after a house price bubble in Massachusetts; also from John Simon about bank failures after the late 19th century property bubble in Melbourne. But the leverage in housing bubbles will normally tend to be dangerous only where banking systems are fragmented and bank profitability is poor.

Today the UK and Australian banking systems are well capitalised and relatively concentrated. If house prices plunge, home-owners afflicted by negative equity will normally continue to service their mortgage debt. And the banks have substantial collateral. The bad debts tend to arise when unemployment goes up. But on the basis of current lending practice, it would take exceptionally high levels of unemployment to generate a systemic financial crisis.

The buy-to-let market, which in both the UK and Australia has been hyper-active of late, is more dangerous than the owner-occupied market because so much activity has been based on deficit financing. No doubt some banks will catch a cold. Yet the speculative activity is not on a scale to do much damage to the banking system or the wider economy. The problem is well understood and ought to be manageable.

The new and interesting phenomenon on the leveraged side of my list concerns derivatives, where the leverage is implicit in the structure of the instrument rather than in conventional borrowing. Since the many crises involving derivatives have so far been more eye-catching than economically significant, I have no idea where, on the spectrum of danger, they belong. But they are definitely dangerous. The great volume of over-the-counter derivatives business is managed by a tiny handful of very big banks. This concentration of risk is worrying and there is no great consolation in the sheer size of the banks concerned. We should not forget that in the last banking crisis in the US the largest commercial bank, Citigroup, very nearly came unstuck. Also noteworthy is that while the new credit derivatives market appears to have spread risk from banks to non-banks, it remains so opaque that no-one can be wholly certain where these risks have ended up. Black holes in the system all too often prove to be accidents waiting to happen.

This brings us to the question of what can be done to prevent or restrain asset-price bubbles. Clearly it is very difficult to act on them in advance, as Charles Bean's paper eloquently attests. And it is especially difficult to take aggressive action to prick the bubble. Everyone here is too delicate to refer to the crude politics of pre-emptive action or to the implications for central bankers' career prospects. But in political terms, the pre-emptive calculus involves taking the risk of precipitating a smaller recession now in the hope of preventing a bigger recession later. One's first thought is that this poses questions of timing within the electoral cycle. One's second is that there is probably no point in the electoral cycle when this is a saleable proposition to the politicians. As for voters who are basking in the early warm glow of a wealth effect, they are unlikely to be receptive to arguments for early pain. The fact is that few people are going to thank a central banker for delivering a pre-emptive recession.

That forces us back onto weaker responses such as taking asset prices into account in pursuing standard inflation targeting. This amounts to holding onto your seat on the way up and hoping to be able to clean out the Augean stables in double-quick time on the way down. In the current version of the ploy, you gamble on a positive wealth effect in housing offsetting the negative wealth effect in equities. The aim is to keep the consumer in play in the hope that the public and corporate sectors will come to the rescue in time to prevent a savage unwinding of imbalances. It is too early to pass a verdict on the success or otherwise of this experiment.

That leaves the option of leaning against the bubble in subtle and nuanced ways that fall short of targeting asset prices. This is where the debate becomes theological and it will no doubt run and run. But it is probably also safe to predict that there will be an increasing focus on what can be done to address asset-price bubbles through regulation. The pro-cyclical nature of much regulation in banking and insurance is clearly a contributory factor in some bubbles. And it would certainly be possible to attempt to damp down a bubble via the Basel capital adequacy regime, even if prudential watchdogs feel instinctively uneasy about the use of their powers to secure macroeconomic objectives.

At this point I would like to highlight something that is not directly related to monetary policy, but which should nonetheless be of concern to central bankers: the impact on bubbles of the incentives structures that operate within financial intermediaries and fund management groups. This is an old problem. Many of you will recall in the 1980s and early 1990s that some lending bankers were awarded bonuses on the basis of the volume of lending. That played a part in both the Latin American debt crisis and the property crisis in the US and much of Europe in the early '90s. I doubt whether this practice still goes on, but there are plenty of other disturbing incentives in existence. Many traders in banks, for example, are being rewarded with bonuses based on absolute returns without adjustment for risk. That is a recipe for gung-ho speculation and subsequent trouble.

In the context of the latest bubble, the incentive structures in fund management bear thinking about. A securities bubble reflects, among other things, a lack of stabilising speculation. One of the new things in the equity market over the past decade or so has been index-tracking. This has been a boon to the retail investor, but not for the wider market place since index-trackers are the opposite of contrarians. For them, as far as the stock market valuation is concerned, what is, is right. And then, of course, we have closet indexing, which reflects the fund managers' desire to minimise their business risk. As well as being a dereliction of fiduciary duty, this is an opt-out from the stabilising speculator's role.

So we have a question about where stabilising speculators are going to come from, when retail investors buy and hold, professional investors hug indices and herd, and hedge funds increasingly follow long/short market neutral policies. Volatility must by definition increase if the free float dwindles to a marginal level. The snag is that professional investment practice has become dangerously remote from the detailed analysis of individual companies and the recent bubble was exacerbated by the pervasive spread of institutional herding. This is partly a result of the malign influence of short-term performance measures. Too little policy effort has been directed at encouraging pension trustees and others to make better and more responsible use of the numbers in the interests of the ultimate beneficiaries.

To conclude, much of the debate on bubbles has highlighted irrational exuberance. But there is a fair amount of rational exuberance that has contributed to bubbles because of the impact of distorting incentives on behaviour across the financial community. On the more substantive issues concerning asset prices and monetary policy we are all agreed about the difficulties. I am sure I am not alone in being grateful to the Reserve Bank of Australia for having helped us understand them better.

3. Glenn Stevens

I want to begin by trying to outline some areas where I think we might have a measure of consensus. Then I will give some perspective on areas where it is not so easy to agree, and finish with some observations about future research.

Firstly, asset-price 'bubbles'. There was quite a bit of discussion about how to recognise a bubble and, indeed, how to define one. John Simon's definition was, in effect, 'I know it when I see it'. I thought Saul Eslake made a useful contribution here in suggesting that a bubble was when a one-time price level shift, which was well based in fundamentals, came to be perceived as a permanent change in the rate of growth of a price. My own definition would be, I think, that a bubble is when the main 'fundamental' on which people focus is simply yesterday's change in the price. In general, it is quite clear that people find it very hard to pin down a precise definition of what is, and is not, a 'bubble'.

But I think we should not get too hung up about trying to decide what is a 'bubble'. To do so is certainly not very helpful from a policy point of view. It tends to promote the idea that if we can define something as not being a bubble, then we can forget about it; and conversely, that if something can be defined to be a bubble, then an implication follows that something drastic must be done. But policy-makers do not think this way, and nor should they. It is more useful to couch the discussion in terms of something like the following question: 'Is something occurring which seems increasingly likely to be a misalignment, and which carries an attendant risk of creating instability when a realignment occurs?' That is, perhaps, somewhat less exciting language, but I think it is a more helpful way in which to frame the discussion.

Second, one of the quotes of the conference came from Gordon de Brouwer's comments on Adam Posen's paper: 'Like the poor, asset-price swings are with us always'. I think this is true. Furthermore, asset-price movements often, indeed almost always, have some fundamental basis at the beginning. And as Warwick McKibbin pointed out in his remarks, the changes in various prices and quantities in the economy associated with changes in some of the key fundamentals can be very large and very persistent.

In addition, not only are asset-price movements always going to be with us, we probably cannot stop them. Nobody, to my knowledge, really suggests that, faced with a sizeable asset-price move, monetary policy (or indeed any other policy) ought to be so adjusted as to ensure that the move is stopped dead in its tracks or reversed. A monetary policy response of that kind would usually be far too extreme for the rest of the economy. But equally, while we cannot stop big asset-price movements occurring from time to time, nor can we simply avert our face and ignore them, and assume that all will be well. My sense is that most people agree that these movements are potentially very important, potentially disruptive, and should not be ignored.

Third, it is really the leverage that accompanies asset-price movements which is the issue, rather than the asset-price movements themselves. I think this was a point quite usefully made as a result of questions from Bill Evans: all sizeable asset-price misalignments presumably do some damage, but the ones which do the most damage are those which were associated with a big build-up in leverage, which always carries the risk of forcing abrupt changes in behaviour by borrowers and their lenders when the prices turn. To coin a phrase, 'it's the leverage, stupid'.

Fourth, I think it is generally accepted that, after an asset-price bust, the conduct of monetary policy is going to involve easing, and quite possibly easing a lot. There is a potential issue of moral hazard here: namely that 'bailing out' market participants in some sense will create further incentives to gear up in the future, to the detriment of the economy's long-term stability. But Adam Posen argued that, in practice, the evidence for this has not been all that clear. Furthermore, I think when faced with a financial system and economy in distress, one just has to incur that risk.

On those issues, it seems to me that there is a measure of consensus. The conduct of policy during the boom is the area about which there is a bit less consensus. However, Charlie Bean in his paper, and Stephen Cecchetti in other writings, have suggested that a medium-term flexible inflation target is a useful framework in which to think about these issues and to communicate the concerns of policy-makers. No-one at the conference disputed this and it is a sentiment with which I am inclined to agree. If a fair number of people accept that, then there is a little progress to show for our discussions.

Charlie went on to say that an inflation-targeting framework may, on occasion, provide a logic for monetary policy to do a little more than just take account of the near-term effects of asset-price movements on activity and inflation. As I read his paper, it set this issue in the context of a possible trade-off of a small amount of current economic activity today in return for a lower variance of economic activity at some stage in the future. In practice, Charlie said that such trade-offs were likely to involve only marginal adjustments to policy. Given our current state of knowledge, I think that is probably right. There is a question as to whether those marginal adjustments actually make any difference to the dynamics of asset-price movements, but at least this seems the right framework in which to think about it. And, of course, contrary to what we in the Bank might have expected when we set up the program for the conference, the Bean and Cecchetti views about all this are actually not that far apart. I hope that this can be taken as some sign that a little bit more common ground is being found in this debate, which at least initially tended to be characterised by people taking fairly extreme positions. As a central banker, I suppose I am naturally predisposed to be more comfortable that there is a bit more common ground in the middle.

My interpretation of the outcome of the Bean/Cecchetti session as it gives us some framework for thinking about and handling asset-price movements is:

- do not *target* asset prices – keep the current general goals in terms of goods and services inflation and variability of economic activity;
- but consider having a somewhat *longer horizon*, which allows asset prices to be brought more effectively into the framework. This is an important point: I think that in central banks' efforts to present inflation targeting as a simple, well-understood framework, we have often said that it involves adjusting policy so as to keep the forecast inflation rate at the target at a two-year horizon. But in the context of asset prices and economic instability, this is an over-simplification. Surely policy-makers care not just about where inflation is in two years' time, but where it might be heading after that and why. That is, we care about the entire future path of prices, not just their behaviour at one particular forecast horizon;
- focus policy discussion more on the *balance of risks,* that is on the forecast distribution in its entirety, not just the central forecast. This was a point very forcefully made by Philip Lowe in his comments. Of course, the balance of risks is a much more subtle concept than 'the number' contained in the central forecast, and popular discussion of forecasts focuses virtually entirely on the latter. But this just says that our efforts in trying to get the balance of risks concept across should be re-doubled;
- policy-makers should be concerned about the build-up in credit which sometimes accompanies asset-price movements – again, it is the highly leveraged movements which are most likely to do damage; and
- all of this ought to be embodied in some sort of cost/benefit framework, an important point made in discussion by Martin Parkinson. I agree – indeed, I think 'conventional' monetary policy, directed simply at fighting inflation, involves articulating why it is worth paying a modest cost in terms of lower short-run growth in order not to pay a much larger cost of lost output later when inflation gets too high. In principle, when we are talking about a particular response to possible asset-price misalignments, we are talking about exactly the same sort of thing.

My sense of the discussion on these issues was that no-one violently objected to the ideas. But that's not the same thing as saying people enthusiastically embraced them. I think most people, including me, have a certain wariness about policy activism even when they accept the logic that policy can't just blithely assume all will work out for the best. And that wariness is less due to the difficulties of deciding whether something is a bubble, than to some other quite practical difficulties.

One is communication. The difficulties in explaining a rise in interest rates designed to head off incipient inflation in the CPI are already hard enough. When we are talking about problems resulting from asset-price fluctuations, we are really talking about potential costs which may occur several years in the future. We cannot point to those costs today, only the risk of incurring them. This is a more difficult idea to communicate, if only because the time horizons are so much longer. We have to try harder, as I have argued above. But some aspects of past experience are not encouraging. Our own experience, for example, when we introduce a discussion of a new variable in our public statements is that there tends to be a small number of people who, on seeing that, say 'ah, you have stopped targeting inflation and you are now targeting the exchange rate, or credit, or [substitute variable here]'. It is very easy to be misunderstood.

In addition, as highlighted by the Gruen, Plumb and Stone paper, the dynamics of asset-price booms and busts are quite complicated. And the first order of business is to try to make fairly sure that any policy response would be stabilising, rather than destabilising. An aggressive policy response late in the asset-price boom could be quite destabilising – the problem being, of course, we do not know at any point in time whether the boom is in its late stage or not. This problem exists with any policy exercise, but I think most people accept it is unusually acute in the case of asset-price swings.

David Stockton made a useful point in pointing to the possibility of Type I and Type II errors. That is, policy-makers might think something is a worrying misalignment, respond to it as if it were, and turn out to be wrong. Alternatively, they might see an asset-price development which they judge to be benign, not respond to it, and turn out to be wrong there instead. Which of these errors would be the most costly, and under what particular sets of circumstances? It seems to me that future research might usefully try to think along these lines, because I think that is in fact how policy-makers actually think.

So, in conclusion, how would I sum all this up?

1. This is all very hard – no-one should think these are easy issues.
2. We should keep a close eye on leverage.
3. We should talk about concerns that we might have about asset markets and leverage. At the very least, we should be careful by our actions and our words not to exacerbate them: 'first, do no harm'.
4. *Perhaps* we should, at some times, be prepared to lean a little into asset-price swings, on the grounds of 'least regret', but with considerable care.
5. Be ready to clean up afterwards.
6. Be on the look-out for other instruments.

4. General Discussion

The general discussion indicated that there was broad agreement with most of the points highlighted by the round-table speakers. Several of the participants discussed the emphasis placed on leverage by some of the wrap-up speakers. In particular, while there was agreement that increases in leverage are typically an important factor in the development of asset-price misalignments, some suggested that it was possible for bubbles not associated with significant growth in leverage to still have substantial real effects on the economy. Such effects were thought primarily to be the resulting distortions in the allocation of both physical and human capital. Warwick McKibbin explained that this misallocation of capital, combined with the assumption that capital is not particularly fungible between sectors, underpinned the sizeable and prolonged real effects of asset-price misalignments that he found in his simulations. Additionally, some participants thought that the role of monetary policy in reacting to such supply-side imbalances was limited, and that it is better suited to dealing with the demand-side consequences of asset-price misalignments, such as limiting adverse wealth effects.

There was also discussion of John Plender's contrast of the experience of the Great Depression and the recent equity boom and bust. Several speakers stressed that the US policy response to the recent collapse in equity prices and macroeconomic weakness has been markedly different to the tightening of credit conditions that occurred in the earlier episode. Most participants appeared to agree that the moral hazard implications of aggressive post-boom policy responses (the so-called 'Greenspan put') were likely to be minor.

A number of speakers addressed the possibility of using alternative policy instruments (other than monetary policy) for dealing with asset-price misalignments. Several speakers noted that aspects of the tax code could contribute to the development of asset-price misalignments. Hence it was thought that fiscal policy could be another instrument used to react to price misalignments, and it could do so in a more targeted manner. In addition, by being more targeted, fiscal policy responses could avoid the costs of blunter demand-management policies on the broader economy.

Another theme relating to fiscal policy was the issue raised in Stephen Cecchetti's paper, namely the influence of asset-price misalignments on fiscal behaviour. Booming asset prices increase tax revenues, and may lead to over-reliance by governments on these revenues. The recent sharp falls in US equity prices have indeed resulted in falling capital gains tax revenues and resulted in fiscal problems in some US states.

Among the other issues raised, one participant argued that for assets such as housing, where the quantity supplied is relatively inelastic with respect to price, supply-side (rather than demand-side) policies might be a more appropriate means of addressing price misalignments. Another participant suggested that a possible area for future research is the impact of asset-price bubbles on the distribution of income and wealth, and whether they cause inequality to rise. In addition, there was agreement that further research was warranted on the issue raised by John Plender about the opaque redistribution of risk through credit derivatives and securitisation.

Biographies of Contributors

Charles Bean

Charles Bean is Executive Director and Chief Economist at the Bank of England. In addition to his membership of the Monetary Policy Committee, he is responsible for the Monetary Analysis & Statistics Divisions of the Bank. Prior to joining the Bank of England, he was a Professor of Economics at the London School of Economics, and was Head of Department during 1999–2000. Professor Bean has published widely, in both professional journals and more popular media, on European unemployment, on European Monetary Union, and on macroeconomics generally. From 1986 to 1990 Professor Bean was Managing Editor of *The Review of Economic Studies*. He has also served in a variety of public policy roles, including as a consultant to HM Treasury and as special adviser to the House of Lords inquiry into the European Central Bank. He holds a PhD in Economics from the Massachusetts Institute of Technology and a MA from Cambridge.

Jeffrey Carmichael

Jeffrey Carmichael was the inaugural Chairman of the Australian Prudential Regulation Authority. Previously Dr Carmichael for over 20 years held senior positions with the Reserve Bank of Australia, and for seven years was Professor of Finance at Bond University. He has also served on a number of Government inquiries and boards, including as a member of the Wallis Inquiry; a Commissioner on the Queensland Government's Inquiry into Non-bank Financial Intermediaries in Queensland and the Queensland Government's Audit Commission; Chairman of the Australian Financial Institutions Commission; and Chairman of the Queensland Office of Financial Supervision. Dr Carmichael is a private consultant to the World Bank, the Asian Development Bank and a number of countries in the area of regulatory structures and policy. He has published in a number of leading journals, including the *American Economic Review* and the *Journal of Finance*. In 1995 he was awarded an Officer in the Order of Australia for service to education, finance and the community. Dr Carmichael has a PhD and a MA in Economics from Princeton University and honours Masters degree in Economics from the University of NSW.

Karl E Case

Karl Case is the Katherine Coman and A Barton Hepburn Professor of Economics at Wellesley College, and is a Visiting Scholar at the Federal Reserve Bank of Boston. He is also a founding partner in the real estate research firm of Case Shiller Weiss, Inc. and serves as a member of the Boards of Directors of the Mortgage Guarantee Insurance Corporation (MGIC), Century Bank, The Lincoln Institute of Land Policy and the New England Economic Project. Professor Case's research has been in the areas of real estate, housing, and public finance. He is author or co-author of five books, including *Economics and tax policy* (1986) and *Principles of economics*, a basic text now in seventh edition with Ray C Fair of Yale University. He holds a PhD in Economics from Harvard University.

Stephen G Cecchetti

Stephen Cecchetti is Professor of International Economics and Finance in the International Business School at Brandeis University. He also is a Research Associate with the National Bureau of Economic Research. Professor Cecchetti is on the Board of Editors of the *Journal of Economic Literature* and the *Economic Policy Review* (Federal Reserve Bank of New York). He is also on the advisory board of the *Journal of Money, Credit and Banking*, which he edited from 1992 to 2001. His research interests include inflation and price measurement, monetary policy, macroeconomic theory, the economics of the Great Depression, and financial economics. Prior to joining Brandeis University he was Professor of Economics at Ohio State University. Professor Cecchetti was also the Executive Vice President and Director of Research, Federal Reserve Bank of New York during August 1997–September 1999. He has also served on the Board of Editors of the *American Economic Review* from 1992–1998. He holds a PhD and a MA in Economics from the University of California at Berkeley.

Gordon de Brouwer

Gordon de Brouwer is Professor of Economics in the Asia Pacific School of Economics and Government and Executive Director of the Australia-Japan Research Centre at the Australian National University (ANU). His research interests include the economies of Australia, Japan and east Asia, open economy macroeconomics and policy, monetary and financial economics, and international relations. His publications include *Hedge funds in emerging markets* (2001), *Financial integration in east Asia* (1999), and he is the contributing editor of *Financial governance in east Asia* (2003) and *Financial markets and policies in east Asia* (2001). He is co-author of *Strengthening Australia-Japan economic relations* (2002), a major report written for the Department of Foreign Affairs and Trade. Before joining the ANU in January 2000, he was Chief Manager, International Markets and Relations, at the Reserve Bank of Australia. Professor de Brouwer holds a PhD from the ANU, and a Masters of Commerce from the University of Melbourne.

Malcolm Edey

Malcolm Edey is Assistant Governor (Economic) at the Reserve Bank of Australia (RBA), a position he has held since January 2002. Dr Edey has published on a variety of topics, including monetary policy, financial markets, and saving and superannuation. He was the editor of the 1996 RBA conference volume *The future of the financial system*. Prior to his current appointment Dr Edey was the Head of Domestic Markets (2001–2002), Economic Analysis (1997–2001) and Economic Research (1995–1997) Departments at the RBA. Earlier he spent three years working in the Economics Department of the OECD in Paris, where he worked on monetary and financial policy issues and on the economic survey of Mexico. Dr Edey holds a PhD from the London School of Economics.

Barry Eichengreen

Barry Eichengreen is the George C Pardee and Helen N Pardee Professor of Economics and Professor of Political Science, University of California, Berkeley. He is also a Research Associate at the National Bureau of Economic Research, a Research Fellow at the Centre for Economic Policy Research, and an International Research Fellow at the Kiel Institute of World Economics. Professor Eichengreen has published widely on the history and current operation of the international monetary and financial system. His books include *Capital flows and crises* (2003), *Financial crises and what to do about them* (2002), and *Golden fetters: the gold standard and the Great Depression, 1919–1939* (1992). Previously, among several other academic appointments, Professor Eichengreen was a Senior Policy Advisor at the International Monetary Fund during 1997–1998. He holds a PhD in Economics, a MA in History and both a MA and a MPhil in Economics, all from Yale University.

David Gruen

David Gruen is currently on a two-year secondment at the Australian Treasury, which began in January 2003. Before that, he was Head of Economic Research Department at the Reserve Bank of Australia, from May 1998 to December 2002. He has worked at the Bank for 13 years, in the Economic Analysis and Economic Research Departments. From August 1991 to June 1993, he was visiting lecturer in the Economics Department and the Woodrow Wilson School of Public and International Affairs at Princeton University. Before joining the Reserve Bank, he worked as a research scientist in the Research School of Physical Sciences at the Australian National University. He holds PhD degrees in Physiology from Cambridge University, England and in Economics from the Australian National University.

Philip Lowe

Philip Lowe is currently the Head of Economic Analysis Department at the Reserve Bank of Australia (RBA). He has written numerous papers on the Australian economy, monetary policy (including on the implications of asset-price misalignments for monetary policy), and the financial system. He was the editor of the 1997 RBA conference volume *Monetary policy and inflation targeting*. Prior to his current appointment Dr Lowe has been the Head of Domestic Markets, System Stability and Economic Research Departments at the RBA. During 2000–2002 he was the Head of the Financial Institutions and Infrastructure Division in the Bank for International Settlements' Monetary and Economic Department. Dr Lowe holds a PhD in Economics from the Massachusetts Institute of Technology.

Robert N McCauley

Robert McCauley is the Deputy Chief Representative and chief economist at the Bank for International Settlements' (BIS) Representative Office for Asia and the Pacific in Hong Kong. Mr McCauley has written widely on topics such as bond market volatility, offshore lending to US corporations, the profitability of direct foreign investment in the United States, national differences in the cost of capital, the impact of Japanese asset deflation on Pacific capital markets, foreign currency banking in greater China, and monetary policy setting and operating procedures in east Asia. His publications include *Dodging bullets: changing US corporate capital structures in the 1980s and 1990s* (1999, co-authored with J Ruud and F Iacono). Prior to his current position, Mr McCauley was in BIS Monetary and Economic Department from 1994, where he analysed international capital flows and foreign exchange markets, publishing the monograph *The euro and the dollar*. He also spent 13 years at the Federal Reserve Bank of New York in a variety of roles, including managing the International Finance Department and serving as lead economist to the inter-agency bank supervisors' committee that rates country risk. In 1988, while on leave from the Federal Reserve at the Joint Economic Committee of the US Congress, he organised the first modern hearing on US foreign debt. Mr McCauley has also taught at the University of Chicago's Graduate School of Business. Mr McCauley holds a BS from the University of Maryland and did graduate work in Economics at Harvard University.

Warwick McKibbin

Warwick McKibbin is Professor of International Economics and Convenor of the Economics Division in the Research School of Pacific and Asian Studies at the Australian National University. He is also a non-resident Senior Fellow at the Brookings Institution in Washington DC, a Board Member of the Reserve Bank of Australia, and President of McKibbin Software Group. He is a Fellow of the Australian Academy of Social Sciences and a founding member of the Harvard University Asian Economic Panel. Professor McKibbin's research interests are diverse, including macroeconomic policy, international trade and finance, macroeconomic modeling and greenhouse policy issues. He has published widely, including *Global linkages: macroeconomic interdependence and cooperation in the world economy* (1994, co authored with Jeffrey Sachs) and *Climate change policy after Kyoto: a blueprint for a realistic approach* (2002, co-authored with Peter Wilcoxen). Professor McKibbin spent 16 years at the Reserve Bank of Australia and has been a visiting scholar at the Japanese Ministry of Finance and the United States Congressional Budget Office. He has consulted widely for international agencies including the United Nations and the World Bank, as well as for numerous national governments. He holds a Masters and a PhD in Economics, both from Harvard University.

David Merrett

David Merrett is Associate Professor in the Department of Management and co-director of the Australian Centre for International Business at the University of Melbourne. His areas of research include the internationalisation of Australian firms, the evolution of 'big business' in Australia, and the history of the Australian banking system. His publications include *Business institutions and behaviour in Australia: a new perspective* (ed, 2000) and *ANZ Bank: a history of the Australian and New Zealand Bank and its constituents* (1985). He previously has been an Associate Professor in the Department of Business Development and Corporate History, and in the Department of Economic History, at the University of Melbourne. Professor Merrett holds a Masters of Economics from Monash University.

John Plender

John Plender is a senior editorial writer and commentator at the *Financial Times* in London, a position he has held since 1981. He writes a weekly column on economics and business, and a fortnightly opinion page. He combines this with publishing and current affairs broadcasting for the BBC and Channel 4. Previously he was the financial editor of *The Economist* from 1974 to 1980, and an adviser in the Foreign Office policy planning staff in 1980. John Plender received the Wincott Award, a British award for financial journalism, in 1994. His books include *That's the way the money goes* (1981), *The square mile* (with Paul Wallace, 1985), *A stake in the future* (1987) and *Going off the rails* (2003). John Plender holds a degree from Oxford University and is a chartered accountant.

Adam Posen

Adam Posen is a Senior Fellow at the Institute for International Economics, Washington DC. His research focuses on macroeconomic policy in the industrial democracies, G3 economic relations, and central banking issues. Dr Posen is the author of the book *Restoring Japan's economic growth* (1998) and co-editor (with Ryoichi Mikitani) of *Japan's financial crisis and its parallels to US experience* (2000). He also co-authored (with Ben S Bernanke, Thomas Laubach and Frederic S Mishkin) *Inflation targeting: lessons from the international experience* (1999). From 1994 to 1997, Dr Posen was an economist in international research at the Federal Reserve Bank of New York. In 1993–1994, he was Okun Memorial Fellow in Economic Studies at the Brookings Institution. He holds a PhD in Political Economy and Government from Harvard University.

Anthony Richards

Tony Richards is Head of Economic Research at the Reserve Bank of Australia. He began his career in the Economic area of the Reserve Bank, before moving to the International Monetary Fund (IMF) where he worked on international capital markets issues, and on numerous countries including Korea, Russia and the Baltic countries. He was Deputy Division Chief in the IMF's Asia and Pacific Department prior to rejoining the Reserve Bank at the start of 2002 as Chief Manager for International Markets and International Relations in the Bank's Financial Markets Group. Dr Richards' academic and policy research has been published in leading international economic and financial journals. He holds a Masters in Public Administration from Harvard University and a PhD in Business Administration from the George Washington University.

John Simon

John Simon is Senior Research Manager in the Economic Research Department of the Reserve Bank of Australia. He has eclectic research interests and has previously published papers on a variety of topics, including the decline in worldwide output volatility, estimating the proportion of Australian households that are financially constrained, and the influence of information technology on growth. He was co-editor of the 2001 RBA conference volume *Future directions for monetary policies in east Asia*. John Simon holds a PhD in Economics from the Massachusetts Institute of Technology.

Glenn Stevens

Glenn Stevens was appointed Deputy Governor of the Reserve Bank of Australia in December 2001. He also is a member of Advisory Boards of the Hong Kong Institute for Monetary Research, and the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne. He has spent most of his professional career in the Reserve Bank of Australia, joining the Bank's Research Department in 1980. In 1990, he was a Visiting Scholar at the Federal Reserve Bank of San Francisco. Glenn Stevens was Head of the Economic Analysis Department of the Reserve Bank from August 1992 to September 1995, and Head of its International Department from September 1995 to December 1996. From December 1996 to December 2001, he was Assistant Governor (Economic), responsible for overseeing the economic analysis and research of the Bank's staff and formulating policy advice for the Governor and Board of the Bank. Glenn Stevens holds a MA in Economics from University of Western Ontario, Canada.

David Stockton

David Stockton is the Director of the Division of Research and Statistics at the Board of Governors of the Federal Reserve System. The 275 members of the Division of Research and Statistics carry out a wide range of economic analysis, forecasting, and research activities related to the US economy and financial markets. He also serves as Economist to the Federal Open Market Committee, with responsibility for developing the staff economic and financial outlook and presenting that outlook and the accompanying analysis to the Committee. Dr Stockton's main fields of research include macroeconomics, monetary policy and prices. Prior to his appointment to his current position, Dr Stockton was the Deputy Director of the same division. Dr Stockton holds a Masters and a PhD in Economics from Yale University.

Trevor Sykes

Trevor Sykes is Senior Writer on the *Australian Financial Review* in Sydney. He is also the creator of the well-known Pierpont column which he has been writing – in the guise of a cynical old clubman – for 31 years. He has been Editor of *The Bulletin,* Editor-in-Chief of *Australian Business* magazine, assistant editor of the *Australian Financial Review* and Melbourne Bureau Chief of the *Australian Financial Review*. He has won five national awards for finance reporting. Trevor Sykes is the author of seven books about Australian financial scandals, including *Two centuries of panic* (1988), *The bold riders* (1994) and *The numbers game* (2001).

List of Conference Participants

Charlie Bean
Bank of England

Stephen Bell
The University of Queensland

Jillian Broadbent
Company Director and *Reserve Bank of Australia Board Member*

Robert Carling
New South Wales Treasury

Jeff Carmichael
Carmichael Consulting

Karl Case
Wellesley College

Chris Caton
BT Financial Group

Stephen Cecchetti
Brandeis University

Tim Colebatch
The Age

Max Corden
The University of Melbourne

Gordon de Brouwer
The Australian National University

Mardi Dungey
The Australian National University

Malcolm Edey
Reserve Bank of Australia

John Edwards
HSBC, Australia

Barry Eichengreen
University of California, Berkeley

Saul Eslake
Australia and New Zealand Banking Group Limited

Bill Evans
Westpac Banking Corporation

Ross Gittins
The Sydney Morning Herald

David Gruen
Department of the Treasury, Australia

Philip Lowe
Reserve Bank of Australia

Robert McCauley
Bank for International Settlements

Ian Macfarlane
Reserve Bank of Australia

Warwick McKibbin
The Australian National University and *Reserve Bank of Australia Board Member*

David Merrett
The University of Melbourne

Alan Mitchell
The Australian Financial Review

Adrian Pagan
The Australian National University and *The University of New South Wales*

Martin Parkinson
Department of the Treasury, Australia

John Pierce
New South Wales Treasury

John Plender
Financial Times

Michael Plumb
Reserve Bank of Australia

Adam Posen
Institute for International Economics

Anthony Richards
Reserve Bank of Australia

Tim Robinson
Reserve Bank of Australia

Colin Rogers
The University of Adelaide

John Simon
Reserve Bank of Australia

Glenn Stevens
Reserve Bank of Australia

Dave Stockton
Board of Governors of the Federal Reserve System

Andrew Stone
Reserve Bank of Australia

Trevor Sykes
The Australian Financial Review

Wataru Takahashi
Bank of Japan

Max Walsh
The Bulletin

Alan Wood
The Australian

Ian Woolford
Reserve Bank of New Zealand

Judy Yates
The University of Sydney

Acknowledgment

The editors are grateful to Pam Dillon, Danièle Di Paolo, Paula Drew, Joanne Flynn, Kylie Lowe, David Wong and the staff of Economic Research Department for much help in organising the conference and producing this volume.

Other Volumes in this Series