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Property Markets and Financial Stability

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Table of Contents

Introduction

Alexandra Heath, Frank Packer and Callan Windsor

Property markets have long been recognised as an important source of risk to financial stability. Many economies have had multiple episodes of rapidly increasing property market prices leading to significant stresses for their financial system. Despite the recurring patterns of boom and bust, every crisis has its own unique features and there is always something new to be learned by carefully examining what went wrong, as well as what could have gone wrong but did not.

Although the shockwaves emanating from the global financial crisis that started in 2007 have yet to fully dissipate, enough time has elapsed to gain valuable insights into the relationships between property markets and financial stability. One of the purposes of the 24th annual RBA research conference, on the topic of 'Property Markets and Financial Stability', is to take stock of what has been learned by recent events in property markets and elucidate what lessons policymakers might take away from these experiences.

The Conference also marks the completion of the two-year research agenda of the Representative Office for Asia and the Pacific of the Bank for International Settlements (BIS). Four of the six papers presented at this Conference were commissioned by the BIS Asian Office at a workshop they co-hosted with the Monetary Authority of Singapore (BIS 2012). The BIS is very grateful to the RBA for sharing the platform of its longstanding annual research conference for the presentation of this research in 2012, as well as ensuring the participation of renowned researchers and senior central bank officials both within and outside the region.

There is a rich history of RBA and BIS research related to the link between property price cycles and financial stability. Kent and Lowe (1997), for example, show that large and rapid falls in the price of assets used as collateral for loans, such as housing assets, can have adverse effects on financial system stability. While financial regulation can significantly reduce the costs of collapses in asset-price bubbles there remains a case for monetary policy tightening in the early stages of an emerging property-price bubble. Borio and Lowe (2002) note that even with price stability, financial imbalances – especially the combination of asset price increases and rapid credit growth – are good predictors of a financial crisis.

Such findings have given rise to a fertile area of research at the BIS focused on the use of macroprudential tools, defined as those specifically targeting systemic risk, to moderate swings in property prices, related credit growth and other sources of financial vulnerability (see CGFS (2010) and the citations therein). The predictive capacity of financial imbalances for banking crises – evidenced all too clearly in the most recent crisis – has also motivated the general countercyclical capital buffer framework of Basel III, as well as related country-specific frameworks such as the one recently adopted by the Swiss National Bank, which uses the mortgage-to-GDP ratio and property prices as key indicators of the need to build up more capital in their financial system (SNB 2012).

The RBA's communication with the public over the early and mid 2000s also demonstrates the weight policymakers have placed on the link between property price cycles and financial stability (see Bloxham, Kent and Robson (2010) for an overview of these communications). Prior to two cash rate rises over November and December 2003, the Bank was engaged in an extensive dialogue with the public on the dangers of an overheating housing market for financial stability. In a speech in May of 2003, for example, Assistant Governor John Laker drew attention to the risks for financial stability posed by a substantial correction in the housing market, and suggested it was important for individual institutions not to 'lower their guard' (Laker 2003).

At the Conference one of the main themes that came out of the presentations and discussions was that the details of institutional arrangements, including financing arrangements, legal systems and policy settings, are fundamentally important for understanding the way property markets evolve and the implications these dynamics could have for both macroeconomic and financial stability. The corollary of this general observation is that it is important to think carefully about such details before transferring a lesson learned in one set of circumstances to another.

In opening, Glenn Stevens highlights the intimate link between property price cycles and financial stability by reflecting on Australia's historical experience and draws several policy lessons. First, he recognises that the policy debate has shifted towards acknowledging the need to pre-emptively respond to asset and credit price cycles – a theme that was revisited several times throughout the Conference. Second, Stevens stresses that monetary policy cannot succeed in managing cycles, asset values and leverage by itself; prudential supervision and the will to enforce prudential regulations are crucial for achieving financial stability policy objectives. Finally, he touches upon the importance of carefully measuring property price dynamics, particularly when making international comparisons.

The paper by Yongheng Deng, Joseph Gyourko and Jing Wu emphasises the importance of measurement issues in the analysis of property market dynamics. Based on detailed city-level data from China, they argue that housing price indices that approximate repeat sales measures, which are regarded in advanced economies as the most accurate means of controlling for changes in the composition of homes sold each period, can provide a biased picture of property market developments compared with more traditional hedonic measures. Most participants agreed that there are many problems of 'matching' comparable housing transactions in an emerging economy where a large share of the housing stock has been built recently. However, a number of participants also warned that the remarkable changes occurring in Chinese cities such as Beijing and Shanghai imply that measuring the generic characteristics used in a hedonic model, such as proximity to a subway system or to the centre of a city, is also extremely difficult.

Frank and Veronica Warnock focus on the importance of institutions in explaining housing market development. They start by observing that, in contrast to advanced economies, the problem for many emerging economies is that their housing finance systems are still insufficient for their country's needs. The Warnocks' analysis shows that a number of institutional variables affect the size of mortgage debt as a share of GDP, including the strength of property rights, the quality of available credit information and macroeconomic stability, and thus improvement in these variables would be likely to contribute to the development of mortgage markets. A point made during the discussion was that demographic factors (such as the age distribution of an economy and

life-cycle needs of population) should also be considered. The availability of fixed-term mortgages was also proposed as a positive factor, though it was also pointed out that the flexibility afforded by variable rates in a number of economies helped ease the burden of interest rate repayments in the recent crisis and mitigate the financial stability consequences of falling property prices.

The keynote speaker, John Muellbauer, emphasises the importance of taking into account economy-specific details when analysing the dynamics of housing prices. The paper he presents assesses the different channels through which changes in housing prices can affect the real economy. Muellbauer shows that channels that are very important for some economies – such as the link between housing wealth and consumption in the United Kingdom and the United States – do not have a significant influence in others, such as Japan and France. At the same time, emerging markets often have quite different channels that are important, such as the impact property prices have on the balance sheets of local governments in China. When considering policy responses to perceived bubbles, Muellbauer recommends distinguishing between two types of housing market overvaluation: one based on overshooting due to extrapolative expectations such as the recent housing market boom in the United States, versus overvaluation due to a sharp weakening of fundamentals such as in the United Kingdom and Finland during the late 1980s and early 1990s.

The paper by Luci Ellis, Mariano Kulish and Stephanie Wallace focuses on understanding the way in which different features of property markets and loan contracts affect property price dynamics and their consequences for financial stability. Their paper uses a simple model to demonstrate that while housing prices in markets with elastic supply may increase by less during the boom period, the potential for an overhang of supply after housing prices peak will be greater, and so the bust phase of the housing cycle could in fact be more damaging to financial stability under these conditions. The model also demonstrates that when finance is obtained through an interest-only loan structure (which is often the case with commercial property), the probability of default is higher during the bust phase than when the financing is via a variable-rate loan structure, as is common in the Australian residential property market.

Frank Packer and Tim Riddiough also explore how differences in institutional arrangements might account for why some property markets are more resilient, while others are more prone to booms and busts. In particular, they investigate how commercial real estate investment trusts (REITs) in the United States are well designed to convey accurate information about the balance of supply and demand in the commercial property sector. They argue that, as a result of this, the commercial property market in the United States was not the source of financial instability that it had been in earlier decades and in fact proved much more stable than the residential real estate market during the most recent financial crisis. Packer and Riddiough find more mixed evidence for the stabilising effects of REITs in other economies, and there was considerable discussion after the presentation among the conference participants about the extent to which the lessons drawn from the United States could be relevant for other markets. Which isn't to say these markets have been ignored in other countries: the Bank of Japan has even purchased Japanese REITs since 2010 as part of their unconventional monetary policy easing measures (Bank of Japan 2012).

Giovanni Dell'Ariccia summarises the state of knowledge on the relationship between housing cycles, bank risk-taking and the likelihood of poor macroeconomic outcomes and/or financial instability. He points out that while the state of economic modelling is not sufficient to fully

understand the underlying relationships, it is still possible to find variables that are useful indicators of those changes in bank lending behaviour that increase systemic fragility. In particular, Dell'Ariccia points to the risks of increasing leverage, lower credit standards and a rise in loan types that are more attractive when property prices are expected to grow strongly. The author concludes that monetary policy should be used more actively than just to help 'clean up' after a downturn in the housing cycle. At the same time, there is no definitive evidence as to which policies will be the most effective in preventing an unsustainable build-up in housing prices and credit.

The question of whether monetary policy or prudential policies have had any systematic effect on housing prices or housing credit is addressed in the paper by Kenneth Kuttner and Ilhyock Shim. Using a large cross-country panel dataset, they find that increases in short-term interest rates do have some dampening effect on housing price growth, as do caps on loan-to-value and/or debt-to-income ratios, although the effects are rather modest. Prudential policies also have a strong, statistically significant effect on housing credit growth, suggesting that such policies can be effective tools for stabilising cycles in housing prices and credit, thereby ensuring the resilience of the banking system.

The role of monetary policy is also a focus of the policy panel. All four panellists, Carlos Araújo, Per Jansson, Tae Soo Kang and Kiyohiko Nishimura, indicate that their institutions have had some success with using monetary policy in the early stages of a housing price and/or credit cycle, and there is general agreement that there is a role for monetary policy to 'lean' against housing price booms. There is also some discussion about the way in which communication can increase the effectiveness of monetary policy in this task. Nishimura makes a distinction between the early stages of a housing price and/or credit cycle as opposed to the collapsing stage; during the latter it is almost impossible to achieve much with standard monetary policy tools.

The panellists also discuss the effectiveness of macroprudential policies. While noting that some policies had been effective, Kang relates how in Korea's experience there have also been unintended consequences associated with avoidance of restrictions on lending, which in turn has led to a broadening of the policies over time to cover loopholes. General discussion picked up on the theme of the importance of a strong prudential supervisory regime and how best to ensure that there is a cooperative relationship between institutions with responsibility for prudential supervision and financial stability.

All four panellists also confirm the importance of correctly assessing the underlying fundamentals of supply and demand. Carlos Araújo notes that while the Banco Central do Brasil is monitoring rapid growth in credit and housing prices, the significant undersupply of housing and ongoing structural changes to the housing finance system means that these developments were less of a concern than otherwise. Nishimura and Kang both emphasise the importance of demographic change in assessing the longer-term risks and sustainability of housing price developments.

The importance of learning from past experience and continuing to pursue reform even after crisis conditions have passed is stressed by Jansson and seconded by others. In particular, Jansson attributes some of Sweden's resilience over the past five years to the fact that fiscal policy had been run in a sustainable manner and the prudential supervisory regime had been strengthened following previous crises.

In his closing comments, Stephen Cecchetti emphasises the need for internationally comparable data on property prices. He also conjectures that if all property financing were to be moved out of banks and into markets, financial systems would be more stable, but boom-bust cycles would remain, as these cycles reflect imbalances that are more fundamental than those of the financial structure itself. Cecchetti also highlights that we urgently need to know more about the effectiveness of various policy measures and their interaction.

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Opening Remarks

Glenn Stevens

Introduction

Welcome to Sydney. It is a great pleasure to see you here and to open this Conference. For the Reserve Bank of Australia this is the 24th annual conference; however, it is the first one that we have co-hosted with the Bank for International Settlements (BIS). It is a great pleasure to do that.

This year the theme is 'Property Markets and Financial Stability'. Recent events have highlighted the importance of that linkage and how great the dangers to economic stability can be if we do not appreciate the linkage between property markets and stability. In earlier conferences we have touched on these themes but we have not devoted a full conference. So the topic is welcome – it is also timely.

It has, of course, increasingly been a theme of research by the BIS. The BIS Office in Hong Kong started to focus on the theme in 2010 as a result of a request by the BIS Asian Consultative Council. A year ago there was a workshop hosted by the Monetary Authority of Singapore to review the progress being made on the contributions to this research program. A number of projects that were commissioned as a part of this program have come to fruition as research papers that will be presented over the next two days.

There is little doubt that property price swings and financial stability are intimately connected, our own experience in Australia certainly confirms that. To start things off I would like to talk very briefly about that and about some of the simple, and occasionally painful, lessons that we have drawn along the way.

Australian Experience

The history in Australia dates back to the 1890s when there was a very pronounced property price cycle that was very important for the city of Melbourne (Fisher and Kent 1999). In a way, that episode is of some interest for this Conference because some of the drivers of that cycle, initially at least, were population growth and urbanisation which are important factors in parts of Asia today. But the episode in Melbourne was also fuelled by foreign capital inflow, speculation and a decline in lending standards. The term `Marvellous Melbourne' was coined to describe the apparently easy prosperity of that time. I have read that Melbourne claimed to be the biggest city in the British Empire after London in those days.

In Australia the 1890s depression, particularly acute in Melbourne, was much worse than the 1930s on several metrics, particularly financial ones. Something like half of the trading banks suspended payment and a large number of non-bank financial institutions failed. So it was a very severe experience.

Our more recent experience with cycles in property markets occurred in the 1980s, the 1990s and the 2000s against the backdrop of broad-based deregulation of the financial sector. This deregulation removed the strictures of very tightly constrained regulation on banks and the credit rationing to the community that resulted from those regulations (Battellino and McMillan 1989). Deregulation saw banks freed from those shackles and looking to compete. Liberalisation of the capital account increased access to offshore funding which allowed credit growth to be faster than deposit growth. This persisted for many years, though it is changing now. A more liberal policy towards granting banking licences also saw foreign banks enter the market, heightening competition, especially in the area of corporate lending.

As you might expect, with this deregulation occurring after a long period of financial repression, risk management practices in financial institutions were not necessarily all they could have been. The initial result was a boom in commercial property – finance and prices – in the late 1980s that unwound quite painfully in the early 1990s when a recession hit. This episode exposed the earlier poor lending, with parts of the banking system coming under severe stress, and once again, interestingly enough, the city of Melbourne was quite prominent in that dynamic, though the problems were not confined to Melbourne.

So the initial experience of liberalised financial markets in my lifetime in this country was initially painful for banks and for the economy.

Subsequently, in the long recovery, banks were looking for other forms of lending which were safer. They looked around and saw an opportunity in households which, to that point, had been relatively constrained in their lending choices and were probably, by international standards, rather under-leveraged. For the ensuing 15 years or so, that is where the growth was. The profitability and stability of that business saw new entrants to the market and heightened competition, and banks' margins were eroded. The net result was that households, which had been credit constrained for a couple of generations, found they could borrow more, and that is exactly what they did. The ratios of debt to income and dwelling prices to income spent about 20 years rising to new, higher levels.

We are still debating whether that is a new, stable and sustainable higher equilibrium. I think it is plausible that moving from a constrained credit equilibrium to an unconstrained one is, in fact, a one-time move to a higher-equilibrium level. But it is difficult to know how high that equilibrium could be. One of the difficulties in this debate is that of getting accurate measures of dwelling prices and incomes and all the other fundamental factors. It is particularly hard to do this when we want to do international comparisons and that is a thing I will return to later.

However, to begin it is worth reviewing what conclusions we have drawn about property values, policy and financial stability from these experiences, beginning a century ago, but also in more recent memory.

Lessons Learned

The underlying monetary policy framework

It is customary to say that it is crucial to get the underlying monetary framework right. Indeed maintaining overall macroeconomic stability is the most important thing that monetary policy

can do. Macroeconomic instability, and certainly lack of growth, drives many of the proximate causes of borrower distress, which in turn are very damaging for macroeconomic stability. There is no doubt that the RBA's capacity to achieve macroeconomic stability has been enhanced greatly by the implementation of the flexible inflation-targeting regime that we have had for nearly 20 years now. This provides a framework for clearly communicating the goals of monetary policy, building credibility by demonstrating that our actions are consistent with these goals, and ultimately providing a nominal anchor for the economy.

But I would also say that establishing a credible and enduring monetary policy framework around controlling consumer price inflation, though critical, is not enough. Financial stability and monetary policy are related – the relationship is not simple, it is complex, but you certainly cannot divorce the two. We came to this conclusion based on our own experience; however, one only needs to look around the world to see that lesson has been writ large in many places.

Asset prices

The second lesson is that asset prices, and property prices in particular, do matter. And they matter more than just for the information they contain about future economic activity and prices. Everybody agrees that asset prices are important and should evoke some response to the extent that they convey information about future output and consumer price inflation. But that is not saying anything more than we should build the best forecasting model. Asset prices actually matter more than that. They matter in ways, and over time horizons, that are not well captured by the standard Phillips curve framework that I think still underlies much of the standard inflation-targeting framework in operation around the world. They matter because property holdings tend to be leveraged. Big swings in asset values where the holdings are not leveraged will not, I conjecture, matter all that much. It is property that is being used as collateral for significant lending by financial institutions that makes property prices so important. It is actually the leverage that matters.

Now there has been a long debate about whether monetary policy should respond to asset prices – the so-called lean-versus-clean debate. A lot of people taking part in this Conference have contributed to this debate, which has been going on at least since the Japanese bubble economy ended, and that is about 20 years ago. Should monetary policy lean into the asset price upswing? The case to do that is that the growth cost might be small and the benefits of avoiding future pronounced instability might be great. The argument against is that we just do not know enough about asset price and credit dynamics to do this with any precision or with the hope of much success, at least without risking serious damage to other parts of the economy.

I would have thought that by this point we have to conclude that simply expecting to clean up after the credit boom is not sufficient anymore; the mess might be so large that monetary policy ends up not being able to do the job when the time comes. Moreover, if the monetary policy clean-up after the asset price bust involves interest rates low enough to prompt some other sector of the economy to leverage up in order to spur the growth, then the clean-up itself might leave its own toxic consequences.

The debate has moved, it seems to me, some way towards doing a bit more leaning. Monetary policy cannot surely ignore any incentive it creates for risk-taking behaviour and leverage. The

risk-taking channel, as some now call it, is very important. But, at the same time, monetary policy cannot succeed in managing cycles, asset values and leverage by itself.

Prudential supervision

This is where we would draw a third lesson from our own observation and that of other countries in recent years. Policymakers have discovered – or maybe I should say rediscovered – the importance of prudential supervision.

Currently, there is a big debate about the appropriate structure of supervisory and regulatory arrangements. In this country, following the early 1990s' experience and following a financial system inquiry in the mid 1990s, we decided to put all the prudential supervision of banking, insurance and pension funds into one institution. That was thought to be the structure most consistent with achieving the appropriate policy objectives.

That decision paralleled one taken in the United Kingdom at about the same time. Ironically, the United Kingdom now seems to be moving back the other way. In the United States and Europe as well, there is extensive discussion of redesigning the architecture of supervisory and stability arrangements. All of this is important: getting all of the relationships right between the various entities; getting their charters properly clarified and aligned; and providing the communications between them. There is also the Basel III work and the burgeoning agenda of the Financial Stability Board, and beyond that, the G-20. This is a response to the inevitable post-crisis demand that the events of the last five years never happen again. All of this work is good, but we need to make sure that we do not neglect a few very simple eternal verities.

One of those is that serious supervision is critical. The most elegantly crafted rules will not make much difference if the capacity and will to enforce them is not in place. There is probably too much tendency to fall for the easy line that if only we can craft better regulations and bring the bankers under control then all will be well. Actually, it is the application of the rules and the framework that matter. After all everybody was using some version of Basel II or Basel I. This was more or less the same set of regulatory arrangements pre-crisis. But not everybody had a collapse of their banking system. In fact, I would say probably more countries did not have a banking crisis than did have one. The regulatory framework certainly is important, but the way it is applied matters. The quality of supervision may actually matter more than the exact detail of the black-letter regulations.

Those are a few observations that I would draw from experience. I have one final remark about property prices in particular and that is that measurement matters and measurement is difficult.

Measurement

Over the years looking at this set of issues in Australia we have found that some of the apparently easily available aggregate data on dwelling prices were rather less useful than you might hope. For one thing they are affected by compositional shifts in the nature of transactions. Having some transactions in very high-priced locations this month compared with very low-priced transactions last month will have a significant impact on aggregate measures of prices. Measures of prices can also lag what is actually happening in the market considerably due to the way they are compiled. These and other issues prompted the RBA to invest quite a lot of effort in trying to improve measures of dwelling prices. We worked with private sector data providers to come up with

measures of dwelling price movements that abstract, as far as you can, from these problems by using matched samples or hedonic methods. As a result of these efforts, Australia now has better measures of dwelling prices than before. Hopefully this leads – although this is less clear – to a more informed debate. Commercial property prices, of course, are even more difficult to measure, being highly diverse and turning over more rarely so there tends to be much more reliance on subjective valuations in that sector.

One particular area where measurement matters is when you do international comparisons. The RBA has tried to look at ratios of dwelling prices to income across countries and compare the levels rather than just the movements from some base point (Stevens 2012). It turns out this is very hard to do; getting comparable data on dwelling price levels and for that matter disposable income levels is very difficult. It also highlights that such comparisons need to be done with due caution.

Although measurement matters, unfortunately we cannot always wait for the perfect dataset before trying to factor these important dynamics into our practical policymaking decisions. The assumption that if only we could get the perfect data then everything would then follow easily, I think is another delusion. We do have to try to get better data; however, in the interim we have no choice but to use whatever imperfect information we do have.

In conclusion let me say I am very pleased to see a conference devoted to these issues underway. It is fitting and timely that this occurs here in Sydney where we have been giving consideration to these issues for many years. We certainly have learned that getting our underlying policy frameworks correct is critical but we have also learned that it is not enough. The ability to manage financial stability risks is inextricably linked to the strength of the prudential supervisory regime and it requires all the agencies involved in that to work together effectively. We also have to work on getting better data, but after all that we remain acutely conscious that there is much we do not know.

I am pleased then to see that the papers that will be presented here today and tomorrow demonstrate the sort of careful analysis that this question of the interaction between property prices and financial system stability demands. As a result I am sure the discussions you have over the next couple of days will be productive and I wish you well in your deliberations.

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Land and Housing Price Measurement in China

Yongheng Deng, Joseph Gyourko and Jing Wu*

1. Introduction

The stability of residential property markets has become an important topic for policymakers and scholars ever since the collapse of the subprime mortgage market in the United States helped precipitate the largest economic crisis seen in that country since the Great Depression. Many commentators now are raising questions about the stability of housing prices in China given the extraordinary boom in values and China's growing share of global growth.[1]

In this paper, we take a closer look at Chinese housing markets, investigating two of their features in detail. One is the land market. China is virtually unique globally in that transaction prices of vacant land are regularly observed. We construct constant quality land price indices for 35 major cities and analyse their characteristics.

The other aspect of the housing market studied here is how best to measure prices. Without an accurate gauge of real, constant quality prices, neither investors nor policymakers can be well-informed about the true condition of property markets. Ever since Case and Shiller (1987) popularised repeat-sales price indices in the United States, they have become the gold standard for housing price measurement, replacing older hedonic techniques that were used to adjust for quality drift in the housing stock. However, China, along with many emerging markets, provides a unique challenge to the use of repeat-sales indices because there is plenty of new construction but few cases of multiple sales of existing units. Drawing on the work of Wu, Deng and Liu (forthcoming), we show that hedonic modelling approaches generate a more accurate picture of housing price growth in Chinese markets.

In this paper we report results on land price appreciation and sales growth based on a new and unique dataset on residential land markets across 35 major Chinese cities. Key stylised facts about Chinese land markets include the following. Residential land values have skyrocketed in China over our 2003–2011 sample period. Even with the recent pullback in land prices in 2011 observed in many markets, the average annual compound rate of real, constant quality land price growth is still above 10 per cent in the typical market and exceeds 20 per cent per annum in eleven cities.

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1 For some recent examples, see Anderlini (2011), Chovanec (2011) and Krugman (2011).

Extremely high rates of price appreciation are not restricted to the big coastal region markets such as Beijing and Shanghai, which experienced real annual growth rates of 20.2 per cent and 23.7 per cent, respectively. In fact, the city of Hefei, the capital of Anhui province in central China, has the highest real annual average growth rate of 30.1 per cent.[2] In addition, the markets of Changsha, Chongqing, Lanzhou, Nanjing and Tianjin are almost indistinguishable from Beijing and Shanghai in the magnitudes of their land price growth. The first three of those cities are in the central or western region of the country. In addition, there is heterogeneity in the magnitude of price growth across markets, with eight (Jinan, Kunming, Nanchang, Shijiazhuang, Qingdao, Yinchuan, Xian and Urumqi) experiencing real land price growth of less than 10 per cent a year on average. Only one market, Urumqi, had negative price growth over the five years for which we have data.

While there is a strong common temporal factor in land price growth across cities, city-specific effects can explain virtually none of the variation in price growth. Thus, prices tend to move in the same way across most markets in a given year, possibly due to shifts in the Chinese macro environment or national market sentiment. There is also large mean reversion in annual price growth, on the order of 35 per cent. This is quite different from what other researchers have found for US housing (not land) prices over short horizons such as a year. A preliminary investigation suggests that frequent adjustment of central government policies is a factor in explaining this pattern. Mean reversion in land price growth is larger if land prices were increasing in the previous year. This is consistent with evidence that the Chinese Government intervenes regularly to tame the property market.

Land prices also are quite volatile – three to five times more so than housing prices according to our data. Construction costs are fairly flat over our sample period and construction workers' wages grew strongly, but with relatively low variation around the trend, so the volatility in housing prices appears to be driven by land prices, rather than by the cost of other factors of production.

We also document the supply side of local land markets, showing a doubling of space supplied via land auctions since 2008. City-specific effects are influential in explaining the variation in new supply, but an economically meaningful common, national component is also present. In addition, we provide evidence that local political economy factors can help explain the variation in supply over time within a given market. The volume of land sales is higher the more recently the local Chinese Communist Party chief took over. It also is higher if local government has been spending more than it brings in to budgetary revenues, forcing it to rely more on land sales as an important source of funds.

The second part of our paper focuses on the measurement of housing price changes in China. Most of the housing stock is relatively new and has not transacted multiple times. Hence, it is impractical to construct housing price indices using paired repeat-sales transaction data. Presently, there are two widely known price series reported in China. One reflects the simple average of transaction prices within each city on new housing units, with no attempt to control for heterogeneity in the quality of the housing units or markets. The other is a comparison of the average prices of new units sold in individual housing complexes during different stages of the complexes' sales periods. This series is an average of changes in complex-based average prices over different sale stages and over time.

2 Technically, Xining has a higher annual rate of appreciation of 49.9 per cent, but we only have three years of data on that market.

The behaviour of the simple-average series varies widely across markets. It shows more starkly rising prices in bigger, more developed coastal markets than in smaller, less developed interior ones. The second series, based on changes in average prices within a housing complex, exhibits little price growth over time and little volatility in general. Relying on the analysis in Wu *et al* (forthcoming), we show that both indices suffer from severe biases. The simple average housing price index underestimates true constant quality price growth due to falling quality over our sample period.[3] The comparison of complex-level average pricing across different sale stages over time also suffers from downward bias due to both unobserved unit-level heterogeneity and the pricing strategy of developers (i.e. Chinese residential housing developers typically sell the better units with higher prices earlier, and gradually drop prices in later stages). We contrast these two series with a traditional hedonic-based price index that we estimate separately, and argue that the hedonic housing price index more accurately reflects changes in price appreciation over time in the eight major markets for which we have data. The simple hedonic model indicates that housing price growth has been very high in virtually all markets.

The plan of the paper is as follows. The next section begins by describing the unique land price data that we have amassed for major Chinese markets. Changes in real constant quality land prices are then estimated, along with a description of how quantities have changed on the supply side. This section closes with a brief examination of the drivers of the price and quantity change series. Section 3 then turns to the issue of how best to measure housing price changes in an emerging market like China. As just noted, we provide a real, constant quality hedonic price index for newly built housing in eight major cities and contrast it with the existing official indices. Section 4 concludes.

2. Land Price Growth in China: Measurement and Analysis

2.1 Data collection and creation of constant quality land price indices

With very rare exceptions, researchers typically do not have access to raw data on land values because sales of land parcels separate from the buildings on them are seldom observed.[4] A special feature of the Chinese market is that sales by local governments of the right to use land over long periods of time occur regularly in each city, and have been consistently recorded since 2003. Legally, the Chinese Government retains ultimate ownership of all urban land, so what we observe is the transfer of a leasehold interest. In 1988 a constitutional amendment allowed the purchase of use rights for up to 70 years for residential properties. All future rental payments are included in the upfront price paid by the purchaser, so we treat the initial lump sum payment as the transaction price of the land parcel.

The sample starts in 2003 due to a ruling by the Ministry of Land and Resources (MLR) in May 2002 that required all residential and commercial land parcel leasehold purchases subsequent to

3 One important factor appears to be inferior location or site quality, as rapid urbanisation pushes new buildings further out along the urban periphery of many Chinese cities. The underlying hedonic traits controlled for in our estimation are described below in more detail.

4 In the US context, Haughwout, Orr and Bedoll (2008) is one counter-example. See Ching and Fu (2003) and Ooi, Sirmans and Turnbull (2006) for a discussion of land transactions observed in Hong Kong SAR and Singapore, respectively.

July 2002 to be sold via some type of public auction process.[5] Values since then can be reasonably expected to reflect fair market values. The MLR also requires the local land authority to publicly report the winning bidder and the transactions price. Furthermore, it is standard procedure for the local authority selling the parcel to publish detailed information on the parcel's address, size, designated usage, land conditions on delivery, and major planning indicators such as the floor area ratio.

Wu, Gyourko and Deng (2012) were the first to collect these data on land sales for the capital city of Beijing. In this paper, we expand that effort to include information on the 35 major cities listed in Table A1. To our knowledge, this is the first comprehensive description of major local land markets in China.

More specifically, we worked with Soufun, a leading real estate data vendor in China, to obtain the data for residential land parcel transactions from each local land authority's website.[6] Table 1 reports summary statistics on the number of cities covered by year, along with the number of land parcel transactions and the floor area involved. There are complete data dating back to 2003 for fifteen markets. Another seven have data that began in 2004, and the remainder started more recently. There is an average of about 25 transactions per city in the initial year, with that number typically ranging from about 27 to 50 in subsequent years.[7]

5 Prior to this ruling, called the 11th Provision, most transactions of urban land parcels were done by negotiation between a developer and a local government. This process was criticised for being opaque and open to corruption. For our purposes, the prices that resulted seem likely to be below free market levels, with the degree unknown and possibly changing over time depending upon local circumstances. Currently, all transactions must be done via public auctions, including regular English auctions (*pai mai*), two-stage auctions (*gua pai*), and sealed biddings (*zhao biao*). See Cai, Henderson and Zhang (2009) for a comparison of these three types of auctions.

6 Our data exclude parcels wholly designated for public housing units because the pricing mechanism for those sites is different. Public housing programs in China include low-rent units (*lian zu fang*), public rental units (*gong gong zu lin fang*), affordable housing units (*jing ji shi yong fang*) and price-controlled units (*xian jia fang*). Typically the parcels designated for low-rent units would be directly allocated by local governments, while parcels for price-controlled units are required to transact via public auctions.

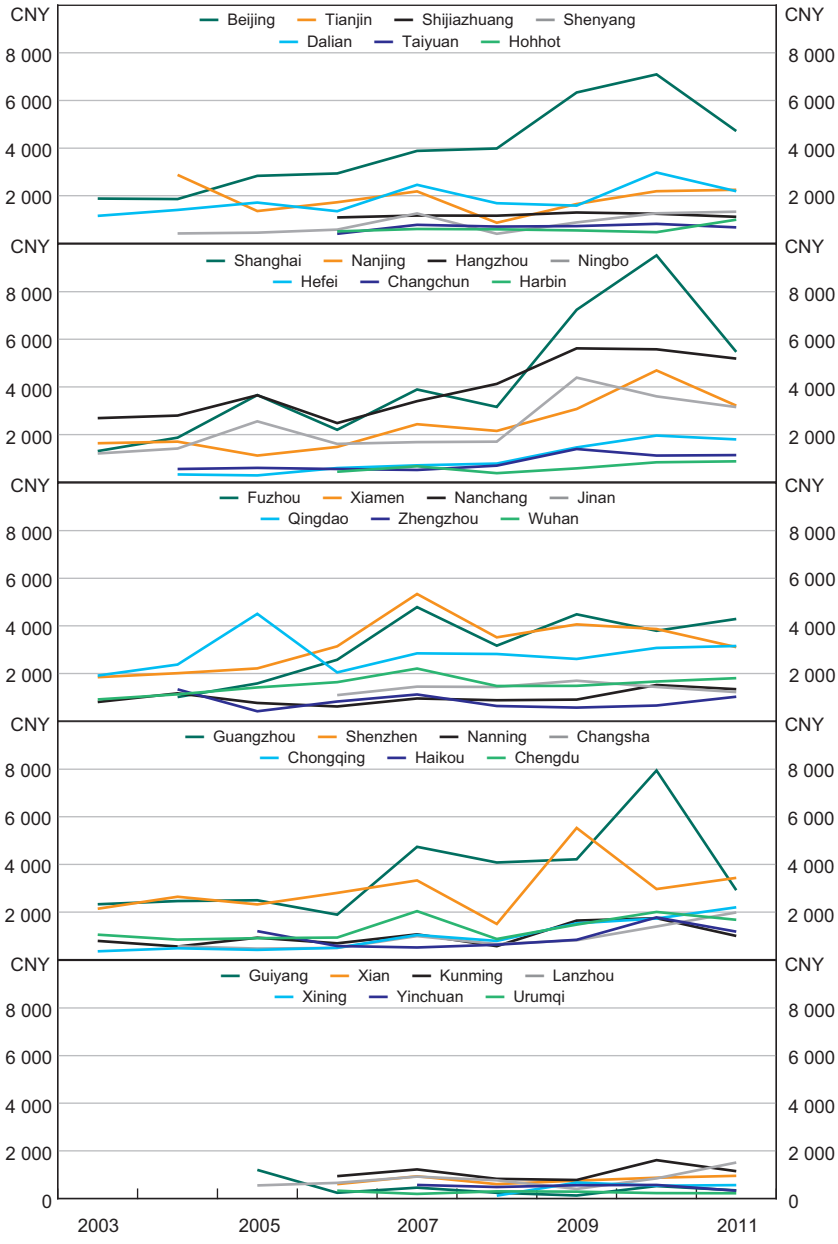
7 We actually observe the specific date of the land sales, but have limited sample sizes at monthly and quarterly frequencies. Hence, our analysis does not investigate higher frequency periods.

Table 1: Land Transactions

	Number of cities covered	Number of land parcels sold	Total floor area of land parcels sold Million square metres
2003	15	378	44.40
2004	22	681	70.62
2005	24	773	93.49
2006	33	1 133	182.68
2007	34	1 413	246.47
2008	35	963	169.83
2009	35	1 564	281.33
2009	35	1 759	336.37
2011	35	1 749	288.15
Aggregated	**na**	**10 413**	**1 713.34**

Land parcels in China are priced in terms of the floor area of housing permitted to be built on the parcel, instead of the land area. Real prices in constant 2009 yuan per square metre of permitted space are computed by deflating by the relevant monthly CPI series for each city. Figure 1 plots the simple means of these real values for each year in each market. There is substantial heterogeneity in prices across markets, and one can see the mean reversion that will be documented more formally below. The growing dispersion apparent in Figure 1 is misleading, as it is partially due to the inclusion of additional markets over time. For example, for the 15 markets with complete data throughout our sample period, in 2003 land was nearly eight times more costly in the most expensive market (2 693 yuan per square metre of floor area in Hangzhou) than in the least expensive city (352 yuan in Chongqing). By 2011, the gap between the highest and lowest of these 15 markets was just over five times (i.e. with Shanghai at 5 470 yuan and Nanning at 997 yuan per square metre). This is not a small absolute difference by any means, but still pales in comparison to the nearly 25 times gap in 2011 between Shanghai and Urumqi (222 yuan per square metre) for the full sample of 35 markets.

Figure 1: Real Average Residential Land Prices
2009 yuan per square metre of floor area



Source: authors' calculations

We do not work with the unadjusted transactions prices in the analysis below because they may be driven by quality changes that could arise for a number of reasons. One is that the highest quality sites might be sold first, so that the change in the unadjusted mean values for a given city

would understate the true constant quality rate of price appreciation. On the other hand, local governments might reserve the good parcels and only list them during the more recent boom periods of the stimulus years. This would result in an overestimation of price growth in the simple average series. In addition, some land parcels were not levelled on delivery in a few cities in the early years of our sample. Not controlling for this would result in overestimation of true, constant quality price growth.[8] It also is possible that sales of high-quality parcels occur whenever the local government has the greatest need for revenue. Thus, the bias could go in either direction for different markets.

Consequently, we follow Wu *et al* (2012) in creating constant quality land price indices for each market. Our city-level hedonic price index is estimated using ordinary least squares (OLS), with the log of the real transaction price as the dependent variable. The explanatory variables are: (a) the parcel's distance to the centre of the corresponding city (*D_CENTER*), which is measured after mapping the precise location of each site with Geographic Information Systems software; (b) the distance to the nearest subway station (*D_SUBWAY*), which is relevant in 10 of the 35 cities with operating subway systems during our sample period; (c) district dummies which control for local/neighbourhood-level fixed effects not captured by the two previous location controls; (d) a set of physical attributes including the land area of the parcel (*SIZE*), the density permitted on the site when it was built (*FAR*) and whether the parcel is levelled on delivery (*LEVEL*); (e) variables that indicate whether a small portion of the residential land parcel is designated for affiliated commercial properties (*COMMERCIAL*), public establishments (*PUBLIC*), or public housing units (*PH*); (f) the parcel's transaction form as reflected in whether it was purchased via sealed bidding (*BIDDING*), regular English auction (*AUCTION*), or two-stage auction (the default group); and (g) year dummies, whose coefficients are used to create the constant quality price index.

Our land price hedonic model works at least tolerably well in each of the 35 cities. The coefficients on the quality controls are generally consistent with expectations, and we always can reject the null hypothesis that they have no explanatory power. Adjusted R^2 statistics vary from a low of 0.17 (Urumqi, for which data begin in 2006) to a high of 0.72 (Fuzhou, for which data begin in 2004). Table A1 reports some summary statistics on these underlying regressions, all of which are available upon request.[9] The land price index in each city is constructed from the estimated coefficients of the time dummies, where 2009 is the base year (i.e. year 2009 = 100).[10]

8 If a land parcel is not levelled on delivery, the purchaser has to pay additional cost for relocating previous occupiers of the parcel, removing the existing buildings, and so forth, which would negatively affect the transaction price of the parcel. Before 2003, whether a parcel was levelled upon delivery was a key part of the negotiation between the developer and the local government. After that, most land parcels sold via public auctions are levelled on delivery, although there were a few exceptions in some cities, especially during the early years. We directly control for this in the hedonic estimation as described below.

9 We also conducted a two-stage Heckman estimation to control for potential bias arising from the fact that there were a total of 614 parcels listed that failed to result in transactions (either because there were no bidders if there was an auction or the bid prices were lower than the local government's reserve price, which is relevant for cases involving sealed bids). If these failures are disproportionately concentrated in certain periods such as the financial crisis, selection bias would result in an overestimation of the price index for that period. We could not find any statistically significant indications of sample selection bias based on the inverse Mills ratio estimated from the first-stage probit model.

10 Average annual appreciation in our hedonic price index is about 5 percentage points higher than in the unadjusted price series, which suggests that parcel quality has been falling over time on average. This does vary by time and market to some extent.

2.2 Land price growth from 2003 to 2011

Implied real, constant-quality compounded average annual growth rates for each of the 35 cities are listed in Table 2. Among the 22 markets with data back at least to 2004, there are only 2 in which constant-quality land price growth is estimated to have appreciated at an average compound rate below 10 per cent (Nanchang and Qingdao, at 7.8 per cent and 5.9 per cent, respectively). Nine have experienced average compound annual growth rates above 20 per cent. Naturally, this implies extremely high aggregate growth in real land values. The greatest price appreciation has occurred in Chongqing, which saw prices escalate by 577 per cent between 2003 and 2011. The analogous figures for Beijing and Shanghai are 336 per cent and 448 per cent.[11] Six of the fifteen markets with data back to 2003 have average compound annual growth rates above 20 per cent, which implies their land prices have grown by more than 330 per cent between 2003 and 2011. Qingdao's relatively low 5.9 per cent per annum average compound growth has led to 2011 prices that are 58 per cent higher than in 2003.

Summary statistics on the distribution of annual appreciation rates over time are presented in Table 3. Double-digit average annual price appreciation is the norm; the simple average across markets is only below 10 per cent in two years and negative only during 2007–2008. The 34 markets with data for that time period were almost evenly split between those experiencing positive and negative price growth. Even though average real land price growth was slightly positive in 2010–2011, more markets saw price declines than increases that period.

The extremely high volatility of land prices is also demonstrated in Table 3. There are very wide swings in the mean growth rates across individual years, and there is evidence of mean reversion at annual frequencies. The average absolute difference in mean price growth rates between consecutive time periods is 24.5 per cent. The swing in growth rates upon entering the global financial crisis from 2006–2007 to 2007–2008 was –51.7 percentage points, and the decline from 2009–2010 to 2010–2011 following the end of the stimulus was –28.8 percentage points. The gaps between the markets with the highest and lowest land price growth in any given year also are extremely wide. Those differences range from 60 percentage points in 2003–2004 to 165 percentage points in 2005–2006. While most markets tend to move in the same direction within any one year, individual cities can and do experience outsized booms and busts at given points in time. And, there are generally a handful of local markets in which land prices fall in any given year.

11 Hefei's real land values grew 531 per cent between 2004 and 2011.

Table 2: Real Compound Annual Growth Rates in Constant Quality Land Values
2009 yuan, per cent

15 markets, 2003–2011 8 years		7 markets, 2004–2011 7 years		2 markets, 2005–2011 6 years		9 markets, 2006–2011 5 years		1 market, 2007–2011 4 years		1 market, 2008–2011 3 years	
Chongqing	27.0	Hefei	30.1	Lanzhou	20.7	Hohhot	19.7	Yinchuan	8.9	Xining	49.9
Shanghai	23.7	Changsha	20.3	Guiyang	12.4	Haikou	17.8				
Hangzhou	21.8	Tianjin	20.2			Taiyuan	12.2				
Nanjing	20.5	Fuzhou	17.7			Harbin	10.8				
Beijing	20.2	Changchun	13.9			Jinan	7.2				
Shenzhen	20.1	Shenyang	13.7			Xian	6.9				
Xiamen	18.7	Zhengzhou	10.3			Shijiazhuang	5.1				
Ningbo	18.5					Kunming	2.0				
Chengdu	16.7					Urumqi	–2.9				
Dalian	15.8										
Guangzhou	14.7										
Wuhan	13.3										
Nanning	12.3										
Nanchang	7.8										
Qingdao	5.9										

Table 3: Real Annual Land Price Growth – Summary Statistics

	2003–2004	2004–2005	2005–2006	2006–2007
Mean – %	32.1	12.2	23.5	46.4
Standard deviation – %	21.7	23.1	40.5	42.1
Max – %	64.1	47.2	128.8	131.2
Min – %	4.4	–28.0	–36.1	–29.2
Number of cities	15	22	24	33
Number with positive appreciation	15	15	17	28
Number with negative appreciation	0	7	7	5
	2007–2008	**2008–2009**	**2009–2010**	**2010–2011**
Mean – %	–5.3	28.5	31.4	2.6
Standard deviation – %	24.0	30.7	29.4	30.2
Max – %	38.6	93.1	83.6	108.6
Min – %	–59.9	–20.2	–31.6	–44.2
Number of cities	34	35	35	35
Number with positive appreciation	18	27	29	16
Number with negative appreciation	16	8	6	19

Table 4 provides additional insight into just how volatile land prices have been in Chinese cities. Given that land is the residual claimant on property value in standard models, we would expect it to be more volatile than housing prices overall. The top panel of Table 4 compares simple mean growth rates of housing and land prices over time in our sample of cities, along with similar measures for construction costs and wages in the construction industry.[12] The bottom panel then reports the annual standard deviations of those variables.

12 The housing price growth rate is derived from the constant quality price index for newly built housing units, which will be described in detail in Section 3. Construction costs and wages in the construction industry are both reported by the National Bureau of Statistics of China (NBSC); since no city-level statistics are available for these two series, the series in the corresponding provinces in which the cities are located are adopted instead. All four series in Table 4 are in real terms and are deflated by the CPI index in each city. Construction cost and wage data for 2011 are not yet available.

Table 4: Housing Prices, Land Prices, Construction Costs and Wages
Per cent

	2004	2005	2006	2007	2008	2009	2010	2011
Mean of annual real growth rates								
Housing price	4.14	5.56	6.72	13.60	8.18	9.17	23.31	8.47
Land price	32.07	12.22	23.51	46.39	–5.34	28.46	31.36	2.57
Construction cost	6.26	0.12	0.22	1.26	6.77	–1.87	1.76	na
Construction industry wage	8.24	12.38	14.19	10.73	8.56	14.62	10.26	na
Number of cities included	15	22	25	33	34	35	35	35
Standard deviation of annual real growth rates								
Housing price	4.91	3.64	6.13	12.41	8.31	6.39	11.60	7.82
Land price	21.68	23.06	40.52	42.11	23.98	30.72	29.44	30.22
Construction cost	2.23	1.68	1.39	1.38	2.49	1.31	1.29	na
Construction industry wage	5.78	4.29	4.61	5.07	4.33	9.01	4.89	na
Number of cities included	15	22	25	33	34	35	35	35

Sources: National Bureau of Statistics of China; authors' calculations

Land price growth well exceeds overall housing price growth in all years except 2008 and 2011, when we estimate that land prices either dropped or stagnated, while housing prices increased modestly. In contrast, construction costs were fairly stable over our sample period, with the highest rate of cost growth being 6.8 per cent in 2008. Construction wages grew by more on average in each year, but wage growth still pales compared with land price appreciation. Standard deviations in land price growth range from 22 to 42 per cent, depending upon the year, so the volatility is quite high. These magnitudes are three to four times larger than the standard deviation of any other factor price reported in Table 4.

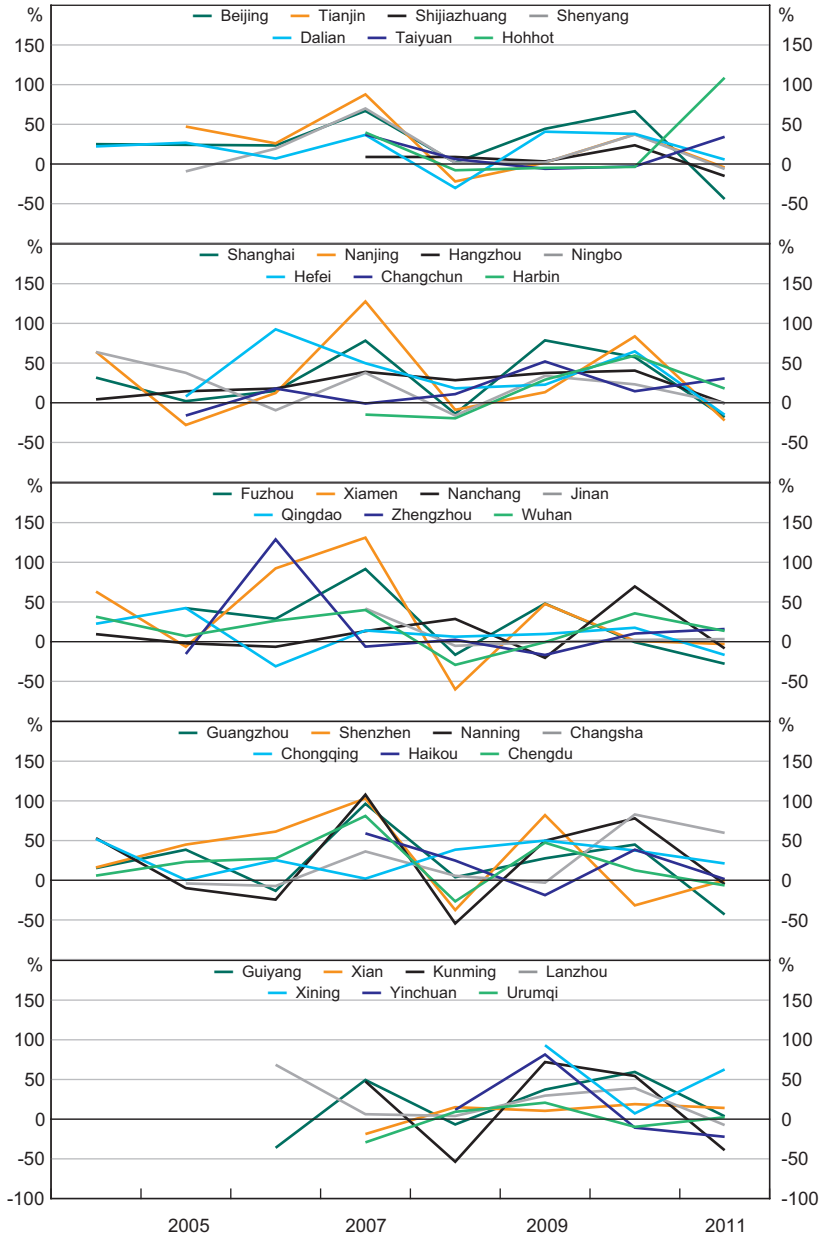
Figure 2 plots the log of each city's land price index, where the price in 2009 is set to 100. Figure 3 plots real land price appreciation rates for the same set of cities. Here, one begins to see the common movement in price growth across markets.

Figure 2: Real Constant Quality Residential Land Price Index
2009 yuan per square metre of floor area, index 2009 = 100

Source: authors' calculations

Figure 3: Real Constant Quality Residential Land Price Growth

2009 yuan per square metre of floor area, year-ended



Source: authors' calculations

The strong influence of a common, national effect on city-level land price growth is more evident from simple regressions of annual land price appreciation on year and/or city dummies. Table 5 reports summary statistics from these regressions. Year dummies alone can account for 24 per cent of the variation in annual land price growth in the 35 markets depicted in Figure 3. This is more than four times the explanatory power of a regression on the city dummies alone ($R^2 = 0.05$) and one cannot reject the null hypothesis that the city fixed effects are jointly equal to zero. These factors are largely orthogonal to one another, as the explanatory power of the regression that includes them both is $R^2 = 0.28$. Thus, some common, national effect can account for over one-fifth of the variation depicted in Figure 3, while there does not appear to be any fixed city trait that can explain much of it.

Table 5: Can Year and City Fixed Effects Explain Local Land Price Growth?
Dependent variable – log change in real annual land price index

Independent variables	Model		
	(1)	(2)	(3)
Year fixed effect	Yes	No	Yes
City fixed effect	No	Yes	Yes
R^2	0.24	0.05	0.28
Adjusted R^2	0.21	–0.11	0.13
F-stat for the joint test that all year fixed effects equal 0	9.89***		8.89***
F-stat for the joint test that all city fixed effects equal 0		0.30	0.37
Number of observations	233	233	233

Note: ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively

This raises the question of whether there are time-varying local market characteristics which can explain the variation in land price growth. To investigate this, we created a number of variables that reflect demand, supply and credit conditions in each market. The demand for residential land is derived from the demand for housing itself, so one variable to include is a measure of the supply-demand balance in the housing market ($hsdratio_{i,t}$). More specifically, it is the ratio of the floor area of newly built housing listed in city i and year t ($hlisted_{i,t}$) to the floor area of newly built housing that was sold in the same city and year ($hsold_{i,t}$):

$$hsdratio_{i,t} = hlisted_{i,t} \,/\, hsold_{i,t}. \quad [13] \qquad (1)$$

In the regression model estimated below, we introduce the one-year-lagged term, $hsdratio_{i,t-1}$, to avoid potential issues associated with reverse causality. This variable should be negatively correlated with the change in local land prices, as a higher value of this ratio indicates increasing oversupply in the housing market.

13 The numerator and denominator are based on data provided by the Ministry of Housing and Urban-Rural Development (MHURD). Each reflects activity permitted by a local housing authority. This variable is only available until 2010.

We also control for expected non-farm employment growth in the city using a variable akin to the one developed by Bartik (1991). This variable, $epgrowth_{i,t}$, is calculated as the weighted average of national employment growth rates by industry, where the weights reflect each city's share of that industry's aggregate employment. More specifically,

$$epgrowth_{i,t} = \sum_{j=1}^{18} \frac{e_{i,j,t-1}}{e_{i,t-1}} \frac{\tilde{e}_{i,j,t} - \tilde{e}_{i,j,t-1}}{\tilde{e}_{i,t-1}} - \frac{e_t - e_{t-1}}{e_{t-1}} \quad (2)$$

where e_t is the national employment level in all non-farm industries, $e_{i,j,t}$ is city i's employment in industry j in year t, $\tilde{e}_{i,j,t}$ is the national employment level in industry j outside of city i, and the j subscript indexes the 18 non-farm employment sectors in China.[14] This variable should be positively correlated with the change in local land prices, as it is close to being a pure demand shifter.

US credit markets are thought by many to have played a prominent role in helping generate the stark rises in housing prices seen in many US markets. For China, we proxy for local credit market conditions with the amount of new loans issued to developers each year in each market, denominated in billions of 2009 yuan.[15] The specific measure used in the regression analysis below is $developloan3yr_{i,t}$, which is the lagged, three-year average of these loan amounts (i.e. the average for the three years from $t-3$ to $t-1$). This variable is expected to be positively correlated with changes in local land prices to the extent that easier credit market conditions in the local property market allow developers to bid up land prices.

To see if time-varying local market conditions influence land markets, the log change in the individual city market land price indices is regressed on these factors plus year dummies in a random effects estimation as follows:

$$\text{dlog}LP_{i,t} = \alpha + \beta epgrowth_{i,t} + \gamma hsdratio_{i,t-1} + \delta developloan3yr_{i,t} + \varphi year_t + \varepsilon_{i,t}, \quad (3)$$

where $\text{dlog}LP_{i,t}$ is the log change in city i's annual land price index and all other variables are as described above.[16] The results are reported in the first column of Table 6. Note that this table only uses data up to 2010 because that is the latest year available for some regressors.

14 All employment data are from the NBSC. Because industrial classifications were adjusted in 2003, this variable is available in a consistent format beginning in 2004. Currently the data are only available until 2010.

15 These data are sourced from the NBSC.

16 We also experimented with directly controlling for city fixed effects. The standard Hausman test indicates the random effects specification is preferred; however, the results are robust to using city fixed effects.

Table 6: Can Time-varying Local Traits Explain Local Land Price Growth?

Dependent variable – log change in annual land price index; 2003–2010

Independent variables	Model	
	(1)	(2)
Expected employment growth ($epgrowth_{i,t}$)	0.0825	0.1722**
	(0.0530)	(0.0696)
$expgrowth_{i,t}$ * 2009/10		–0.2120*
		(0.1089)
Previous supply-demand balance in housing ($hsdratio_{i,t-1}$)	–0.1245**	–0.1570*
	(0.0603)	(0.0852)
$hsdratio_{i,t-1}$ * 2009/10		0.0231
		(0.1222)
Previous three-year average loan volumes to developers ($developloan3yr_{i,t}$)	0.0019*	0.0013
	(0.0011)	(0.0017)
$developloan3yr_{i,t}$ * 2009/10		0.0011
		(0.0023)
Year fixed effect	Yes	Yes
City fixed effect	No	No
R^2	0.27	0.29
Number of observations	183	183

Notes: Standard errors in parentheses; ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively; 16 observations are dropped due to the missing value in $hsdratio_{i,t-1}$

Each coefficient has the expected sign, with those on the supply-demand conditions and liquidity measures being statistically significant at standard confidence levels. The expected employment growth variable is significant at the 12 per cent level. The second column of Table 6 augments this baseline specification by including interactions of each local trait with a dummy variable indicating the period after the global financial crisis began and China instituted its massive stimulus program (i.e. 2009 and 2010). Here, we see that virtually all of the impact of the time-varying local traits is due to variation in the years prior to 2009. While caution is in order given the limited degrees of freedom involved, we cannot find any local trait that is strongly correlated with land price changes in a statistical or economic sense during the stimulus period.

Even prior to the stimulus, the economic importance of these traits is limited. Computing standardised marginal effects of the three local characteristics using the coefficients from column (2) of Table 6 yields the following: (a) a one standard deviation increase in expected employment growth in a city is associated with an increase in the log change of its land prices of one-fifth of a standard deviation; (b) a one standard deviation increase in the ratio of floor space listed relative to that sold in the market in the previous year is associated with the log change of

local land prices falling by half of a standard deviation; and (c) a one standard deviation increase in the lagged average of developer loans in the city is associated with an increase in the log change in land prices of about one-tenth of a standard deviation.

In one sense, it is comforting to know that our proxies for local market fundamentals and credit conditions work as any simple economic model would predict, especially given the limited time series over which we can estimate the relationships.[17] However, it still is the case that these effects are small relative to the impact of the common national effects reflected in the coefficients on the year dummies. On average, the typical 'year effect' explains about 30 per cent, which is roughly equal to one standard deviation of the log change in annual land prices for the cities in our sample. This suggests that changes in sentiment about the country's economic prospects will influence local land markets more than the supply-demand fundamentals of those markets themselves.

One other noteworthy feature of Figure 3 is the mean reversion apparent in the series. Table 7 reports results from very simple models of the log change in current land price appreciation on its lag, controlling for time and city fixed effects (in most cases). One does not want to make too much of these findings given the limited time series (and the fact that we do not have data over a complete housing cycle), but the findings confirm the visual impression delivered by Figure 3. Essentially, if land price growth is 1 percentage point higher this period, it is about 0.35 per cent lower next period (column (1)). This is quite different from what researchers have found in the housing market in US where there is strong persistence in housing price growth across years and mean reversion over longer periods such as five-year intervals (e.g. Case and Shiller (1987), Cutler, Poterba and Summers (1991), Glaeser *et al* (2010)).

17 We experimented with other local traits, but they were insignificant and/or did not change the basic tenor of the results reported in Table 6. For example, we also collected data on local infrastructure investments related to transportation, environmental projects (e.g. drainage, purification, gardening and greening), and so-called basic infrastructure (e.g. water supply) as reported by MHURD. Those measures are highly positively correlated with our developer loan variable (the correlation ranges from 0.77 to 0.86 depending upon the specific infrastructure measure). Including one of these infrastructure variables in lieu of our credit market proxy yields very similar results to those reported in Table 6. We also developed a measure of expected time on the market using data on local housing inventory and the amount of sales. This variable is positively correlated with our supply-demand ratio *hsdratio*, and has no independent influence. However, it is correlated with log land price changes in the expected way. This highlights that our goal here is not to claim some type of tight causal relationship for a specific variable; we have too short a time frame and lack plausibly exogenous variation for such a convincing analysis. Rather, our point is to note that there are various local traits that plausibly capture fundamental conditions which are correlated with land price appreciation in ways that a simple economic model would predict.

Table 7: Mean Reversion in Annual Land Price Growth
Dependent variable – log change in real annual land price index

Independent variables	Model			
	(1)	(2)	(3)	(4)
dlog($LP_{i,t-1}$)	–0.3527	–0.4427	–0.4243	–0.5961
	(0.0764)***	(0.0891)***	(0.0749)***	(0.0864)***
dlog($LP_{i,t-2}$)		–0.1905		–0.3806
		(0.0888)**		(0.0868)***
YEAR2006	–0.0156			
	(0.0909)			
YEAR2007	0.2479	0.3149		
	(0.0891)***	(0.0875)***		
YEAR2008	–0.1850	–0.1175		
	(0.0857)**	(0.0885)		
YEAR2009	–0.0273	0.0302		
	(0.0887)	(0.0840)		
YEAR2010	0.1151	0.1459		
	(0.0849)	(0.0865)*		
YEAR2011	–0.1354	–0.0567		
	(0.0849)	(0.0832)		
Constant	0.2114	0.1978	0.2131	0.3038
	(0.0732)**	(0.0734)***	(0.0249)***	(0.0330)***
City fixed effect	Yes	Yes	Yes	Yes
R^2	0.34	0.36	0.12	0.17
Number of observations	198	163	198	163

Notes: Standard errors in parantheses; ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively

This naturally raises the question of why this pattern exists in the data, and whether the volatility in the land prices provides useful information to understand housing price movements. We do not answer that question here, but Table 8 provides some intriguing insight into one possible factor. The Chinese Government is known to intervene in the housing market, especially to tame it. For instance, when housing markets in some coastal region cities started to boom in 2004–2005, the central government issued a series of intervention policies between late 2005 and early 2006 to cool the market. Similar patterns also apply to the cases of intense interventions in late 2007, where the effect was later intertwined with the global financial crisis, and more recently in the second half of 2010. The huge stimulus package in December 2008, and the introduction of measures focusing on encouraging housing consumption around the same time (State Council Decree, No [2008]131), are a counter-example because they may have at least partially fuelled

the skyrocketing housing prices and land prices in 2009. The results in Table 8 lend credence to a role for the government. The first specification interacts the lagged land price appreciation term with a dummy variable indicating the direction of land price growth in the previous year. The results indicate that mean reversion is larger if land prices were increasing in the previous year. Subsequent specifications in Table 8 investigate whether local fiscal conditions might also have played a role. Those specifications include a triple interaction variable $deficit_{i,t}$, (that includes the size of the local fiscal deficit in the previous year), which is calculated as the ratio between local budgetary fiscal expenditure $bexp_{i,t}$ and budgetary income $binc_{i,t}$ in city i and year t,

$$deficit_{i,t} = bexp_{i,t} \,/\, binc_{i,t}. \tag{4}$$

Table 8: Augmented Mean Reversion Estimates
Dependent variable – log change in real annual land price index

Independent variables	Model			
	(1)	(2)	(3)	(4)
dlog($LP_{i,t-1}$) * (dlog($LP_{i,t-1}$) ≥ 0)	–0.4323	–1.1490	–0.5528	–1.6853
	(0.1173)***	(0.5071)**	(0.1203)***	(0.5165)***
dlog($LP_{i,t-1}$) * (dlog($LP_{i,t-1}$) ≥ 0) * $deficit_{i,t-1}$		0.4626		0.8139
		(0.3674)		(0.3860)**
dlog($LP_{i,t-1}$) * (dlog($LP_{i,t-1}$) < 0)	–0.2039	0.3254	–0.1770	0.7549
	(0.1831)	(0.8092)	(0.1963)	(0.8846)
dlog($LP_{i,t-1}$) * (dlog($LP_{i,t-1}$) < 0) * $deficit_{i,t-1}$		–0.3903		–0.6748
		(0.5952)		(0.6557)
Constant	0.2290	0.2177	0.2542	0.2888
	(0.0759)***	(0.0777)***	(0.0391)***	(0.0424)***
Year fixed effect	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes
R^2	0.34	0.29	0.13	0.09
Number of observations	198	163	198	163

Notes: Standard errors in parantheses; ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively

In the analysis, $deficit_{i,t}$ serves as the proxy of a local government's fiscal pressures and reliance on land sales.[18] The coefficients on this term are not statistically significant at standard confidence levels, but the sign indicates that mean reversion from price growth booms is smaller if the local government has been running larger deficits. Perhaps governments running larger deficits have less of an incentive to actively implement any countervailing policies emanating from the central government in Beijing. In contrast, when price growth has been falling, such cities might have an incentive to be especially aggressive in reversing the decline in prices, which would lead to the larger mean reversion effect. The pattern of these results is consistent with this expectation, although it is at most marginally significant. We certainly have not established any causal relationships, but the exercise does serve to illustrate the potential usefulness of a rich panel of observations on local land markets.

2.3 Stylised facts about quantities: the volume of land sales during 2003–2010

Figure 4 plots the floor area sold by year across our sample of markets. Table 9 reports summary statistics on the amount of space supplied. Note that the supply of space has increased greatly, and this is not solely due to the rise in the number of cities covered in our sample. The aggregate supply of space has roughly doubled just since 2008, when all 35 cities are included in the sample. Figure 4 also depicts some convergence in the flow amount of new space supplied across markets over time.[19]

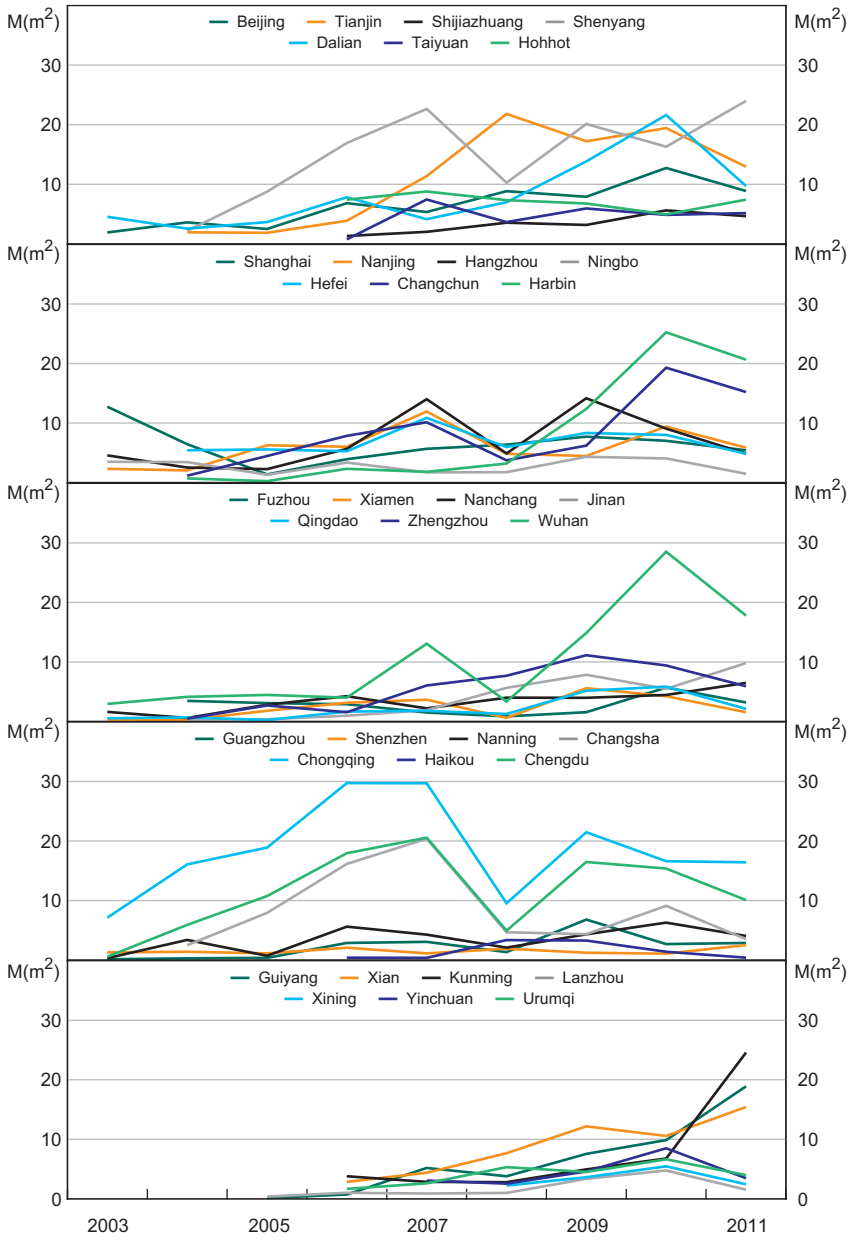
Table 9: Summary Statistics on Floor Area Sold
Millions of square metres

	Mean	Standard deviation	25th percentile	Median	75th percentile	Number of cities included
2003	2.86	3.13	0.53	1.89	4.52	15
2004	3.25	3.43	1.16	2.52	3.58	22
2005	3.98	4.31	1.32	2.59	5.55	24
2006	5.62	6.25	1.68	3.79	6.02	33
2007	7.46	7.17	2.11	4.33	11.35	34
2008	5.34	4.29	2.52	4.41	7.48	35
2009	8.04	5.72	4.55	6.20	12.36	35
2010	10.13	6.94	5.21	7.36	13.45	35
2011	9.26	7.84	3.20	6.33	12.96	35

18 In China, local governments' fiscal income mainly comes from two sources: budgetary income from local tax, and off-budget income, most of which is from land sales. Under the current 'tax revenue sharing system' established in 1994, local governments can only retain 40–50 per cent of the budgetary income, but are burdened with 70–80 per cent of the budgetary expenditure, which places heavy fiscal pressure on them. Consequently, local governments have to rely on land sales as a major off-budget income source. According to a report by the Ministry of Finance of China to the National People's Congress, in 2010, total land sales income reached 2 914.7 billion yuan nationally, equaling 74.1 per cent of local governments' budgetary income. See Tsui (2005) for more details about the current public finance system in China.

19 There is a similar convergence if we restrict the sample to the 15 markets for which we have consistent data back to 2003.

Figure 4: Residential Floor Area Sold



Source: authors' calculations

Table 10 reports results analogous to those in Table 5, demonstrating whether this movement in supply can be explained by city or time fixed effects. Both factors are empirically relevant, although city fixed effects can explain more of the variation. It is not surprising to find significant city fixed effects here, as the amount of space supplied is certainly linked with market scale. However, there are statistically and economically meaningful year effects, so we cannot reject the null hypothesis of a strong common or national effect in new supply.

Table 10: Can Year and City Fixed Effects Explain Local Land Supply Volume?

Dependent variable – log of annual land supply volume, millions of square metres of floor area

Independent variables	Model		
	(1)	(2)	(3)
Year fixed effect	Yes	No	Yes
City fixed effect	No	Yes	Yes
R^2	0.22	0.42	0.68
Adjusted R^2	0.20	0.34	0.60
F-stat for the joint test of all year fixed effects equalling 0	8.34***		18.18***
F-stat for the joint test of all city fixed effects equalling 0		5.03***	8.87***
Number of observations	268	268	268

Note: ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively

Table 11 reports some simple regressions to see if time-varying city traits can explain any of the variance in the supply series. Here, besides the city and year fixed effects, we introduce two local politics variables. One measures the degree of budgetary deficit in the previous year as defined above, and the other measures the length of time (in years) that the top local Chinese Communist Party (CCP) officer has been in his (or her) position. The results in column (1) of Table 11 show that if the city government was spending a lot relative to its revenues in the previous year, it is likely to sell more land this year. In addition, the more land that gets supplied the newer is the top CCP officer in the local government.[20] While these results should be viewed as simple correlations they strongly suggest that local political economy considerations play an economically meaningful role in land supply developments. The second column of Table 11 includes interaction terms with the stimulus period of 2009–2010. Both coefficients are positive, but neither is statistically significant. Columns (3) and (4) investigate whether current deficit situations (not just lagged ones) are correlated with supply conditions (this variable is only available until 2010). The answer is yes, and the finding that CCP officers new to their offices sell more land is robust to these changes in specification.

20 Other research suggests that performance in boosting local economic growth is a key determinant of local officers' career path in China (Li and Zhou 2005). The newly appointed officers are strongly incentivised to expand government expenditure or investment more aggressively to build political capital for their future promotions, and thus generate higher demand for fiscal revenues.

Table 11: Can Political Factors Explain Local Land Supply Volume?
Dependent variable – log of annual land supply volume,
millions of square metres of floor area; 2003–2010

Independent variables	Model			
	(1)	(2)	(3)	(4)
Degree of budgetary deficit in the previous year ($deficit_{i,t-1}$)	0.9488**	0.7862*		
	(0.4253)	(0.4573)		
$deficit_{i,t-1}$ * 2009/10		0.3012		
		(0.3084)		
Degree of budgetary deficit in the current year ($deficit_{i,t}$)			1.1884***	1.0838**
			(0.4407)	(0.4840)
$deficit_{i,t}$ * 2009/10				0.1372
				(0.2931)
Length of CCP top officer in current position ($length_{i,t}$)	–0.0558*	–0.0713**	–0.0569**	–0.0674*
	(0.0285)	(0.0344)	(0.0283)	(0.0344)
$length_{i,t}$ * 2009/10		0.0406		0.0273
		(0.0523)		(0.0522)
Year fixed effect	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes
R^2	0.22	0.21	0.19	0.19
Number of observations	234	234	234	234

Notes: Standard errors in parantheses; ***, ** and * indicate significance at the 1, 5 and 10 per cent level, respectively

In sum, city and year fixed effects can explain about 60 per cent of the variation in the supply of new space annually in our 35 market sample. Local political economy factors also appear to be empirically relevant, as the fiscal balance of the city and whether the local CCP chief is new to his or her job also are correlated with supply.

2.4 Some final comments on very recent changes in Chinese land market data

The widespread, but not universal, declines in real constant quality land prices in 2011 are similar in nature to what happened in 2008 as the global financial crisis unfolded. Nineteen markets saw real land values fall in 2011 versus sixteen in 2008. Those earlier period declines were quickly reversed by the massive Chinese Government stimulus in 2009 and 2010. Only time will tell if something similar occurs this time.

There is still substantial heterogeneity across markets, even in the most recent data, so it remains inaccurate to claim that there is some single national Chinese land or property market. Sixteen

markets still experienced positive land price growth in 2011, and nine of them had double-digit price growth (and each of these nine were in the interior of the country).[21] There were some very big price declines too, with ten of the nineteen cases of falling prices experiencing double-digit drops. Many of these markets were along or near China's coast.[22]

We have also collected data for the first quarter of 2012. These city-level samples are small, so we do not report price index or change data. However, there are stark falls in transaction volumes, whether measured by the number of parcels sold or by the permitted square metres on those parcels. Using the latter metric, 2012:Q1 volumes are 65 per cent of their 2011:Q1 levels and 46 per cent of 2010:Q1 levels, on average. In only 6 of our 35 markets are permitted square metres on sold parcels in the first quarter of 2012 greater than that in the first quarter of 2011; the analogous number when comparing 2012:Q1 to 2010:Q1 is seven.[23] In 21 of the 35 markets (or 60 per cent of our sample), levels of permitted square metres in 2012:Q1 that are at least 50 per cent below levels prevailing in 2010:Q1. The changes here are especially stark among the coastal markets: Beijing's numbers are down by 75 per cent; Shanghai's by 91 per cent; Fuzhou's by 96 per cent; Dalian's by 92 per cent; Qingdao's by 91 per cent; Ningbo's by 89 per cent; Guangzhou and Xiamen had no land sales in 2012:Q1, so their levels are down by 100 per cent. These percentage changes are not artificially high because of the comparison with the 2010:Q1 stimulus period. Twenty-two of our thirty-five markets have permitted square metres on sold land parcels in the first quarter of 2012 that are more than 50 per cent below their levels in the first quarter of 2011.

In sum, transaction volumes in the land market have plummeted in most (but not all) major Chinese cities in the first quarter of 2012. This suggests that demand from private developers is very low. It is well known that house prices around the world do not follow a random walk (e.g. Case and Shiller (1989)) and tend to be sticky downward with quantities falling before prices do. If this is the case in China, then these most recent transaction data are foreboding and bear close scrutiny going forward. If they do not reverse to a significant extent, one would expect sharp price declines in the near future.

3. What is the True Level of Housing Price Growth in China? Measurement and Analysis

Measuring housing price growth may seem like a straightforward matter given the now-widespread acceptance of the repeat-sales methodology reintroduced and popularised by Case and Shiller (1987, 1989).[24] However, it is not so in China (and other emerging markets), where a significant portion of the housing stock consists of new (or relatively new) housing units that have not yet been sold multiple times. Obviously, a repeat-sales index captures price changes of existing homes, which by definition are the only ones that have been sold more than once.

21 Those markets are Changchun (30.8 per cent), Changsha (59.8 per cent), Chongqing (21.2 per cent), Harbin (18.1 per cent), Hohhot (108.6 per cent), Wuhan (13.6 per cent), Xian (14.0 per cent), Xining (62.4 per cent), and Zhengzhou (16.1 per cent).

22 The biggest declines were in Beijing (–44.2 per cent), Fuzhou (–27.7 per cent), Guangzhou (–43.0 per cent), Shanghai (–18.0 per cent), and Qingdao (–16.6 per cent). The other coastal markets of Dalian, Ningbo, Hangzhou, Shenzhen and Xiamen were either flat or slightly negative.

23 Only Changsha, Changchun, Chengdu, Jinan, Wuhan, Yinchuan and Zhengzhou have levels of permitted square metres above those during the stimulus period in the first quarter of 2010.

24 Their work is based on the seminal contribution of Bailey, Muth and Nourse (1963).

China reports two housing price series, each of which is based exclusively on the values of newly built housing units. According to statistics published by MHURD, 64 per cent of all the floor space transacted in 2010 was from newly built units, so accurately measuring the price change on new units captures much of the variation in the value of entire housing stock in China.[25]

One series is the called the 'Average Selling Price of Newly Built Residential Index'. This is the simple average of transaction prices (total sales value divided by total size of housing unit transacted) on new housing units, and is based on statistics reported by all developers in each market. It makes no attempt to control for any quality differential across markets or drift in the quality (positive or negative) in housing units over time. It is available for all markets across China. The other series, which is officially termed 'Price Indices in 70 Large and Medium-Sized Cities' ('70 cities index'), is a measure of changes in average prices on unit sales within individual housing complexes over sales stage or time. More specifically, this index is calculated by first computing the average sale price of new units each month, by housing complex. The monthly series is then the average of each complex's average price changes over time weighted by transaction volume.

Figure 5 plots each series for the eight major markets reported in Wu *et al* (2012) between 2006:Q1 and 2010:Q4.[26] Table 12 reports the implied average compound price growth for each series over our sample period. There are two noteworthy features of these data. First, data from the '70 cities index' never show much price appreciation in any of the eight major markets. In some, but not all, of these cities, the simple average price index also exhibits relatively little growth and volatility. Second, the two series are not highly correlated with one another.

Table 12: Real Average Compound Quarterly Housing Price Growth Rates
2003–2010, per cent

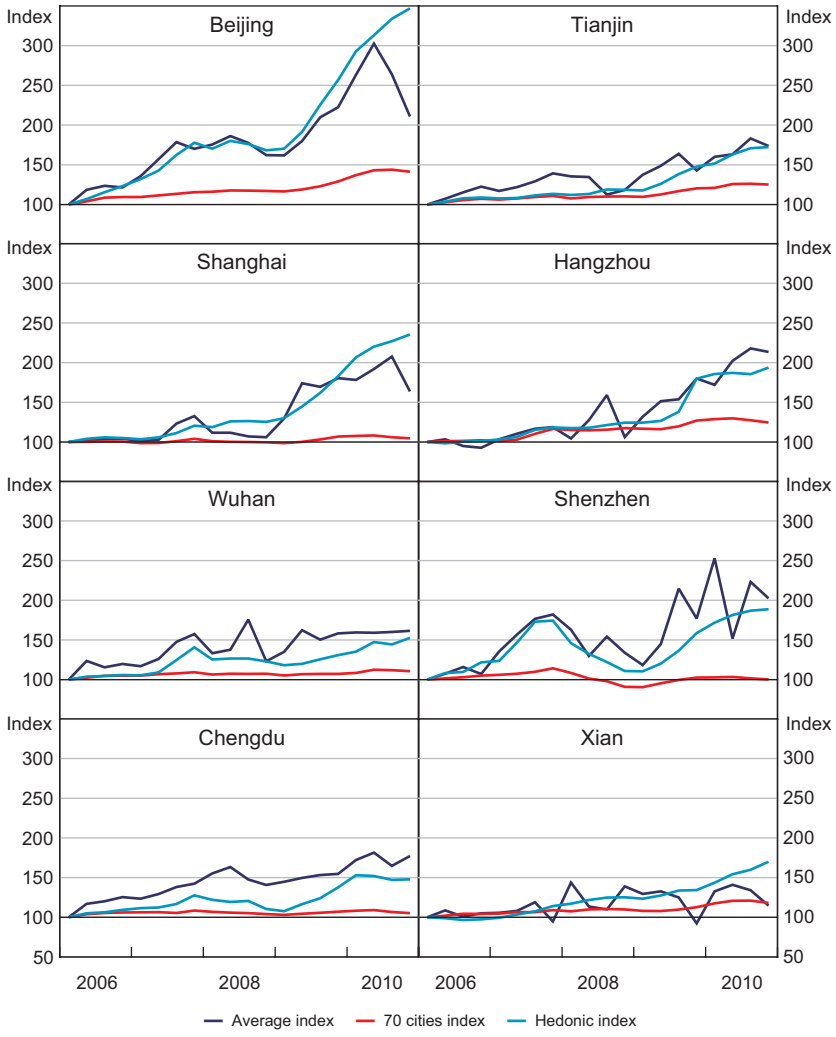
City	Average index	70 cities index	Hedonic index
Beijing	4.00	1.83	6.77
Tianjin	2.95	1.18	2.90
Shanghai	2.63	0.25	4.61
Hangzhou	4.08	1.17	3.54
Wuhan	2.56	0.54	2.25
Shenzhen	3.78	0.01	3.40
Chengdu	3.06	0.27	2.08
Xian	0.73	0.89	2.84

Sources: National Bureau of Statistics of China; authors' calculations

25 Ideally, one would like to capture price changes on existing housing, too, but currently the reported transaction prices of existing units are not considered to be of high quality in China, at least partially because an unknown number of people are reporting lower values to avoid transaction taxes and capital gain taxes.

26 The average price index started in the mid 1990s, and the '70 cities index' started in 1997. Both indices significantly adjusted the coverage or estimation method in the second half of 2005, and hence here we only display each series since the first quarter of 2006.

Figure 5: Comparison of Real Newly Built Housing Price Indices
March quarter 2006 = 100



Sources: National Bureau of Statistics of China; authors' calculations

If these data are to be believed, the '70 cities index' in particular sends a comforting message about the state of housing markets in major Chinese cities, in that they do not indicate there has been a boom that might have led to substantial overpricing (relative to underlying fundamentals) of housing prices in these places. However, Wu *et al* (forthcoming) provide good reasons to believe these series are biased downward, possibly quite substantially. For example, it is well known that price growth calculations based on simple averages will overstate (understate) the true change in constant quality values to the extent that quality rises (falls) over time. To determine the extent of heterogeneity across markets and quality drift over time, one must go to the data.

The continuous suburbanisation of sites as urban growth has skyrocketed in major Chinese cities means that new units are being produced in housing complexes farther away from the urban core. Using data on an anonymous Chinese market, Wu *et al* (forthcoming) report that the average distance from the city centre increased by 50 per cent between 2004 and 2007 (i.e. from 4.2 kilometres to 6.1 kilometres). If this is typical of most rapidly growing markets, then location quality has changed a lot in recent years. In the US context, this would not be a signal of lower quality, as sorting into suburban sites is often associated with higher location quality, particularly as higher-income households sort into homes located in high-quality school districts. There is no reason to expect any such spatial sorting in China, and Wu *et al* (forthcoming) report results from a hedonic housing price regression (see below for more on their model and the hedonic approach) indicating that not controlling for the fact that new housing units are being built farther out from the urban core is associated with more than a 14 per cent underestimation of constant quality prices. Hence, the rapid growth in urban Chinese markets is associated with units being built on lower-quality sites, and not controlling for this feature results in a meaningful underestimation of constant quality price growth over a period as short as three years.[27]

Increasing density is another trait of new housing complexes that suggests quality has deteriorated over time. Based on data from various issues of the *Statistics Yearbook of China*, Wu *et al* (forthcoming) calculate that permitted floor area ratios (*FAR*) increased by over 60 per cent between 2000 and 2010 (i.e. from 2.15 in 2000 to 3.57 in 2010). Their hedonic analysis, using micro data on an unnamed Chinese housing market, indicates this does not severely depress prices, but increasing density is considered a disamenity in any reasonable housing or urban model, so it is yet another reason why the two government indices might understate true price growth, all else constant.[28]

Strategic pricing behaviour by developers is yet another reason why the second '70 cities index' might substantially understate true housing price appreciation. As Wu *et al* (forthcoming) argue, the trade-off between setting a higher price and the carry costs of unsold units, as reflected in their time on the market, is likely to lead developers to price their units so the last units sold are of lower price. In their empirical analysis using data from the same anonymous Chinese housing market, they provide results from a hedonic regression that is consistent with this conclusion, as the last unit sold in a typical housing complex goes for 11 per cent less than the first unit sold in the same complex. Thus, not being able to control for the timing of sales, which the '70 cities index' does not do, is likely to lead to substantial underestimation of the true price increase.

Even if individual housing unit quality has not deteriorated over time (and it could have increased), all this suggests that the quality of the housing complexes in which the units are located has fallen over time, probably because of their inferior locations.[29] Not being able to control for this

27 That said, accurately controlling for this trait is difficult in a period of extremely high growth. If the true centre of activity is changing, we would expect an unchanging noisy measure to lead to a downwardly biased hedonic price.

28 The *ceteris paribus* assumption is critical here. Increasing density may bring other benefits such as more and better restaurants, improved infrastructure, and the like. The entire package could result in higher overall quality for a given location. However, we are concerned here with the direct impact of more structure on a given amount of land. That is a disamenity and the direct effect should be to lower prices. The hedonic model by Wu *et al* (forthcoming) also suggests a significantly negative effect of high density.

29 The vast majority (over 95 per cent) of new housing units are situated in condominium-like high-rise complexes according to recent issues of the *Statistics Yearbook of China*. The rest are so-called landed houses, which means the units are detached and on their own plot of land. In this report, we focus exclusively on the former type of housing unit.

downward quality drift means that both indices reported by the government underestimate the true extent of housing price growth.[30]

Therefore, we apply the hedonic estimation approach to all the newly built housing units transacted between 2006 and 2010 in the eight major cities reported by Wu *et al* (2012).[31] The resulting series and their real average compound growth rates are reported in Figure 5 and Table 12. There are two noteworthy features of the comparison between this constant quality index and the two existing official indices. First, in each of the eight cities the hedonic indices grow much faster than the '70 cities index'. The deviation from the real average compound price growth rates varies from 1.7 percentage points in Wuhan to 4.9 percentage points in Beijing. This implies that the bias arising from the strategic pricing behaviour by developers in the newly built markets is important. The '70 cities index', which is presently the most influential housing price indicator in China, appears to be fairly unreliable in terms of capturing price changes over time.[32]

The relationship between the hedonic price index and the average price index is mixed. The average compound growth rate of the hedonic price index is higher in the cities of Beijing, Shanghai and Xian, but fairly similar in Tianjin, Hangzhou, Wuhan and Shenzhen. In Chengdu, the average price index grew faster than the hedonic price index during the sample period. As suggested above, the key potential bias facing the simple average method is due to quality shifts of transacted units, which would vary with time and by city. In general, the eight cities covered here are the most developed cities in China, in which the process of urban expansion started earlier and has slowed in recent years. This suggests that the effect of urban expansion on the average price index would be more important in the emerging cites. Even though it seems that the bias in the average price index in these eight major markets would not significantly affect our judgment of their market conditions during the sample period, we still would not want to extrapolate that conclusion to other markets or to the national level.[33]

Another difference is that the average price series is always more volatile than the hedonic price index, which at least partially reflects fluctuation in the quality of units sold. This effect is especially important in relatively small markets such as Shenzhen and Xian, and will make the change in the average price index in specific periods less reliable, such as the sharp fluctuation of the average price index in Shenzhen in 2009 and 2010. Even in large markets like Beijing and Shanghai, such an effect could lead to very different results in some periods like late 2010.

30 Technically, the bias is the result of omitted quality change that is reflected in the residual of the price estimation equation that is negatively correlated with estimated price change (i.e. because quality is falling over time). See Wu *et al* (forthcoming) for a derivation.

31 In the calculation, all the units transacted in the sample period in one city are pooled in a hedonic model. Then, after controlling for the major locational and physical attributes, the hedonic price index is calculated based on the time dummy coefficients. See Wu *et al* (forthcoming) for the example in one city and more details about the calculation process.

32 NBSC updates and reports the '70 cities index' each month. But for most cities, NBSC does not directly report the average price, only the aggregated transaction volume and its total value. Therefore, the former series is much more well known to the public.

33 As calculated by Wu *et al* (forthcoming), the real average growth rate of the aggregated average price index in 35 major cities was significantly lower than that of the hedonic price index (1.87 and 3.94 percentage points, respectively).

4. Summary and Conclusion

This paper reports the first results and summary statistics on conditions in Chinese land markets using new data based on auction sales from 2003–2010 in 35 major cities. While there is meaningful heterogeneity in land price growth across markets, on average, the nine years to 2011 saw land values skyrocket in many markets, not just those on the coast. The typical market has experienced double-digit compound annual growth in real values on average.

Three notable characteristics about the land price growth series are their strong mean reversion at annual frequencies, the strong common factor in their movements, and their very high volatility. Mean reversion is about 35 per cent from one year to the next. Year dummies account for just over one-fifth of the variation in these data, while city fixed effects are not statistically significant. Volatility is quite high in comparison with other factors of production used in housing, suggesting that the volatility in housing prices is being driven by the land market, not construction costs or construction sector wages.

Quantities, not just prices, have been increasing sharply in recent years. The amount of space supplied has typically doubled since 2008. The supply of land is better explained by city-specific factors, although there is some common, year effect, too. Local political economy factors can account for some of the variation in supply over time within cities.

We also investigated the quality of the two most prominent housing price indices in China, and concluded that a traditional hedonic price index would more accurately reflect how housing prices have changed over time in eight major markets in China. Repeat-sales indices have become standard in many markets, but they are not as useful in emerging markets, such as China, because the bulk of the housing stock is relatively new and has not traded multiple times. China's most prominent index, which reflects changes in the averages of sales within a housing complex over time, shows very little volatility and limited overall price appreciation. It appears to suffer from severe downward bias for the reasons discussed in Wu *et al* (forthcoming). A simpler average price index, also published in China, shows marked rises in some markets, but not in others. It appears to be most biased downward where quality change has been the greatest. This tends to be in the smaller and emerging markets. We conclude that simple hedonic price indices that can control for basic unit traits, as well as the quality of the housing complex's location, capture changes in housing prices over time more accurately in most markets. Hedonic price indices show very high housing price appreciation over time and appear to reflect the path of housing prices in Chinese markets more accurately.

We believe these data will serve as the foundation for much broader and in-depth future work on Chinese land and housing markets. There is much more to be done in investigating how local market traits might explain the time series variation documented here more effectively. Other potentially important questions include whether changes in local land prices are good predictors of what will happen to housing prices in the future and whether there is an economically important collateral channel effect for non-real estate sector firms seeking credit through the Chinese finance system.

Appendix A

Table A1: Summary of Land Price Hedonic Models

City	Starting year	Number of observations	Adjusted R^2
Beijing	2003	355	0.640
Tianjin	2004	369	0.459
Shijiazhuang	2006	94	0.425
Taiyuan	2006	141	0.360
Hohhot	2006	276	0.325
Shenyang	2004	654	0.494
Dalian	2003	473	0.620
Changchun	2004	373	0.350
Harbin	2006	354	0.525
Shanghai	2003	460	0.653
Nanjing	2003	367	0.592
Hangzhou	2003	565	0.663
Ningbo	2003	239	0.491
Hefei	2004	336	0.561
Fuzhou	2004	153	0.723
Xiamen	2003	150	0.715
Nanchang	2003	251	0.379
Jinan	2006	232	0.367
Qingdao	2003	161	0.444
Zhengzhou	2004	214	0.242
Wuhan	2003	486	0.418
Changsha	2004	495	0.294
Guangzhou	2003	139	0.380
Shenzhen	2003	66	0.455
Nanning	2003	218	0.237
Haikou	2006	61	0.184
Chongqing	2003	906	0.584
Chengdu	2003	553	0.694
Guiyang	2005	162	0.177
Kunming	2006	175	0.251
Xian	2006	357	0.437
Lanzhou	2005	76	0.485
Xining	2008	93	0.240
Yinchuan	2007	97	0.348
Urumqi	2006	317	0.171

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Discussion

1. Haibin Zhu

In addressing housing bubble concerns, the first challenge is the measurement problem. Policymakers need to have an accurate grasp of housing market developments, including housing price levels and housing price dynamics, before they are able to assess the degree of housing price overvaluation and decide whether policy actions should be taken to address outstanding concerns.

This paper is a good example of how solid research can support the policy decision process. Based on housing and land transaction data, the authors use the hedonic approach to calculate constant quality housing price and land price indices in 35 Chinese cities. This new and unique dataset on residential land transactions at the city level is by itself an important contribution, and the statistical and economic findings provide valuable insights on the housing boom observed in China over the past decade.

The key findings are as follows. First, in constructing the housing price index, the authors find that the hedonic approach can more accurately reflect time variation in housing prices. By contrast, the two popular measures currently used in China, one using the simple average of transaction prices and the other a pseudo repeat-sale approach, both have significant downward bias. Second, based on new and unique land transaction data, the authors find that residential land values have skyrocketed in China over the 2003 to 2011 sample period. The average annual compound rate of real, constant quality land price growth is above 10 per cent in most cities and exceeds 20 per cent in 11 out of 35 sample cities. Third, land price growth has been higher and more volatile than housing price growth in China. Fourth, there are strong common year effects in land price appreciation, while city fixed effects and local market conditions explain little of the variation in land price growth. This seems to suggest that the frequent adjustment of central government policies is an important determinant of land price dynamics.

While the paper itself has very rich content, my discussion will focus on three aspects: housing price measurement, housing price assessment and the relationship between housing prices and land prices.

Housing price measurement

Constructing a reliable housing price index is a daunting task in China. There are some well-known reasons. For instance, the private housing market (called commodity housing in China) only started to be developed after the housing market reform in 1998. The collection of housing transaction data started even later and the data quality was poor in the early years. The short history and variable quality in data coverage undermine the reliability of housing price estimates. In addition, housing prices tend to be under-reported for tax evasion purposes.

In my view, the most significant finding in this paper is the inappropriateness of the repeat-sale method, popular in advanced economies, in China. As the secondary housing market is small in China, the repeat-sale method is proxied by using new home prices of different units within the same housing complex in different sales periods. Interestingly, the downward bias is the largest for this method, compared with the hedonic approach and simple average of transaction prices.

The authors point out two possible reasons for the underperformance of the pseudo repeat-sale method: unobserved unit-level heterogeneity and developers' pricing strategies. Here I would like to point out another possible reason: the constant hedonic feature assumption implicit in the repeat-sale method is highly problematic in a fast-changing country like China.

The repeat-sale method can be considered as a special application of the hedonic approach, in which housing prices depend on a time trend as well as a number of housing-specific characteristics (hedonic factors) such as location and housing quality. By using sales prices of the same home (or the same housing complex) at different periods, the change in housing prices is a perfect reflection of the time trend *if hedonic factors do not change over time*. However, this assumption is questionable in China due to the rapid urbanisation process and rapid changes in city landscape.

Take for example the two most important hedonic features used in this study: distance to the city centre and distance to the closest subway station. First, the concept and location of the city centre have changed dramatically in many Chinese cities over the past decade. During the rapid urbanisation process, the city area has expanded very quickly. A common phenomenon is that the old city centre has gradually lost its popularity and been replaced by a new city centre that was a suburb only 5 to 10 years ago. Obviously, distance to the city centre can be a time-varying feature.

The distance to the closest subway station is even more questionable. The subway system in China only started to grow in recent years, but the pace of expansion has been astonishing. Taking Shanghai as an example, in 2007 Shanghai had 5 subway lines in operation with a total length of 145 kilometres. In 2011, the Shanghai subway system included 11 lines or 429 kilometres, surpassing New York and Tokyo to become the longest city subway system in the world. By 2020, Shanghai aims to expand the subway system further to 22 lines or 877 kilometres. Such rapid growth has been unprecedented in human history.

If the city landscape changes so dramatically, the constant hedonic feature assumption implicit in the repeat-sale method is simply wrong. This explains the underperformance of this approach in China. Even for the more flexible hedonic approach, the big challenge is to value hedonic features appropriately. This is complicated by the fact that housing prices are forward-looking. For instance, in calculating the distance to the closest subway station, shall we use the current subway system or the planned system?

Housing price assessment

Housing price assessment is not an issue addressed in this paper. However, the finding that actual housing price growth is much faster than reflected in the official data leads to the question of whether there is a housing bubble in China.

Here I would like to distinguish among several concepts that are often confused with each other: rapid housing price growth, housing price overvaluation and housing bubbles (Glindro *et al* 2008).

Rapid housing price growth does not necessarily mean housing price overvaluation or a housing bubble. For instance, in China housing price growth may reflect the fact that prices started at low levels (after the housing market reform in 1998). Also, it could be driven by the rapid increase in the fundamental value of residential properties, against the backdrop of rapid urbanisation, income increases and improved access to the mortgage market.

In addition, because the housing market is not frictionless (e.g. due to lags in supply), actual housing prices can often deviate from their fundamental values. For policymakers, it is important to distinguish between housing price overvaluation driven by imperfections in the housing market and those purely driven by overly optimistic expectations (a narrowly defined housing bubble). The policy implications are quite different: the former can be addressed by removing market frictions and the latter requires measures to control unwarranted high expectations of capital gains, or 'animal spirits' in the housing market.

How high are China's housing prices now? We can probably get a rough idea by calculating housing price-to-income ratios at the city level. Based on JPMorgan's estimates, at the end of 2011 the housing price-to-income ratio averaged 9.1 in China at the national level, which was moderately above reasonable levels (in the range of 6 to 8 times). In tier 1 cities, such as Beijing, Shanghai and Shenzhen, price-to-income ratios were at astonishingly high levels (exceeding 17). This is consistent with the findings in this paper and suggests that any policy action should take into account regional heterogeneity.

Relationship between housing prices and land prices

Another interesting question in this paper is the interaction between housing price and land price cycles. The authors have focused on the impact of land prices on housing prices. They find that there is significant positive correlation between this quarter's housing price growth and last quarter's land price growth, but there is no link between this year's housing price growth and last year's land price growth. In other words, the land price cycle seems to lead the housing price cycle by about one quarter. Here I would encourage the authors to extend the analysis in the following directions.

First, the relationship between housing and land price cycles might be bi-directional. As land price is an important component of total cost for real estate developers, it is not surprising that higher land prices today will lead to higher housing prices tomorrow. However, the impact could also work in the reverse way, because land prices are forward-looking and depend on developers' expectations on future housing price movements. In a buoyant market, rapid housing price increases may have caused developers to form high expectations on future price movements and thus bid high prices in the land auction process.

Second, the finding that land prices lead housing prices by one quarter, but not longer, seems puzzling. From the day a developer purchases land to the day that the project can be ready for sale is at least one to two years in China. If the lead-lag relationship mainly reflects cost considerations, the one quarter lag is difficult to understand.

Finally, housing prices and land prices may be affected by the same factor, such as the role of government intervention. The authors suggest that the common year effect in land price appreciation can be attributed to frequent adjustment in government policies. It will not be surprising if government intervention also affects housing price movements, and hence the two cycles could be synchronised. The rich dataset in this paper allows the authors to dig further into such questions.

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2. General Discussion

The real newly built housing price indices presented in the paper were the subject of much discussion. For Beijing and Shanghai, a number of participants noted, and sought an explanation for, the end-of-sample increase in the paper's real newly built housing price index relative to the average index. Co-author Yongheng Deng said housing price dynamics in Beijing were more complicated than the model could explain. Dr Deng pointed to the role of expectations, suggesting that home buyers in Beijing were entering the market and bidding up prices on the expectation the government would release more stimulus. He also referred to a recent paper which sought to explain the specific divergence between housing price measures in these cities with reference to the role of Central Government state-owned enterprises. Co-author Joe Gyourko also highlighted that, particularly for these markets, sales activity has shifted away from the urban core. The average index, which does not adjust for this shifting in quality, was therefore exhibiting significant downward bias.

Against this background, several participants questioned whether newly built housing and land prices in these cities had moved away from fundamentals. It was suggested that one metric for assessing whether housing prices had shifted away from fundamentals was the ratio of housing prices to disposable incomes in these cities. In Beijing and Shanghai these ratios were higher than in other cities. One participant, however, was unsurprised by cross-city differences in housing price-to-income ratios and argued that different equilibrium outcomes in housing price-to-income ratios by city could be explained, for example, by varying urban density. The authors welcomed this point adding that there could also be a systematic tendency for households in some cities to under-report income.

Another participant said it was useful to emphasise the newly built aspect of the hedonic housing indices, thereby making clear the limitations of these indices for policymakers. For example, the participant said a newly built index could not be used to assess the financial stability of the mortgage market via metrics such as household sector leverage. Instead, what is needed is a stock-weighted concept of prices taking into consideration values from the secondary market. This participant also noted, however, that these newly built housing price indices, combined with the constant quality land price data, were entirely appropriate for assessing the risks in the property

development sector. Indeed, financial stability risks in the property development sector, rather than the household sector, were more likely to spill over to the banking sector (with the recent episode in the United States a notable exception).

While there was broad consensus that a hedonic approach to housing price measurement in China was desirable much of the discussion focused on measurement difficulties. For example, several participants sought more details on the hedonics employed. In particular, one participant requested more information about variables used to capture quality variation within a building (e.g. an apartment on a higher floor). The discussion also focused on how to treat time variation in some of the hedonics. For example, it was suggested that with the subway system rapidly evolving there, it could lead to a time-varying covariance between the hedonic variable 'distance to the nearest subway station' and housing prices. In response, Dr Deng said the hedonic approach to estimating housing prices in rapidly developing regions required careful thought.

One participant echoed the discussant's surprise about the significantly positive correlation between the current period's housing price growth and last quarter's land price growth. Given the development cycle is in years, the participant was surprised that lagged land values beyond one quarter were not a significant determinant of housing prices. Another participant added that causality should, *a priori*, be bi-directional. It was suggested that these anomalies could reflect data issues and that these data were not reliable enough to perform a thorough analysis of the relationship between land and housing prices.

In regard to the volume of land sales, participants picked up on the significantly positive association between the level of local government budgetary deficits in previous years and the volume of land sold in the current period. This link – highlighting the reliance of land sales as an off-budget fiscal income source – was viewed as unstable. One participant said because local governments do not have a local taxing authority they have strong incentives to release land to generate revenue, which comprised a remarkably high share of government revenue in some cities.

Continuing on the theme of sustainability, Dr Gyourko said that while the paper offered no evidence of overvaluation, rates of land price appreciation for certain cities were striking, even considering the fact prices in China were coming off a pre-reform era of undervaluation.

Developing Housing Finance Systems

Francis E Warnock and Veronica Cacdac Warnock*

1. Introduction

Housing finance systems should promote the attainment of adequate housing outcomes for all in an economy. But some are too small, unable to help ameliorate the substantial housing deficits faced in many countries. Others are quite large, apt (but not necessarily destined) to create instability and substantial volatility, as the global financial crisis has highlighted. While the financial instability of some large systems – notably that of the United States – has been the recent focus in many advanced economies, there are more countries with housing finance systems that are too small.

Our aim in this paper is to provide countries that would like to grow their housing finance systems with a simple framework that highlights factors that are all within a government's set of feasible instruments. The framework extends the Warnock and Warnock (2008) assessment of mortgage markets around the world. We gather data from many sources on the size of mortgage markets in 61 economies as of 2009 and show that there is substantial variation. Some countries, such as Australia, Denmark, Ireland, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom and the United States, have quite sizeable mortgage markets that are greater than 80 per cent of GDP, while many others are at less than 10 per cent. We show that this variation in mortgage size can be described, to some extent, by differences in a few fundamental factors, such as the strength of legal rights for creditors and borrowers (mainly bankruptcy and collateral laws), the depth of credit information systems, the ease of registering property (as a proxy for how well the housing market works), and macroeconomic stability. Our analysis of fundamental factors that support the development of mortgage markets provides a framework for countries that want to grow their housing finance systems in a robust, sustainable manner.

An example helps underscore some of the paper's main lessons. Brazil has one of the world's largest and fastest growing economies, and has made impressive progress along a number of dimensions in the past 15 years. But Brazil has a tiny mortgage market (only 3 per cent of GDP), much smaller than a country like Malaysia (31 per cent of GDP). Why? Our analysis shows that Brazil's housing finance system is small in part because its legal system still provides little protection for borrowers and lenders (and hence loans are less likely to be made), its credit information systems are less informative than they could be (negative information is often discarded, making it difficult to create scoring models), its property registration process is onerous and time consuming, and the economy still has the remnants of past macroeconomic instability. In this environment, private

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lenders are naturally unwilling to do anything more than required by law; they are forced by the government to set aside some portion of savings to fund home loans, and they do that and nothing more, leaving Brazil with both a tiny mortgage market and a sizeable housing deficit of almost 6 million homes with about one-quarter of the population living in slums (Galindo *et al* 2012).

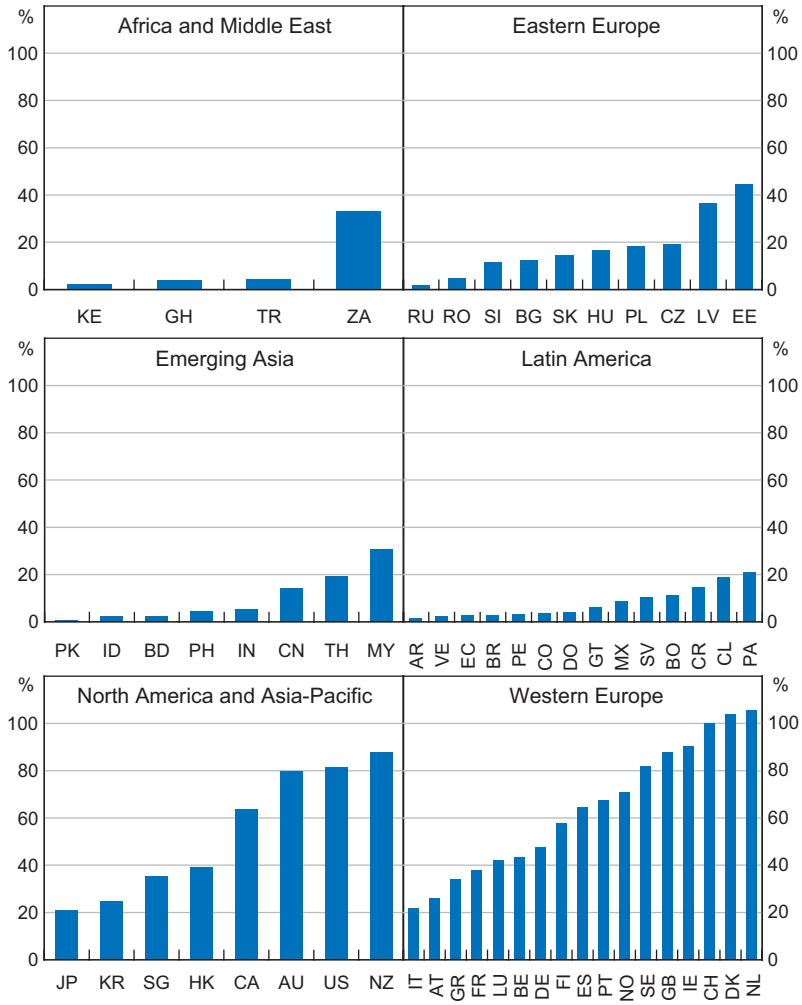
The paper proceeds as follows. The next section presents data on the size of mortgage markets for 61 economies. Section 3 presents a framework of housing finance that then informs reduced-form regressions that are estimated in Section 4. Some ancillary regressions are presented in Section 5. Section 6 concludes.

2. The Size of Mortgage Markets

Figure 1 shows mortgage debt as a percentage of GDP for 61 economies.[1] The panels are separated by region; each has the same scale (0 to 120 per cent) for ease of comparison across regions. There are great differences in the size of mortgage markets across regions and economies (Table 1). Within the set of emerging markets, mortgage markets in emerging Asia are moderately sized, averaging 12 per cent of GDP for the region with the largest being in Malaysia (31 per cent) and Thailand (19 per cent). In contrast, housing finance systems in Latin America tend to be quite small, with an average of mortgage debt that is 5 per cent of GDP. Chile and Panama have the largest mortgage markets in the region, with debt averaging 20 per cent of GDP, but other countries in the region have much smaller markets (Mexico, 9 per cent; Brazil, 3 per cent; Argentina, 2 per cent). Mortgage markets tend to be much larger in advanced economies, averaging roughly 60 per cent of GDP, but they vary greatly across countries. Some advanced economies (such as Denmark, the Netherlands and Switzerland) have mortgage markets that are roughly 100 per cent of GDP, while others (such as Australia, New Zealand and the United States) average around 80 per cent. Japan and Korea are much smaller at around 20 per cent of GDP.

1 To gauge how well a housing finance system functions, other measures could be used. These might include access to housing finance (e.g. the share of households that has access to appropriate financing for shelter) and the availability of a range of financing options. But all else equal, larger housing finance markets are likely to reach a greater proportion of the population and, as a measure, size has the important advantage that it can be constructed for a wide range of countries.

Figure 1: Mortgage Debt
Per cent of GDP, 2009



Note: See Glossary for a listing of country codes
Sources: Bank of Ghana; European Mortgage Federation; Swiss National Bank; Titularizadora Colombiana; UN-Habitat; national sources

Table 1: Summary Statistics
GDP-weighted means

	Advanced economies	Emerging market economies	Latin America	Emerging Asia	Eastern Europe
Mortgage Debt Outstanding	61.4	9.4	5.4	12.4	8.3
Legal Rights for Borrowers and Lenders	7.2	5.5	4.0	6.3	5.1
Credit Information	5.6	4.5	5.2	4.2	4.8
Ease of Registering Property	7.4	6.2	4.4	6.6	7.1
Inflation Volatility	1.14	3.34	4.1	2.3	4.4

Note: See Appendix A for variable definitions and sources

3. Sustainable Housing Finance Systems: Basic Infrastructure

In this section we present a model of the size of a country's mortgage market that will inform our reduced-form regressions. The model is similar to the one in Warnock and Warnock (2008, henceforth WW) which, using cross-sectional data from around 2005, studied 62 economies to examine the extent to which markets enable the provision of housing finance. The study found that, after controlling for country size, economies with stronger legal rights for borrowers and lenders (through collateral and bankruptcy laws), deeper credit information systems, and a more stable macroeconomic environment have deeper housing finance systems. Not surprisingly, many factors associated with well-functioning housing finance systems are those that enable the provision of long-term finance (Burger and Warnock 2006; Chan, Davies and Gyntelberg 2006; Davies, Gyntelberg and Chan 2007; Burger, Warnock and Warnock 2012). The results and policy implications of the WW analysis have important lessons for emerging market economies looking to grow their mortgage sectors, showing empirically some fundamental preconditions that are necessary to develop mortgage markets. We enhance and update that analysis below.

Our underlying framework is the supply of and demand for housing finance. Demand for housing finance is derived from the demand for owner-occupied homes, which in turn depends on demographic, financial and institutional factors such as the rate of household formation, income levels, affordability and the ease of purchasing (and registering) property. On the supply side, one way to think about the provision of housing finance is to split it into two components: (i) the provision of housing finance by a lender that has ample funds at hand; and (ii) the mobilisation of funds within an economy so that lending institutions have access to funds.

In addition, housing finance should be longer-term in nature (as housing costs are typically a multiple of annual income). For lenders with adequate funds to choose to allocate some portion to long-term housing finance, a number of preconditions should be in place:

- *Information on the borrower.* To adequately price a loan, a lender must have information on the creditworthiness of prospective borrowers that enables a determination of the probability of default. The information could be produced by a standardised and accurate source of credit history, such as public credit registries or private credit bureaus. It is best if the source has wide coverage of the population, and the most informative source would include negative as well as positive transactions. Absent standardised information on credit histories, standard banking relationships, in which a bank spends considerable resources acquiring information on potential borrowers, would work but they would be limited (at least geographically, if not in other ways) in the capacity of the lenders and of the housing finance system as a whole to create loans.
- *Ability to value the property.* There should be an ability to determine the market value of the property. This is a natural outcome of a well-functioning housing market in which detailed information on housing transactions is maintained in a systematic way. For example, if data on the sale price and relevant features of the home (location, size, age, etc) are maintained in a mandatory property registry, appraisers can more accurately value prospective homes for lenders and borrowers.[2]
- *Ability to secure collateral.* The lender should to be able to secure collateral against the loan in case of default. The property itself is an obvious candidate for that collateral, providing that, in the case of default, the lender can seize the property. This requires that there is something resembling clear title and that the legal system allows the lender to seize collateral.
- *Macroeconomic stability.* The macroeconomic environment should be stable. If inflation is volatile, the lender would incur substantial interest rate risk if it lends at a fixed rate. In an unstable environment, lenders will typically pass on this risk to the borrowers – who are less likely to fully understand it – by only offering variable-rate loans. Substantial interest rate risk, no matter who bears it, will retard the development of the housing finance system, as either lenders will go out of business (e.g. the United States savings and loans crisis in the 1980s) or borrowers will be unable to repay their loans (or both).

If the conditions for long-term lending are in place, lenders must also have ample access to funds in order to lend:

- *Sources of funds*. In the primary market, deposit-taking institutions, such as banks, can fund mortgages through deposits. However, because deposits are short term, if this is the only source of funds, housing loans will tend to be short term or at variable rates.[3] Short-term loans, given that housing is expensive, are insufficient to fund home purchases.[4] Potential

2 The property registry and appraisal system will also enhance the efficiency of the overall housing market, as consumers will have better information to judge the relative value of various properties.

3 More generally, a well-developed housing finance system will typically have a diversity of lenders in the primary market (such as non-depository mortgage specialists, non-government organisations, microfinance institutions, and contractual savings systems) and greater specialisation within the origination process. See Follain and Zorn (1990) on the unbundling of the mortgage finance business.

4 Short-term funds can be usefully employed to fund incremental housing, as is common with housing microlenders in developing countries.

borrowers might find variable-rate loans attractive, but they are not likely to be able to gauge the substantial interest rate risk they are bearing (CGFS 2006). In addition, a reliance on deposits implies that funding sources are limited geographically, which increases risk. An important additional source of funds for the housing finance system is the secondary market, which buys loans from the primary market and finds many ways to raise funds.[5] Participants in the secondary market include mortgage securitisers, who bundle and repackage mortgages (or parts of mortgages) to create new securities, and investors in these mortgage securities. The securitisers can be public (such as Cagamas Berhad in Malaysia, or Fannie Mae, Freddie Mac or Ginnie Mae in the United States) or private (such as GE Capital); the investors can be domestic or foreign institutions or individuals. Notwithstanding recent events in markets for mortgage securities, secondary mortgage markets can be an important component of a country's broader capital markets.

- *Additional sources of liquidity.* Whatever the usual sources of funds, it can be important to have a backstop, such as a governmental liquidity window, in case of temporary liquidity crunches.

In summary, a basic infrastructure that can enable a well-functioning housing finance system includes factors that promote long-term lending (the ability to value property and to seize it in the case of default, information on the creditworthiness of potential borrowers, macroeconomic stability) and factors that promote the mobilisation of funds (be it through savings and deposits, capital markets, a governmental liquidity window or secondary markets).[6]

We next use the above framework to inform reduced-form regressions.

4. Empirical Determinants of the Size of Mortgage Markets[7]

We model the size of the housing finance sector as measured by the ratio of residential mortgage debt outstanding to GDP as of a point in time, 2009. Analysis of the evolution of housing finance systems is not as easy as one might wish because, for many countries, data through time are not available. Once the decision is made to explain cross-country differences in the size of mortgage markets, the simple supply and demand framework discussed in the previous subsection readily informs reduced-form regressions. Many factors influencing housing finance supply and demand are available from the World Bank's Doing Business reports.[8] *Legal Rights for Borrowers and Lenders* is an index that ranges from 0 to 10, with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit; for a mortgage lender to be comfortable lending long-term, it needs to be able to secure collateral against the loan, and this ability hinges on being able to seize the collateral (the property) in the case of default. The lack of legal protection for creditors has been identified as the single most important regulatory limitation for

5 For example, the development of Fannie Mae in the United States stemmed from market illiquidity. See Davies *et al* (2007) for a discussion of housing finance agencies in Asia.

6 These factors can also be recast in terms of risk mitigation (Van Order 2005). Another important factor is the regulatory and supervisory environment.

7 Our focus on the size of the mortgage market is determined more by current data limitations than a belief that size is the most relevant characteristic. Policymakers should not infer from our analysis that bigger mortgage markets are always and everywhere better, an inference that would overlook important notions of unsustainable debt levels and financial sector stability.

8 Many of the explanatory variables are available through the Getting Credit portion of the World Bank's Doing Business database; see <http://www.doingbusiness.org/methodology/getting-credit> for a complete description.

the development of credit markets in some emerging markets. Regarding housing finance, crucial weaknesses in many emerging markets include the duration of legal proceedings in protecting creditor rights, which can take more than three or four years; the excessive number of appeals allowed on behalf of the debtor during the process; and the lack of political will to protect such rights (Galindo *et al* 2012). *Credit Information* is an index that ranges between 0 to 6 and measures the depth of lenders' access to standardised and informative sources of credit information on potential borrowers, with higher values indicating greater availability of credit information.[9] *Ease of Registering Property* is a variable that measures the ease with which property can be registered for use after purchase, which is crucial for the assets that back mortgages to be used as collateral. An adequate property registry allows potential lenders to evaluate the track record and the liens that rely on the properties they would finance, and hence, by increasing transparency, enhance the value of the mortgage-backed assets. Doing Business ranks countries using three component indicators: the number of procedures, the time and the official costs necessary for a buyer to purchase a property and to transfer the property title so that it can be used, sold, or posted as collateral. We recast the World Bank's ranking into the variable, *Ease of Registering Property*, that ranges from 0 (very difficult and costly) to 10 (easy). The final measure is *Inflation Volatility*, which is related to interest rate risk that can impede long-term lending; we use the standard deviation of quarterly CPI inflation rates over the period 2000 to 2009. *Inflation Volatility* might seem like a simple variable, and it is, but it is vital: countries with high inflation volatility tend not to have functioning bond markets (Burger *et al* 2012), nor will they have mortgage markets of any size.

Figures 2 to 5 show each economy's score on these four dimensions; regional GDP-weighted means for these variables are provided in Table 1.

The depth of credit information (Figure 2) does not vary much across economies. While the Philippines scores 3 out of 6, most economies score 5 or 6. The lack of variation across economies limits this variable's usefulness in cross-sectional regressions, but in reality there is much more variation in the quality of economies' credit information systems than this measure is picking up. A further issue with *Credit Information* is that it does not take into account the percentage of the adult population that is covered. For example, Brazil rates very well, scoring 5 out of 6, but only 27 per cent of adults are included in its public credit registry and, while the private credit registry covers a broader set of the population (54 per cent of adults), it does not maintain both positive and negative information about borrowers, making it very difficult to create an informative credit score.

9 While credit information is market enhancing, over-reliance on externally generated credit scores can lead to instability (Ellis 2008).

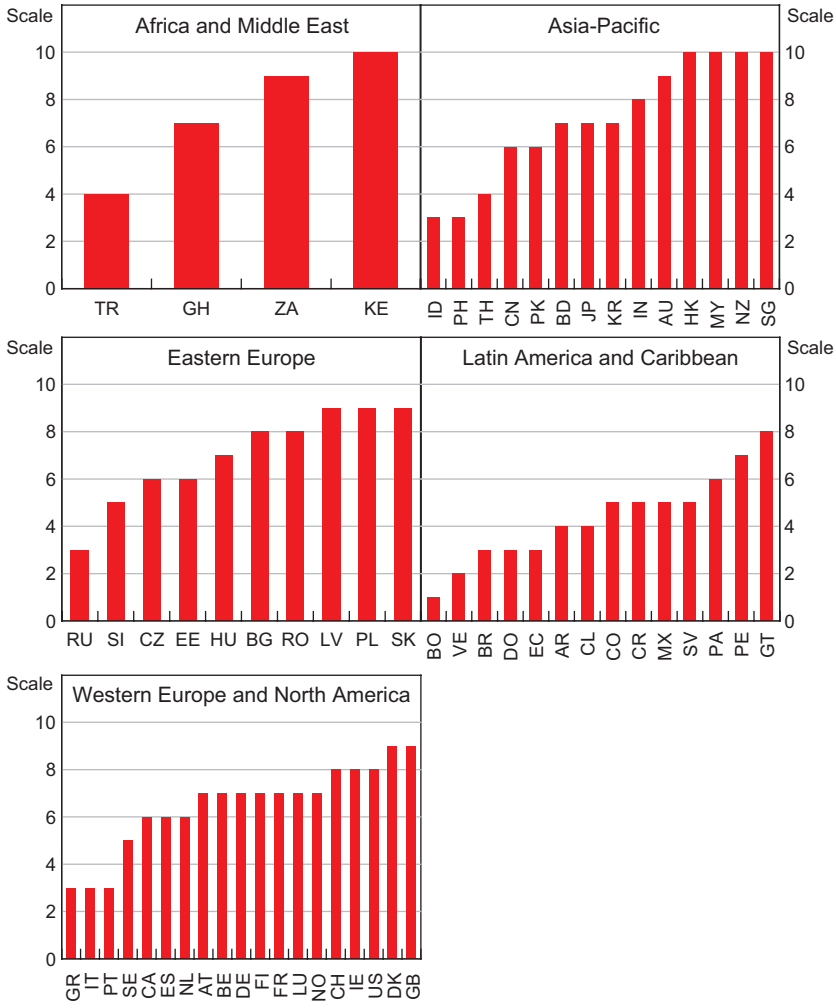
Figure 2: Strength of Credit Information Systems
0 = poor credit information to 6 = strong credit information, 2009

Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

There is much more variation in *Legal Rights for Borrowers and Lenders* (Figure 3), with many countries in Latin America, for example, scoring 5 or below (out of 10) and many economies in other regions scoring much better. While advanced economies tend to score better than emerging markets on this measure, this is not true in every case: three euro area countries – Greece, Italy and Portugal – score at Brazil's level.

Figure 3: Strength of Legal Right for Borrowers and Lenders

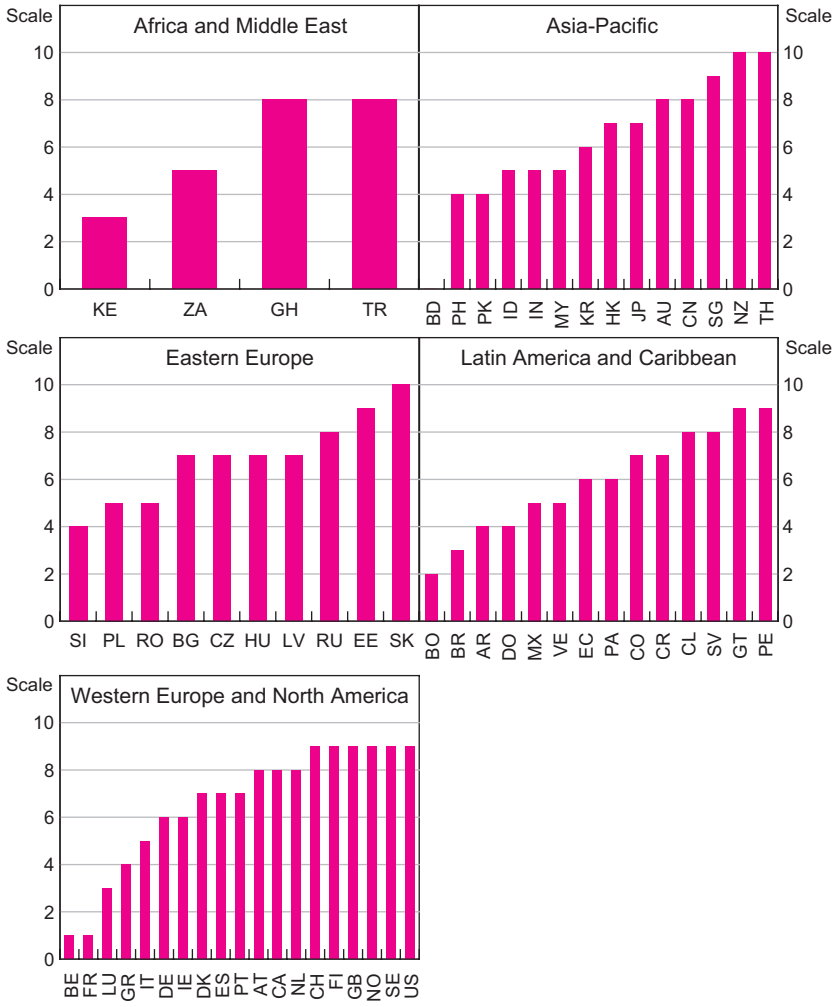
0 = poor legal rights to 10 = strong legal rights, 2009



Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

Substantial variation across economies is also evident for *Ease of Registering Property* (Figure 4). For example, in Latin America, Brazil scores only 3 out of 10, but Chile scores 8 and Peru scores 9; in emerging Asia, the Philippines scores 4 while Thailand scores 10; and among developed countries, Greece scores 4 while Sweden scores 9 out of 10. Other interesting observations are that France scores as poorly as anywhere in the developing world; Italy is no better than the typical Latin American country; and there are many well-scoring Latin American countries as well as relatively high scores for Ghana and Turkey.

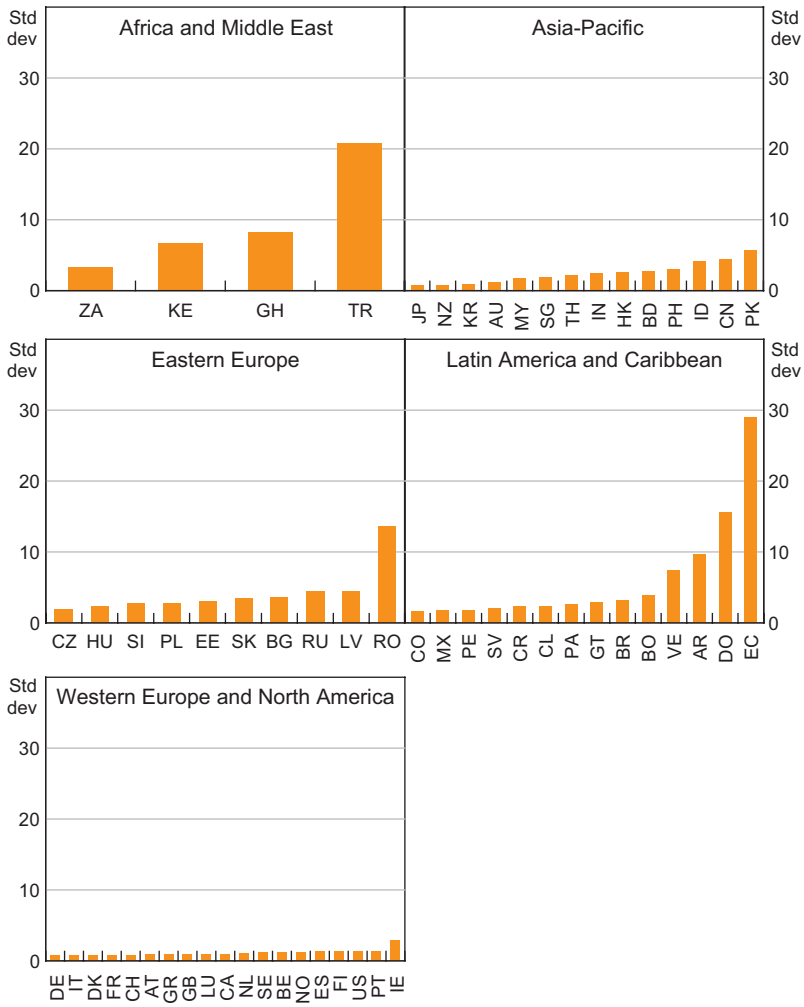
Figure 4: Ease of Registering Property
0 = difficult to 10 = easy, 2009



Note: See Glossary for a listing of country codes
Source: World Bank and IFC (2010)

Reasonably low inflation volatility is evident across most regions, although countries like Ecuador, Turkey and Romania still have substantial macroeconomic instability (Figure 5).[10]

Figure 5: Inflation Volatility
2000–2009



Notes: Standard deviation of 2000:Q1–2009:Q4 annual inflation rates; see Glossary for a listing of country codes
Sources: IMF, International Financial Statistics; authors' calculations

10 We calculate inflation volatility over a 10-year period, so even if a country improves significantly in terms of macroeconomic stability, the sins of the past do not quickly disappear. We feel this is appropriate: it takes years to cleanse an economy of macroeconomic instability.

Table 2 shows results for regressions of the size of mortgage markets as a percentage of GDP on these underlying factors. Across all 61 economies in our sample, economies with stronger legal rights for borrowers and lenders, greater ease in registering property, and less inflation volatility have larger mortgage markets. In emerging markets, the factors are similar except that economies with deeper credit information systems have larger markets, while the property registration variable is (marginally) insignificant. Among advanced economies, the sample size is quite small at only 25 observations, and ease of registering property comes through as the only significant variable.[11]

Table 2: Cross-country Analysis of the Size of Mortgage Markets
Dependent variable = *Mortgage Debt Outstanding as a Per Cent of GDP*

	(1) All economies	(2) Emerging market economies	(3) Advanced economies
Legal Rights for Borrowers and Lenders	3.30**	1.31*	1.48
	(1.39)	(0.69)	(2.31)
Credit Information	1.44	1.71**	–2.65
	(1.88)	(0.76)	(6.84)
Ease of Registering Property	3.50**	1.00	5.71**
	(1.34)	(0.66)	(2.20)
Inflation Volatility	–1.84***	–0.47***	–1.31
	(0.67)	(0.15)	(13.19)
Country Size	1.49	–1.73	–1.37
	(2.05)	(1.13)	(5.89)
Observations	61	36	25
R-squared	0.34	0.40	0.28

Notes: OLS estimation; constants are included but not reported; robust standard errors are in parentheses; ***, **, and * indicate siginificance at the 1, 5 and 10 per cent levels, respectively; see Appendix A for variable definitions and sources

The point estimates imply substantial economic significance for some of the factors. For example, the point estimates in column (1) suggest that changing the value of the *Legal Rights for Borrowers and Lenders*, *Ease of Registering Property* and *Inflation Volatility* variables from the mean values for emerging markets to the mean values for advanced economies (listed in Table 1) would be associated with increases in mortgage debt-to-GDP ratio of 5.6, 4.2 and 4.0 percentage points, respectively. While we caution that these are simple regressions that cannot imply causation,

11 Across economies, mortgage terms also vary. WW note that as at 2005, no emerging market economy had widespread availability of long-term fixed-rate mortgages. Only a few – Malaysia, Thailand and some transition economies in Eastern Europe – had typical maturities of 30 years, and another, non-overlapping subset tended to have fixed-rate mortgages. In contrast, many advanced economies had mortgages with terms of 25 years or greater, and roughly half had predominantly fixed-rate products. While data on such characteristics were not complete or reliable enough to be included in the WW empirical analysis, they note that it is not clear *a priori* whether the prevalence of fixed- or variable-rate mortgages in any economy owes to lender or borrower preferences. It appeared to be the case that within the set of developed countries, those with more stable inflation tend to have a greater share of fixed-rate mortgages.

such increases would be sizeable given that average mortgage debt is 9.4 per cent of GDP in emerging markets.

The regression results in Table 2 show a clear path for countries to take to enable the development of their housing finance systems. Attaining macroeconomic stability is of vital importance. That might seem difficult in a world of substantial international shocks, but many countries have implemented monetary and fiscal policies that increase the probability of achieving low and stable inflation. Somewhat easier, at least if one leaves politics aside, is to enact laws that allow for the creation of meaningful credit information systems and enable better protections of legal rights for borrowers and lenders by strengthening bankruptcy and collateral laws.[12] Based on our regression results, if the Philippines improved their scores for *Legal Rights for Borrowers and Lenders* and *Credit Information* to match those of Malaysia, this would enable a quadrupling of the Philippine housing finance system from just 4.5 per cent of GDP to 18 per cent. Given a housing deficit of between 3 and 5 million units in the Philippines (Monsod 2011), such an increase in the size of the Philippine mortgage market, were it enabled by improvements in the underlying infrastructure, would seem to almost surely be welfare improving.[13]

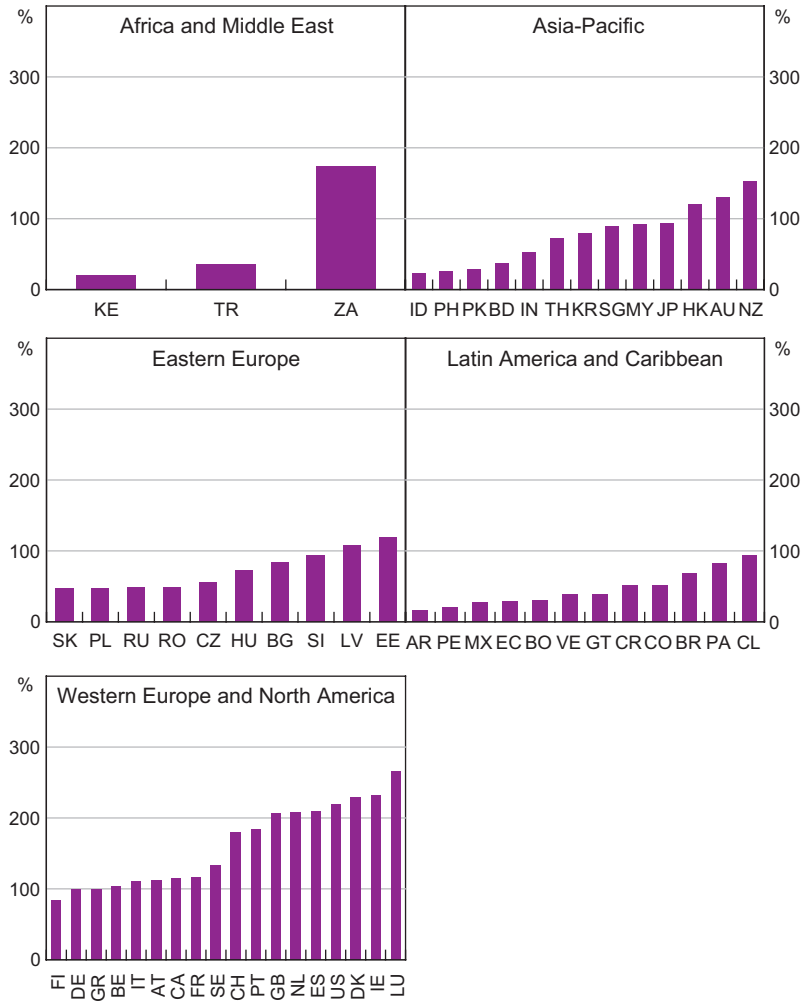
5. Additional Regression Analysis

Countries with deeper financial systems, as measured by private credit as a per cent of GDP (Figure 6), are likely to have larger mortgage markets, in part because the two measures share a number of underlying determinants.

12 An interesting question to ask is whether it could be shown, were times series data on mortgage debt available, that changes in legal rights lead to changes in the size of the mortgage market. Djankov, McLiesh and Schleifer (2007) investigated this question for private credit in a large sample (129 countries) using 25 years of data. They acknowledged that tackling this question would be difficult, as in their sample there were only 32 episodes of changes in creditor rights, many of which were in former communist countries. Thus, it is not surprising that in our smaller, shorter sample legal rights did not change for most countries. Two countries with substantial improvements in the legal rights index are Guatemala (+5) and Peru (+4). While our cross-sectional mortgage debt data do not allow a formal analysis of such changes, a micro investigation would be worthwhile.

13 It should be noted that *The Republic Act No 9510*, or *Credit Information System Act*, which will establish the Central Credit Information Corporation (CIC) that will pool credit information from financial institutions, was signed into Philippine law in 2008. The CIC is expected to launch operations in 2013. See Agcaoili (2012).

Figure 6: Private Credit
Per cent of GDP, 2009



Note: See Glossary for a listing of country codes
Sources: Financial Structure Dataset (Beck, Demirgüç-Kunt and Levine (2000), revised November 2010); authors' calculations

But some of these shared factors seem to explain the size of the mortgage debt market above and beyond their effect on private credit. Columns (1) to (3) of Table 3 show that many of the factors that explain mortgage market size as a per cent of GDP – *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Ease of Registering Property*, and *Inflation Volatility* – also explain mortgage debt outstanding as a per cent of private credit.

Table 3: Additional Analysis of the Size of Mortgage Markets

Dependent variable	Mortgage debt as a per cent of private credit[a]			Mortgage debt as a per cent of GDP
	(1) All economies	(2) Emerging market economies	(3) Advanced economies	(4)
Legal Rights for Borrowers and Lenders	1.29*	0.39	0.75	
	(0.73)	(0.75)	(1.24)	
Credit Information	2.51**	2.56**	2.90	
	(1.15)	(0.97)	(4.77)	
Ease of Registering Property	1.74*	0.62	2.15	2.79**
	(0.92)	(0.68)	(1.62)	(1.31)
Inflation Volatility	–1.10***	–0.53***	–3.58	
	(0.32)	(0.17)	(3.96)	
Country Size	–0.66	–2.78**	–3.53	
	(1.15)	(1.17)	(3.38)	
Housing Price Volatility				–89.58*
				(45.90)
Private Credit (instrumented)[b]				49.43***
				(7.64)
Observations	58	34	24	37
R-squared	0.37	0.42	0.31	0.80

Notes: Constants are included but not reported; robust standard errors are in parentheses; ***, **, and * indicate siginificance at the 1, 5 and 10 per cent levels, respectively; see Appendix A for variable definitions and sources
(a) OLS estimation
(b) Private credit is instrumented using *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Inflation Volatility*, *Country Size* and *Contract Enforcement*

Two additional considerations are addressed in column (4). First, it could be that for a given amount of funds, the decision by lenders to dedicate a portion to housing finance could be influenced by the volatility of housing collateral. To capture this potential effect, we calculate the volatility of housing prices using the four-quarter-ended percentage change in quarterly housing prices over the 2000 to 2009 period and include it as an explanatory variable. The underlying housing price measure, from Cesa-Bianchi (2012), is available for a smaller sample of 38 countries, a mixed sample of mostly advanced economies but with some emerging markets.[14] Second, the results in column (4) are estimated using instrumental variables. Private credit is instrumented using variables similar to those used in Djankov *et al* (2007) – *Legal Rights for Borrowers and Lenders*, *Credit Information*, *Inflation Volatility*, *Country Size* and *Contract Enforcement*. Two housing-specific variables (*Ease of Registering Property* and *Housing Price Volatility*) also enter the regression separately. As expected, private credit (and its underlying determinants) is of primary importance in explaining the amount of mortgage debt outstanding. In addition, larger mortgage markets are seen in countries with

14 The Cesa-Bianchi housing price series bring together prices from various sources, including the BIS property price database (available at <http://www.bis.org/statistics/pp.htm>).

less volatile housing collateral (i.e. lower house price volatility) and lower costs to registering property.

6. Conclusion

We present a road map that countries with small housing finance systems can use to grow their markets. Countries with stronger bankruptcy and collateral laws, deeper credit information systems, greater ease of registering property (a proxy for how well the secondary housing market works), and less macroeconomic instability have larger mortgage markets.

We note that bigger is not always and everywhere better. For a variety of reasons, size (as measured by mortgage debt outstanding scaled by GDP) is not an optimal measure of how well a housing finance system functions. Mortgage market size can be heavily influenced by price dynamics, allowable loan-to-value (LTV) ratios, and tax considerations – favourable tax treatments in countries such as the Netherlands, Switzerland and the United States tend to result in a larger stock of mortgage debt. In addition, mortgage markets that are too large or growing too quickly might contribute to macroeconomic instability (a housing bubble requires, all else equal, a larger housing finance market).

An important recent focus in the literature that we do not address in this paper is the impact of credit conditions on housing price dynamics (see, for example, Crowe *et al* (2011); Duca, Muellbauer and Murphy (2011); Muellbauer and Williams (2011)). We have done preliminary but untabulated analysis that indicates that countries with higher LTV ratios have larger mortgage markets (without materially affecting the significance of other variables). We do not include LTV ratios in our reported regressions because our primary goal is to identify fundamental factors that determine sustainable mortgage markets. We view differences in LTV ratios more as distortions, rather like differences in mortgage interest deductibility.

Much more work on the relationship between housing finance and financial stability is warranted. Indeed, there are many questions yet to answer. Are smaller mortgage markets less prone to bubbles? As countries develop their mortgage sector infrastructure, how should they include monitoring and oversight to detect inappropriate lending, pricing and risk management? Are bank-based financial systems less prone to instability? What lessons can we learn from the failure of the government-sponsored enterprises in the United States, and what is the proper role of the government?

Finally, more analysis of mortgage markets should be conducted once a broad panel dataset of mortgage market size and characteristics becomes available. For some countries such a dataset is already available, and the time dimension could lead to interesting analysis of changes in housing finance systems. For example, in Europe data are now available on the evolution of the size of 27 mortgage markets from 2001 to 2009. The European data indicate that Ireland's mortgage market was 33 per cent of GDP in 2001, 52 per cent by 2004 and 70 per cent by 2006. The doubling in size in just five years was likely to have been a precursor of future problems. If time series can be obtained for other regions, a fuller analysis of the time dimension would be feasible, adding to our understanding of mortgage markets.

Appendix A: Data

Contract Enforcement

Description: Contract enforcement measures the ease (in terms of time, costs and number of procedures) of enforcing contracts. The raw 0 to 181 country ranking is transformed into an index ranging from 0 to 10, with a higher score indicating greater ease in enforcing contracts.

Source: World Bank and IFC (2010)

Country Size

Description: Country size is measured as the log of the 2000–2009 average of GDP (in PPP terms).

Source: http://www.doingbusiness.org/

Credit Information

Description: Credit information is the average of the 2006, 2007 and 2008 indices of the depth of lenders' access to standardised and informative sources of credit information on potential borrowers. The index ranges from 0 to 6, with a higher score indicating a greater availability of credit information (from either a public registry or a private bureau). This variable is lagged in the regressions because changes in credit information systems are likely to affect mortgage origination with a lag.

Source: World Bank and IFC (2010)

Ease of Registering Property

Description: Ease of registering property is an index of the ease (in terms of time and cost) with which newly purchased property can be registered for use (directly or as collateral) or sold. The index ranges from 0 to 10, with a higher score indicating relative ease in registering a property for use after purchase. The index is calculated by averaging three indices measuring: the number of procedures, the time and the official costs of registering property.

Source: World Bank and IFC (2010)

Housing Price Volatility

Description: Housing price volatility is the average of four-quarter-ended housing price growth; calculated using quarterly data over 2000–2009.

Source: Cesa-Bianchi (2012)

Inflation Volatility

Description: Inflation volatility is the standard deviation of quarterly CPI inflation rates, calculated over 2000–2009.

Source: IMF, International Financial Statistics database

Legal Rights for Borrowers and Lenders

Description: Legal rights for borrowers and lenders is the average of the 2007, 2008 and 2009 indices of the strength of legal rights. The index ranges from 0 to 10, with a higher score indicating that collateral and bankruptcy laws are better designed to expand access to credit.

Source: World Bank and IFC (2010)

Mortgage Debt Outstanding

Description: The ratio of mortgage debt outstanding to GDP in 2009, or latest year available.

Sources: Bank of Ghana; European Mortgage Federation; Swiss National Bank; Titularizadora Colombiana; UN-Habitat; national sources

Private Credit

Description: Private credit is defined as claims on the private sector by deposit money banks and other financial institutions as a per cent of GDP.

Source: Financial Structure Dataset (Beck, Demirgüç-Kunt and Levine (2000), revised November 2010)

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Discussion

1. Joseph Gyourko

It is a pleasure to be able to discuss such an interesting and important paper. We know from recent experience in the United States and other countries that housing markets can be the epicentre for systemic failures in national financial and banking sectors. However, we also know relatively little about the nature of different countries' mortgage markets. That these recent collapses occurred with little warning highlights the paucity of our knowledge in this area. This paper aims to help bridge this gap in data and understanding. The importance of this work derives from its relevance both to practising regulators and ivory-tower academics.

The paper itself focuses on the determinants of the size of national mortgage markets. Its primary contribution is empirical. There is very little prior research or data that facilitate useful cross-country comparisons of national housing finance systems, so global analysis is virtually non-existent. This paper should be seen as a part of the authors' long-run research program to remedy this shortcoming. A limitation of the present work is that the data represent a single cross-section for the year 2009, which restricts its use in more complex empirical analysis because causal identification is quite challenging with just a cross-section. Hence, the authors' ultimate goal certainly should be to create a true panel dataset so that empirical researchers can use variation over time within countries to test different hypotheses about what drives mortgage (and ultimately) housing markets.[1]

The goal of the analysis is to explain the size of national mortgage markets as a function of various fundamentals:

$$\textit{Mortgage Market Size}_i = f(\textit{fundamentals}_i), \tag{1}$$

where the subscript *i* indexes the 61 economies in the authors' sample. *Mortgage Market Size* is measured in two ways:

- the ratio of total mortgage debt to GDP (*Mortgage debt/GDP*); or
- the ratio of total mortgage debt to total private credit outstanding (*Mortgage debt/Private credit*).

The authors' conclusions are robust to the precise measure of market size.

Market fundamentals can be thought of as being in one of four categories. The first is *Legal Rights for Borrowers and Lenders*. The authors' data show that the strength of borrower and lender legal rights are not systematically higher in economies with higher per capita incomes. For example,

1 In this sense, the study of mortgage markets across countries finds itself in a situation similar to that of the study of land-use restrictions across local housing markets. Cross-sectional databases have been constructed in that area too, but no true panels exist. In both cases, the topic of study is too important to wait for perfect data. Hence, we must make do with what data we have and continue to improve on its quality, as in this paper.

there is substantial variation across economies in this measure, with many countries in Europe (e.g. Greece, Italy and Portugal) having the same index number as Brazil and other Latin American countries.

The second category of fundamentals is based on *Credit Information*. It turns out that virtually all economies have similarly well-developed credit information systems according to their measure, as there is only scant variation in the index number for this variable across economies. The lack of variation in this variable should be kept in mind, as it will be relevant to our discussion of their regression results below.

The third category of fundamentals comes under the rubric *Ease of Registering Property*. Unlike *Credit Information*, but like *Legal Rights for Borrowers and Lenders*, there is substantial cross-section variation in the authors' evaluation of national property registration systems. It turns out that France is an outlier among developed countries, with a system that is as difficult and opaque as anywhere in Africa or the Middle East. Italy's system is of no higher quality than that found in the typical Latin American country. There are also a variety of high-quality systems in African, Middle Eastern and Latin American nations.

The fourth and final category of fundamentals is *Inflation Volatility*. This is measured by the degree of variation in inflation rates over time and is pretty uniform across economies, with the exception of a few outliers that have had large price growth spikes in recent decades.

The authors use these fundamentals to try to explain differences in national mortgage market size by estimating Equation (1). As noted, they have a single cross-section for 2009 on 61 economies and begin by estimating simple and straightforward ordinary least squares (OLS) regressions. The limitations of relying solely on a cross-section of data are well known. If there are omitted factors, especially those that change over time, that are correlated with an included trait, then the estimated coefficient on that trait will be biased due to specification error. Of course, this is why having panel data would be better, but that must be left to future work, as the authors had to engage in a near-herculean effort to create the larger and improved cross-section employed in this paper.

That said, I have two recommendations for improving the current model before a panel dataset becomes available. The first is to use rates of change as an explanatory variable in the subset of countries (typically more advanced and richer) for which the authors already have time series data. As we look back on the recent financial crisis, rapid and large changes in mortgage debt in Ireland and the United States should have been a signal to all of us that something was amiss in those places. More specifically in the framework of this paper, a large, rapid increase in scale would probably predict a market that is too large relative to fundamentals. The authors can only investigate this for a limited number of countries, so the degrees of freedom and statistical power might be low, but I think it would be interesting to see if this helps explain national mortgage market size.

The second recommendation I have is for the authors to try to develop a fifth fundamental variable that measures the stability and/or size of the national banking system. It strikes me as probable that countries with strong and sound financial regulatory systems for banks are likely to have mortgage markets that are appropriate to the fundamental economic needs of the nation. Perhaps this variable would add to the explanatory power of the paper's baseline regression.

This is not to say the reported analysis is not helpful. Quite the contrary is the case, as the findings generally make good sense to this reviewer. For example, the authors usefully look for heterogeneity in the effects of fundamentals by estimating their model on subsets of advanced and emerging market economies. The explanatory power of these fundamentals is greater for emerging markets, with an R^2 of 0.40 versus 0.28 for advanced economies. That is interesting, but one does not want to make too much of this particular difference, as there is more variation in the underlying explanatory variables among emerging markets. In fact, the only fundamental that helps predict mortgage market size among advanced economies is the *Ease of Registering Property* index. Recall that there is substantial variation in this measure even across European countries; it is very difficult to register property in France, but not in other core countries. Most advanced countries have relatively strong legal protections for lenders, so there is little variation in this fundamental variable. By definition, a variable with little or no variation cannot predict one with substantial variation. This certainly is not a call for the authors only to use explanatory variables with lots of variation. The data are the data, and the authors have a convincing reason for including a control for the *Ease of Registering Property*. Rather, my comment is intended to highlight for the reader (and policymakers in particular) that one should not interpret an insignificant coefficient as indicating that a given fundamental variable is not important or, more specifically, that one could (say) eliminate strong legal protections for lenders with no effect on mortgage size. This clearly is a key fundamental and weakening those rights would impair development of the mortgage market, as the results for emerging countries indicate.

For this subset of emerging economies, only the *Ease of Registering Property* index is not statistically significantly correlated with mortgage market size. The *Legal Rights for Borrowers and Lenders* index, *Credit Information* index and *Inflation Volatility* each help predict mortgage market scale in emerging economies. There is substantial variation across countries in these variables, so that the variables have a chance to explain the similarly large variation in national mortgage market sizes. And, it turns out that their impact is consistent with the prediction of Warnock and Warnock's (2008) model.

The current paper would benefit from a deeper explanation of what the coefficient magnitudes imply. In particular, it would be helpful if standardised marginal effects were reported for each fundamental, not just the raw coefficients. Another suggestion for potential improvement would be to add regional dummies to the main global specification. This would control for regional/continental fixed effects. I would also encourage the authors to experiment with some non-linear specifications. This seems particularly relevant for the *Inflation Volatility* variable, where the values are similar for most countries, but differ greatly for a few outliers. This could be germane for other variables if particularly high or particularly low index values for some fundamentals have differentially large effects on mortgage market development.

Discussions with the authors have raised a couple of further questions that I think are relevant for evaluating any housing finance system. First, there are big differences across countries in their commitments to having long-term, fixed-rate mortgages (e.g. 30-year loans in the United States) available for their citizens. What are the risks and benefits of including this feature in any type of mortgage finance system? Second, how should we think of moral hazard and government backstops in each type of system? Can we really get away from some type of catastrophe insurance? Would anyone believe the government would not intervene in the event of a major

housing collapse, regardless of the legal rules in place? How should we go about designing systems with such beliefs and expectations in mind?

I hope these thoughts are of use to the authors as they think about future work. We will all benefit from more research in this area by these authors.

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2. General Discussion

The variables used to explain the size of a country's housing finance system in the cross-country model received considerable attention from participants. Several inquired about the effects of additional explanatory variables on the model's results.

One participant was interested in the effect of income inequality on the size of housing finance systems. As an example, the participant pointed out that Brazil has higher income inequality than Denmark and has a smaller housing finance system. Another participant wanted to see the effects of additional market variables such as the amount of currency in circulation, referring to the case of Italy where the housing finance system is small because its people have a high propensity to use cash for purchases and the model did not capture this channel. The example of Italy was used again by another participant to consider the effects of the legal structure on the size of housing finance systems. The participant suggested that Civil Law systems, such as Italy's, which are less reliant on precedent, could have longer average time between foreclosure and possession, which would affect the size and development of the mortgage market. Yet another participant requested information on the effect of the underground economy on the size of housing finance systems. The participant said even with good fundamental factors, such as legal protections, a country may have a small housing finance system because of unverifiable earnings from the underground economy. Accordingly, some of the explanatory variables may have less explanatory power relative to what would be expected.

The authors, Frank Warnock and Veronica Warnock, said they had considered a lot of these explanatory variables, having worked with these data for some time. They mentioned that a lack of time series data – making it difficult to create a panel – limited the scope for including these additional regressors. (The lack of panel data to assess the research question was a common lament among participants.) However, in previous work the effect of the informal economy for Latin American countries had been considered.

The prevalence of fixed versus variable rates for housing mortgage loans, and the differing effects these rate structures might have on the stability and size of housing finance systems, generated a lot of discussion. One participant argued that variable mortgage interest rates were more effective in stabilising financial conditions for the household sector following a financial shock; all borrowers get a timely reduction in their interest payments including those with low or negative

equity. Another participant suggested policymakers, when thinking about these systems, should consider the demand for maturity transformation in an economy. In economies with very young populations one would expect to have a high demand for long-term fixed annuity payments, while for relatively older populations the opposite would be expected. Finally, another participant suggested that a prevalence of fixed versus variable rates in an economy could be the result of policy decisions designed to improve affordability. For example, in the United States, a 30-year fixed rate, combined with tax covers, extends affordability into the tails of the income distribution to households with very little amortisation.

In regard to variables that were included in the model, there was some discussion about the insignificance of the *Credit Information* variable and whether inflation – capturing macroeconomic volatility – could have non-linear effects. *A priori* several participants thought the *Credit Information* variable would be a highly significant fundamental factor in determining the size of a country's housing finance system. Frank Warnock said the lack of significance was a data quality issue, with very little cross-country variation in the *Credit Information* index. He said they had worked in many of the economies that scored highly on this index and found it hard to reconcile these high scores with their experience on the ground. In response to the inquiry about non-linear inflation effects, one participant suggested normalising *Inflation Volatility* by taking the first difference of inflation for a given country and dividing it by inflation lagged one period. This would ensure the *Inflation Volatility* term was bounded between zero and one.

Following this discussion, one participant queried whether the demand for housing across different economies deserved more attention relative to the supply of housing, which the existing explanatory variables were interpreted as capturing. The participant indicated that they expected demand-side issues would be more important in advanced housing finance systems (not necessarily advanced economies) and questioned the usefulness of having 61 advanced *and* developing economies in the sample on this basis. The participant proffered two countries with relatively large housing finance systems, Denmark and the Netherlands, as an example. In these economies, the government provides incentives to borrow through an established system. The role of government is, therefore, important in stimulating the demand for housing debt in these economies. It was also mentioned by the participant that the historical legacy of the mortgage finance system was an important determinant of its current size. For example, Denmark has a long history of mortgage finance relative to other economies and this, in turn, generates a particular housing finance system outcome. While not addressing the demand-side incentives to take on mortgage debt, the authors said they had thought about how to include a variable to capture the incentive to pay down mortgage debt. For instance, the authors said the extent of mortgage interest tax deductibility in an economy was a candidate variable for the model, but that data limitations rendered it difficult to include.

Finally, one participant questioned whether the insights from the model were also applicable to a period in which real estate prices were declining. In response, the authors reiterated that the data they were using was only a cross-section and that to get at business cycle effects, panel data were required.

When is a Housing Market Overheated Enough to Threaten Stability?

John Muellbauer*

1. Introduction

In many economies, housing prices are subject to boom-bust cycles and in some cases these cycles are linked to severe economic and financial instability. Overheating can have both a price and a quantity dimension, but it is likely that they are linked by common drivers. It is helpful to make the distinction between housing prices overshooting due to extrapolative expectations and 'frenzy', given fundamentals, and shifts in possibly fragile fundamentals. The contribution of careful econometric modelling to estimating the effects of the former is demonstrated: central banks or other policymakers should institute quarterly surveys of housing price expectations of potential housing market participants to help assess the first type of overshooting.

Assessing the fragility or otherwise of the economic fundamentals is more complex. Credit supply conditions in the mortgage market are the 'elephant in the room'. Without taking a measure of credit conditions into account, one simply cannot understand the behaviour of housing prices, household debt and consumption in countries such as Australia, the United Kingdom, the United States, South Africa or France, or understand the vulnerability of some economies to high levels of household debt. Other financial and economic indicators of vulnerability are discussed, including high bank leverage ratios, high ratios of loans to deposits, and high debt, deficit and current account to GDP ratios. Models of early warning of financial and economic crises estimated on large country panels need to be quite complex, for example, including some important interaction effects since shock transmission is very institution-dependent.

The outline of this paper is as follows. Section 2 questions the 'one size fits all' approach to explaining housing prices and their wider consequences by examining differences in recent housing price cycles across countries. This exercise illustrates the importance of country-specific institutional factors, as well as different types of economic shocks in determining a country's housing price dynamics. Differences in the feedback mechanisms between housing prices and the real economy are also important. Section 3 introduces the connection between housing and economic and financial stability. Feedback loops operate via construction and its impact on income, employment and housing prices, via consumption, and via the financial system, all of which proved important in the banking crises and GDP declines suffered by the United States, Ireland and Spain in recent years. Section 4 discusses problems with modelling housing prices,

* This paper draws on the author's research with a number of colleagues including Janine Aron, Valerie Chauvin, John Duca, Keiko Murata, Anthony Murphy and David Williams. Research support from the Open Society Foundation, The Oxford Martin School and the European Central Bank, via the Wim Duisenberg Fellowship, is gratefully acknowledged. Comments from Janine Aron, John Duca and Andrea Fracasso are much appreciated but the author takes responsibility for interpretations made in this paper.

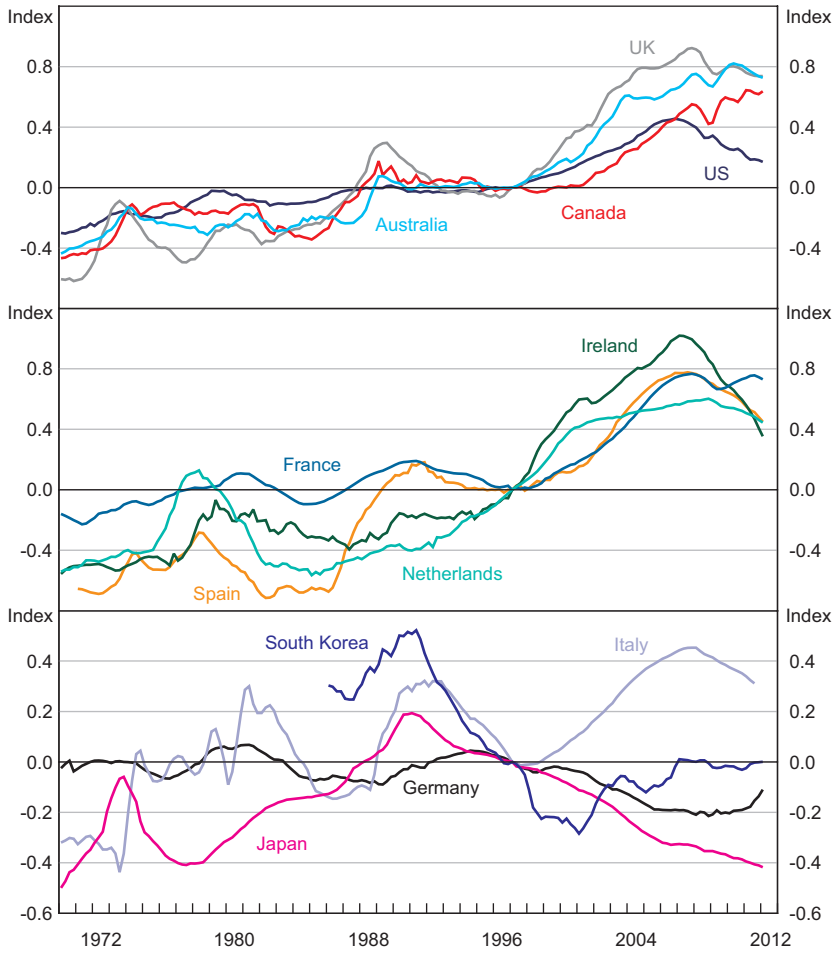
compares alternative approaches and discusses the measurement of user cost, emphasising the treatment of expectations of capital appreciation and of the risk premium. I contrast overvaluation arising from extrapolative expectations and 'frenzy', conditional on economic fundamentals, from overvaluation due to unsound fundamentals such as unsustainable levels of income, or interest rates, or the architecture of credit. Since overheating in housing markets can involve quantities as well as prices, and they are likely to be linked by common drivers as recently demonstrated in the United States, Ireland and Spain, Section 5 turns to possible drivers of construction booms and busts. As we shall see, econometric research on these questions still has far to go.

Since consumption typically accounts for around 60 to 70 per cent of GDP in developed economies, it is important to quantify/gauge the linkages between consumption and housing, which vary with the nature of credit market architecture across economies and over time. The multi-equation approach pioneered by my colleagues and myself that treats credit supply conditions as a latent variable provides sophisticated answers and is outlined in Section 6. I also suggest some simple single equation tests that indicate whether housing has important effects on consumption and whether shifts in credit availability have had important effects on the relationships between consumption, income and wealth portfolios. Feedbacks via the financial system are discussed in Section 7. Most obviously they occur when mortgages to households and loans to developers go bad, or when regulation fails to prevent unsustainable credit practices from spawning real and financial bubbles. Since mortgage data tend to be far more systematic than data on commercial real estate debt, I focus more attention on residential mortgages. Section 8 draws some conclusions.

2. Explaining Housing Prices – One Size Does Not Fit All

In the decade 1997 to 2007, the rise in real housing prices was unprecedented in many countries, though absent in a few, notably Japan and Germany. The three panels of Figure 1 illustrate this with real housing price data from the Organisation for Economic Co-operation and Development (OECD). The top panel includes four Anglo-Saxon economies: the United States, the United Kingdom, Canada and Australia. These are all economies with liberal credit markets and independent monetary policies. The United Kingdom shows the highest appreciation in real housing prices since 1970, followed by Australia, Canada and the United States, though from 1970 to 2005, appreciation was similar in the United States and Canada. The US pattern is smoother than those of the other economies, reflecting averaging over heterogeneous regional markets, a generally more elastic housing supply, and the nature of the Federal Housing Finance Agency (FHFA) data used. Of these four economies, the United States has experienced the greatest fall in real housing prices since 2006, while housing prices in Australia and Canada rose to new highs after the global financial crisis.

Figure 1: Real Housing Prices
Log price indices, base = March quarter 1997

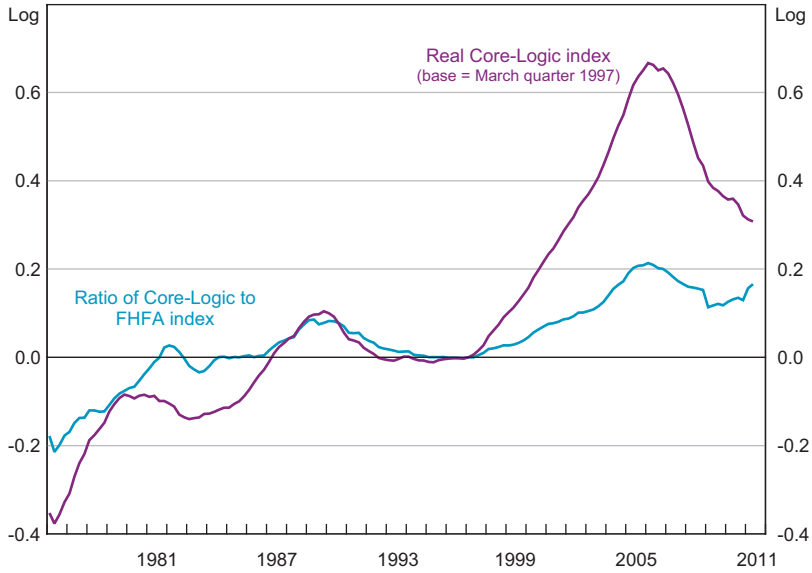


Source: OECD

Figure 2 shows an alternative US housing price index, the Core-Logic index, which is based on prices for a wider range of homes financed with prime and non-prime mortgages, and its log ratio to the FHFA index, which tracks home sales financed with prime, conforming mortgages.[1] The Core-Logic index shows greater appreciation during the subprime boom and rises more sharply during the 1980s. It also declines more in the early 1990s and after 2006. Indeed, the similarity of the United States with other Anglo-Saxon economies is greater for the Core-Logic index than for the FHFA index.

1 This version of the Core-Logic index excludes 'distressed' sales stemming from actual or imminent foreclosures.

Figure 2: United States – Real Housing Prices



Source: OECD

The middle panel of Figure 1 illustrates housing prices for a group of euro area economies – France, Spain, the Netherlands and Ireland – where mortgage credit appears to have been relatively freely available over the decade before the global financial crisis. Spain and Ireland experienced a similar rise in real housing prices from 1970 to 2007, and all four economies went through large appreciations from the late 1990s to 2007.[2] The largest subsequent declines occurred in Ireland followed by Spain. A remarkable fact is that from 1997 to the end of 2007 Spain and France had almost the same rise in real housing prices. Yet Spain's housing and mortgage markets and wider economy are now in deep crisis while France's are not.

The bottom panel of Figure 1 covers Germany, Italy, Japan and Korea where mortgage credit availability has long been restricted with little evidence of major shifts in the past decade.[3] Japan experienced a great rise in real housing prices (actually housing land prices) in the 1980s but real housing prices have been in almost continuous decline since their 1991 peak.

The differences between the economies illustrated in Figure 1 are so extreme as to call into question the 'one size fits all' tendency of conventional modern macroeconomics. Clearly, institutional differences, as well as different types of economic shocks, matter greatly.

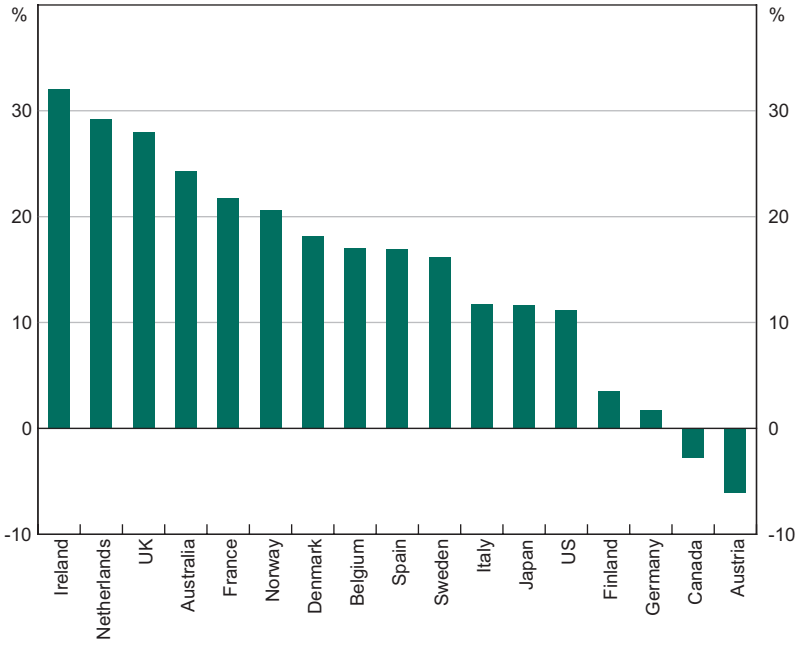
Over the years, the IMF has regularly pointed to risks posed by housing price bubbles and developed a methodology for judging the degree of overvaluation. For example, the analysis subtitled, 'Assessing Overvaluation in House Prices', was published shortly after housing prices peaked in many countries and before the most severe stage of the global financial crisis (Cardarelli,

2 The housing price index for Spain, which begins in 1987, is linked to a housing price index for Madrid for earlier years. This undoubtedly results in an upward bias of the pre-1987 rise in real housing prices reported for Spain.

3 In Korea, the experience of the 1980s housing price boom and later bust led the authorities to take systemic action to forestall repeated occurrences (Igan and Kang 2011).

Igan and Rebucci 2008, pp 113–114). For each country, housing price growth is modelled as a function of the lagged ratio of housing prices to per capita personal disposable income (PDI), growth in per capita PDI, short-term interest rates, long-term interest rates, credit growth, and changes in equity prices and the working-age population. The unexplained increase in housing prices from 1997 to 2007 defines the 'housing price gap', a measure of overvaluation (Figure 3).

Figure 3: IMF Housing Price Gaps Estimated in Early 2008



Source: Cardarelli *et al* (2008)

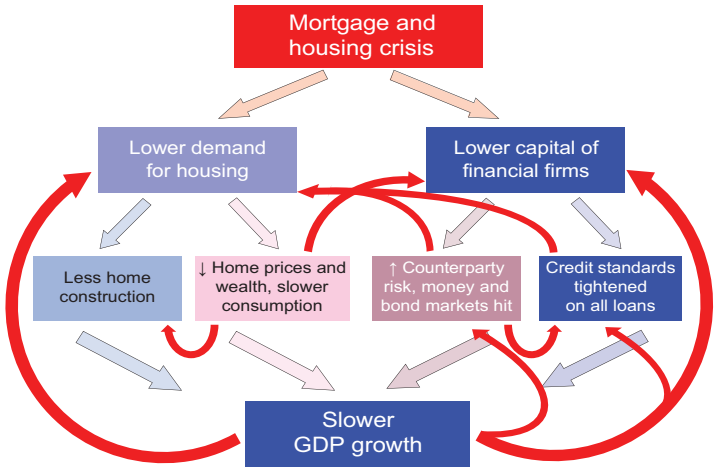
The relationship between these estimated gaps and subsequent falls in real housing prices is poor, apart from Ireland. The United States, ranked 13th, has experienced a sharper fall in real housing prices than all the countries ranked as higher risks, except for Ireland and Spain. Australia, France, Norway, Belgium, Sweden and Finland had all experienced *rises* in real housing prices by the third or fourth quarter of 2010 relative to the first quarter of 2008 despite their supposed overvaluations, though prices in Australia have slipped a little since then.

Cardarelli *et al* (2008) lacks a clear theoretical foundation. The omission of the supply side is a fundamental problem – making no distinction, for example, between Ireland and the United States, where there were large expansions of housing supply, and the United Kingdom where there was not. The imposition of a long-run income elasticity of 1 for housing prices without any justification is another serious problem. Permanent shifts in credit conditions and shifts in the age structure of the working-age population play no role in the analysis, the former being a particularly crucial omission. Further, no distinction is drawn between temporary overshooting conditional upon fundamentals and the fragility of the fundamentals themselves. Finally, no account is taken of feedback loops between the housing market and the wider economy. These issues will be addressed in the course of the paper.

3. Housing and Financial Stability

Figure 4 presents some of the mechanisms and feedbacks which operated in this crisis in the United States. Starting from left to right, it illustrates the linkages via construction, which fell by about 3.5 percentage points of GDP after three years (see Duca, Muellbauer and Murphy (2010)). Second, it illustrates the linkages via consumption, as collateral values dropped and credit contracted. The third and fourth channels track the negative feedback loops via credit markets and the banking sector more generally, through credit contraction triggered by rising bad loans, risks of bank insolvencies and higher risk spreads. In turn, the decline in economic activity feeds back negatively on home values, amplifying the initial shocks.

Figure 4: The Financial Accelerator Operating in the US Subprime Crisis



Source: Figure designed by John Duca and taken from Duca and Muellbauer (2012)

This second channel played a central role in the US crisis. Indeed, in the Great Recession, the saving rate rose by 4 percentage points, as consumption fell by 4 per cent more than income, in sharp contrast to a rather flatter saving rate in prior US recessions. Consumption also plays a key role in upswings of the business cycle, where negative feedbacks become positive feedbacks. As suggested by the contrast between Spain and France discussed below, recognising differences between countries in whether this channel is operative can substantially improve our understanding of whether a housing price boom is likely to be followed by an economic and financial crisis.

Countries where this channel is absent almost certainly include Germany, Italy, France, Japan and China. In China, there may, however, be another channel with consequences for GDP, which operates via the budget constraint of local governments. According to a 2012 report from the British Consul General in Chongqing, the China Real Estate Information Centre reported that city

income for the first 11 months of 2011 from land transfer fees was down in 50 out of 66 cities studied (UK Trade & Investment 2012). Seventeen cities had a drop in income from land transfers totalling CNY500 billion (approximately £50 billion). Provincial governments also receive tax revenues from real estate and construction companies and some collateralise their debt (or that of the local government financial vehicles) with land under the assumption of increasing prices. As a result, a decline in land prices and revenues can have consequences for health and other local expenditures, and for the quality of local government debt, currently thought to be around 25 per cent of GDP.[4]

The fallout in the United States on credit availability after the financial crisis, despite strenuous policy efforts to soften the impact, is well known (see, for example, Duca *et al* (2010)). Mortgage delinquency and the proportion of mortgages entering foreclosure proceedings reached unprecedented levels in 2009–2010. The average loan-to-value (LTV) ratio for first-time home buyers as recorded in the American Housing Survey in 2009 fell to 1990s levels (Duca, Muellbauer and Murphy 2012b). The net percentage of domestic respondents tightening standards for residential mortgage loans in the Federal Reserve Board's Senior Loan Officer survey reached unprecedented heights in 2008–2009 (Federal Reserve 2012). All of these factors negatively affected the real economy.

4. What Can be Learned from Housing Price Models?

There are two basic theories of housing price determination. The first is based on supply and demand functions, and a price adjustment process which brings supply and demand into balance. The second is based on finance and assumes that arbitrage brings housing prices and rents into an equilibrium relationship, again after a price adjustment process. In both approaches, interest rates as well as shifts in access to credit for households, provide an important link between the macroeconomy and housing prices.

4.1 The supply and demand approach

In this approach, the supply – the stock of housing – is given in the short run. Then housing prices are determined by the inverted demand curve, that is, by the stock of housing and the factors driving demand. Let the log of housing demand, h, be given by:

$$\ln h = -\alpha \ln hp + \beta \ln y + z \tag{1}$$

where hp is the real housing price, y is real income and z represents other demand shifters. The own-price elasticity of demand is $-\alpha$, and the income elasticity is β. Solving for housing prices, hp, yields:

$$\ln hp = \left(\beta \ln y - \ln h + z\right) / \alpha \tag{2}$$

Note that forecast simulations of housing prices for this model would need a residential investment equation as well as assumptions on income, interest rates and credit availability. An advantage of the inverted demand function approach (i.e. expressing price as a function of quantity and the other factors shifting demand) is that it is well grounded theoretically, unlike many 'ad hoc'

4 See Renaud (2012) for an excellent account of the risks for the Chinese economy of real estate developments of the last decade.

approaches. In addition, we have strong priors regarding the values of the key long-run elasticities, corresponding to the 'central estimates' set out in Meen (2001). For example, many estimates of the income elasticity of demand suggest that β is in the region of 1, in which case the income and housing-stock terms in the above equation simplify to log income per property, i.e. ln*y* – ln*h*. But the elasticity of housing prices with respect to income, given the stock, is β/α, which is typically substantially above 1 since the own-price elasticity, α, is below 1.

The demand shifters included in *z* cover a range of other drivers. Since housing is a durable good, intertemporal considerations imply that expected or 'permanent' income and 'user cost' should be important drivers. The user cost takes into account that durable goods deteriorate, but may appreciate in price and incur an interest cost of financing as well as tax. The usual approximation is that the real user cost, *uc*, is:

$$uc = hp\left(r + \delta + t - \Delta hp^{e} / hp\right) = hp\left(uch\right), \tag{3}$$

where *r* is the real after-tax interest rate of borrowing, δ is the deterioration rate plus transaction costs and a risk premium, *t* is the property tax rate, and $\Delta hp^{e}/hp$ is the expected real rate of capital appreciation. Before discussing user cost further, I consider the other basis for modelling housing prices.

4.2 The rent-arbitrage approach

Housing prices have also been modelled using the rent-arbitrage approach, particularly in the United States, where rental markets are well-developed and rents are generally market determined, in contrast to the more heavily regulated rental markets of some European countries. This approach is grounded in finance and assumes that, in the absence of substantial frictions and credit restrictions, arbitrage between owner-occupied and rental housing markets equates the rent-to-price ratio for housing with the real user cost of capital term *uch* defined in Equation (3) as the cost of mortgage finance, $(r+\delta+t)$, minus expected appreciation, $\Delta hp^{e}/hp$:

$$rent / hp = uch. \tag{4}$$

A similar result also obtains when agency costs make renting housing services more expensive than owning a home. Inverting and taking logs of Equation (4), implies:

$$\ln\left(hp / rent\right) = -\ln\left(uch\right) \tag{5}$$

where the elasticity of the price-to-rent ratio with respect to the user cost term equals –1.

However, Kim (2008) shows that in an equilibrium model, when rental agency costs are accompanied by binding, maximum LTV ratios on marginal home buyers, the equilibrium log price-to-rent ratio is more complicated:

$$\ln\left(hp / rent\right) = f\left(\ln\left(uch\right), \max LTV\right). \tag{6}$$

In this case, the size of the negative real user cost elasticity can be smaller than 1, in line with empirical results (see Duca, Muellbauer and Murphy (2011) for evidence and discussion). Kim's result is close in spirit to Meen (1990) who considers the result of relaxing mortgage credit constraints. He shows that when there is a binding credit constraint, the user cost term in the

optimal housing price-to-rent ratio includes the shadow price of the credit constraint (such as a maximum LTV bound), which will be related to the pervasiveness of such constraints.

Note that forecast simulations for housing prices from a model of this kind require an equation for rents and assumptions on the path of the LTV ratio ceiling. Duca, Muellbauer and Murphy (2009) suggest that US rents adjust relatively slowly to their long-run determinants, which are the general price level, the level of housing prices, the nominal mortgage rate and user cost.

4.3 User cost and expectations

Both the inverse demand and the arbitrage approaches depend heavily on the user cost concept. An important practical issue for the modeller is measuring expected housing price appreciation. One might have thought that regularly monitoring household expectations of housing prices would be a high priority for central banks and other policymakers. However, actual surveys of housing price expectations are unfortunately sparse and intermittent, which is likely to be a consequence of the 'pretence of knowledge syndrome' (Hayek 1974; Caballero 2010) that has long plagued conventional macroeconomics. Bracke (2010) analyses some of the sparse survey information for the United States and United Kingdom and finds strong evidence that expectations of future appreciation are linked with past observed appreciation and cannot be reduced to a combination of other macroeconomic predictions. He also finds a high dispersion of responses across households. He interprets these findings in a sticky information or epidemic framework of spreading information. Hamilton and Schwab (1985), Case and Shiller (1989, 1990), Poterba (1991) and Meese and Wallace (1994) find housing price changes are positively correlated and that past information on housing fundamentals forecasts future excess returns. Capozza and Seguin (1996) and Clayton (1997) also find evidence against rational housing price expectations.

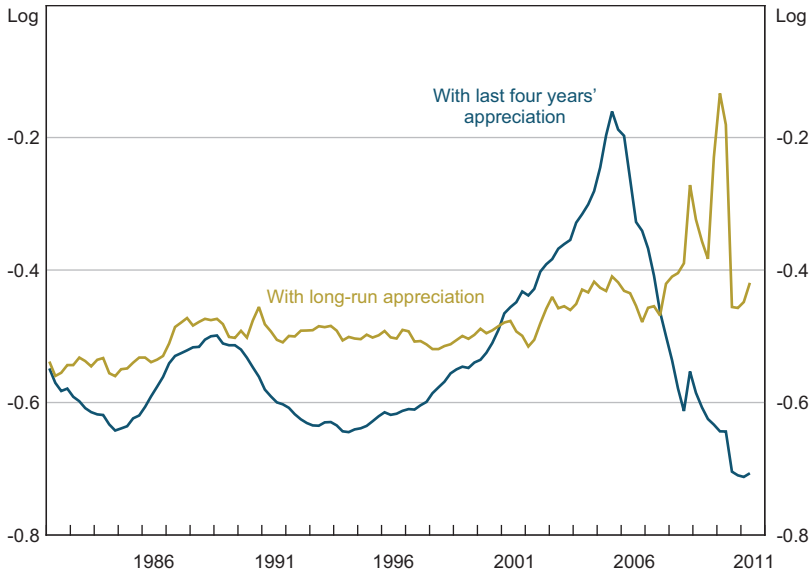
In our research on aggregate US housing prices (Duca *et al* 2011, 2012a, 2012b), we find evidence that a user cost calculation that uses the average rate of appreciation over the previous four years to proxy for expectations produces the best fit for both the inverse demand and the rent arbitrage approaches. In econometric work on housing prices in Norway using the inverse demand approach, Anundsen finds that the four-year average rate of appreciation in an expression for user cost also gives the best fit.[5] Cameron, Muellbauer and Murphy (2006) estimate a UK regional housing price model and test for an asymmetry between appreciation and depreciation phases and also find a four-year memory of depreciation produces the best fit. In current research on France, Chauvin and Muellbauer (2012) find that an average of one- and four-year lagged appreciation gives the best-fitting user cost measure. While there is probably not a universal law of precisely how housing price expectations are formed, there is at least a hint from this set of evidence that econometric modellers should treat the lagged four-year rate of appreciation as an important candidate for measuring user cost. This horizon is close to the five-year window used by Himmelberg, Mayer and Sinai (2005).

A four-year memory has important implications for the overshooting of housing prices: it implies that a series of positive shocks such as the subprime mortgage boom and the fall in interest rates experienced in the United States, which cause housing prices to appreciate, will cause further appreciation over a considerable period even if the fundamentals do not change further

5 Personal communication with André Anundsen, 30 June 2012.

or mean-revert. An estimate of the importance of this phenomenon can be derived from Duca *et al* (2012a, 2012b), who study the FHFA housing price index for the United States. Figure 5 plots the log user cost term scaled by its estimated coefficient in the long-run solution for real housing prices against an alternative which uses the average historical appreciation from 1982 to 2011. The difference of around 35 per cent averaged over the four quarters from 2005:Q2 to 2006:Q1 is a measure of the degree of overshooting due to extrapolative expectations.[6] Our model suggests that this was a very important component of the overshooting in US housing prices. Of course, given sluggish adjustment, housing prices never got to the peak implied by this long-run solution: the equilibrium correction towards the other fundamentals was already offsetting the pull from extrapolative expectations and, before long, other fundamentals turned sour. Mortgage interest rates drifted up from their lows in 2005 and, in 2007, LTV ratios started to fall.

Figure 5: United States – Contribution of the User Cost Term to Estimated Housing Prices



Notes: Long-run log real FHFA housing prices; for more details see Duca *et al* (2012b)
Source: author's calculations

Thus, there was an important role for extrapolative expectations in the overshooting of housing prices in the United States. This is consistent with the snapshot surveys by Case and Shiller in 2003 which suggested that many households had absurdly positive expectations of appreciation. Shiller (2007) emphasises the psychological element in expectations. But since we can account for the other drivers and quantify the adjustment process, we can understand the series of positive economic shocks that ultimately drove expectations. This is extremely helpful in quantifying the degree of overvaluation and the time path for likely corrections.

6 It seems likely that adding a time-varying risk premium to user cost (see below) would bring down the estimated peak effect in 2005, but would not greatly alter the overall conclusions.

A sceptic might argue that dynamics estimated from modelling aggregate housing price indices could be distorted because of aggregation bias. In other words, different regions might exhibit different dynamics, and none might be like the aggregate. One test of our model is the predictions it generates. In Duca *et al* (2009) the time path of future housing prices was simulated using the rent-arbitrage approach. It correctly forecast that there would be a second leg to housing price declines after the tax credit for first-time home buyers was withdrawn in June 2010. It also forecast that 2012 would see the bottom of nominal housing prices and obtained the same result with the inverse demand approach in Duca *et al* (2012a, 2012b). At the time of writing, the Case-Shiller 20-city home price index had risen significantly by September from its low reached in February 2012. The FHFA housing price index lags several months behind the Case-Shiller index so our forecast made in December 2009 for lows in the second half of 2012 is plausibly on track. A range of other housing market indicators are also improving, lending credibility to our conclusion.[7]

Other approaches to modelling expectations of capital appreciation are also possible. One might, for example, model future housing price appreciation in a semi-rational model using data that households would have some knowledge of, such as lagged housing price changes, income, mortgage interest rates and growth of mortgage debt, as a simple proxy for changes in credit availability. The fitted value could then serve as a proxy for expected appreciation. But over what horizon is future appreciation likely to be relevant? Obviously, one quarter ahead, given transaction costs and delays, is not a plausible horizon. One year ahead is more plausible but also seems arbitrary. If some average with declining weights of future appreciations is to be taken, what weights should be used? These are relevant research questions.

There is evidence that non-linear 'frenzy' effects can operate in countries with volatile housing prices. Hendry (1984) first used the cubic of recent appreciation to model this phenomenon. Muellbauer and Murphy (1997) find supporting evidence for the United Kingdom and Muellbauer and Williams (2011) do so for Australia. One interpretation is that if housing price rises exceed thresholds given by transaction costs and costs of finance, the potential speculative gains become so attractive that the number of bidders in the housing market rises sharply, resulting in an acceleration of housing prices. This can be an overshooting mechanism additional to the one discussed above. The cubic has the property that 'frenzy' can also operate on the downside so that the fear of capital losses might also raise transaction volumes leading to sharp price declines. An alternative interpretation is that in periods of falling prices, defaults rise, leading to a rise in the proportion of auction sales, and so more rapid price movements.

The user cost approach itself suggests an intrinsic source of non-linearity in housing price dynamics. Equations (5) and (6) suggest that the log of the user cost term *uch* is the right functional form for explaining log housing prices. The log function has the property that *log x* tends to minus infinity as *x* tends to zero. The log function therefore amplifies the effect of user cost as it becomes small – which can happen in housing price booms as Figure 5 amply illustrates.

The user cost, neglecting the risk premium, can take on negative values if rates of capital appreciation in housing price booms exceed interest and other costs of owning a home. Since the log of a negative number cannot be defined, this is a problem. We can write:

7 Pessimists who point to the continued high levels of stocks of housing in foreclosure tend to forget that housing prices reflect both the owner-occupied and rental markets, and vacancies in the latter are at decade lows.

$$uch_t = r_t + \delta_t + t_t - E_t \Delta \log hp \tag{7}$$

where $E_t \Delta \log hp$ is the expected annualised rate of change of real housing prices over the relevant horizon. While this term can be large enough to make the expression in Equation (7) negative, this may not be a problem if expectations, averaged over households, have the form:

$$E_t \Delta \log hp = \lambda const + (1-\lambda) av \Delta \log hp \tag{8}$$

where λ is positive and less than one, and $av\Delta \log hp$ is the relevant annualised historical rate of appreciation. The specification in Equation (8) clearly reduces fluctuations in the implied expected housing price appreciation.

Another possibility is to assume that annualised transaction costs and the risk premium are always large enough to make the expression in Equation (7) positive. Some transaction costs are monetary and there is considerable variation across countries in the size of such costs. But since there are typically costs of moving, costs of fine-tuning the decorative state of one's new dwelling, as well as non-monetary costs associated with disruptions of social networks and learning about new environments, it may be reasonable to suppose that these costs are always large enough.

However, it also seems likely that the risk premium is time-varying and could increase with recently experienced volatility and with the extent to which prices deviate from perceived economic fundamentals. One might have thought that such a specification would pose challenging problems of non-linear estimation and identification. However, for French housing price data, it is possible to go quite far. In particular, a simple version of *uch* is defined as:

$$uch_t = 0.12 + 0.85 mr/100 - \Delta_4 \log pc_t - 0.5\left(\Delta_4 lhp_t + \Delta_{16} lhp_t / 4\right) \tag{9}$$

which assumes that total annualised transaction costs of all kinds plus a constant risk premium is 12 per cent and that the appropriate average rate of tax relief on mortgage interest is 15 per cent, giving an after-tax mortgage interest rate of $0.85mr/100$, where mr is the nominal percentage rate of interest on mortgages. Then the annual inflation rate is subtracted to obtain the real after-tax interest rate where pc_t is the consumer price index. Finally, we subtract the annual rate of increase of real housing prices averaged over the last four quarters and the last sixteen quarters, respectively. The user cost term *uch* is positive throughout the sample. A plot of log *uch* – with the last four years' appreciation and without a risk premium – scaled to measure its long-run impact on log real housing prices is shown in Figure 6. The user cost term makes the largest contribution to long-run housing prices in 2005:Q3.

These data can be used to test a linear versus a log-linear specification. For data from 1980:Q4 to 2003:Q4, linearity is strongly rejected against log linearity. For the full sample to 2011:Q1, linearity is marginally preferred. However, by raising the composite transaction cost/risk premium term from 0.12 to 0.20, log linearity again does better for the full sample. This finding and the shift in parameter estimates are consistent with the hypothesis of a time-varying risk premium. Such a risk premium can be modelled in terms of a measure of housing price volatility, *hpvol*, defined as a moving average of the absolute deviation of changes in log real housing prices, *lhp*, from their mean, *m*, as follows:

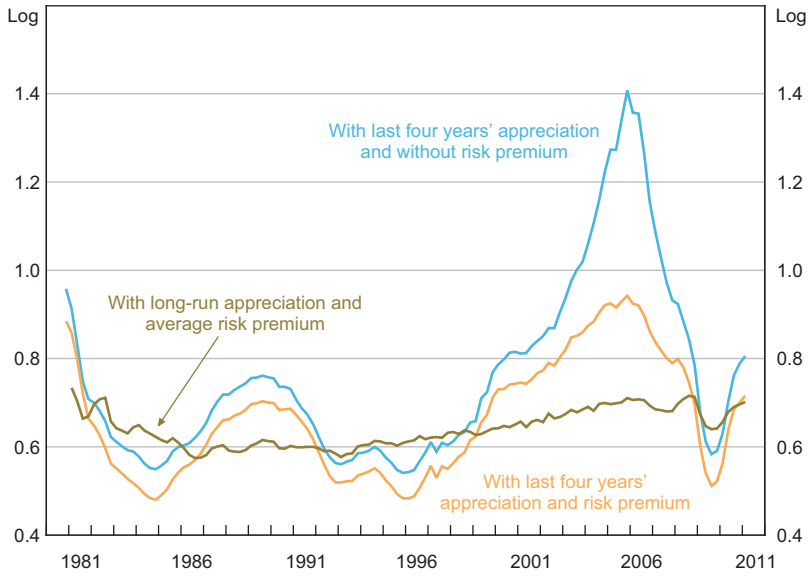
$$\begin{aligned} hpvol_t = {} & abs\left(\Delta_4 lhp_t - m\right) + 0.7\, abs\left(\Delta_4 lhp_{t-4} - m\right) + 0.7^2\, abs\left(\Delta_4 lhp_{t-8} - m\right) \\ & + 0.7^3\, abs\left(\Delta_4 lhp_{t-12} - m\right) / \left(1 + 0.7 + 0.7^2 + 0.7^3\right) \end{aligned} \tag{10}$$

Adding this measure of the risk premium to the previous user cost term with a coefficient β to be estimated results in:

$$\log uch2_t = \log\left(\beta hpvol_{t-1} + uch_t\right) \tag{11}$$

For French data, the estimate of β is highly significant at 0.63 (t = 5.1). Parameter stability and fit both improve with this risk adjustment of the user cost term. Figure 6 compares the time profile of the log user cost term with last four years' appreciation and without risk adjustment to the log user cost term with last four years' appreciation and with risk adjustment. Measured in terms of the long-run impact on the log of the French real housing price index, Figure 6 makes clear that risk adjustment substantially lowers the peak impact of the log user cost term relative to values over the rest of the period.[8]

Figure 6: France – Contribution of the User Cost Term to Estimated Housing Prices



Note: Long-run log real housing prices
Sources: Banque de France; Institut National de la Statistique et des Études Économiques (INSEE); OECD; author's calculations

As was done earlier for the United States, it is possible to estimate the impact of extrapolative expectations of housing price appreciation for France. This is shown in Figure 6 which also plots the long-run impact of the log user cost term with long-run appreciation and the historical mean risk premium on the log of real housing prices. At the peak in 2005, the difference between this series and the series with the last four years' appreciation and last quarter's risk premium is around 0.22, representing 'overvaluation' due to extrapolative expectations of around 25 per cent in the

8 For simplicity, the coefficient of –0.37 (t = –4.5) estimated for the log risk-adjusted user cost term has been applied to both measures. Omitting the time-varying risk adjustment results in a substantially smaller coefficient (in absolute value) on log user cost even if a small constant is added to user cost to prevent it falling into a negative range.

level of real housing prices. While this is a substantial amount, it is a lower figure than the US estimate reported above, in part probably because that estimate does not take into account a time-varying risk premium. However, the main reason is likely to be that the positive shocks from financial innovation in the United States during the 2000s were a lot stronger, so that US housing prices deviated more from sustainable long-run fundamentals than was the case in France.

4.4 Overshooting due to the decline of fragile fundamentals

Overshooting due to extrapolative expectations, given economic fundamentals, is one aspect of overvaluation. Another, sometimes even more important reason for overshooting, is if the 'fundamentals', which include income, credit supply, interest rates and the housing stock, themselves overshoot. There are many examples of this. First, consider Finland. After the credit liberalisation of the 1980s (without a reduction in the generous tax relief on mortgage interest), Finland experienced a huge housing price and consumption boom, and faced a large reduction in exports in the early 1990s when the former Soviet Union collapsed. At the same time, German unification led to a rise in interest rates. The subsequent decline in income, employment and credit came on top of a housing market which would have been overvalued even if fundamentals had held constant. In the resulting crisis, GDP fell by 14 per cent and unemployment rose from 3 per cent to almost 20 per cent.

The United Kingdom too experienced a decade of credit liberalisation in the 1980s, a boom in credit, consumption, housing prices and an increase in the balance of payments deficit. Muellbauer and Murphy (1990) argued:

> … our empirical evidence on the determination of housing prices suggests an important extrapolative component in expectations, giving rise to bouts of speculative frenzy. With the sharp rise in house prices, residential property became more than half of personal sector wealth. Financial liberalization allowed households to cash it in as consumer expenditure financed by borrowing.
>
> In our view, in contrast to that of at least one of our discussants, liberalization of housing finance had important effects on personal wealth, consumption and hence the trade deficit. (pp 349–350)

The discussion by Mervyn King (1990) summarised our policy recommendation for the demand side as follows:

> First, they would increase capital-adequacy requirements on mortgage loans on the balance sheet of firms in the financial-services industry. Second, they would introduce a national tax on residential property and restrict the scope of mortgage interest relief. Both their diagnosis and proposed cure raise the question of how far developments in the housing market can be blamed for the recent emergence of large balance of payments deficits. (p 383)

He then dismissed both the diagnosis and cure, arguing that the more likely explanation for the boom in credit, housing prices and consumption was that income growth expectations had become more optimistic.

Soon after this 1989 debate (published 1990), domestic inflation rose sharply. The United Kingdom had entered the Exchange Rate Mechanism (ERM) with an overvalued exchange rate. Base rates were raised from 7.5 per cent in 1988 to 15 per cent in 1989 in an attempt to curtail domestic inflation and curb balance of payments deficits. Housing prices fell from 1991 to 1995 and mortgage arrears and foreclosures rose to all-time records in 1991:Q2. In 1992, the Bank of England

launched a (secret) lifeboat of liquidity to support the financial system and, given the pressure of high interest rates within the ERM and a severe domestic recession, the United Kingdom was forced to exit the ERM in September 1992.

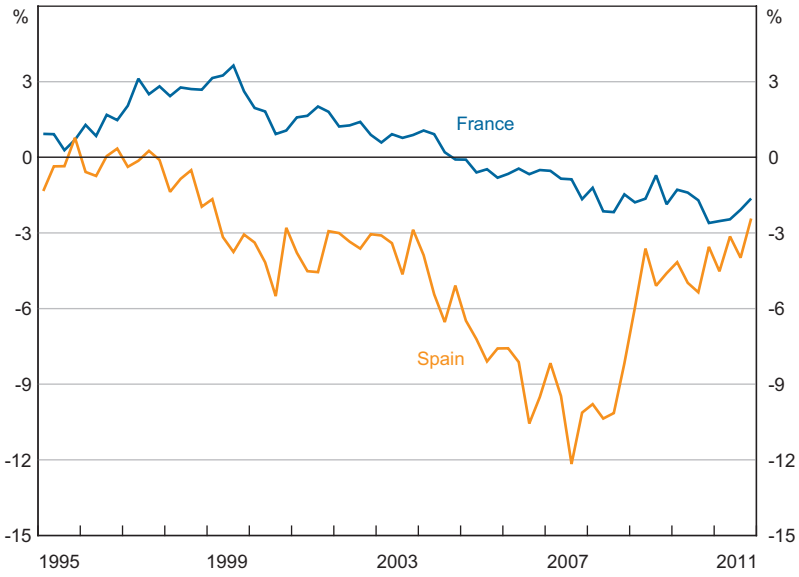
In the more recent UK crisis, what proved most unsustainable were the extreme levels of leverage of the banking system, the maturity mismatch implied by short-term money market financing of longer-term mortgages and the structural deficits run by the government. The exchange rate too was overvalued, given the crowding out of capacity in the non-financial sector of the economy by the long boom in the financial sector, which now faced an unprecedented contraction.

Duca *et al* (2011) show for US housing prices, based on the rent-arbitrage approach, the most obvious fundamental shift was the decline in the LTV ratio for first-time home buyers to levels last experienced in the 1990s. In the inverse-demand approach, the property building boom in 2002–2006 also plays a role, since the housing stock had risen significantly relative to income and population by 2007, adding to downward pressure on prices.

The contrast between Spain and France is also instructive. Chauvin and Muellbauer (2012) suggest that the housing collateral effect on consumption is absent in France, but micro-evidence from Bover (2005) suggests that it is positive in Spain. Spain almost certainly experienced a rather greater expansion of credit availability than France but its effect on real housing prices was offset by a far greater construction boom. Lending to companies, many in the construction business, was certainly part of this expansion in Spain and part of the problem Spanish banks currently face.[9] Spain also experienced very high levels of immigration, which added both to labour working in construction and to demand for housing. In terms of economic fundamentals, Spain's international competitiveness measured in relative unit labour costs declined more than France's. Together, these effects largely account for the far greater ballooning of Spain's balance of payments deficit shown in Figure 7, which contrasts the current account-to-GDP ratios of the two countries since 1995. In Spain the current account balance reached –10 per cent of GDP in 2008 while France's never fell below –2.5 per cent in 2008.

9 Paralleling recent problems in Spain, US bank failures during the recent crisis were largely due to bank lending to construction and land development companies.

Figure 7: Current Account Balance
Per cent of GDP

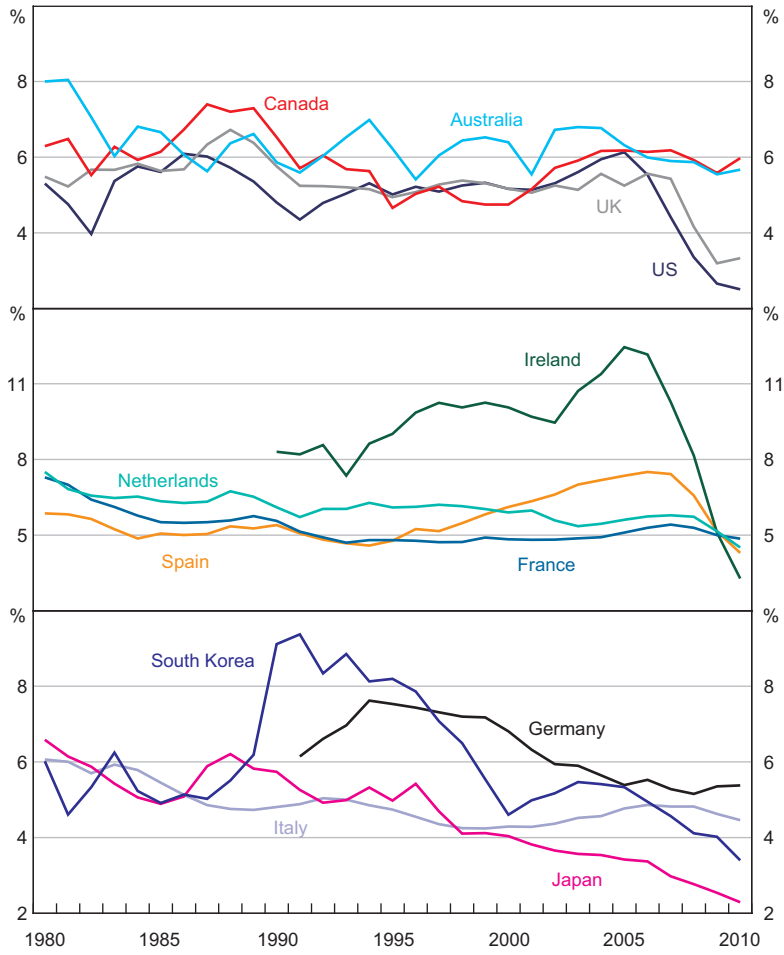


Source: OCED

5. Modelling Residential Construction: What Scope for Overshooting?

The three panels of Figure 8 show the ratio of residential housing investment to GDP for the same three sets of countries examined in Section 2. The top panel of Figure 8 most strikingly contrasts the collapse of housing building in the United States and the United Kingdom since 2006 and 2007 with the steady performance in Australia and Canada. In the United States the peak-to-trough decline accounts for around 3.5 per cent of GDP. In the United Kingdom, the peak-to-trough decline was around 2 per cent of GDP and in 2009–2010, construction volumes fell from low levels to even lower levels, such that the United Kingdom built fewer homes in 2010 than in any year since 1923. The boom in 2002–2006 in the United States contrasts with 15 years of little fluctuation in the United Kingdom.

Figure 8: Residential Housing Investment
Per cent of GDP



Source: OECD (2011)

The middle panel of Figure 8 suggests that the collapse of housing construction in Ireland was around 9 per cent of GDP and around 3.5 per cent in Spain, while France and the Netherlands had far more modest declines. The building boom in Ireland and Spain seems to have begun in the mid 1990s but the OECD data indicate a more extreme boom in Ireland. The impact of excess supply, as well as of the credit crunch, is the most plausible explanation for the fall in housing prices in Ireland displayed in the middle panel of Figure 1.

The bottom panel of Figure 8 sheds light on the fall in real housing prices experienced by Germany after the late 1990s and by Korea in the 1990s: the expansion of the housing stock due to high levels of investment seems to have been part of the explanation in each case.

But what determines residential investment? The determinants of the supply of housing are extraordinarily complex. The literature on the econometrics of new housing construction is

correspondingly diverse and contradictory. DiPasquale (1999) explains some of the reasons why we appear to know so little about housing supply. Housing supply comes from new buildings as well as conversions and rehabilitation of the existing stock. Data on expenditure on improvements suggest that it has become a substantial fraction of total gross investment in housing. But the behaviour of builders and owners is likely to differ, and among owners, owner-occupiers may behave differently from landlords. New construction can be for owner-occupation, the private rental sector or for the social rental sector, each with different drivers. Housing is heterogeneous and the available data on numbers of units usually ignore this heterogeneity by type and location.

Government intervention in some countries had or has been on a massive scale. For example, as a matter of policy, the construction of social housing in the United Kingdom (and, for that matter, in many other countries, such as the Netherlands) has declined sharply since the 1970s. The incidence of rent controls has varied greatly. The literature on private residential construction has converged to some extent in recent years in agreeing on the importance of land supply and, hence, zoning and planning restrictions, and other interventions, such as the taxation of developers (see Muellbauer and Murphy (2008) for further references and Quigley (2007) for a review of the US literature).

Wide disagreements on details remain. Estimates for housing supply elasticities differ greatly, even when they are meant to refer to the same country and time period, sometimes even within the same study. Mayer and Somerville (2000) argue that residential construction responds not to the level of real housing prices, but to their rate of appreciation, and that this could be part of the reason for the great instability of estimates of the supply elasticity. Stripped to the essentials they advance two main arguments. The first is that residential construction is a stationary series while real housing prices are non-stationary, so that a cointegrated relationship cannot exist explaining the former by the latter. The second is that housing values are basically land values plus the value of the bricks, mortar, etc, erected by builders on the land. The structures are reproducible and their supply price is given by costs little affected by demand in the long run. Land, however, is non-reproducible. Builders effectively onsell the same land they acquired earlier so that their profit consists of the normal mark-up on construction costs plus the capital gain on land. Capital gains in land are approximately capital gains in housing minus the rise in other construction costs. Hence, expected capital gains in land (or housing) will be important drivers of residential construction volumes. To be more precise, because builders also need to take the cost of capital into account, a user cost concept analogous to that which influences household demand for housing should help explain variations in residential investment.

The relevant interest rate will be the rate at which builders can borrow, which will be correlated with, but not identical to, mortgage interest rates. Furthermore, access to borrowing by large and small construction companies may sometimes move differently from access to mortgages by households. It is also possible that builders may have better-informed expectations with regard to capital gains than households. Nevertheless, it is likely that an extrapolative element governs these expectations too. Hence it is likely that similar factors, namely extrapolative expectations of capital gains, low interest rates and easier access to borrowing, explain both the overshooting of residential construction volumes in housing booms and the overshooting of housing prices in, for example, Ireland, Spain and the United States. User cost, together with an ageing population,

could also help explain the declining levels of residential construction in Japan, illustrated in the bottom panel of Figure 8.

Most housing economists, if asked before 2005, would have argued that economies where the supply responsiveness of housing is relatively high, as in Ireland, Spain and the United States, should experience *lower* housing price volatility than economies where housing supply is unresponsive as in the United Kingdom. The evidence that has since become available strongly contradicts this hypothesis. The explanation lies partly in the lags in the response of the stock of housing, which may continue to rise when housing prices have already started to fall, and partly in the common drivers of overshooting noted above – clearly if supply overshoots, then the subsequent fall in home prices needed to restore equilibrium will be greater. The argument here is similar to that of the classic 'hog cycle'.[10] The common drivers of overshooting would include the greater relaxation of credit conditions and poorer lending standards, and hence greater reversal in prices after 2007, in at least Ireland, Spain and the United States. Another reason for greater volatility in countries with high supply elasticities lies in the macroeconomic feedback on unemployment and incomes, which occurs when residential construction volumes collapse.

6. How Can We Tell if the Consumption Channel Operates?

There has been much disagreement among economists on whether variations in housing wealth matter for consumption. The pre-crisis view of Mervyn King and the Bank of England, that housing price fluctuations reflect shifts in income expectations and play no causal role for consumption, has long been popular.[11] In a number of papers I have explained that classical theory, in which credit constraints and buffer stock saving play no role, suggests that there could be a small positive housing wealth effect on non-housing consumption but that the housing wealth effect was likely to be negative on the standard national accounts' concept of consumption, which includes imputed rent from housing.[12]

Moving beyond classical theory to take credit constraints into account, the conclusions are quite different: a liberal credit market tends to result in a positive effect of housing prices on consumption because collateral constraints on owners are relaxed and there is less need for the young to save for a housing deposit even at higher prices. However, in the long run, the accumulation of higher debt will eventually reduce consumption. With an illiberal credit market, the collateral effect is weak, while the need of the young to save for a housing deposit increases with higher housing prices. In the latter case, higher housing prices reduce consumer spending, as seems to have been the case in Italy and Japan. Institutional differences between countries therefore matter greatly, and so does properly controlling for changing credit conditions in econometric work.

With proper controls for shifting access to credit, income growth expectations, interest rates and the change in the unemployment rate, empirical estimates of the shifting marginal propensity to

10 Here pig farmers respond to high prices by breeding more pigs in year t, but because pigs take two years to reach maturity, supply in year $t + 2$ then overshoots and excess supply reduces prices at $t + 2$ which then reduces the supply of pigs at $t + 4$, causing prices to rise once more.

11 Attanasio and Weber (1994) and Attanasio *et al* (2009) are among the adherents, but Attanasio, Leicester and Wakefield (2011) represents a pronounced shift away from this position. In the latter paper, the authors set up a micro-simulation with a realistic representation of credit constraints in the UK mortgage market and simulate the implications for consumption of housing price shocks with these frictions.

12 See Muellbauer and Lattimore (1995) and Muellbauer (2007); the argument is easiest to follow in Aron *et al* (2012).

consume out of housing wealth tend to be lower but more accurately determined than estimates widely found in the literature, such as Case, Quigley and Shiller (2005).

To meet the King/Bank of England view with evidence, it is necessary to have a quantitative measure of shifts in credit conditions as well as of consumers' permanent income. In the Latent Interactive Variable Equation System (LIVES) approach, an index of credit conditions can be extracted from a system of equations that typically includes consumption and other credit-related variables such as mortgage debt, housing prices, home equity withdrawal, mortgage refinancing rates and potentially other components of household flow-of-funds data.[13] Such a system is also a major step towards developing a general equilibrium analysis in which household portfolios, on the basis of which consumers make consumption decisions, are endogenised. It is a key component of modelling efforts to understand the links between finance and the real economy.

A starting point for understanding consumption is the canonical form of the life-cycle/permanent income consumption function. Following Aron *et al* (2012), the best log-linear approximation to this is:

$$\ln c_t = \alpha_0 + \ln y_t + \gamma A_{t-1} / y_t + \ln\left(y_t^p / y_t\right) \tag{12}$$

where c is real per capita consumption, y is real per capita non-property income, the p-superscript denotes the permanent version of this income concept, and A is real per capita net worth. γ is a close approximation to the marginal propensity to consume (MPC) out of net worth. Note the coefficients of unity on the log income terms in the canonical model.

The following is a generalisation, with partial adjustment, of the canonical permanent income model of consumption in Equation (12):

$$\ln c_t \approx \lambda\left(\alpha_0 + \alpha_1 r_t + \alpha_2 \theta_t + \ln y_t + \alpha_3 E_t \ln\left(y_t^p / y_t\right) + \gamma A_{t-1} / y_t - \ln c_{t-1}\right) + \varepsilon_t \tag{13}$$

where λ measures the speed of adjustment. This version relaxes the constraint on the coefficient for permanent income (since not all consumers may be so forward looking) and allows the real interest rate r and income uncertainty θ (typically proxied by changes in the unemployment rate) to affect consumption.

There are two reasons why this specification is not general enough. First, the net-worth constraint that all assets are equally spendable should be regarded as absurd by any banker. Obviously liquid assets should be more spendable than illiquid assets and economic theory implies that housing and financial assets are not equivalent. It follows that net worth should be disaggregated into at least three components: Aron *et al* (2012) find that net liquid assets (defined as liquid assets minus debt), illiquid financial assets, and housing assets are the minimal set for useful empirical work. Second, credit market liberalisation shifts some of the key parameters. Most importantly, it is likely that credit market liberalisation will raise the average consumption to income ratio, given

13 Our initial attempt to measure shifts in mortgage credit conditions in Muellbauer and Murphy (1993) estimated an equation for the LTV ratio for first-time buyers to 1979 and took the forecast errors after 1979 as the indicator of shifts in mortgage credit availability. This proved to be highly significant as a measure of the rise in the marginal propensity to consume out of illiquid assets (including housing) in the UK consumption function. The method was later extended to a system of regional LTV ratio data, which allowed this residual to be extracted as a common factor. Fernandez-Corugedo and Muellbauer (2006) extended this model further to a 10-equation system including proportions of LTV and loan-to-income ratios exceeding traditional thresholds. In Aron and Muellbauer (forthcoming), the LIVES method was applied to a 2-equation system of consumption and debt.

household portfolios and, if access to home equity loans increases, the marginal propensity to consume out of housing wealth should also rise.

A typical symptom of omitting important shifts in credit conditions when estimating extended versions of Equation (13) with wealth split into its main components is that the coefficients on these wealth components are unstable over time and the speed of adjustment is typically low and/or unstable. For quarterly data, any speed of adjustment below about 0.2 is generally a symptom of misspecification. For US quarterly data from 1966 to 2011, one can find a great variety of adjustment speeds for 25-year sub-periods ranging from less than 0.1 to 0.35, and hugely unstable coefficients on net worth components, ranging from sometimes negative for liquid assets to sometimes positive for debt, and similarly for housing wealth.

The Bank of England investigated the housing wealth to consumption linkage in Benito *et al* (2006). In a consumption equation estimated for 80 quarters in a rolling window from 1998:Q1 to 2006:Q1, they report a significant decline in the relationship. Few details of the model are available except that it was in an equilibrium correction form with a long-run solution linking consumption with income and net financial wealth, and that only the change in housing wealth, and not the level, was allowed to influence the change in log consumption. No information is given on whether the controls include the change in the unemployment rate or interest rates, or the size of estimated adjustment speeds. Omission of such controls and of indicators of the radical credit market liberalisation that began at the end of 1979 would undoubtedly affect the empirical estimates. Muellbauer (2007) and Aron *et al* (2012) report that the coefficient on the level of housing wealth-to-income ratio interacted with the credit conditions index of Fernandez-Corugedo and Muellbauer (2006) is highly significant (*t*-ratio around 6) and stable.[14] Since the credit conditions index rose from the mid 1990s into the 2000s, this indicates that, in the relevant period, housing wealth actually had a rising influence on consumption, the opposite of the Bank of England conclusion.

Estimates from research for the United Kingdom, the United States, Australia, South Africa and France all point to: quarterly adjustment speeds between 0.3 and 0.4; increases in the ratio of consumption to income with more liberal credit market conditions; the MPC for net liquid assets between around 10 and 16 per cent; MPCs for illiquid financial assets between around 2 and 4 per cent; and highly variable MPCs out of housing wealth ranging from slightly negative to around 5 per cent.[15] For these countries, credit market liberalisation had an important impact on consumption. Once this impact is controlled for, the remaining parameters are stable and well determined, while tests confirm both cointegration and that consumption is the main variable adjusting to the cointegration vector.[16] The combination of wealth and credit effects, in

14 Incidentally, to obtain approval for Fernandez-Corugedo and Muellbauer (2006) to appear as a Bank of England working paper we had to remove three passages. The first suggested that the level of UK household debt might pose a threat to future financial stability. The second referred to academic research on herd behaviour by banks. The third argued that there were sometimes delays in the reporting of bad loans on bank balance sheets.

15 See Muellbauer and Williams (2011); Aron *et al* (2012); Chauvin and Muellbauer (2012); Duca *et al* (2012b); and Aron and Muellbauer (forthcoming). Japan is the only country where there appears to have been no break in consumption behaviour emanating from credit market liberalisation.

16 This is exactly the opposite conclusion from that reached in the influential work of Lettau and Ludvigson (2001, 2004, 2011) which claims that assets, and not consumption, do the adjusting to a cointegration vector defined on consumption, income and net worth. Their work implicitly assumes that the vast changes in US credit market architecture since the 1950s had no impact on the relationships between consumption, income and household portfolios.

conjunction with accounting for how financial innovation has shifted key financial real linkages, is necessary to understand the behaviour of consumption in these economies.

7. Non-linearities from the Bad-loans Feedback Loop: Understanding Payment Delinquencies and Foreclosures

The banking channel is the third of the major macroeconomic channels involving the housing market. This can be illustrated by comparing the differing experiences of the United States, Spain, Ireland and the United Kingdom since the financial crisis began in 2007.

Banks in Ireland were caught both by contagion from the United States and by a double domestic lending problem: reliance on funding from short-term money markets which seized up in August 2007, and overextension and poor quality of lending both to property developers and households (Kelly 2009). The overwhelming bad-loan problem led to a massive bank bailout by the government, and a credit crunch with sharply tighter loan conditions. The guarantee hastily given to the Irish banks by the Irish Government and the collapse of tax revenue contributed to a more than doubling in two years of the government debt-to-GDP ratio and to a sovereign debt crisis in 2010–2011.

Irish banks were also hit by contagion from the United Kingdom, although UK banks were far less exposed to UK mortgage markets and UK property developers. Indeed, by 2010, bad domestic mortgage loans accounted for only a small part of the bad-loan book of UK banks. Bad loans that financed highly leveraged takeovers and risky commercial and unsecured borrowers impaired the balance sheets of domestic UK banks far more. Without unprecedented monetary policy actions, including dramatic reductions in the policy rate and 'quantitative easing', there would have been far more severe problems in the UK mortgage market.

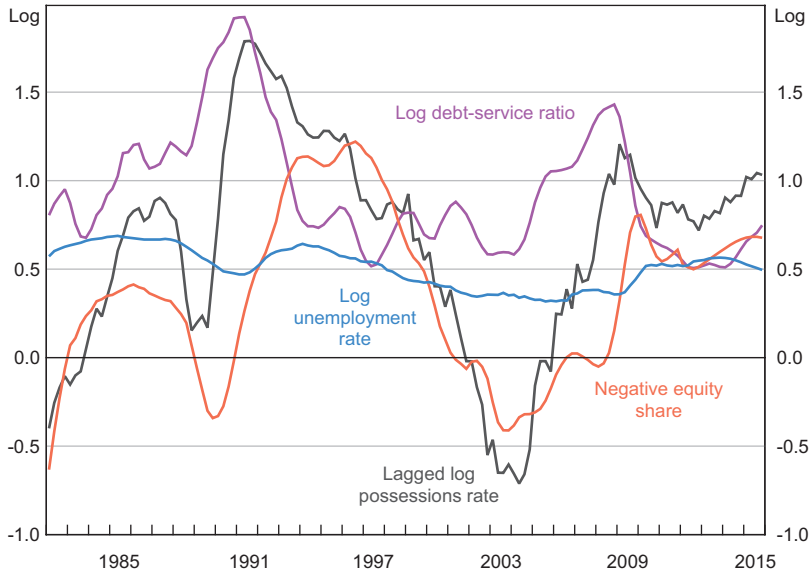
As is well-known, the subprime crisis in the United States triggered major falls in US housing prices, a surge in mortgage defaults and a wider banking and credit market crisis, which spread to other overleveraged banks and financial institutions globally. There is a large literature on US mortgage foreclosures since a number of micro datasets are in the public domain. Variants of 'double trigger' models where negative equity and cash flow problems are both causes of foreclosure are now generally accepted (see Bhutta, Dokko and Shan (2010), *inter alia*). The 'ruthless default' alternative based on options theory under which rational households simply default if negative equity goes beyond a threshold even if they can still service their mortgage has been found empirically defective.

In the United Kingdom, mortgage loans are full recourse and defaulting borrowers can be pursued for up to seven years for the shortfall between the loan and what the lender receives from the sale of the foreclosed property. This makes it more likely that foreclosure (mortgage possession or repossession) involves both a weak debt/equity position and a cash flow problem with debt service. Moreover, because most mortgages are made at adjustable interest rates, shocks to the debt-service ratio from variations in interest rates can be an important cause of both foreclosure and payment delinquencies (mortgage arrears), in addition to negative net equity and income loss, for example, due to unemployment. The United Kingdom, like most countries, has no micro-data in the public domain on representative samples of foreclosures. But it does have aggregate time series data going back to the early 1980s. Aron and Muellbauer (2010) analyse and estimate the

effects on UK arrears and possessions of lower loan quality in the late 1980s and the 2005–2007 period, the subsequent tightening of access to refinancing possibilities, and government policies. These policies included increasing forbearance on lenders through the enforcement of a code of practice, and increasing the generosity of income support for those with payment difficulties. The UK Government also took other policy measures to support those at risk of defaulting.

Figure 9 shows the estimated long-run contributions to the log of the possessions or foreclosure rate in the UK from the debt-service ratio (the mortgage interest rate multiplied by average mortgage debt and divided by income), the proportion of mortgages in negative equity, and the unemployment rate.[17] The outcomes from 2010 onwards are based on an assumed economic scenario in which interest rates start a return to more normal levels only at the end of 2013. Figure 9 shows the contribution of higher interest rates in 1989–1992 in driving up foreclosures through the debt-service ratio, the contribution of dramatically lower rates over 2008–2010 in preventing a larger rise in foreclosures, and the effects of simulated interest rate normalisation. Increases in the proportion of home owners with negative equity explain why foreclosures did not fall more rapidly in the mid 1990s and accounted for much of the rise in the foreclosure rate from 2004 to 2010.

Figure 9: United Kingdom – Long-run Contribution of Key Explanatory Variables to Estimated Possessions Rate



Source: author's calculations

This research also suggests that the policy of increasing lender forbearance on delinquent borrowers reduced the foreclosure rate by about 12 per cent from where it would otherwise have been both in the mid 1990s and since late 2008. Models of mortgage arrears (payment delinquencies) give

17 The proportion in negative equity is based on a theoretical relationship between the mean and the tail of the distribution of log debt/equity ratios, calibrated to a few survey-based estimates of the proportion in negative equity.

a somewhat larger relative weight to the debt-service ratio and the unemployment rate, but the negative equity share remains highly significant. Complete identification of the effects of previous weak lending standards and of policy responses is not possible, though sign restrictions in the 3-equation system of foreclosures and two measures of arrears are helpful. This aggregative approach would be more accurate if data were available on foreclosures and arrears rates by vintage of issue. Then vintage effects associated with the quality of lending at the time of origination could be identified and provide early warning of stresses to come.

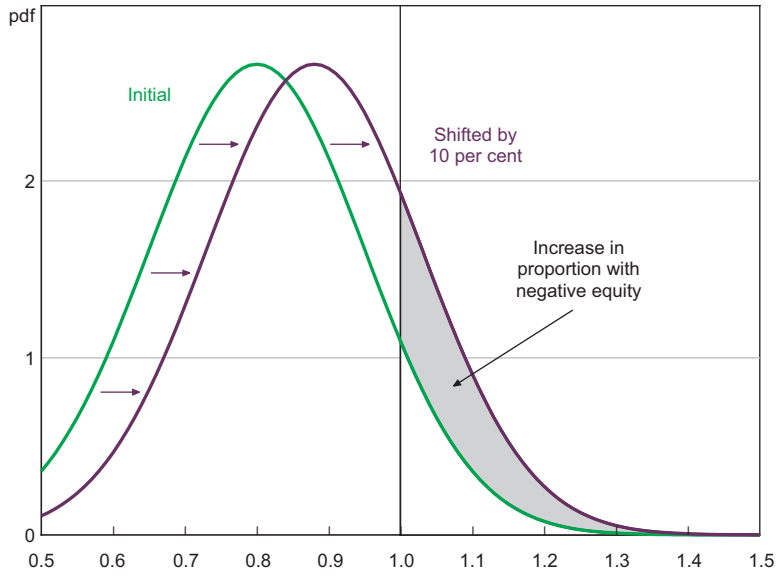
The survey on mortgages published quarterly since 2005 by the UK's Financial Services Authority (FSA) is also very useful. This reports key characteristics of distributions of LTV and loan-to-income ratios and other mortgage descriptors such as interest rates and the terms of rate adjustments, loan duration, whether securitised or not, low documentation or not, owner-occupier or landlord. Unfortunately, the new survey data cannot be matched well with previous survey data, precluding continuity with pre-2005 history. Nevertheless, the pioneering efforts of the FSA deserve to be copied by all mortgage market regulators and will be very useful in future.

Models of mortgage arrears and foreclosures can be linked to the bad-loan books of mortgage lenders and used for stress testing the stability of the financial sector of the economy under different scenarios. The models should contain an important non-linearity or amplification in the transmission of shocks via the housing market to the financial sector, and so the economy, reflecting the non-linear link between housing prices and the incidence of negative equity. In the distribution of the debt-to-equity ratio, the area under the distribution for values greater than one is the fraction of mortgages with negative equity (with home equity less than debt). If average housing prices fall by 10 per cent, say, this distribution shifts to the right, and this area would increase by much more than 10 per cent (Figure 10). Thus, beginning in 'normal' times, even a large rise in housing prices has little effect in reducing an already low level of foreclosures. But a moderate fall in housing prices moderately raises the level of foreclosures, while a large fall in prices leads to disproportionately large increases in foreclosures. This is an important asymmetry which helps account for the fact that business cycle contractions are often far sharper than business cycle expansions.

Bad loans, which could arise from corporate lending to construction companies or from household mortgages coupled with poor general business conditions, affect bank profits given the structure of trading income and expenses. The pricing structure of each bank's balance sheet, especially the mismatch between assets and liabilities, influences each bank's vulnerability to shocks to interest rates, spreads and default probabilities. This influences the ratings banks receive from ratings agencies, which can affect funding costs and liquidity and possibly even induce bank failure. Banks may engage in fire sales to boost liquidity. Interactions between banks with network externalities (where counterparty risk constrains behaviour) generate the possibility of further losses which, in turn, reduces funding liquidity and thereby increases the possibility of bank failure. Survivors bear credit losses which impair their balance sheets and assumptions need to be made about the portfolio/risk strategies pursued by the survivors. At the end of each period, balance sheets, and loan and trading books are set for the beginning of the next period. Bank lending also feeds into

the macroeconomic picture for the beginning of the next period, when new macro or financial shocks arrive.[18]

Figure 10: Distribution of Debt-to-equity Ratios



Note: Not the true distribution; for illustrative purposes only

This gives a good flavour of the kinds of realistic feedbacks and shock amplification which arose in the global financial crisis and which potentially could arise again. It also highlights the risks associated with higher interest rates in the aftermath of the financial crisis and the role played by housing and mortgage markets in transmitting and amplifying such risks.

8. Policy Conclusions

For assessing whether a housing market is overheated enough to threaten financial and economic stability, policymakers should avoid relying on analysis from a 'sausage machine' approach to large multi-country datasets which skate over data quality, a proper treatment of the supply side and of credit markets, and institutional variation across countries and over time. That said, there is much to be learned from comparative cross-country analysis of historical experience. My bias is that careful econometric modelling of individual country datasets, in a comparative perspective, can make a huge contribution.

Overheating can have both a price and a quantity dimension, but it is likely that they are linked by common drivers. However, much depends on the land use planning regime which profoundly affects the supply response: there is at least one country, the United Kingdom, where private sector housing construction appears not to respond to price signals, whether housing prices or user cost.

18 A model for risk assessment which broadly shares these features, RAMSI, has been designed at the Bank of England: see Aikman *et al* (2009).

It is helpful to make the distinction between overshooting of housing prices due to extrapolative expectations and 'frenzy', given fundamentals, and shifts in possibly fragile fundamentals. The contribution of careful econometric modelling to estimating the effects of the former has been demonstrated and evidence provided that this type of overshooting was important in 2005 in the United States and to a lesser extent in France. However, it is high time that central banks and other policymakers conduct regular quarterly surveys of the housing price expectations of potential housing market participants to help assess the first type of overshooting.

Assessing the fragility and evolution of the economic fundamentals is a more complex task. Our experience has been that credit supply conditions in the mortgage market are the 'elephant in the room'. Without taking them into account, one simply cannot understand the behaviour of housing prices, household debt and consumption in countries such as Australia, the United Kingdom, the United States, South Africa or France. Although central bank surveys of mortgage market conditions have been run by the US Federal Reserve since 1990 (with improvements since 2007),[19] the European Central Bank (ECB) since 2002, and by the Bank of England since 2007, precise interpretation of the results is difficult until a long track record is available. In part, this is because the survey responses tend to be affected by other economic conditions, as well as by longer-term shifts in credit supply.

The systems approach my co-authors and I have pioneered to measure a credit conditions index is extremely helpful. But the results need careful interpretation. For example, Muellbauer and Williams (2011) estimate a credit conditions index for Australia, which shows a fairly spectacular rise in the 1980s, from the late 1990s to 2007, and on estimates up to 2008, a modest decline. From circumstantial evidence on financial regulation in Australia, the relatively modest leverage and continued profitability of its banking system, as well as skilful counter-cyclical policies of its central bank, one would conclude that these credit fundamentals are more robust in Australia than in the United States, Ireland, the United Kingdom and Spain. Australia's dependence on exporting to China and more generally its reliance on a permanent improvement in its international terms of trade does point to a potential vulnerability in other economic fundamentals. If these fundamentals turned negative, the high levels of household debt in Australia could seriously constrain growth even though the appropriate exchange rate adjustment could very likely be managed without a rise in interest rates, and fiscal policy would also be available, given low levels of government debt.

The vulnerability of consumption to high levels of household debt has been hidden by analysis that relies on aggregate net worth in modelling consumption rather than on a more accurate but simple three-component disaggregation of wealth as has been revealed by Aron *et al* (2012). With estimates in different countries of the MPC out of liquid assets minus debt of between 0.10 and 0.16, it is clear that credit market liberalisation – which boosts consumption and debt – can leave households vulnerable to a credit crunch and asset price declines, as demonstrated by the long and painful process of household deleveraging in the United Kingdom, the United States, Ireland and Spain. Assessing the fragility or otherwise of credit conditions is critical for accurately judging the fragility of economic fundamentals in economies with high levels of household debt

19 The mortgage module was added in 1990 to a survey which began in 1966. Non-prime loans were distinguished from 2007.

relative to income. In turn, since credit conditions themselves depend on the bad-loan book of the banking sector, they depend on multiple financial and economic influences.

The size of the housing collateral effect on consumption is another aspect of this potential fragility since the absence of such an effect, for example, in France or Japan, means that part of the potentially amplifying feedback loop is missing, implying less economic instability. In the United Kingdom, the United States, Australia and South Africa, this feedback loop is powerful. Distinguishing between economies where most mortgage debt is at fixed rates, as in the United States or France, and where most mortgage debt is on floating rates, as in the United Kingdom, is also useful since interest rate risk can be important in the latter. However, one should avoid overgeneralising. For example, in the United Kingdom the rise in interest rates in 1988–1991 was a powerful crisis trigger, but the ability of the Bank of England to cut rates rapidly in 2008–2009 and the large impact of these cuts on cash flows of indebted households, greatly softened the impact of the recent financial crisis. In this respect, monetary policy in the United Kingdom in 2008–2009 was more powerful than in the United States.

Since housing supply is crucial for understanding long-run developments in housing prices, it is important to include it among economic fundamentals. Fortunately, this is easy since the capital stock evolves fairly slowly even with high rates of investment. However, residential investment is potentially highly volatile as the staggering chart for Ireland in the middle panel of Figure 8 demonstrates. The implications for employment and income and further negative feedbacks of a 9 percentage point fall in residential construction as a share of GDP in Ireland have been all too obvious. Falls in population growth in economies with high levels of international migration, as in Ireland and Spain, can also contribute to housing market declines when economic conditions worsen.

Among financial indicators, the bank leverage ratio and the ratio of loans to domestic deposits are likely to be important. The first is a clear indicator of the stability of the banking system and extreme levels of the second typically indicate potential maturity mismatches between loans and sources of funding. In Ireland and the United Kingdom, the resort to short-maturity money market borrowing was a crucial source of vulnerability when these markets dried up in 2007, though in Australia, where lending practices were far more cautious and banks remained profitable, it was not. The level and nature of securitisation of loans through asset-backed securities can also be a source of vulnerability as the US subprime crisis amply illustrates. There are well-regulated, low risk and transparent versions of this form of finance such as securitising *prime* mortgages, but also unstable forms, such as special investment vehicles that funded subprime mortgages, junk bonds, and even private equity investments with short-term debt. So it is not securitisation in general, but the form it takes that can reduce financial and macroeconomic stability.

Clearly, the quality of financial regulation and the general policy stance of the central bank is another important factor in judging the fragility of the fundamentals. In Australia, the Reserve Bank has long had a pragmatically cautious respect for the risks posed by credit and housing price booms, and has been decisive in raising rates to head off incipient booms; the Australian Prudential Regulation Authority has always been tough on bank supervision. Before 2007, the Bank of England's views were quite different, as the discussion of the article by Benito *et al* (2006) and footnote 14 reveals. In 2006, the financial stability division of the Bank of England had little

influence on the Bank's policies and the Bank only introduced its survey of credit conditions in 2007. Lack of appreciation of the power of the financial accelerator by the Bank of England's leadership, combined with the light-touch regulation pursued by the government in the game of competitive advantage with New York and other financial centres left the United Kingdom ill-prepared when the global financial crisis arrived.

The history of financial and exchange rate crises suggests that foreign currency-denominated loans can be a serious source of instability if the exchange rate is on a potentially movable peg. The lessons of the Asian economic crisis of 1997–1998 in this respect seem not to have been learned in countries such as Latvia and Hungary, now suffering the consequences of high levels of such loans.

In the more standard real economy sphere, useful signals are the ratios of public and private sector debt and current accounts to GDP, which tend to be good indicators of whether a country is living beyond its means and also may be indicative of a potentially overvalued exchange rate. Spain, Ireland, the United Kingdom and the United States are all cases in point. However, overly simplistic interpretations need to be avoided. Australia has run current account deficits continuously for decades partly because of the flow of foreign investment to its resources sector. As the inter-temporal balance of payments theory in Muellbauer and Murphy (1990) implies, it can be rational to run sustained deficits if future productivity growth will be higher or if the economy has the capacity to generate higher income, for example, from the exploitation of natural resources.

The role of taxation should also not be ignored. I have long advocated using national property taxes linked to recent market valuations as an automatic stabiliser in economies where housing and mortgage markets play an important role as shock transmitters and amplifiers (Muellbauer 2005). Such a system raises the tax burden in housing price booms and lowers it when housing prices fall. It worked well for many years in Denmark until the automatic link with market values was abandoned for short-term political gain in 2001. The politics of property are very sensitive, and wealthy elites have a powerful influence. Even now, UK politicians seem unwilling to reform a regressive property tax system linked to 1991 valuations, in which zero marginal tax rates apply to properties above approximately £1.5m in current price terms. In Australia, where the tax system has long favoured buy-to-let investors, it can be argued that tax reform could do more to discourage high levels of gearing and risk taking in this sector.

This list of potential influences and this brief discussion of their complexities suggests that models of early warning of financial and economic crises estimated on large country panels would need to be quite complex. For example, such models should include some important interaction effects based on detailed institutional understandings of each economy. Obvious dummies for interaction effects would include whether home equity loans are common as a simple proxy for the consumption-housing channel, typical LTV ratios for first-time home buyers, and whether mortgage rates are floating or are fixed. This is a very active research area, with recent examples including the IMF's *Global Financial Stability Reports* and the report of the ECB's team examining macro-financial linkages (Hubrich *et al* 2011).

As is now widely accepted, in addition to the standard stabilisation tools, instruments of macroprudential policy are needed and are under active discussion. One of these, very closely connected with mortgage markets is the maximum permissible LTV ratio, which appears to have

been rather effective in Hong Kong (Wong *et al* 2011) and other economies. The Bank of England seems to regard this as politically too sensitive to be regulated by the Bank (Tucker 2012), but this is all the more reason why such regulation should not be left to politicians. Cyclical variation in capital requirements to tighten standards in booms are clearly beneficial.

As far as lending to the corporate sector is concerned, history suggests that at least a tripartite sectoral division of such requirements is needed for the financial sector, the real estate-connected corporate sector and the rest of the corporate sector. There seems no sensible alternative for managing the commercial real estate sector since activity is so very heterogeneous and measurement so difficult that no standard model such as loan-to-cash flow or loan-to-value is likely to work. As well as focusing on risks posed by overvalued housing prices, this paper has also highlighted the importance of building booms fuelled by excess corporate borrowing in causing financial and macroeconomic instability. It is important therefore for complementary macroprudential policies to be imposed both on lending to households and to corporates in real estate development.

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General Discussion

Participants commented on the paper's recommendation for central banks to begin conducting regular surveys of housing price expectations. One participant said the Bank of Japan has been conducting such land price surveys for over 10 years. However, they noted this period in Japan has been characterised by price declines and was, therefore, a poor case study for analysing the usefulness of these data in assessing the degree of extrapolative expectations during periods of rapid housing price appreciation. The same participant also picked up on the issue of a 'four-year memory', where housing price expectations are estimated using the lagged four-year average rate of housing price growth. The participant said while a 'four-year memory' was a useful rule of thumb for policymakers, what is needed is a theoretical foundation. In response the paper's author, John Muellbauer, said the 'four-year memory' was just a well-established artefact of the data and therefore seemed to be a serious candidate for doing exploratory econometrics. Another participant echoed the paper's plea for public institutions to collect survey data on housing price expectations. The participant said requests for such data from a central statistics bureau in the past had been rejected and found it perplexing and interesting that there was very little motivation to collect these data.

In regard to the proposed 'risk-adjusted' user cost approach, one participant sought clarification on two problems they had encountered when considering the approach using Chinese data. First, the data exhibit too much noise, posing a problem for identification, and second, this approach is problematic because it is possible for the user cost to be negative, and the log cannot be calculated. In responding, Prof Muellbauer referred to the application of the risk-adjusted user cost approach to French data. In this case, transaction costs combined with a risk premium are large enough to ensure the user cost was positive throughout the sample. He also said non-linearities are so important in these data that they solve the identification problem, noting a time-varying approach adjusting for risk – where risk increases in response to recently experienced volatility – outperforms alternatives, which include not risk-adjusting or taking a linear version of the model.

The feedback channels through which housing price declines could affect the real economy were the subject of much discussion. One participant reaffirmed the importance of the local government channel in China given local governments' reliance on land sales for revenue. However, the participant wanted more evidence for the proposition that lower housing prices could stimulate consumption in the Chinese economy. Using Japan as an example, the participant said very low housing prices have not boosted consumption in the Japanese economy. The participant also said while Japan does not exhibit housing wealth effects on consumption, it does have a very strong property market investment channel particularly for small and medium-sized firms that, in the Japanese bubble economy, speculated in the land market. Regarding this investment channel, Prof Muellbauer agreed that credit liberalisation had affected companies' responses to real estate price fluctuations rather than households. However, he disagreed with the notion that there were no housing wealth effects on consumption in Japan. Citing previous

research, he said a stable consumption function had been estimated for Japan covering the last 50 years and, with appropriate controls, there was a slightly negative wealth effect. Prof Muellbauer indicated that this result was robust across the age distribution. Another participant shared their insights regarding the housing wealth effect on consumption. For Hong Kong, the participant said empirical estimates from micro-data suggest that wealth effects are predominately caused by a precautionary saving motive rather than credit constraints. They said the dominance of the precautionary saving motive suggests consumption feedback loops from the housing market to the real economy are broadly based and not only transmitted through credit constrained households.

On the topic of instruments for macroprudential policy, such as maximum loan-to-value ratios, one participant expressed concern about the effectiveness of these policies for mitigating risks in both the residential and commercial real estate markets. The participant said if observers and policymakers are intent on squeezing risk out of the residential market with such instruments, they cannot ignore the possibility that risk-taking behaviour would go elsewhere, such as loans to other parts of the property development sector, including commercial real estate. Moreover, it was noted that it is within these sectors that the risks are more correlated. Spain and Ireland were proffered as examples of where banks' lending books became untenable primarily due to bad loans to the property development and commercial real estate sector. In sum, therefore, the participant said policymakers needed to balance any focus on macroprudential tools for mitigating risks in the household sector with the realisation that these tools may not be effective in other areas of the property market and may indeed increase risks in these sectors. Prof Muellbauer agreed, but noted the performance of residential mortgages in, say, Ireland, is still very important for banks' balance sheets.

Tangential to these comments, another participant asked whether the policy implications borne out of the models were robust enough to make specific recommendations to regulators. Prof Muellbauer said he did not have a complete model of the system, and as such any recommendations or forecasts would be piecemeal. He said work completed for the United Kingdom on mortgage defaults is robust; this model has been running for a couple of years and has recently been revised for the government. It outperforms other forecasts for arrears and possessions and the risks that it flags are correct.

Property Market Cycles as Paths to Financial Distress

Luci Ellis, Mariano Kulish and Stephanie Wallace

1. Introduction

Property market busts are usually implicated in some way in episodes of financial instability. The losses on US mortgages that sparked the recent financial crisis are a good example of this connection, as are the episodes in Japan, Scandinavia and Australia in the early 1990s, which largely stemmed from commercial property lending. One might think property loans should be fairly safe, given the protection afforded to the lender by the collateral. History suggests, though, that property market cycles cause financial and economic busts far more frequently than does unsecured lending.

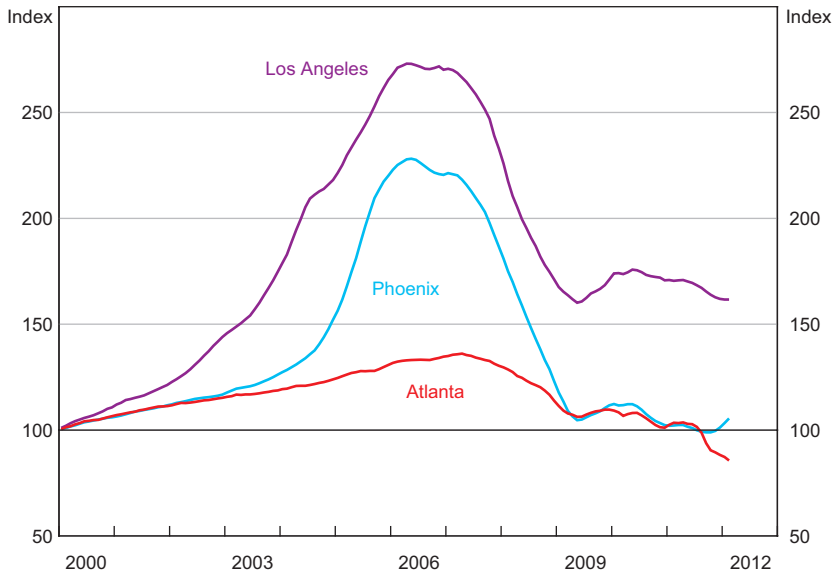
Property-related loans also seem more prone to engendering banking and financial crises than loans secured against, for example, motor vehicles or business plant and equipment. Like financial securities, but unlike those other types of physical collateral, property may hold or even increase its value after the loan is extended. This fact may induce both borrowers and lenders to treat the collateral as the primary guarantee of repayment, rather than as a second line of defence should the borrower's cash flow prove insufficient to service the loan. In addition, the knowledge that property values can rise, and especially an expectation that they will, encourages lenders to permit greater leverage on property loans. As Fostel and Geanakoplos (2008) and Geanakoplos (2009) show, not only do leverage cycles induce asset price cycles, but (expected) asset price cycles induce leverage cycles too.

In this paper, we examine how the flexibility of supply and the contract features of loans influence property boom-bust cycles and the resultant financial distress. On the first of these, many authors have observed that price booms tend to be larger in markets where the supply of property is constrained, as seems to be the case in the United Kingdom, for example. It seems an obvious point that the steeper the supply curve in the property market, the more property prices will increase after some positive demand shock. In this paper we show, however, that this need not imply that the subsequent decline in prices will also be more damaging for financial stability. The price cycle by itself can be a misleading statistic of risks to financial stability, partly because debt dynamics result from a combination of both price and quantity dynamics, and partly because the distribution of debt is far more important in creating financial distress than is its aggregate value. We show that when property supply is more flexible, the distribution of debt at the end of a boom is more likely to trigger episodes of financial distress and instability.

The differing experiences of housing markets in US cities during the recent boom-bust cycle are a case in point. Housing supply in Atlanta, for example, is known to be quite flexible. As

Figure 1 shows, Atlanta experienced only a small run-up in prices during the boom compared with other cities. However, the price bust has been large: using Case-Shiller data up to early 2012, housing prices in Atlanta were 36 per cent below their peak, a slightly larger fall than the 20-city composite index, and only a few percentage points less than the 40 per cent decline in Los Angeles. Importantly, prices in Atlanta are below their 2000 levels, implying that some home owners who purchased more than a decade ago are now holding a property worth less than they paid for it.

Figure 1: US Housing Prices
January 2000 = 100, seasonally adjusted



Source: Standard & Poor's

Whether a fall in prices translates into financial distress depends on a range of factors. The latest available Federal Reserve Bank of New York data (for late 2010) suggest that the fall in Atlanta has indeed resulted in high rates of negative equity, and thus arrears and foreclosures: on average, Georgia counties in the Atlanta region had arrears rates 2 percentage points above the national average of 5.3 per cent.[1] At 21.8 per cent, the 90-day arrears rate on subprime loans in Georgia, using available state-level data, was at a level similar to those in states most associated with the bubble (California, Nevada and Arizona), and noticeably above the national average (17.9 per cent), while for prime mortgages, the arrears rate in Georgia (3.4 per cent) was actually above that in Florida (3.2 per cent) and Arizona (2.9 per cent).

For a given decline in prices, whether borrowers end up in negative equity depends on their initial loan-to-value (LTV) ratios and how quickly they amortise their debt. Features of the loan contract are therefore central in translating an observed macro-level aggregate outcome to a financial

1 See <http://data.newyorkfed.org/creditconditionsmap/>. The relevant counties are Cherokee, Clayton, Cobb, Coweta, Dekalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Newton, Paulding and Rockdale. Flows into foreclosure were also above the national average. However, the stock of foreclosures was below those in the states most associated with the bubble, where processing backlogs have been particularly acute.

stability outcome. Negative equity does not always trigger default, however. Before default occurs, there usually needs to be a problem with capacity to repay, as well as a negative equity position (Foote, Gerardi and Willen 2008). Problems might result from negative income shocks such as unemployment, but other loan contract features, such as a requirement to increase repayments or refinance altogether, can also be important.

The sources of banking crises and other episodes of financial instability are not confined to home mortgage loans. In fact, they are more often driven by losses on commercial property loans, especially on loans to developers of either residential or non-residential property. We show that cycles in commercial property can lead to episodes of financial distress that are several times worse than those spurred by cycles in housing markets.

Differences in time-to-build lags and loan contracts help explain why commercial property lending can pose more of an issue for financial stability than does mortgage lending in most countries. Time to build is usually longer for commercial property than for at least some kinds of housing, which amplifies the price cycle. In addition, the loan contract features typical in the commercial property market are more likely to encourage default. Interest-only loans are common. Because the principal is not run down over the loan term, the share of borrowers with loans worth more than the property (negative equity) is higher for any given decline in prices. Typical loan terms are also usually shorter than home mortgage loan terms in many countries, requiring borrowers to refinance periodically. If these borrowers are in negative equity at the refinancing date, they are very likely to default. Default rates are therefore likely to be higher and more concentrated than for portfolios of amortising home mortgages.

In this paper we set up a simple stock-flow dynamic partial equilibrium model of the property market and use it to simulate cycles. We illustrate how features of the property market, including supply flexibility, time to build and the prevailing loan contract features, can affect price and debt dynamics. Our key innovation is to translate those simulated cycles into measures of financial distress; we do so with an overlapping generations type structure for debt as follows: in every period we assume that a new cohort enters the market and purchases, at the current price, the net new supply of property, financed by debt subject to an LTV ratio. Given the form of the loan contract, that is, the interest rate, the term and the type of amortisation, we keep track of the distributions of debt and equity in property over time.

We show that a more responsive supply of property to prices can generate dynamics which are more likely to generate financial distress. If the flow of new property supply is highly responsive, the price response will be smaller in a boom than if supply were inflexible (Paciorek 2012). This may suggest that the downswing might be less likely to create financial distress, but we show that this is not always the case. If supply is quite responsive, large amounts of new property will be constructed during the boom, creating an overhang of excess supply once the boom ends. Prices will then fall further, potentially putting even those who bought prior to the boom into negative equity. In addition, more of the loan book will be accounted for by borrowers who bought at or near the price peak – because of the increased flow of new property purchases in those periods. Therefore if supply is more responsive, more of the loan book is liable to be in negative equity, a necessary condition of default. The effect of a highly responsive supply on loan performance is exacerbated when there are time-to-build lags, that is, if production is highly responsive to changes in price but adds to supply periods later.

In this respect, our results provide an explanation of Atlanta's experience and, more generally, the cross-country experience of recent years. The modelling exercise, however, provides a number of other insights as well. In particular, we find that the characteristics of the loan contract can be decisive in determining whether a given cycle in property prices and construction turns into an episode of financial distress and instability. We find, as in Ellis (2008), that amortisation is a pivotal determinant of the extent of negative equity.

We also find that the response of interest rates to the price cycle has an asymmetric effect on our measures of financial distress. Specifically, higher interest rates help attenuate the boom in prices but also make running down existing (variable-rate) debt more difficult and so increase the vulnerability of indebted cohorts. On the other hand, lower interest rates during the bust support property prices and simultaneously allow indebted cohorts to deleverage faster. Lower interest rates help reduce measures of financial distress through both of these channels.

These findings imply several things about the appropriate policy response. First, it would be a mistake to focus overly on housing lending at the expense of property development lending when assessing risks to financial stability. Second, policies intended to mitigate these risks should not be calibrated solely on aggregate macro-level variables such as asset price indices and credit. Diligent prudential supervision is clearly helpful, but it seems less clear from our results that tightening prescribed prudential ratios beyond some threshold can eliminate most of the increase in financial distress. And finally, while tightening monetary policy during a property boom may be helpful, it seems that it could be even more important to leave room to ease monetary policy during the bust.

The rest of this paper is structured as follows. The next section discusses our model. Section 3 presents the key results, both for a benchmark case which is calibrated to the housing market, and for another case designed to proxy for the commercial property market. Section 4 discusses some possible policy responses and Section 5 concludes.

2. Model

We present a model that captures some essential features of property markets, like the durable (stock) supply and long holding periods. It is a linear, dynamic, partial equilibrium stock-flow model of property with adaptive price expectations. Many of these assumptions, if not all, are worth relaxing in further research. But we intentionally keep the model simple, in order to focus on the channels through which property market developments can affect the degree of financial distress and thus the risks to financial stability.

Our modelling exercise can be thought of in two steps. In the first step, we use this model to generate property cycles. In the second step, we use these implied dynamics to study their financial stability implications. In particular, we assume that, in every period at the prevailing property prices and quantities generated from the first step, agents take on debt to finance the purchase of the new stock of property, subject to an LTV ratio. Given the term of the loan and interest rate, we keep track of each cohort's balance sheet using standard amortisation formulas, to explore the distribution of indebtedness, equity in their property and financial vulnerability.

2.1 First step: a simple dynamic model

We assume that the aggregate demand for property at time t, H_t, is given by the equation below.

$$H_t = \alpha_0 + \alpha_1 \lambda_t y_t - \alpha_2 p_t + \alpha_3 p^e_{t+1} - \eta r_t \quad (1)$$

In Equation (1), y_t is (exogenous) income, which we assume to be constant and normalise to unity; p_t is the price of housing and r_t is the (exogenous) interest rate in period t; all parameters (denoted by Greek letters) are positive. The exogenous process λ_t is a demand shifter term that increases demand relative to income. There are several ways to interpret this variable, but we treat it as representing credit conditions relating to serviceability: if households are permitted to borrow more on the same income, their demand for housing rises. The expected property price in the next period is denoted as p^e_{t+1} which, in turn, is updated as shown in Equation (2). Adaptive expectations imply that any interest rate changes are unanticipated.[2]

$$p^e_{t+1} = p^e_t + \omega\left(p_{t-1} - p^e_t\right) \quad (2)$$

Equation (1) represents the aggregation of the behaviour of explicitly heterogeneous households (the cohorts described below). As such it cannot be directly related to the kinds of behavioural relationships that hold at the individual or representative agent level, for example the user cost equation frequently seen in the literature (e.g. Meen 1990, 2000). In addition, our model ignores taxes and has no rental market, so some of the inputs in the arbitrage relations underlying user cost are omitted. We do, however, incorporate the remaining explanatory variables from the user cost model, including housing prices, expected housing prices, income and interest rates.

The flow supply of housing, h_t, is given by the expression below.

$$h_t = \beta_0 + \beta_1 p_t - \tau r_t \quad (3)$$

Supply responds positively to prices and negatively to interest rates, consistent with standard models in the literature, such as Topel and Rosen (1988). Period t flow supply adds to the stock in period $t + J$, where J corresponds to time to build. In particular, the stock of property obeys the law of motion shown in Equation (4), where $J \geq 0$ and δ denotes depreciation.

$$H_t = (1-\delta)H_{t-1} + h_{t-J} \quad (4)$$

Given initial conditions and time paths for λ_t and r_t, Equations (1)–(4) determine the path of the endogenous variables, H_t, h_t, p_t, p^e_{t+1}. We generate a cycle through an exogenous temporary increase in λ_t, which we interpret as a temporary easing of lending standards around serviceability.[3] Allowing an easing in lending standards to stimulate property demand ($\alpha_1 > 0$), is consistent with an assumption that buyers are credit constrained (La Cava and Simon 2003); lending standards, or more generally credit conditions, have previously been found to be important drivers of household consumption and housing-related outcomes (Muellbauer and Williams 2011).

2 An alternative specification where an arbitrary expected path of future interest rates enters into Equation (1) does not change the qualitative results presented in subsequent sections. These additional results are available from the authors on request. We chose this adaptive specification because we wanted to show that cycles can occur even without extrapolative ('bubble') expectations about price growth; the qualitative conclusions about supply are similar when extrapolative expectations are assumed, and for otherwise similar parameterisations, the outcomes for our financial distress metrics are, if anything, more severe.

3 Because we have specified income as a constant, our results would be identical if we had instead manipulated α_0, but this equivalence would not hold when income is rising.

2.2 Second step: financial distress indicators

In order to translate market dynamics into measures of financial distress, like the percentage of the loan book in negative equity, or the equity shortfall of these loans as a percentage of aggregate debt, we assume an overlapping-generations structure of property buyers and track each cohort's repayment, equity and outstanding debt over time.

We interpret each period's net purchases of newly built property as being the purchases of a new cohort of households; there are N cohorts in total at any one time. To fund their purchases, the new cohort borrows at the exogenous interest rate r_t. For simplicity, we abstract from any requirement to accumulate a down payment prior to purchase. This assumption ensures that households purchase their home in the period they are 'born', rather than delaying until they have accumulated some savings. We therefore do not have to model the housing tenure decision or a rental market; these would make useful extensions for further research.[4]

The quantity of property held by the cohort that is k years old at the start of period t is $q_{k,t}$. The cohort of buyers that enters at time t purchases the quantity of property released by the departing cohort, $q_{N-1,t-1}$, and any *net* addition to the stock of property $h_{t-J} - \delta H_{t-1}$. Implicitly then, one can think of cohorts as repairing or maintaining their property, so that the quantity of property held remains constant over their lives, that is $q_{k,t} = q_{k+1,t+1}$. The new cohort absorbs any new construction that does not offset depreciation, so in every period the aggregate property stock equals the holdings of the population, $H_t = \sum_{k=0}^{N-1} q_{k,t}$. So the quantity of property purchased by time-t buyers, $q_{0,t}$, is given by Equation (5).

$$q_{0,t} = q_{N-1,t-1} + h_{t-J} - \delta H_{t-1} \tag{5}$$

Time-t buyers take out a mortgage for $\kappa p_t q_{0,t}$ to fund their purchase, where κ is the LTV ratio. Repayments are calculated according to Equation (6), known as the credit-foncier formula, which implies that borrowers make constant repayments over the life of the loan.[5] The proportion of the repayment going towards amortising the loan principal therefore rises over the life of the loan. This is the standard model for required loan repayments in most industrialised economies. The term of the loan T is always assumed to be less than the cohort's lifespan N. If interest rates were to remain constant over time ($r_t = r$) – an assumption that we relax below – the constant repayment for a household that is k years old at the start of period t is given by the credit-foncier formula:

$$R_{k,t} = \frac{\kappa p_{t-k} q_{0,t-k} r (1+r)^T}{(1+r)^T - 1} \tag{6}$$

The end-of-period outstanding debt for the cohort who is k years old at the beginning of time t, if the interest rate remains constant over time, is:

$$D_{k,t} = \frac{\kappa p_{t-k} q_{0,t-k} \left((1+r)^T - (1+r)^{k+1} \right)}{\left((1+r)^T - 1 \right)} \tag{7}$$

4 The down payment constraint can be binding for first home buyers (Duca and Rosenthal 1994). See, for example, Kaplan and Violante (2011) for a model in which optimising households can be thought of as saving for a down payment.

5 If the interest rate changes, the repayment is recalculated such that it would remain constant for the rest of the loan term assuming no further rate changes. In the model all loans have variable rates.

If the interest rate changes, however, Equations (6) and (7) need to be recomputed with the updated values of the remaining term ($T - k$), interest rate and outstanding principal. The equity of each cohort is defined as the difference between the current value of the property and the debt outstanding, that is:

$$E_{k,t} = p_t q_{0,t-k} - D_{k,t} \tag{8}$$

A commonly used measure of financial vulnerability is the share of the loan book in negative equity. We calculate this share at each time t, S_t, as the debt owed by cohorts in negative equity, $\left(\sum_{k=0}^{T-1}\left(D_{k,t}\,|E_{k,t}<0\right)\right)$, divided by total debt outstanding:

$$S_t = \frac{\sum_{k=0}^{T-1}\left(D_{k,t}\,|E_{k,t}<0\right)}{\sum_{k=0}^{T-1} D_{k,t}} \tag{9}$$

Interest-only loans, which are a common form of finance in commercial property markets, simply have a constant repayment equal to the interest on the initial loan value. The principal is not reduced over the term of the loan, but is instead cancelled in a lump-sum payment at maturity.

Finally, the entering cohorts are the only buyers, and the properties of the exiting cohorts are the only ones that change hands.

2.3 Calibration

For the numerical analysis we select the benchmark parameterisation shown in Table 1. Given the value of r_t, the model forms a vector autoregression on the endogenous variables, H_t, p_t, p_t^e and h_t. In steady state, price expectations are equal to actual prices; that is, there are no forecast errors. We set the interest rate r_t to 3 per cent and interpret it as a real rate. The depreciation rate of the housing stock, δ, is chosen so that in steady state the flow supply of housing equals 2 per cent of the stock. Income, y_t, is normalised to 1 and the measure of lending standards, λ_t, is also taken to be 1 in normal times and 1.5 when lending standards ease. This can be interpreted as an easing in a serviceability requirement that allows borrowers to borrow 50 per cent more on the same income; for example, a repayment-to-income ratio limit that rose from 30 per cent to 45 per cent.

Table 1: Benchmark Calibration

	Parameter	Value
δ	Depreciation rate	0.02
r	Real interest rate	0.03
N	Life span (years)	55
T	Loan term (years)	20
κ	Loan-to-value ratio (per cent)	80
J	Time to build (years)	1
α_0	Constant in demand equation	30
α_1	Demand response to lending standards	3
α_2	Demand response to price expectations	1
β_1	Flow supply response to price	0.04
ω	Expectations adjustment	0.8
η	Demand response to interest rates	35.98
τ	Flow supply response to interest rates	0.36

Interest rates influence both stock housing demand and flow housing supply. We set η and τ to match the observation that an increase in interest rates leads to a decrease in housing prices (Meen 1990). In particular, we set them so that, assuming a 20-year loan term, a 1 percentage point increase in interest rates leads to one-third of a percentage point reduction in the steady state price, which is within the range of past empirical estimates (e.g. Berger-Thomson and Ellis 2004). Given these values, we set α_0 and β_0 to obtain a steady-state price-to-income ratio of around 5, and the benchmark values of α_1 and β_1 so that the demand and flow supply elasticities in steady state equal 1; for supply, this is higher than the elasticity for the United Kingdom found in Meen (2000), but well below that for the United States in Topel and Rosen (1988), which is better approximated by the β_1 value of 0.08 used in some of our comparator, non-benchmark simulations. The parameter ω is one of the key determinants of the system's dynamic stability; in particular, it governs the speed with which price expectations adjust and we set it so that it would take the system around five years to reach its new steady state after a one-period shock, if there were complete depreciation. The parameters ω, α_0, β_0, η and τ are kept fixed throughout the simulations; our conclusions do not depend on particular values of these parameters.

To derive measures of financial distress we make assumptions about the characteristics of the loan contract and study the implications of varying these characteristics. In a benchmark case, we consider mortgages on residential property, and assume loan characteristics that are realistic for this market. We take the initial loan size to be 80 per cent of the dwelling price. Given a loan term, T, of 20 years, an interest rate of 3 per cent, and the formula given by Equation (6), the implied repayment is then around 30 per cent of income. We also assume that households live for $N = 55$ years. The household lives in the same dwelling until it dies. Mortgages are paid down following a credit-foncier amortisation schedule. Later we apply the model to commercial

property and consider interest-only loans that must be refinanced at shorter horizons. Table 2 provides details of the simulations that follow.

Table 2: Details of the Simulation

Figure	Contract type	J	T	β_1
2	Amortising	1	20	0.04 and 0.08
3	Amortising	0 and 3	20	0.08
4	Amortising	0 and 3	20	0.08
5	Amortising	Varies	20	Varies
6	Amortising/interest-only	1	Varies	0.08
7	Interest-only	3	5	0.08
8	Amortising	1	20	0.08

3. Simulation Results

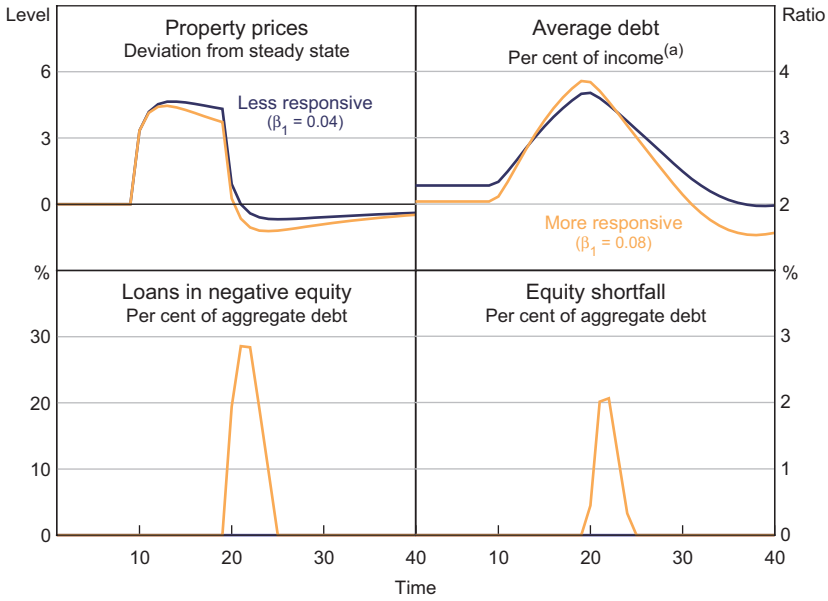
We consider a temporary easing in lending standards (an increase in λ_t) which initiates a price boom. In reality, if the easing of a constraint is sustainable, say, because artificial government restrictions on lending in a regulated sector are rescinded, part (but not all) of the initial increase in borrowing and prices will also be sustainable. If, however, the easing in lending standards were temporary then a bust is more likely. We therefore consider a case where lending standards ease temporarily in period 10, and tighten 10 years later, in period 20.

3.1 Supply flexibility and time-to-build lags

Figure 2 compares two property cycles where cohorts take out standard amortising loans. The only difference between them is in the responsiveness of flow supply. With the benchmark calibration of $\beta_1 = 0.04$, the cycle in property prices, debt and equity is such that no cohort experiences negative equity. In the alternative calibration where supply is more responsive, $\beta_1 = 0.08$, there is a peak in negative equity soon after lending standards tighten (and property demand falls).

Higher flow supply responsiveness is associated with a larger peak in negative equity during the bust in spite of a lower price peak during the boom. The difference, in part, is because a larger proportion of the housing stock is held by relatively young households, who absorbed the increase in quantity during the boom and who hold relatively high levels of debt. Younger households are more vulnerable because they have had less time to amortise their debt. Additionally, and perhaps more importantly, the larger supply overhang in the more responsive case leads to a larger *percentage* decline in prices. It is the percentage decline that matters when considering the likelihood of outstanding debt exceeding the value of the property. This is because the LTV ratio is expressed as a proportion of the property value, and because the time taken to pay off a given proportion of a credit-foncier loan is independent of the initial loan size. Indeed, the reason why no cohorts experience negative equity when $\beta_1 = 0.04$ is because the *proportionate* price decline is too small to drive property values below the level of debt, given the LTV ratio, interest rate and loan term.

Figure 2: Increase in Flow Supply Responsiveness

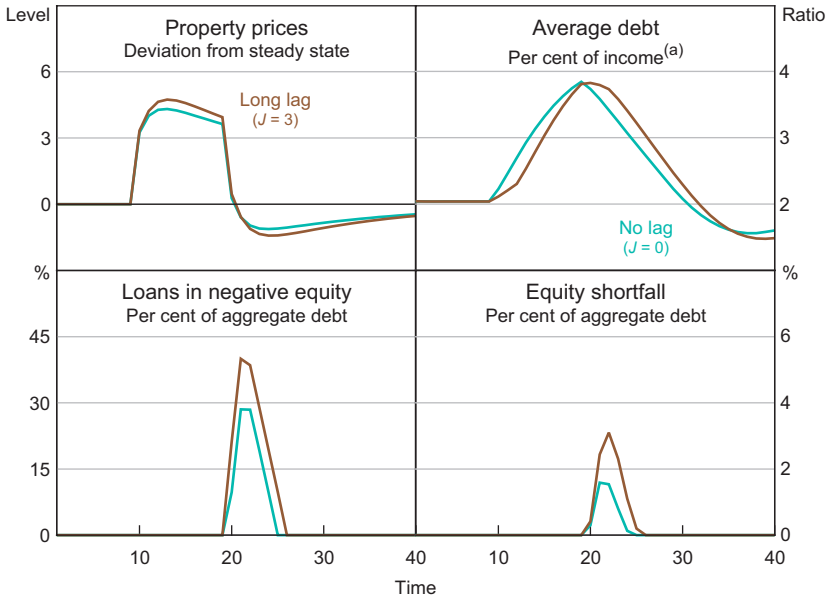


Note: (a) Indebted cohorts only

The value of β_1 governs the responsiveness of flow supply to prices. But current flow supply in the presence of time-to-build lags is predetermined. The short-run supply responsiveness is a function of both β_1 and the lags implied by time to build. In particular, if time to build is short, supply responds almost immediately to current price signals. However, if there are long lags, new supply is a response to past price signals. This can be especially destabilising when construction decisions are made in response to a temporary price boom.

This case is shown in Figure 3. The lagged response of new supply exacerbates the price upswing because new supply does not put downward pressure on prices for some time. Higher prices during the boom encourage more construction, and ultimately exacerbate the price fall as new supply continues to come on line even as prices are falling.

Figure 3: Effect of Longer Time-to-build Lag



Note: (a) Indebted cohorts only

In reality, if property developers could anticipate and completely internalise the effects of their decisions to build on future prices, they might not build as much in the upswing. But in a market with many players, the developer of the marginal property project gains all of the revenue but does not bear the cost of the negative effect its project has on prices of existing properties and those already under construction.

In addition to amplifying the price cycle, time-to-build lags also increase financial distress by affecting the distribution of debt. Relatively more debt is taken on closer to the bust when new supply comes on line, as prices are higher because of the delay. Figure 4 shows, at each point in time, the percentage of total debt that was originated in the previous five years; as debt rises, the flows of new borrowing initially rise and then start to decline as a share of the (rising) total. As shown, when time-to-build lags are longer, at the time of the bust more of the debt is accounted for by younger households, who have had less time to pay down debt, and so are more likely than older households to go into negative equity.

Figure 4: Effect of Time-to-build Lag on the Distribution of Debt
Percentage of debt originated in the last five years

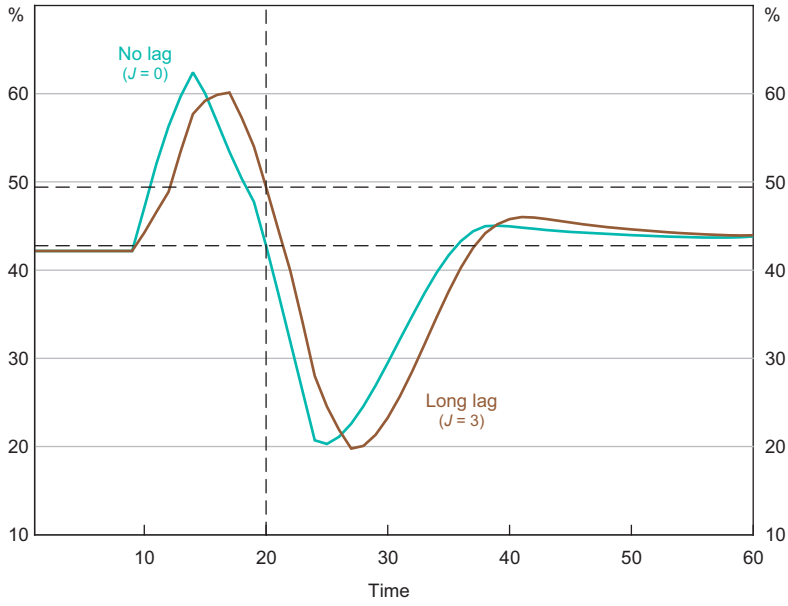
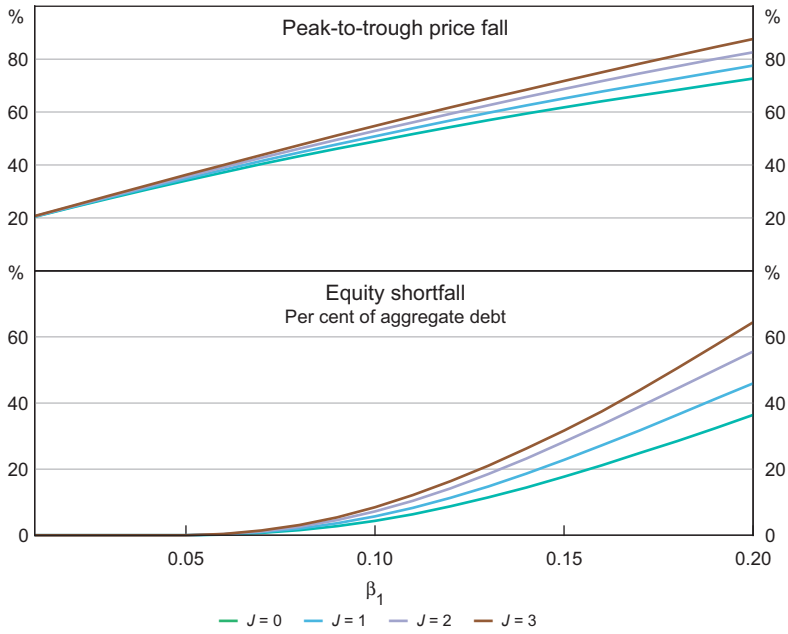


Figure 5 traces out the values of two measures of financial vulnerability – the peak-to-trough fall in prices, and the maximum equity shortfall, relative to the total loan book, over the simulation – for different values of supply flexibility (β_1) and time-to-build lags (J). Time-to-build lags are most destabilising when supply is more responsive (β_1 is higher). The relationship between the effects of time to build and supply responsiveness on the equity shortfall is non-linear.

The effect of flexible property supply on measures of financial distress is consistent with the stock supply of property being large relative to the flow supply. This effect is exacerbated when there are time-to-build lags ('hog cycles') in construction: production is then highly responsive to changes in price but adds to supply periods later. In the meantime, prices rise even further, inducing even more supply later. The subsequent overhang of excess supply in the bust is therefore much larger, as is the decline in prices and thus the share of borrowers that potentially face negative equity. This is consistent with the findings of Chinloy (1996), that even where supply seems quite flexible, the scope for supply adjustments, rather than price changes, to absorb demand shocks is limited, making price cycles likely even in the flexible-supply case. As we have shown above, this effect is exacerbated by time-to-build lags.

Figure 5: Financial Vulnerability Indicators
For different degrees of price flexibility (β_1) and time-to-build lag (J)



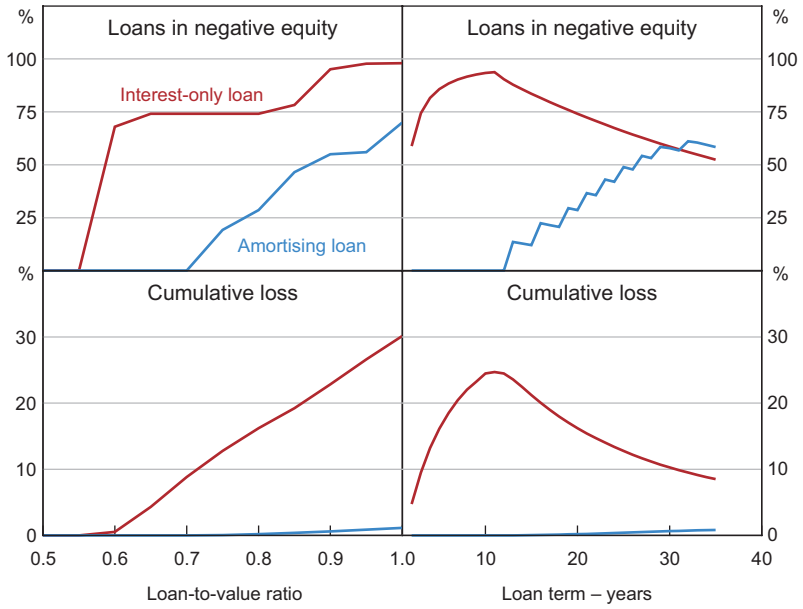
3.2 Features of the loan contract

The share of the loan book that is in negative equity is sensitive to features of the loan contract. In particular, contract features which lead to principal being paid down faster reduce the incidence of negative equity. For amortising loans of a given term, of course, principal is reduced faster in the first few years under low interest rates than under high rates; this fact becomes relevant when considering possible policy responses, in Section 5.

Figure 6 shows four panels that highlight differences in measures of financial distress between amortising and interest-only loan contracts. The top left panel shows the peak share of the loan book in negative equity as a function of the LTV ratio. The top right panel shows how the peak share of the loan book in negative equity varies with the term of loan. The bottom panels translate the incidence of negative equity into a cumulative loss rate, which we describe below.

Interest-only loans are more at risk of being in negative equity because the debt is not run down over time. This can be compensated for by demanding a lower LTV ratio. Given our calibration, to ensure the losses remain below 4 per cent of aggregate debt (which seems consistent with the loss rates that sparked distress among US lenders) the LTV ratio must be set to at most 65 per cent in the interest-only case, whereas this level is never reached in the amortising case for any positive down payment (LTV ratio below 100 per cent).

Figure 6: Loan Contract Features
Per cent of outstanding debt



The top right panel shows that, at our parameter values, the incidence of negative equity is higher at longer terms for an amortising loan. This is because two forces are at work as the term of the loan increases: outstanding debt in the economy increases as more cohorts hold onto debt for longer periods, but, as the term increases it also takes longer to run down the principal. This is particularly relevant for those cohorts who bought at boom-time prices. For a range of plausible parameter values, this second effect dominates. The stepwise shape of the amortising case reflects the inclusion of the entire debt of each additional cohort in negative equity, even though the extent of the equity shortfall is very small, and so the implied losses shown in the bottom right panel vary smoothly.

However, with interest-only loans, the amortisation effect is absent. As the term increases the outstanding debt in the economy would also increase. If the term is sufficiently short, say one period, and the LTV ratio is low enough to buffer all period-to-period price fluctuations, no cohort will ever find itself in negative equity. At longer terms, however, some price fluctuations can be sufficient to put some cohorts in negative equity. But the effect of increasing the term is bounded because at sufficiently longer terms, all cohorts who buy above the steady-state price plus the buffer given by the LTV ratio will be in negative equity at maturity. In our simulations, the price cycle depends on the number of periods of lax lending standards, the speed with which expectations adjust and the depreciation rate. At the chosen parameter values, the top right panel of Figure 6 suggests that terms of around 10 years are riskiest. But in general it is the number of periods that prices are at boom-time levels that determines – for interest-only loans and given an LTV ratio – how many cohorts will find themselves in negative equity at maturity.

Experience has shown that not all mortgage borrowers in negative equity will default; Foote *et al* (2008) found that, in recent decades in the United States, only about 10 per cent of borrowers in negative equity actually defaulted. Some kind of negative shock to capacity to pay is also necessary to induce a mortgage default, or even a temporary period of arrears that subsequently cures, that is, the borrower makes up the missed payments and thereby gets back on schedule (Vandell 1995; Van Order 2007; Foote *et al* 2008). Around 13 per cent of Australian households with mortgages experienced a period of unemployment or shift from full-time to part-time work during 2008–2009 (RBA 2011). Most of these households did not fall behind on their payments, and indeed some of them remained ahead of schedule; about half of all households with mortgages report that they are ahead of schedule. This suggests that a reasonable assumption would be that 10 per cent of households in negative equity in any period will experience an income shock that will result in default. In that case, the effects of supply responsiveness and the other factors explored above on lenders' losses will be a fraction of the total equity shortfall, which is in turn a small proportion of the loan book in negative equity.

In contrast, it is reasonable to suggest that interest-only loans will default if they are in negative equity at the point that they must be refinanced. Interest-only loans are common in commercial property markets because in property development the finance is usually repaid with the proceeds of the sale of the (completed) project. This requires, however, that property prices have not, in the meantime, fallen below the expected value on which the project plan was based. Accordingly, default depends on whether the project is in negative equity at the point that it is refinanced or completed; an income shock is not needed. Thus defaults are higher and more concentrated for interest-only loans than for amortising loans.

The distinction between amortising loans and interest-only loans helps explain why commercial real estate and property development loans have higher rates of default during busts. It also helps explain why the US subprime and other non-conforming mortgages performed so badly in the early part of the housing bust in the United States. The structure of the loan contract, namely the deeply discounted teaser rates, created large jumps in required repayments that all but forced the borrower to refinance within a few years (Gorton 2008; Ellis 2010). In effect, subprime borrowers showed high and correlated default rates, like property developers, in part because the mode of finance had come to closely resemble property development finance.

We translate the default rate into a loss rate on the assumption that the loss given default is equal to the difference between the property value and outstanding debt (the equity shortfall). The bottom panels of Figure 6 show cumulative losses, that is, the total losses over the whole simulation, expressed as a ratio to the peak level of debt. In reality, losses would probably be larger, as the recovery value of the collateral may be lower than the market price because of the effect of distress sales on realised prices. There may also be costs associated with managing the defaulted loan.

The bottom two panels of Figure 6 also show that default and loss rates are much higher under interest-only loan contracts than under amortising mortgages, even when the path of property prices is the same in both cases. The difference between loss rates in the two markets is even starker than for the peak negative equity measure, mainly because the extent of the equity shortfall is greater in the interest-only case, and because defaults are triggered by different events – refinancing rather than income shocks.

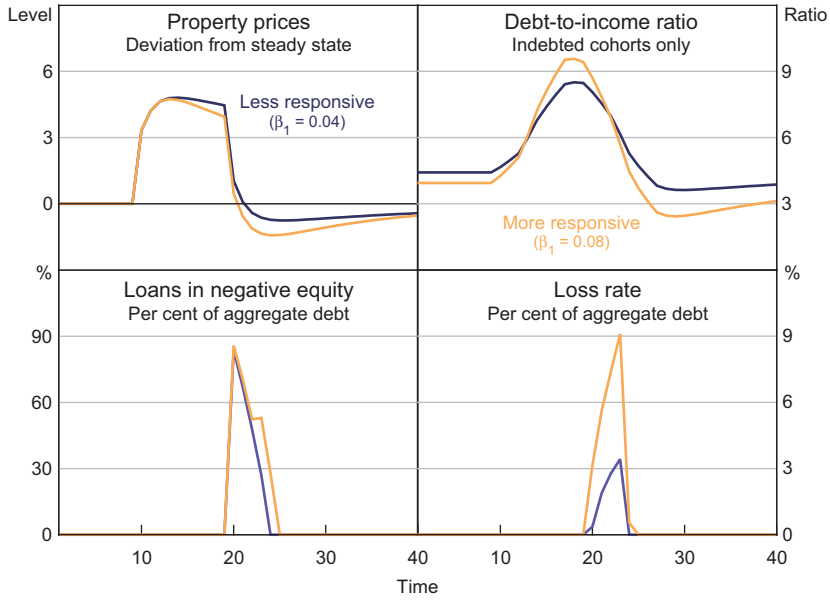
3.3 Application to commercial property

We now re-calibrate the model to capture some key features of the commercial property market (particularly property development) and its financing. These features are among those examined in Ellis and Naughtin (2010): in particular, the time to build is often longer than for housing; the loans have shorter terms and are typically non-amortising; and the loan portfolio includes a large fraction of development loans.

We explore these as possible factors that, especially in combination, could explain why commercial property lending has been more likely than housing lending to instigate a banking crisis. Historically, it is more common for bank distress to stem from losses on commercial property lending, including lending to developers of either commercial or residential property, than from mortgage lending to households. This was the pattern in the US savings and loan crisis, the episodes of banking distress in the early 1990s in Australia, Scandinavia and Japan, and the recent period in the United Kingdom, Ireland and Spain. Property developers were also disproportionately represented in the bad loans that followed the Asian financial crisis in 1997–1998. Arrears rates on housing loans can rise strongly when unemployment increases – especially if housing prices are falling – but this is an effect of the banking distress and economic downturn, not a cause. The recent US housing crash seems to have been an exception, where mortgage arrears and defaults rose sharply well before the economy turned.

As shown before, longer times to build (J) worsen the performance of a loan portfolio during a bust; Figure 7 shows simulation paths for different levels of supply responsiveness when $J = 3$. The effect of longer times to build is exacerbated by the interest-only nature of property development financing. The peak shares of negative equity – at 84 per cent for the inflexible supply case and 86 per cent for the more flexible supply case – compare with figures of 0 and 29 per cent in the benchmark case shown in Figure 2, which was designed to mimic typical contract features for home mortgages. The interaction of the loan contract features with the time-to-build lags can compound their individual effects.

Figure 7: Calibration to Commercial Real Estate
Five-year non-amortising loans refinancing at the end of the five-year term



4. Policy Response

Previous simulations assumed a constant interest rate. Next, we consider the impact on financial stability of a counter-cyclical interest rate response. Figure 8 contains three sub-figures. Figure 8(a) compares the simulation with more flexible supply (β_1 = 0.08), and in which interest rates are constant over the cycle, with the case in which interest rates are increased from 3 per cent to 5 per cent during the boom and are then lowered to 1 per cent during the bust. Figure 8(b) considers the 'clean-only' case where the interest rate only responds to the bust and is lowered to 1 per cent as before. Figure 8(c) considers the 'lean-only' case in which the interest rate increases to 5 per cent during the boom, but returns to 3 per cent, not 1 per cent, in the bust.

Figure 8(a) shows that a combined policy of raising rates in the boom and cutting rates in the bust reduces negative equity, by dampening demand in the boom and supporting it in the bust. There is also a second effect that loans amortise faster when interest rates are lower.[6] We have assumed default rates are a function of negative equity and any need to refinance. However, if the affordability of the repayment also affects default, cutting during the bust reduces the default rate, given negative equity, as well as the proportion of the loan book in negative equity.

6 The dampening effect of interest rates on prices yields similar reductions in financial vulnerability in both the contractionary and easing phases. The amortisation effect is also of a similar absolute magnitude in both phases, although in the contractionary phase it works to offset the price effect, while easing further reduces vulnerability. In the benchmark case the price effect dominates, so raising rates in the boom reduces vulnerability. However, in alternative calibrations with a smaller price effect, raising interest rates in the boom can actually exacerbate financial vulnerability by increasing debt burdens at the time of the bust.

Figure 8: Effect of Monetary Policy on Housing Market Dynamics

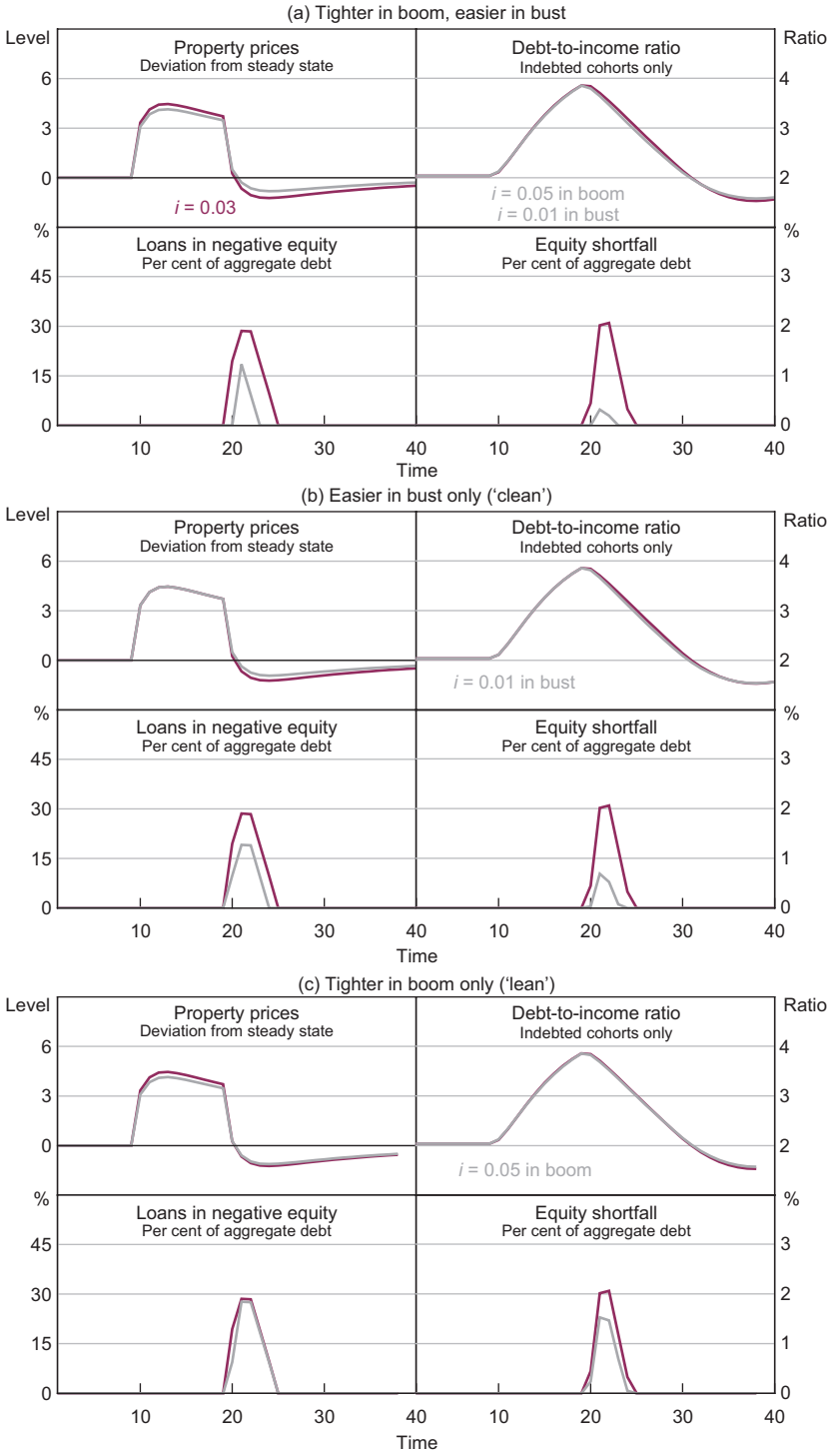


Figure 8 sub-figures (b) and (c) indicate that most of the benefit of the interest rate response comes from easing during the bust, both in terms of negative equity and possible reductions in the default rate. The share of negative equity is lower because, once interest rates are lowered, amortisation occurs more quickly. This is an inherent feature of the credit-foncier loan contract and does not require borrowers to maintain their earlier repayment amounts as interest rates fall. Interestingly, the aggregate debt-to-income ratio is very similar in all four scenarios shown in Figure 8, which highlights the important point that aggregate measures mask the underlying risks to financial stability.

Another policy tool that has sometimes been advocated in the literature (e.g. Crowe *et al* (2011)) is a restriction on LTV ratios. This policy works through two channels as well: first, it ensures that borrowers have more equity to begin with, so there is a larger buffer to be eroded by falls in prices before the borrower is in negative equity; and second, more potential borrowers will be priced out of a rising market if they have to accumulate a larger deposit. Since we abstract from the requirement to accumulate a down payment we can only explore the first channel here. Given the findings of Wong *et al* (2011) that LTV caps do not prevent the boom and bust in prices, but rather protect the banking system from the effects, we suspect that this is the more relevant channel in practice.

Table 3 shows that lower initial LTV ratios do reduce the peak share of borrowers in negative equity, but they are not a panacea. If the boom-bust cycle in serviceability standards is moderate ($\Delta\lambda$ = 0.5 to 1.0 – a 50–100 per cent expansion in borrowing capacity), bounding LTV ratios away from 100 per cent reduces peak negative equity but further restrictions make essentially no difference. If, however, the change in λ is very large, even quite severe restrictions on LTV ratios reduce – but cannot entirely forestall – a large increase in negative equity.

Table 3: Peak Equity Shortfall as a Percentage of Outstanding Debt

$\Delta\lambda$	$\%\Delta p$	Loan-to-value ratio				
		0.6	0.7	0.8	0.9	1.0
0.5	31	0.0	0.0	0.0	0.9	3.8
1.0	49	0.0	1.0	5.1	10.4	16.2
1.5	61	3.1	9.8	16.8	23.8	30.1
2.0	69	12.8	21.2	29.0	35.9	41.6
2.5	75	24.4	33.2	40.7	46.6	51.6

5. Conclusions and Policy Implications

In this paper we have presented a simple model that illustrates that both the flexibility of supply of new property and the terms of financing its acquisition influence how property cycles translate into financial distress, and thus impinge on financial stability. Importantly, the magnitudes of the boom and bust in prices or debt do not translate monotonically into financial distress, either for the borrowers or the lenders.

If supply is inflexible, the increase in demand manifests more as a price boom than a quantity boom, but a smaller fraction of the loan book is originated at boom-time prices. Flexible supply, on the other hand, absorbs much of the demand shock, so the price effect is smaller in the boom. In the bust phase, however, the larger supply overhang induces prices to undershoot their pre-boom level by more than if supply is fairly inflexible. This can push even cohorts who bought their property before the boom into negative equity.

More importantly, the more responsive is supply, the more property is transacted at boom prices. The fraction of the loan book liable to fall into negative equity, and perhaps default, is higher. While this finding can be partly offset by existing owners trading up, it remains true that the net addition to the stock of property must be bought by someone. Therefore the fraction of the loan book accounted for by new borrowers with higher leverage (and hence greater vulnerability to price falls) will always be greater when supply is more responsive. These effects are exacerbated by time-to-build lags, which accentuate the price cycle.

An implication of our results is that credit constraints affect the severity of the downturn and subsequent distress. If credit constraints are binding on borrowers, then an easing of those constraints will have a large effect on demand for credit, and thus for property. If the lifting of a constraint is sustainable, say because artificial government restrictions on lending in a regulated sector are rescinded, some of the initial increase in borrowing and prices will also be sustainable. If, however, the easing in lending standards is temporary – a reflection of over-exuberance or poor incentives, for example – then a severe bust becomes more likely.

A related point is that the contract terms of the loans used to finance property purchases also matter a great deal for the financial stability outcome of a given-sized property boom-bust cycle. Loans that build in some amortisation of principal over time are less destabilising, since fewer borrowers are then liable to fall into negative equity if prices fall. Short-term loans that must be rolled over are particularly dangerous: this helps explain why commercial property lending, and especially property development loans, have been so much more problematic for financial stability in the past.

Our results help explain why commercial property lending is more prone than home mortgages to busts severe enough to create a banking crisis. Longer production lags make the price cycle more severe, and the terms of the typical loan contract in this market make borrowers more likely to default. And these factors interact to exacerbate the effect of either one alone. Beyond our results, there may be several structural and institutional factors that make commercial real estate and property development lending riskier than home mortgage lending. They include the lesser attachment a firm has to its premises than a household is likely to have to its home, implying that the costs of default are lower in commercial real estate. The effect of prior defaults on current demand is also important. If a loan to an owner-occupier of commercial property defaults, the borrower may well have gone bankrupt and disappeared as a future source of demand for commercial property. In contrast, households who lose their homes to foreclosure still have to live somewhere and do not reduce demand for housing to the same extent, even if they temporarily 'double up' with another household as has been seen in the United States recently.

Regardless of whether we consider residential or commercial property markets, the extent of financial distress during the bust is not necessarily well proxied by the amplitude of the price

cycle or by aggregate measures of indebtedness, like aggregate debt-to-income ratios. Rather, the distribution of debt, in particular the proportion of debt held by recent or more vulnerable borrowers, is a fundamental determinant of financial stability. Aggregate variables, on their own, might therefore be misleading guides for policies intended to promote financial stability. As the experience of the 2000s shows, countries with bigger price booms or the highest debt-income ratios were not necessarily the ones that had larger price busts or higher rates of mortgage defaults.

These findings raise the question of what policy options are available to forestall or ameliorate these property cycles and the distress they can engender. While it would be useful to pick a value for the responsiveness of supply that avoids building up a supply overhang, this value is almost certainly not a choice variable in the short to medium term. Recent research suggests that land availability, reflecting geographic constraints, explains much of the variation in the extent of the price upswing that can be attributed to supply factors generally (Huang and Tang 2012). Indeed, zoning laws and other land-use restrictions often seem to be a political response to manage the consequences of geographic constraints on land availability (Glaeser, Gyourko and Saiz 2008; Saiz 2010).

To the extent that policies can reduce the fixed costs of expanding supply, and thus its short-term sluggishness (time to build), they are probably worth doing. This will not eliminate property boom-bust cycles, but it may dampen their more harmful aspects. In contrast, deliberately raising the overall flexibility of supply is likely to be counterproductive if there are lags in the production process: in our model, supply delayed is *worse* than supply denied.

It would be ideal if some policy could perfectly offset the kinds of temporary demand shocks that can spark harmful property cycles. Certainly diligent prudential supervision can help guard against unwarranted easing in lending practices. Our findings imply that this supervision is particularly necessary in jurisdictions where supply is quite flexible. However, there are probably limits on the capacity of policy to offset this behaviour fully. Lending practices are multidimensional and hard to observe. Lenders might not even be aware that they are easing standards; although the US Senior Loan Officer Survey clearly shows the tightening subsequent to the boom, the easing during the boom is less obvious.

In addition, many demand shocks that could spark a property boom may be fundamental – stronger income or population growth, for example. It is not always clear in real time whether such a shock is permanent or temporary, and if the latter, how long it will last. Prudential supervision probably cannot be calibrated finely enough to provide a perfect counter-cyclical offset to such shocks, but it is an important part of the policy response, in that it can prevent at least some of the potential easing in lending standards that might otherwise occur.

Recently there has been considerable interest in more explicit, quantitative regulatory responses to property booms, under the label of 'macroprudential tools'. Capping LTV ratios below 100 per cent does seem to do some good; it is no surprise that lenders typically require down payments from borrowers. But our results and the recent experience of some countries both show that further tightening of the cap does not make as much difference. If the easing in other aspects of lending standards is large enough, even a very onerous LTV cap of 60 per cent does not prevent a large subsequent increase in the prevalence of negative equity.

Interest rates, however, can be an effective counter-cyclical policy instrument. To the extent that the central bank's intellectual model of the economy incorporates the effect of property markets cycles and credit on output and thus inflation, monetary policy will offset some of the harmful effects of property cycles as a matter of course. Interestingly, our results suggest that the bulk of the effect of monetary policy on financial stability comes from easing during the bust (the 'clean' phase) rather than in the boom (the 'lean' phase). This implies that there is a case to ensure that policymakers have scope to cut interest rates when needed, which puts the constraint of the zero lower bound on interest rates in a new light.

If our results generalise further, they might have stronger implications for both the monetary policy framework and the desirable structure of property lending. Policymakers need to be aware of how the transmission of monetary policy to output and thus prices can differ depending on the structure of the mortgage market and the mode of finance for property development. If loans are predominantly variable-interest rate and monetary policy is set according to domestic circumstances, then policy easing in the face of a bust seems to be reasonably effective in reducing loan distress. On the other hand, inappropriately low interest rates during an expansion could enable a harmful boom. For example, if most loans are fixed rate or the economy is part of a slower-growing currency area, interest rates could be set too low for the segment of the property market that borrows at variable rates.

Suggesting that monetary policy respond to property cycles is not the same thing as advocating the targeting of asset prices. Our results imply that the level or change in aggregate indices of asset prices are not good guides to predicting the extent of financial distress during the bust, and neither is the amplitude of the cycle in credit.

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Discussion

1. Christine Whitehead

Introduction

I am most grateful for the opportunity to comment on such a thoughtful and interesting paper – and one which takes a view about the role of modelling which very much chimes with my own: that model development needs to be grounded in reality and that simple models often have the best chance of providing useful insights. Complexity can come later when the basic dynamics have been addressed.

Some of the ideas that lie behind the model were discussed at a conference in Sydney in September 2009 and later extended (Ellis 2011). That conference was the first time I met Luci Ellis and I was impressed by her understanding of the need to relate the behaviour of property markets to issues of financial stability – the topic of today's Conference.

My comments centre around four main issues: (i) the objectives of the model and its structure; (ii) the model's findings and their potential implications for policy; (iii) international evidence relevant to these findings; and (iv) ways forward, both in terms of developing the model and with respect to possible policy measures to improve financial stability.

The objectives of the model and its structure

The starting point for the model

A core objective of the Conference and this paper in particular is to bring together macro and monetary specialists on the one hand, and those who concentrate on the operation of property markets on the other – and to make each better understand the other. In the main they do not engage. Property analysts generally take the macro environment as given and then ask what follows for their particular concerns. Macro specialists tend to regard property as a dangerous source of instability, a conduit and leading indicator of stress, but one which can effectively be described in terms of aggregate variables without recourse to more detailed analysis of the fundamentals of these markets and the distinctions between them.

One objective of this paper is to question some of these presuppositions and to suggest that there needs to be rather greater understanding of exactly how the conduits between property markets and overall financial stability operate. The paper discusses important differences between commercial and residential property markets with respect to their impact on macro volatility, and differentiates between demand and supply pressures. In this context the paper argues that there are good reasons to expect commercial property markets to generate greater volatility than

housing markets and that in both cases supply conditions may be more important than conditions in the mortgage market, whatever the original cause of instability.

A second objective is to see whether a highly simplified partial equilibrium model which tracks the effects of a change in credit conditions can shed light on these important relationships and help to clarify the relative merits of different policy instruments aimed at reducing market volatility and the negative effects that these may have on macro stability. It is worth noting that this is, of necessity, seen as the only policy goal and that the only relevant policy instruments in the model are those within the remit of the monetary authorities. It is up to the property market specialists to analyse the effects on other housing and industry objectives and to argue about trade-offs when these are not fully congruent with macro stability.

Core attributes of the model

The model is basically made up of two distinct and traditional existing models, one of credit control and the other of supply response. The starting point is a sudden slackening in credit conditions in a world where all (identical) individuals are credit constrained. The impact of this change is first on demand; then on price with a feedback effect because price rises lead to expectations of further price increases; and then on supply. The supply model is basically a cobweb/hog cycle model where supply responds to earlier price increases and where the relative elasticities help determine how volatile the outcomes might be.

The credit constraint in the model is based on the loan-to-income (LTI) ratio, while loan-to-value (LTV) ratios are held constant for each cohort of purchasers and the deposit is assumed to be available. Negative equity is seen as a prerequisite of financial distress and is mediated by the capacity to pay, which will be affected by changes in interest rates and employment conditions. Everyone is in the same boat and everyone is an owner-occupier; there is no alternative source of housing. The formulation of the supply side is straightforward, depending on responsiveness to dwelling prices but with a lag reflecting speed of adjustment.

These are, of course, extreme simplifications and an assessment of the model depends upon whether its predictions speak to real world experience and clarify the factors that policymakers and regulators should be taking into account when using more sophisticated techniques.

Four factors stand out as of particular importance: expectations, which reinforce the demand response to any weakening of the credit constraint and therefore can be expected to generate a greater supply response although not immediately; the loan contract form (annuity versus interest-only mortgages), which can affect the extent and timing of financial distress in terms of negative equity and the likelihood of default; the timing of purchase decisions in relation to when the downward shock to prices occurs, which helps determine which cohorts suffer negative equity; and the time-to-build lag, which affects the extent of over-response on the supply side – the longer the time it takes to bring supply to the market, the greater the chance of over-response.

The most important findings

As always is the case, the findings follow from the assumptions. There is thus a continuing debate as to whether they are robust, particularly because of the model's partial equilibrium nature. But

at least with a simple model you can reasonably easily track the conduit between assumption and outcome.

An important issue is the distinction between the impact of a fundamental and sustainable change in credit conditions, and a change which is unrelated to fundamentals and will ultimately be reversed. Here the assumption is that the observed easing of credit is out of line with fundamentals and will therefore be reversed. If the change were in line with fundamentals the outcome would be desirable (although because the rapid demand response includes an expectations element and the supply adjustment is slow but significant, there could still be some resultant volatility). In the 1970s and 1980s for instance, when deregulation occurred in many countries, the outcomes were mainly desirable, even though they did generate some overheating. In the 1990s and 2000s there was a general belief that fundamentals had changed further because of lower inflation and interest rates. Later in the cycle it became obvious that the system was out of line with fundamentals. Even so, by no means all of the earlier credit relaxation was the result of overenthusiasm; excessive caution also has costs.

Diversity in loan contract forms matter because of their differential effect on risk and financial distress, so it is not enough to look simply at aggregate lending figures. In this context, one simple reason why commercial property is seen to be a source of more concern with respect to financial stability than housing is that commercial lending is almost always in the form of interest-only loans. This means that the borrower will go into negative equity far more rapidly than under traditional loan forms and will have a considerable incentive to default at the time of renegotiation. Of course the other major issue here is that the commercial property is not the borrower's home.

Probably the most important finding is that relatively elastic supply responses may well be undesirable in the face of price volatility because, when prices turn down, there is more likely to be oversupply and continuing downward pressure on prices. This can lead to greater financial distress through its impact on negative equity. Equally, developers, while increasing their output, take out more loans and are overexposed relative to asset values, with adverse effects on their viability and the security on their loans.

The pattern of transactions also matters, as those who have purchased or invested nearer the time of the downturn will run into difficulties more quickly. If there has been a concentration of loans made just before the 'crash', problems of financial distress are exacerbated – something which was observed in many countries in the late 1990s, but has been less of an issue among mortgagors this time around because of low levels of activity in the run-up to the crisis, particularly in Europe.

Another particularly important finding is that longer times to build increase volatility, as prices bear even more of the adjustment to demand and expectations because the investment (supply) comes on to the market later, by which time the cycle may have turned and the demand disappeared. This generates an overhang in new supply which puts further downward pressure on prices during the downswing.

So what do the findings imply for where policy should concentrate? In the paper the emphasis is on interest rates and particularly, because of the latest experience, on their potentially asymmetric benefits in the downturn because they reduce repayments under variable-rate systems, giving consumers a greater chance to maintain their repayments. Other instruments, such as limiting LTI and LTV ratios, as well as the use of longer-term and interest-only instruments, may also have

traction. Equally interesting, but not under the monetary authority's control, are mechanisms for introducing greater flexibility, particularly on the supply side, with respect to build times and adjustments to changing market circumstances. But the most important lesson is that policymakers need better to understand how regulatory and macro policy instruments feed through into property markets of different types and thus affect financial stability differentially.

International evidence

Here I am mainly drawing on evidence from Europe and particularly on the results from the series of studies that the Finance Working Group of the European Network of Housing Research has been carrying out since before the crisis.[1]

The global financial crisis, starting from 2007, provides an extreme example of many of the issues analysed in the paper. Few commentators doubted that during the early to mid 2000s credit markets had become very much more lax and that this had resulted in rapid increases in debt-to-GDP ratios, a cause for concern to international and national commentators alike (Girouard, Kennedy and André 2006; Girouard *et al* 2006). Most commentators, however, expected a soft landing as fundamentals re-emerged. The reality has been very different in most European countries – and provides examples of many of the predictions made by the model.

Much of Europe has experienced price falls and continuing volatility, especially since 2007. The main exception has been Germany, where after a decade or two of falling real prices there are now signs of upward pressure, and Switzerland, where the growth in owner-occupation over the last few years appears to be supporting quite large price increases.

Consistent with the model the biggest problems have been in the two countries with the greatest supply responsiveness – Ireland and Spain. Ireland in particular has suffered continuing falls in dwelling prices of possibly over 50 per cent, although data are difficult to interpret. Both countries have large supply overhangs and no chance of coming back to equilibrium in the next few years. In both countries it is the supply side, especially in terms of commercial property, which has impacted most on banks and financial stability. These are also the two countries where construction accounted for a very large proportion of GDP and so had the furthest to fall.

In most other countries that have been particularly badly affected by the financial crisis, supply elasticities were very much lower and stimulus packages have been needed to support supply in the face of the crisis. In the Netherlands, the United Kingdom and much of Scandinavia, overhangs were reduced rapidly with the help of government initiatives.

The evidence across many European countries is that the increasing importance of variable interest rate mortgages, far from increasing risk as usually predicted, but consistent with the model, have helped support existing purchasers and reduced problems of arrears and foreclosure. The fact that employment in many European countries has remained relatively high in the face of falling demand has also been of fundamental importance.

1 The following references provide much of the supporting evidence for these comments:
Post-financial crisis commentary: Scanlon, Lunde and Whitehead (2011); Scanlon and Whitehead (2011); Whitehead and Scanlon (2011); Scanlon, Whitehead and Lunde (2012).
Pre-financial crisis: Whitehead and Gauss (2007); Scanlon, Lunde and Whitehead (2008).

The United Kingdom for instance appears, at least in the short term (now stretching to five years), to have benefited from many of the attributes which in other conditions are argued to be particularly undesirable – including very low supply elasticities and the use of variable interest rate mortgages, as well as the fact that few first-time buyers were able to enter the market prior to the crisis because of affordability problems (rather than credit constraints).

Contrast this with the crisis of the late 1980s–early 1990s. Across much of Europe there were high levels of transactions immediately before this crisis, rapid declines into negative equity and very large numbers of households unable to maintain their payments. This resulted in enormous problems of arrears and possessions in the housing market and an even bigger problem of bankruptcies in the commercial property market.

Where there is perhaps less resonance with the findings of the model is in the experience with new mortgage products and higher LTV and LTI ratios.

There was rapid growth in the use of new mortgage products as well as lessening of credit constraints during the early 2000s across most of Europe. Innovations included:

- The increasing use of variable-rate mortgages, even in countries such as Denmark which had a centuries-long history of fixed-rate products.
- The rapid growth of interest-only mortgages without a defined method of repaying the principal – as a means of helping affordability.
- Longer mortgage terms – up to one hundred years (and maybe more) in Spain for instance – again looking to improve affordability in a low interest rate environment.
- Remortgaging in line with increases in capital often as a way for existing mortgagors to consolidate their debts. Often this did not result in higher LTV ratios because of increasing dwelling prices.
- Higher LTV ratios, again to enable the purchase of increasingly costly housing. As prices were rising much faster than incomes this worsened LTI ratios, although not always repayment-to-income ratios because of falling interest rates.
- Self-certified mortgages, especially in the UK's subprime and near-prime market, which at its height took perhaps 5–7 per cent of the overall mortgage market.

Clearly, these products increased the risks to borrowers if dwelling prices were to fall, interest rates to rise, or incomes and employment to decline. But much of the evidence shows that the picture was more nuanced than these general statements imply, and overall there is very little evidence that these products were a significant source of observed problems. Even in the context of the subprime market, LTV ratios were much lower than in the traditional first-time buyer market so negative equity was less of a problem. Moreover, self-certification was often a necessity for self-employed households (sometimes using the money to support their business) more because of the specifics of regulatory requirements rather than because of a move to over-indebtedness. One result was that subprime lenders were quicker than traditional lenders to call for possession once the downturn hit, and thus did not take significant losses. Rather it is the lack of funding sources, and indeed demand, that has driven subprime lenders out of the market.

As already noted, in many western European countries, economy-wide outcomes have so far limited the risks associated with many of these products. Equally, most governments and

mortgage industries have developed screening and forbearance measures which have led to far fewer defaults than predicted at the beginning of the crisis. As examples, many French loans go up to 125 per cent of the value of the home, but other requirements with respect to income and employment have ensured that defaults are only in the hundreds. In the United Kingdom, industry-based forbearance rules, which were implemented 'voluntarily' in the 1990s (and indeed had been part of industry practice since the 1890s), were formalised and have resulted in effective management of arrears in the vast majority of cases. Possessions are now lower than before the crisis.

Another reason is that much of the lending went to established home owners who were not generally over-indebted. The proportion of first-time buyers had been declining in many countries because of affordability issues and transactions were generally at relatively low levels before the crisis. Moreover many first-time purchasers who did buy were self-regulating by not taking all the funding being offered. The situation was therefore rather more stable than the aggregates might have predicted.

Of course this is partly because dwelling prices have rebounded in most European countries and interest rates remain low. Conditions may well worsen and, in any case, problems will continue for long periods. This is particularly obvious in Ireland where legally enforced forbearance over the short term is combined with very widespread negative equity. Similar issues apply in Spain although the means of addressing them is different; there have been many more foreclosures of marginal buyers and new loans are often only available for properties owned by the bank in question. But in both countries it is the supply-side loans, both to housing and commercial property developers, which have caused the major headaches for bankers and the government, not the demand side. This picture is mirrored, although usually not to the same extent, across western Europe.

Even though the empirical evidence is against innovative products being a key cause of instability, regulatory and government responses across Europe have tended to concentrate on reducing or eliminating their use. In the United Kingdom, the FSA is consulting on restricting the use of interest-only mortgages to those who can already afford annuity loans; in Denmark they are looking to limit interest-only mortgages and maybe to further constrain variable-rate mortgages; in Sweden LTVs are to be limited to 80 per cent. Only in the context of loans to those in negative equity to help them adjust has there been some moderation of immediate regulatory restrictions in Ireland and the United Kingdom. It would be good to see a little more detailed analysis of the role played by different products – but one cannot be surprised that risk-averse regulators are acting to restrict their use, especially given political pressures.

But the most important general lesson from European markets may be that demand-side crises can be addressed much more readily than supply-side crises. The position with respect to developer loans is far less tractable and has been subject to much less detailed analysis. The impact of declining dwelling prices, commercial rents and transactions across all property markets on developer balance sheets (and thus on bank balance sheets) has had dramatic effects on investment capacity. The process of unwinding looks as though it will take many years, putting downward pressure both on construction industries across Europe and on economic growth potential.

Ways forward

Relaxing the assumptions

While the international evidence supports many of the findings of the model at least in general terms, given its massive simplifications it can really only be the starting point for more detailed analysis.

Areas of immediate concern include:

- Both the form of the expectations variable on the demand side and the lack of a supply-side expectations variable. The current form dampens the price effect over time. As John Muellbauer said in discussion, using a different form which exacerbated the impact might give very different results. One would also expect developers to take account of expected future prices, especially where there is a known time to build. Examining a number of formulations of expectations on both sides of the market would probably generate food for thought.
- The assumptions around negative equity and its relation to financial distress among consumers perhaps needs further thought. It may well be that other measures, such as arrears and possessions, are highly correlated with negative equity so the simplification does not matter, but trying different formulations might well prove valuable. Many of the negative outcomes initially predicted in 2008 in Europe have not happened, in part because negative equity is not a direct source of distress – even though it clearly impacts on the extent of industry losses if mortgages are not insured.
- The effect of inflation. More rapid inflation allows easier adjustment to real dwelling price equilibrium and shorter periods of negative equity, which again would impact on the scale of financial distress as identified in the model.
- The assumptions of one dwelling/one mortgage over the lifetime of existing owners. This clearly allows easy calculation of losses and the extent of negative equity, but excludes issues relevant to financial stability where the majority of additional mortgage debt has been going to existing owner-occupiers.
- Similarly, restricting the consumption side to identical individuals, all of whom face the same credit constraint, obviously makes the model more tractable but at the cost of missing important relationships between aggregate borrowing and stability.
- The same issues apply to the lack of a private rental sector, especially with respect to effects on stability, as its existence introduces a group of stakeholders with different equity, risk profiles and patterns of borrowing. In practice, transfers of both dwellings and households between the sectors has had some dampening effect on volatility, and limited some of the most negative consequences of the financial crisis.
- The most important area of concern for academic economists would undoubtedly be the partial equilibrium nature of the model. However, addressing this concern would involve a large-scale project which may not be feasible at this time.

Nobody could expect all these issues to be addressed within the model, although some could be introduced without adding too much complexity. Others would probably best be addressed

outside the model by supplementing the model with a more general analysis of the core factors linked to volatility and thus financial stability – and in particular looking at whether there are ways by which the outcome of a given shock could be dampened. Factors that moderate the scale of the problem may well be just as valuable in policy terms as addressing the initial cause.

Policy implications

The main policy implications follow from the findings – and again are inherently indicative.

First, the details of the housing and credit markets matter. Understanding aggregate macro variables is simply not enough to effectively understand the nature of the conduit from property to stability.

It is important to try to distinguish between changes which relate to fundamentals and relaxing constraints when fundamentals do not change. Often there will be elements of both and a risk-averse system may need to assume the worst – or at least to look more carefully at more detailed evidence better to understand the causes. Even adjusting to changes in fundamentals may need to be managed, especially if the scale of change is large, simply because supply cannot adjust rapidly. Dampening unnecessary volatility is highly desirable – as long as it does not generate other large scale negative impacts, for instance on housing supply.

There is the usual issue of whether regulators know best. Obviously they are professionals and in a better position than market players to take an overarching view of risks and their broader effects. But they themselves may not always look at the correct indicators or may interpret them in a partial fashion – and they should not automatically assume that consumers need to be protected from themselves. Some of the suggested post-crisis regulatory changes seem to be more about not getting it wrong in the same way as last time rather than making a positive contribution to stability.

Finally on the housing front, the fact that the model suggests that inelastic supply might help financial stability is not a reason for developing policies to reduce supply responsiveness. Rather the markets should be looking at ways better to predict and adjust to changing circumstances and so reduce the costs of maladjustment. Making the system more inflexible is not the answer.

Perhaps the most important policy implications come from the result that the negative stability outcomes relate more to the supply side than to the mortgage market, and often more to commercial than residential. Relatively, far more emphasis should be put on a better understanding of supply-side issues and how these can be managed into the longer term.

A final comment

The paper has presented enormous food for thought. Yet it is inherently only a starting point for more formal and more detailed analysis. Some relatively simple extensions could well provide insights into the robustness of the findings and their relative importance in limiting the negative impact of property markets on financial stability. Even so, the core findings, which I take to be (i) that aggregates are not enough, and (ii) that there is a need to take more account of supply response, timing and adjustment, are both likely to withstand increased complexity.

Most of my comments have been around the assumptions and findings of the model and on the potential impact of different stabilising instruments. A more traditional economist than I would have concentrated more on its formulation as a partial equilibrium model. Developing a model within a general equilibrium framework would provide greater robustness – but at a real cost.

Finally, I would not base policy directly on the findings – and nor would Luci. But I would take them very seriously as a starting point for a better understanding of the risks of volatility and how these can be mitigated.

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2. General Discussion

Several different issues were taken up by participants. One participant was interested in how the model's results, and the associated policy conclusions, would change with a different assumption about the formation of housing price expectations. It was noted that the model's adaptive expectations on the level of housing prices implied people are constantly forecasting housing prices which are lower than actual outturns during a boom. This is likely to produce a very different set of dynamics (see, for example, Muellbauer (this volume)). In response, the paper's presenter, Luci Ellis, commented that the qualitative results are not affected by the assumption of extrapolative expectations.

Another participant queried the robustness of one of the model's results suggesting monetary policy was more effective in stabilising financial outcomes during the cleaning phase (easing policy rates during the bust) relative to the leaning phase (tightening policy rates during the boom). They suggested that if a risk-taking channel were added to the model, the initial shock to housing prices – designed as a decline in lending standards – could subsequently be moderated through a change in monetary policy and the effectiveness of leaning in the model would increase. In regard to this possibility, Dr Ellis said that although the model was deliberately simple to isolate specific channels through which property market developments could affect the risks to financial stability, the addition of a risk-taking channel could be a useful extension for further research. In regard to the model's result that suggests that monetary policy has an asymmetric effect on measures of financial distress, she said the amortisation effect would still be present, so monetary policy would still be relatively more effective in the bust than the boom.

The policy implications of supply-side flexibility in the property development sector also generated discussion. One participant expressed concern about the lack of a trade-off between the benefits of inelastic supply, as per the model results, and their costs following a permanent shock to the system. The participant said this lack of a trade-off was generated by the temporary and exogenous nature of the shock driving the model's cycle. It was suggested that a different scenario could be generated by using a trend increase in income or a higher level of demand for housing caused, for example, by an easing of one of the constraints mentioned in Warnock and Warnock (this volume). In this situation, very inelastic supply would have a cost for society because not enough resources would go to real estate. Dr Ellis said they had modelled a permanent shock and this still suggested an overshoot in housing prices because of the inherent sluggishness of supply. She went on to say there was, to some extent, a US story motivating the way the shock was designed. In particular, the easing in lending standards in the United States was temporary as per the model's shock, precisely because it had been excessive and ultimately undermined the viability of the lenders that had entered the market or gained market share during the boom phase.

Two questions raised by the discussant were also the subject of robust discussion. These were: (i) can policymakers gauge the fundamentals; and (ii) are regulators better informed than the market? One participant said a more appropriate question to answer, bearing in mind that policymakers are acting under uncertainty, was whether the probabilities of what we are seeing are consistent with fundamentals rising or falling and is there some probability that regulators have a different perspective? The participant argued that the answer to this rephrased question was yes; if a policymaker sees a construction boom occurring, asset prices rising, and a lot of innovation in the financial system with credit growing strongly and new competitors coming into the system, they are in the position to say risk is rising or the probability of something going wrong is increasing and this justifies thinking about a policy response. Another participant agreed and expressed the view that within a regulatory institution there are more people working on this problem, and thus, relative to other market participants, regulators are better placed to take the whole system into account and have a better sense of the fundamentals. In response, the discussant, Christine Whitehead, said it is concerning to observe regulators and international organisations rejecting evidence because it does not fit their models. Too many are still thinking in silos and this Conference is an attempt to break these down, Dr Whitehead said.

Securitisation and the Commercial Property Cycle

Frank Packer and Timothy Riddiough*

1. Introduction

The financial crisis of 2007–2009 was triggered by declining housing prices and propagated by securitisation. Combined with high mortgage loan balances, falling housing prices in the United States caused immediate and widespread household financial distress. This distress subsequently fed through to the residential mortgage-backed securities (RMBS) market, as most relevant mortgage debt had been placed into loan pools. Securities were subsequently issued against the promised cash flows. When RMBS prices fell sharply, it came to light that holdings of RMBS were concentrated in systemically important financial institutions and that repo financing of the highly rated securities had created complex interconnected debt-funding chains (Gorton 2009). Concentrated risk and systemic linkages resulted in large-scale bank distress and failure.

Declining valuations of RMBS were exacerbated by information problems. Mortgages in a loan pool typically numbered in the thousands, often with complicated mortgage designs and no mechanisms in place to generate timely, low-cost and high-quality information on the economic performance of the underlying housing mortgage collateral. Furthermore, at issuance the vast majority of RMBS were rated AAA, implying security values that were supposedly insensitive to underlying credit quality. However, the large negative shock to housing prices caused investors to reconsider the information sensitivity of their securities, with the realisation that they really had little ability to assess the credit quality of the underlying collateral and hence determine a current market value (Gorton 2009; Gorton and Ordoñez 2012).

Flaws in the design of the structured RMBS market may not only have added to financial system instability during the crisis, they may have also have contributed to housing market imbalances beforehand. In the years leading up to the financial meltdown, housing prices in the United States deviated positively from their long-term trend for a very long period (starting in 1996 and lasting for approximately 10 years) and by a very large amount (by 50 per cent or more in many markets). During that time it was widely recognised that housing production was running well ahead of estimated demand – particularly in markets such as Las Vegas, Miami and Phoenix (Ellis 2008). A better-functioning RMBS market might have provided investors and developers with more

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timely and less biased signals of market conditions, and dampened some of the excesses in the mortgage and housing markets.

In addition to these information problems, other alleged design flaws in RMBS included: capital requirements that, together with compliant rating agencies (Partnoy 2009), increased demand for highly rated securities; agency problems up and down the securities production chain (Riddiough 2011); and inattention on the part of security investors (Gennaioli, Shleifer and Vishny 2010). In this paper we focus on the issues of information production and price discovery, where *attention* to the information is also relevant. We posit that lack of attention, combined with insufficient information production and a lack of transparency, explain why the RMBS market failed to alert investors and other market participants as to the true state of the housing market.[1]

To address the issue, we appeal to the experience of a related sector. Namely, we study securitised equity interests in commercial property, known broadly as the listed real estate investment trust (or REIT) market. The latest commercial property cycle in the United States has been nowhere near as long and protracted as that of the housing cycle. In fact, the US REIT market has, in aggregate, recovered to its pre-crisis price levels while housing markets are still near the bottom. We conjecture REITs may have had something to do with that. With a REIT 'transmission channel' in mind, we believe that developing a deeper understanding of the REIT market experience might assist in understanding what went wrong in the RMBS/structured securities market. We furthermore will suggest potential policy solutions in terms of how structural features of REIT markets – both good and bad – can be used to organise the securities production process more effectively going forward.

Publicly traded equity REITs are listed, tax-exempt firms that hold equity interests on a pool of commercial real estate assets. Offsetting the benefits of tax exemption are certain rules that govern the financial and operating policies of the firm, including a requirement to pay out a high percentage of income as dividends. REITs are similar to RMBS in the sense that pay-offs to claimholders depend on the performance of a pool of underlying assets. But REIT assets are directly tied to real estate ownership interests, whereas the underlying assets in a RMBS are mortgages that themselves reference the underlying real estate. Another difference is that many REITs are going concerns, and therefore dynamically manage the pool of underlying assets in an attempt to add value for their stakeholders over time.[2]

In undertaking our analysis we bring together a wide range of financial as well as real economic data from a variety of sources. A contribution of this paper is the extent to which we draw from disparate data sources to analyse financial and real economic characteristics of commercial property markets in 14 economies. Sample time periods differ depending on the economy covered, and the data category. The United States is the case that gets the most in-depth treatment, with some

1 There is a recent literature that argues for price opacity as opposed to transparency in secondary market trading (Pagano and Volpin 2008; Dang, Gorton and Holmström 2011; Gorton and Ordoñez 2012). The basic idea is that lemons problems cause secondary markets to break down when certain traders are perceived to be informationally advantaged. When information acquisition costs are high, it may be best for all traders to be 'equally ignorant'. If traders form beliefs consistent with equal ignorance, trade will occur (albeit with some noise) and welfare can improve. But the conditions required for 'equal ignorance' seem difficult to satisfy in practice, suggesting that this equilibrium is extremely fragile. Consequently we take a polar opposite tack and argue that 'sunlight is the best disinfectant', with better information production and a sufficiently transparent market microstructure providing a better approach to enhance trading efficiency.

2 In contrast, most types of RMBS are static and closed, in the sense that an asset pool is assembled at the time of security issuance and that pool does not change except to the extent that mortgage loans go to term, prepay or default.

data going back to the 1980s. Appendix A presents data descriptions, definitions, time periods and sources by category and economy. These data allow us to undertake a comprehensive review of commercial property construction cycles (with a focus on office construction) as well as the development and characteristics of REIT markets in the United States and globally.

We analyse and compare the recent boom and bust in both housing and commercial property markets in the United States in Section 2. Although the summary characteristics of these property markets resemble each other in some ways, we find that the commercial property market downturn occurred later than that in the residential property market. There have also been very significant differences in market performance since early 2009. Specifically, commercial property markets in the United States have in aggregate more or less fully recovered to their pre-crisis pricing levels, whereas residential property markets have recovered only marginally from the troughs of the cycle.

We find that large and persistent differences in new construction during the growth years of the early and mid 2000s help to explain these performance differentials. Although it is well known that far too many housing units were produced in the United States over this period, it is less well known that commercial property markets did *not* experience a construction boom. Commercial property supply, in fact, stayed in balance throughout the biggest real estate bubble in the United States since the 1920s. In contrast, US housing is still dealing with inventory overhang problems long after those in commercial property have dissipated.

After considering several other potential explanations for the muted supply response on the commercial property side, we hypothesise that REITs played a central role. The development of REITs from a global perspective, with a focus on cross-country differences, is reviewed in Section 3. The logic underlying our conjecture is the mirror of our description of what was missing in the private-label RMBS market. Specifically, our conjecture is that commercial property investors and other US REIT market participants discovered prices quickly and without substantial bias. These firms are covered by industry analysts, rating agencies, and 'talking heads' that convey bad as well as good information about the state of commercial property markets. Exchange-traded shares also induce significant volatility into listed share prices, which may give market participants pause when contemplating resource allocation decisions that affect the supply of extremely durable commercial space in local markets. We also note that our conjecture depends on the fact that the REIT market did not reach maturity until the 1990s, which can help to explain why the supply response was different this time around.

To test our 'civilising influence' hypothesis we use the market share of assets held by REITs as a proxy for the general effects of transparency, information production and attention. After reviewing office supply dynamics around the world in Section 4, in the following section we estimate a reduced form model of construction supply for the United States as well as for a number of other economies with relatively large REIT markets. In the US case we find fairly strong and robust evidence that REITs exerted a price-independent moderating effect on the supply response. Although we document that the supply response across most commercial property markets around the globe has moderated in the last 10 to 15 years, we only find weak evidence of a similar REIT-market penetration effect in other economies. Part of the difference is likely to be due to the paucity of data available outside the United States.

Based on our cross-country analysis, we believe an additional reason for the differing results is structural differences in how REIT and commercial property markets operate. For example, in many commercial property markets around the world, it is true that the best assets are held privately by the most experienced and well-connected owner-managers. This is not the case in the United States, where the best human and physical capital is disproportionately concentrated in the listed REIT market. Moreover, the structure of non-US REITs is often relatively opaque, with external management and complicated business models. US REITs in contrast are primarily internally managed and have simple business models focused on investing in one property type (such as office or retail) only.

In summary, we conclude that financial plumbing matters with respect to the realised costs and benefits of securitisation. We show that substantial differences exist in the detailed structure of REIT markets around the world. And counter to the current fashion, we hold up US securitisation *vis-à-vis* commercial property equity interests as a model of a well-structured market that has helped allocate scarce resources efficiently. We make this claim about a sector that predictably boomed and busted every 15 years or so prior to the introduction of a viable and credible securitised equity market.

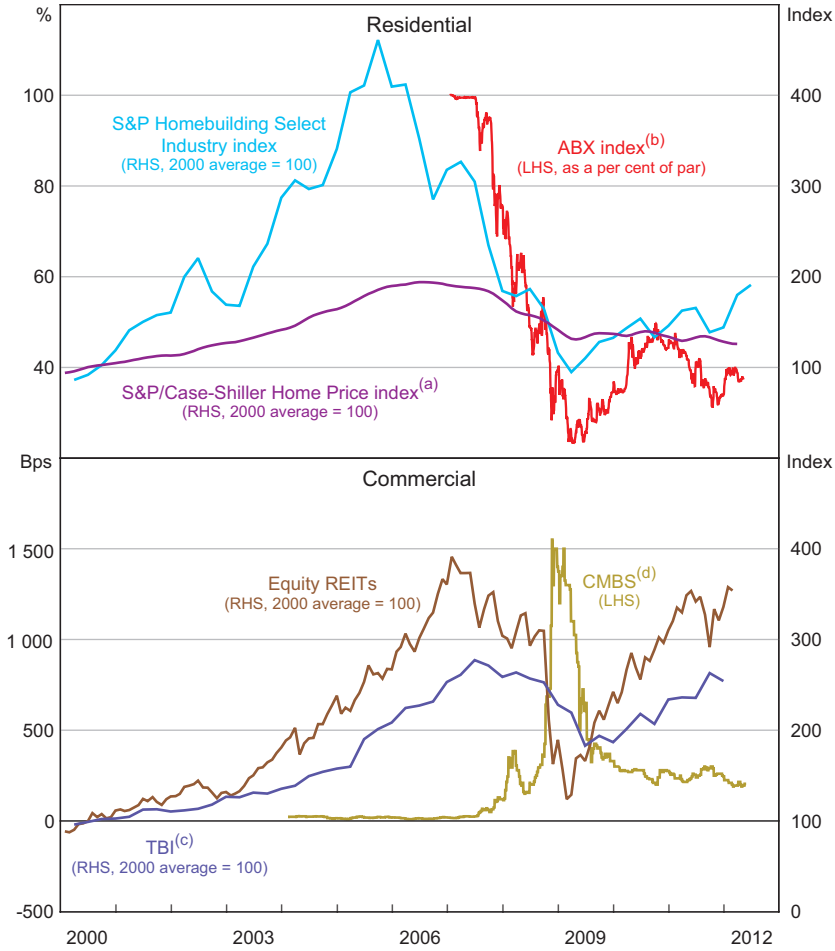
2 The US Real Estate Experience

2.1 A parallel bubble in residential and commercial property markets?

There is general agreement that the United States experienced a bubble in many prominent residential real estate markets in the five-plus years leading up to the financial market meltdown of 2007–2009. The bubble period was characterised by rapid increases in housing prices, together with substantial increases in the supply of homes. This boom was followed by a bust, characterised by steeply declining housing prices and persistent weakness in most housing markets around the country.

Although many analysts have focused their attention on problems associated with housing and the housing finance system, some have argued that there was a parallel bubble in commercial property markets in the United States (Ellis and Naughtin 2010; Levitin and Wachter 2012). The top panel of Figure 1 displays three price series pertaining to residential markets in the United States: an index of home builder share price performance; the aggregated Case-Shiller index of home prices; and a truncated index of credit default swap (CDS) prices on AAA-rated subprime RMBS (the so-called ABX index). The bottom panel displays a comparable set of price indices for commercial property in the United States: an index of REIT share prices; the transaction-based index of commercial property prices; and credit spreads on AAA-rated commercial mortgage-backed securities (CMBS).

Figure 1: United States – Property Markets



Notes: (a) Composite 20 cities
(b) ABX.HE.AAA.07-1
(c) Transaction based index, all properties total return – MIT Center for Real Estate Transaction-based Index up to 2011:Q1 and then NCREIF Transaction Based Index
(d) Commercial mortgage-backed securities, 5-year AAA-rated securities spreads to LIBOR

Sources: Bloomberg; JPMorgan Chase; MIT Center for Real Estate; National Association of Real Estate Investment Trusts (NAREIT); National Council of Real Estate Investment Fiduciaries (NCREIF); Thomson Reuters

An initial examination of the two sets of time series data suggests a similar boom-bust pattern in the housing and commercial property markets. For example, the home builder series shows that prices more than quadrupled from 2000 to late 2005, which was followed by a price decline of more than 75 per cent, with prices bottoming in early 2009. A similar pattern can be seen with commercial REIT index prices. The movements in the ABX and CMBS series are particularly dramatic. Residential ABX prices on AAA-rated bonds declined from a par value of 100 in early 2007 to just over 20 per cent of par in early 2009 (implying a required yield in excess of 40 per cent),

while AAA-rated CMBS credit spreads increased from about 30 basis points (0.3 per cent) to more than 1 500 basis points (15 per cent) over the same time frame.

A closer and more complete examination of these data, however, reveal significant differences. First, note that the home builder price index peaks in late 2005 and that Case-Shiller home prices peak around the middle of 2006. With hindsight we now know that these early peaks on the housing side signalled big troubles to come in the broader financial markets. This is more than a year before the commercial property market peaks, which shows these two markets were not as closely synchronised as some have suggested. It also means that the downward slide in commercial property prices was particularly sharp, as both markets hit a bottom in early 2009.

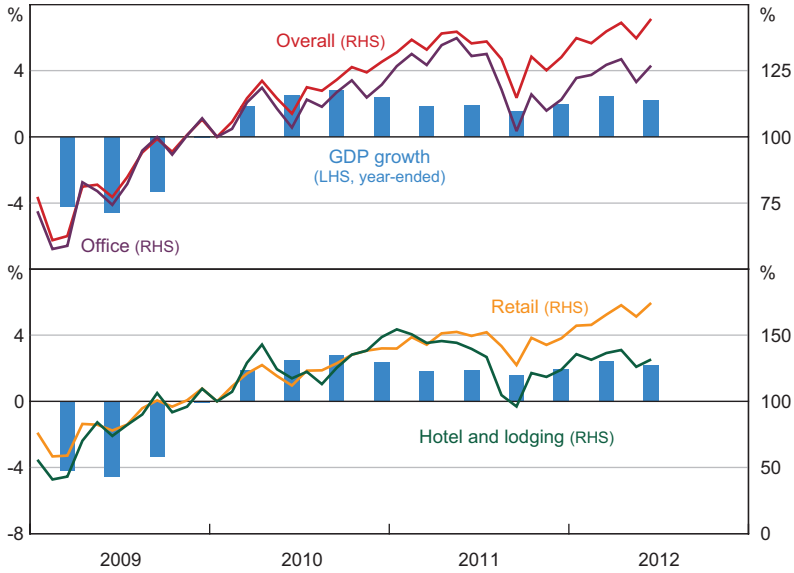
There is a second, more crucial difference between US housing and commercial property markets. Case-Shiller home prices have remained at their lows, while home builder and ABX price indices show what can best be described as a tepid recovery. In contrast, commercial property prices are seen to have almost fully recovered to their pre-crisis highs. Thus, while price declines were sharp on the commercial side of the property market, housing price declines have been more protracted and ultimately more severe. Most importantly, most housing markets are still not out of the woods, whereas many commercial property markets have moved well beyond crisis.

In the next sub-section we will begin to try to explain these differences, but at this point we would like to briefly comment on the nature of price bubbles. First, finding consensus on what constitutes a pricing bubble remains elusive, and there are some that maintain that there is no such thing. That said, there does seem to be fair agreement that there was a bubble in US housing markets (some markets more than others). This consensus has formed not because of the magnitude of housing price declines, but rather because housing prices have yet to start recovering four whole years after the full-scale financial market meltdown occurred. Assessments that there was a bubble on the commercial side, though made by several very well-respected economists, have been much less frequent. This seems to be because commercial property markets began to recover shortly after their early 2009 trough and have in a large part recovered to their pre-crisis levels. While we do not necessarily rule out the possibility that a bubble occurred in commercial property markets, we argue the bubble (if it happened) was something different and less severe than that which occurred in the housing markets.

2.2 What explains the post-crisis differences between housing and commercial property markets?

In our discussions with economists and industry professionals, we have heard a number of different rationales as to why commercial property markets have vastly outperformed housing markets since early 2009. Many of the proposed explanations have focused on differences in demand-side fundamentals in the two markets. Certainly rental housing, which constitutes the multi-family housing sector of commercial property markets, has benefited from a dysfunctional and highly uncertain housing market. But other important commercial property sectors, most notably office and retail, have also seen share prices rise in an economy with stubbornly high rates of unemployment and considerable softness in consumer spending (Figure 2). Even hotel property prices, which historically have had a close relationship to GDP growth due to their very short (daily) rental terms, have experienced sharp price increases while GDP growth has stagnated.

Figure 2: United States – REIT Prices and Output Growth



Note: REITs prices deflated by CPI inflation, January 2010 = 100
Sources: Thomson Reuters; national sources

We have also heard arguments that US commercial property, particularly higher-quality income-producing property in desirable locations, has benefited as investors seek investment safe havens during these times of accommodative monetary policy and general economic uncertainty. There is also a related argument that commercial property has benefited from a general shortage of low-risk, high-quality collateral availability, as commercial property offers durable assets with stable cash flow.[3] The latter argument begs the question as to why commercial property has done well relative to housing, since commercial property experienced the same kind of volatility and price declines that housing did from 2006 to early 2009. The safe-haven argument in our opinion has merit, but cannot by itself explain the very large differences in price performance between housing and commercial property since early 2009.

Another argument we have heard explains the differences in recent performance in terms of the relative ease of short selling commercial property through the REIT market relative to housing. For several reasons we believe that short selling can provide at best only a partial explanation. First, if true, we would not have expected to see the big increase in commercial property prices that some describe as a bubble prior to the onset of the financial crisis. Second, exchange-traded home builder shares have been around for a long time and can be shorted. More importantly, housing could be effectively and efficiently shorted through the development of CDS derivative indices on prime and subprime RMBS. Although these markets did not develop until the early to mid 2000s, they did provide investors the opportunity to short housing (as John Paulson did among others,

3 The general argument that some US assets have benefited from the demand of foreign investors because they are perceived to be safe has been made by Caballero and Krishnamurthy (2009), as well as Bernanke *et al* (2011). Discussion specifically about demand for AAA-rated MBS securities can be found in Diamond and Rajan (2009). Anecdotal discussion on the strength of prime commercial property as an investment class can be found in Palmer (2011).

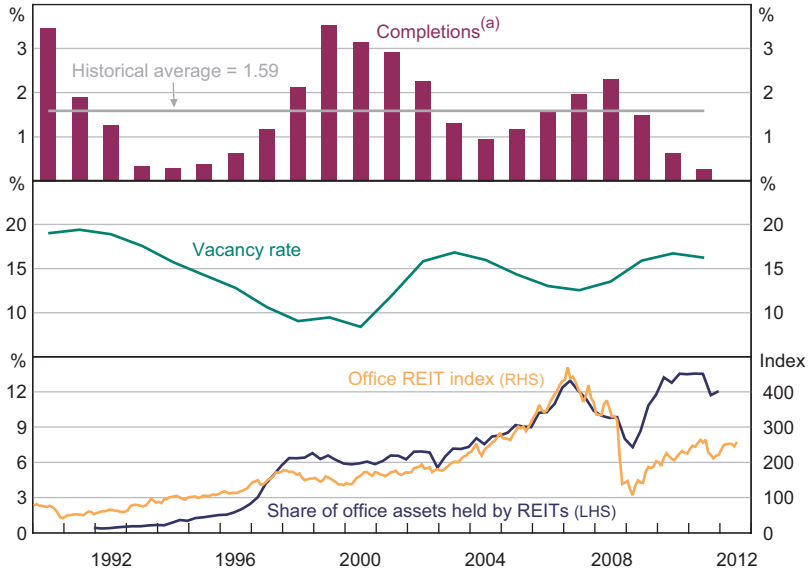
as famously described in Lewis (2010)). Shorting housing through CDS markets is indeed part of the reason why the peak and subsequent downturn in housing security prices happened well ahead of the analogous turning point in commercial property prices.

What about supply-side rationales for the post-crisis performance differentials? We believe that a focus on the supply side provides the key to understanding this issue. Benchmarking appropriate supply flows on the housing side is complex, however, as they depend on factors such as household formation, regulation and second home demand in addition to fundamental variables such as movements in mortgage rates and household income. There is no dispute among researchers, however, that there has been, and currently is, excess housing supply nationally, and that excess supply varies significantly across states. For example, Arizona, California, Florida and Nevada are typically cited as having experienced the biggest housing market boom and bust cycles. According to Wheaton (2012), these states house about 20 per cent of the population of the United States, but accounted for 30 per cent of the housing starts and mortgage loans in the United States in 2005, over 40 per cent of the second and investment homes in 2005, and 50 per cent of the foreclosures in 2009.

One simple way to express the housing oversupply problem is as follows. Over the last 40 years, annual construction has averaged close to 300 000 more units than new households. This incremental supply presumably reflects a steady state in second home growth and demolitions (or some other aspect of aggregate demand for housing). From 1998 to 2008 excess supply averaged approximately 600 000 units per year, implying an excess stock of about 3 million housing units in 2008. Since 2008 some of this excess stock has been absorbed, but estimates are that there is still 1.0 to 1.5 million too many housing units in the United States. As noted by Wheaton and Nechayev (2008) and Wheaton (2012), an overhang of foreclosed homes, declining rates of home ownership, and uncertainty as to policy direction make it unclear just how long it will take to absorb the remaining units (see also Blomquist (2012) on the effects of the shadow inventory of housing in the United States).

This is in contrast to commercial property markets, where new completions of office space as a percentage of the existing stock was about 3.5 per cent in 1990 (Figure 3, top panel). The 1990 start date occurs after the bust in commercial property prices, when the high rates of completion were due to construction lags. Going back to the mid to late 1980s, completions were around 9 per cent of stock. Notably, the skylines of many major US cities were reshaped in the late 1980s, including those of Atlanta, Boston, Dallas, Denver and Los Angeles. We observe completions falling almost to zero in 1994–1996, and increasing again in the late 1990s to early 2000s to peak at just above 3 per cent. Finally, a subdued supply cycle occurs during the mid 2000s, peaking at about 2 per cent in 2008. It is worth noting that similar analysis of other commercial property types, such as retail, multi-family and warehouse, shows similar, and often lower, levels of construction activity.

Figure 3: United States – Real Office Property Market



Note: (a) As a per cent of its total stock, beginning of the period
Sources: CBRE; SNL Financial; Thomson Reuters; authors' calculations

Excluding 1990 on the basis that it reflects residual construction momentum from the go-go years of the mid 1980s, we see that from 1991 to 2011 new office construction averaged around 1.5 per cent of the existing stock, with local peaks in 1999 and 2008 at 3.5 and 2.3 per cent, respectively. It has been estimated that office space depreciates by 1.5 to 2.0 per cent per year (Fisher *et al* 2005), implying that over the most recent 21-year period, the supply of office products has remained in balance. Crucially, during the frothiest part of the housing price and construction boom from 2002 to 2008, there was no analogous boom on the commercial property side of the market. Rather, office property construction activity from 2002 to 2008 was quite modest, in the 1 to 2 per cent range.

Large and persistent differences in the supply response to a dual asset price boom therefore helps explain performance differentials since early 2009. Housing is still dealing with inventory overhang problems, while commercial property markets were appropriately (or some would argue, under-) supplied. This then begs the question of why all the supply was in housing, but not in commercial property. On the housing side, many commentators have focused on mortgage-market capital flows, ineffective and distortionary bank regulation and accommodative housing policy as underlying causal factors for the boom. But capital flows and bank regulation affected commercial property markets as well, suggesting that housing policy may have been particularly important in distorting that market.

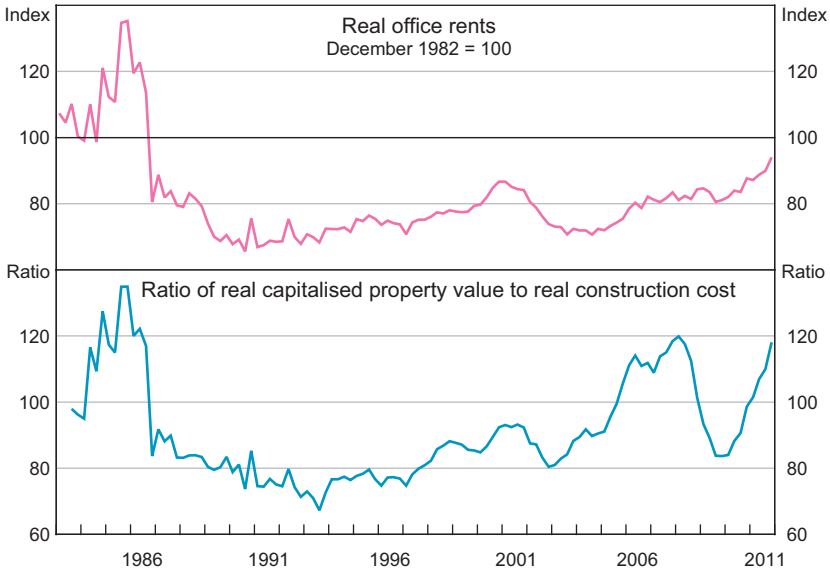
The focus in our view should not be on explaining the supply response on the housing side, which was not surprising given surging housing prices and tsunami-like capital flows that occurred in RMBS markets, but rather on why the commercial supply side was so muted in the face of similar

asset price and capital flow increases. Based on our discussions with real estate economists and industry specialists, we can offer three explanations.

One rationale we have heard from several sources is that the severe bust that occurred in the late 1980s and early 1990s was still fresh in the collective memories of market participants (see also Zhu (2002)). This explanation has some merit, but begs the question of why things were different this time when in the past commercial property markets in the US predictably blew up every 15 years or so.

A second rationale we have heard is that the financial crisis saved the commercial property market as it was just gearing up for a real estate development party. The argument, in other words, is that commercial property rents never recovered to their mid 1980s levels, implying that land was simply not ripe for significant new development during the mid 2000s. This argument can be assessed by comparing asset prices for existing buildings to the cost of construction. The top panel of Figure 4 shows that real office rents (net operating income) peaked in the mid 1980s, declining precipitously thereafter. In fact, real rents have never recovered to their mid 1980s values. This lends considerable support to the 'not ripe for development' argument. But the values seen in the bottom panel of Figure 4 show the ratio of office property values to cost approached those of the mid 1980s, when national completions as a percentage of stock in the late 1980s exceeded 8 per cent. By contrast, completions remained below 2.5 per cent of the existing stock throughout the mid to late 2000s.

Figure 4: United States – Real Office Property Rents and Construction Costs
Deflated by CPI inflation



Sources: Marshall & Swift; NCREIF; national sources

Although the 'not ripe for development' story is undoubtedly an important reason why commercial property development has remained in check, we believe that, given the very low realised rates of development achieved during the frothiest financing market in decades, something more is going on. This causes us to consider a third rationale that is unique to this paper. Our conjecture relies on the existence of the REIT market as a moderating influence on supply response in the face of high asset prices. In this market, investors and other market participants discover prices quickly and without substantial bias. Firms are transparent, and are covered by industry analysts as well as rating agencies in a fashion that conveys information about current commercial property market conditions. Exchange-traded shares induce significant volatility into listed share prices, which may give market participants pause when contemplating resource allocation decisions that affect the supply of extremely durable commercial space in local markets.

We will examine the US REIT market and this conjecture in more detail in Section 3. Our conjecture also depends on the fact that this market did not become viable and credible until the 1990s, which can explain why this time was different in terms of the muted supply response. We maintain that similarly 'viable and credible' information sources did not exist on the housing side. The home builder index was not widely followed, and neither did the broader investment and policymaking community pay close attention to what the newly developed ABX-CDS markets were saying about housing and the broader economy until it was too late.

3. Development, Structure and Performance of the US and other REIT Markets

In this section, as background, we provide historical and institutional detail that is relevant to understanding the development of the REIT markets, both in the United States and in the other major REIT markets around the world. We provide this information in order to explain the key characteristics of REITs, the degree to which REIT markets differ from one another, and how it is that REITs might have had a moderating influence on the allocation of real investment capital in some cases.

3.1 The US REIT market

3.1.1 History and development

REITs were created in the United States in 1960 as a way for individuals to invest in commercial property and as a new channel for income-producing property owners and developers to access capital. REITs are trusts, and as such do not pay taxes at the entity level as long as certain requirements are met. The most important rules are that: (i) the REIT distributes most (currently at least 90 per cent) of its net income to shareholders; (ii) it operates as a mono-line company in terms of owning only equity or debt interests in real property; (iii) the ownership of traded shares in the company cannot exceed concentration thresholds; and (iv) the firm does not operate as a broker-dealer in terms of buying and then selling real estate interests too frequently.

The REIT market grew very slowly during the 1960s, and was effectively ignored by most commercial property market participants. Commercial property in the United States was almost exclusively held by small local operators over this period. Financing sources were primarily

insurance companies and commercial banks. Commercial property markets predictably boomed and busted every 15 years or so. For example, the 1950s was a boom period that witnessed substantial increases in supply. This was followed by a bust in the early to mid 1960s, which was then followed by another burst of growth in the late 1960s and early 1970s, followed by a crash in the mid 1970s. Mortgage REITs (REITs that hold secured debt interests in commercial property) contributed to the boom and bust of the 1970s by supplying cheap and easy construction finance as closely held subsidiaries of development firms or commercial banks.

The bust of the 1970s gave the entire REIT sector a black eye, creating suspicion that the REIT structure was flawed, and that advisers and other agents associated with REITs were conflicted and incompetent (or worse). From that time until the early 1990s, REITs were a backwater with almost no growth or visibility in the commercial property investment community. For example, United States equity REITs, which are REITs that hold ownership interests in income-producing property (and are the focus of our analysis), had a total equity market capitalisation of only US$10 billion in 1990. This represented a market share of less than 1 per cent in the 'investable' US commercial property market, estimated to be more than US$2 trillion in aggregate.

Details associated with the savings and loan (S&L) debacle of the 1980s are well documented.[4] The important aspects of the episode for our purposes are that problems were concentrated with relatively small banks, some larger insurance companies, and privately owned commercial property firms. As a result of getting branded as shady operators in the 1970s, equity REITs (hereafter simply REITs) did not have much access to capital markets and consequently did not participate in the boom of the 1980s. Wall Street was also not very focused on commercial real estate securitisation at that time. Thus, REITs and Wall Street generally sidestepped problems associated with the S&L debacle.

In contrast, private property owners experienced 'equal opportunity' financial distress, in the sense that private owners, large and small, competent and incompetent, had serious financial issues to contend with. Assistance would not be forthcoming from traditional financing sources, as they were completely sidelined, dealing with problems of their own. In sum, by the late 1980s there were serious liquidity problems in a sector that needed to recapitalise in the worst way.

Wall Street responded by taking an off-the-shelf investment vehicle – the REIT – and using it to securitise real estate ownership interests. The reorganised firm could then access the broader capital markets – a new source of liquidity that was relatively unaffected by the S&L debacle – in order to recapitalise.[5] The linchpin to this scheme was that a newly formed REIT with access to capital could snap up distressed assets at fire sale prices from owners that had no such access to capital. Having access to liquidity when the rest of the sector had none implied significant growth opportunities, which lowered the cost of equity capital and increased initial public offering (IPO) proceeds. So great were the growth opportunities that IPO proceeds were generally enough to satisfy existing debt obligations, with money left over to fund new investment.

4 For an insightful as well as entertaining analysis of the S&L crisis from a Wall Street perspective, see Lewis (1989).

5 Wall Street not only brought liquidity to the cash-starved commercial property sector through REITs, but also through the securitisation of debt interests *vis-à-vis* CMBS. Wall Street benefited immensely by buying cheap mortgage assets, pooling the debt, and then carving up the cash flows into various security interests with issuance proceeds that far exceeded the cost of buying the mortgage loans. Wall Street also charged very high up-front fees in the early days of the CMBS market. REITs were immensely profitable for Wall Street firms due to the large number of sponsored IPO's as well as the constant need for these firms to do follow-on equity offerings to fund new investment.

Nonetheless, potential investors were wary of REITs due to previously discussed reputational problems. This caused investment banking firms to focus their efforts on only taking public the better-managed firms that owned higher-quality assets. This fact is critically important, as it laid the foundation for a sector that was credible, in the sense of having some of the best available talent to manage these firms, with a balance sheet that typically contained better-quality assets in better locations. As will be discussed later in this paper, it is not always the case that the best talent and assets are part of the REIT sector in other countries.

Two other factors were important in terms of incentivising distressed owners to contribute their best assets to a REIT investment vehicle. One was that REIT rules were changed in 1986 to allow for internal management. This in effect made REITs viable going concerns, whereas the previous structure that allowed only external management made them more like a static pooled asset fund. The second is that tax rules were relaxed so that privately owned assets with a low accounting cost basis could be contributed to a REIT without immediately incurring a capital gains tax liability. Firms that used this structure are referred to as 'Umbrella Partnership' REITs, or UPREITs.

3.1.2 Structure and performance

This series of events created a REIT IPO boom in the United States that lasted from 1991 to the mid 1990s. Equity capitalisation of the sector increased more than tenfold during this five-year period, going from US$10 billion to over US$100 billion. Some of the most important and best-performing REITs that operate today went public in this time window. Publicly traded REITs have, over the past 20 years, easily outperformed the S&P 500 (with a β of less than unity). US REITs have also outperformed indices of privately owned commercial property by about 3 per cent per year on a leverage-adjusted basis.[6] Today total REIT equity market capitalisation is approximately US$500 billion, representing approximately 15 per cent of the total investable commercial property available in the United States (Table 1). Despite this relatively low market share, REITs exert a disproportionate influence on US commercial property markets, partly because a disproportionate amount of the talent and better quality assets reside in the REIT sector.

6 For a comparison of private versus publicly held asset investment performance between 1980 and 1998, see Riddiough, Moriarty and Yeatman (2005). More recently, according to the table of the 'Historical Compound Annual Net Total Returns of REITS and Private Equity Real Estate' (http://www.reit.com/DataAndResearch/ResearchResources.aspx), the total return on equity REITs over the last 10 years has been 9.88 per cent, while that of unlevered core properties (NPI) has been 6.96 per cent. For a study documenting that most real value in REITs was created for US investors during the new REIT era that began around 1992, see Ott, Riddiough and Yi (2005).

Table 1: Major REIT Markets – Market Characteristics
(*continued next page*)

	North America		Europe				
	US	CA	BE	DE	FR	GB	NL
Mkt cap –US$b	446.8	38.1	7.8	1.9	71.7	44.1	12.0
% of global REIT mkt	54.8	4.7	1.0	0.2	8.8	5.4	1.5
% of country mkt	3.0	2.1	3.0	0.1	3.6	1.4	2.5
IPO vol (2001–2010)	21.3	2.0	0.2		1.6	0.9	
Returns – %							
REITs (2002–2007)	13.2	11.3	7.1		43.0		16.0
Net of mkt	3.5	–3.1	–6.7		31.2		9.0
Net of pr co[(a)]	–14.1	–9.0	1.7		17.8		4.4
REITs (2007–2012)	–3.0	2.2	–4.5	–20.5	–8.6	–15.0	–13.8
Net of mkt	–1.0	5.9	5.1	–12.4	2.9	–11.3	–1.5
Net of pr co[(a)]	–0.1	7.2	0.6	–9.2	11.7	6.5	0.8
REITs (peak to trough)	–75.6	–58.9	–42.4	–88.3	–68.2	–81.5	–69.2
Volatility – %							
REITs (2002–2007)	2.3	2.0	1.4	8.7	3.6		2.0
Mkt	1.8	1.6	2.1	2.3	2.2		2.4
Pr co[(a)]	2.9	2.0	1.0	2.5	1.6		1.7
REITs (2007–2012)	5.2	3.3	2.6	7.7	3.6	4.6	4.4
Mkt	3.3	3.2	3.6	3.6	3.6	3.3	3.8
Pr co[(a)]	7.2	4.6	1.7	2.7	4.5	4.8	5.1
Correlation[(b)]							
REITs (2002–2007)	0.55	0.32	0.18	0.11	0.14	na	0.34
REITs (2007–2012)	0.83	0.62	0.55	0.34	0.77	0.71	0.73
Pr co (2007–2012)[(a)]	0.78	0.69	0.33	0.59	0.59	0.62	0.47
Beta[(c)]							
REITs (2002–2007)	0.67	0.54	0.12	0.57	0.24	na	0.32
REITs (2007–2012)	1.32	0.69	0.45	1.17	0.88	1.08	0.88
Pr co (2007–2012)[(a)]	1.74	0.94	0.28	0.56	0.96	1.10	0.74
Mkt share of office REITs (2011)[(d)] – %	12.1	na	9.1	2.3	2.7	5.8	5.8

Table 1: Major REIT Markets – Market Characteristics
(*continued*)

	Asia-Pacific						
	AU	HK[e]	JP	KR	MY[e]	SG[e]	TH[e]
Mkt cap – US$b	80.4	16.8	42.1	0.3	4.0	32.1	0.6
% of global REIT mkt	9.9	2.1	5.2	0.0	0.5	3.9	0.1
% of country mkt	6.5	1.1	1.2	0.0	1.1	6.1	
IPO vol (2001–2010)	5.8	4.8	15.5	0.7	1.3	5.6	1.9
Returns – %							
REITs (2002–2007)	8.9	29.2	20.1	12.0		34.0	1.2
Net of mkt	–5.2	–1.3	8.6	–5.3		7.8	–10.1
Net of pr co[a]	–1.9	–7.5	–7.8			–19.1	–2.0
REITs (2007–2012)	–17.1	8.7	–16.2	–2.0	20.3	–9.3	0.5
Net of mkt	–9.1	11.4	–1.1	–3.6	9.1	–5.8	–8.2
Net of pr co[a]	0.4	13.9	2.3		4.4	1.5	–3.9
REITs (peak to trough)	–77.1	–38.5	–71.0	–43.7		–73.8	–14.0
Volatility – %							
REITs (2002–2007)	1.6	3.0	1.8	6.1		2.4	1.5
Mkt	1.3	1.8	2.3	3.2		1.7	2.9
Pr co[a]	1.6	2.5	4.1			2.5	4.7
REITs (2007–2012)	4.3	3.3	4.5	6.9	1.8	4.1	1.4
Mkt	3.0	3.7	3.2	3.8	1.5	3.1	3.7
Pr co[a]	4.3	5.1	5.6		2.9	4.1	6.0
Correlation[b]							
REITs (2002–2007)	0.56	0.28	0.23	0.39	na	0.55	0.11
REITs (2007–2012)	0.66	0.47	0.63	0.29	0.32	0.70	0.16
Pr co (2007–2012)[a]	0.67	0.92	0.82	na	0.73	0.87	0.68
Beta[c]							
REITs (2002–2007)	0.53	0.36	0.16	0.85	na	0.80	0.12
REITs (2007–2012)	0.91	0.42	0.94	0.77	0.51	1.03	0.03
Pr co (2007–2012)[a]	0.93	1.17	1.46	na	1.26	1.15	1.21
Mkt share of office REITs (2011)[d] – %	18.9	2.3	3.4	na	na	na	na

Notes: See Glossary for a listing of country codes
(a) Comparable index for listed property developers
(b) Correlations of daily logarithmic changes of the price indices
(c) Beta estimates of simple regression of return on various assets classes on return on market
(d) Share of office space held by office REITs
(e) Due to availability of the data, sample periods for Hong Kong SAR, Malaysia, Singapore and Thailand start on 25 November 2005, 7 July 2010, 28 July 2005 and 19 November 2003, respectively

Sources: Bloomberg; CBRE; EPRA (2011); Thomson Reuters; authors' calculations

Of all the operating and financing restrictions placed on REITs, including those listed in Table 2, which collates aspects of the institutional framework of REITs globally, the dividend payout requirement is probably the most important. This restriction causes firms to distribute a high percentage of available cash flow (typically more than 60 per cent and often more than 70 per cent) as dividends to shareholders. Consequently, REITs can be characterised as cash constrained relative to industrial corporations that do not have any formal obligation to distribute available cash flow to shareholders. The payout requirement causes high-growth REITs to return to the capital markets on a frequent basis to raise money for investment purposes. Doing so imposes a discipline on management, in the sense that there is relatively little free cash flow available to fund new investment (Jensen 1986). Rather, managers of active firms must go out on roadshows with their investment bankers in order to convince outside investors to contribute capital to their firm.

Another important aspect of being publicly traded is that access to equity capital markets allows REITs to operate at lower leverage levels than private firms. Private firms often have difficulty in sourcing reasonably priced outside equity capital, and instead typically rely on mortgage debt with loan-to-value ratios exceeding 70 per cent. In contrast, most REITs operate with leverage ratios of less than 50 per cent. Less leverage had beneficial effects during the financial crisis, as there were only a small number of REIT bankruptcies (two or three) in a sector with well over 100 listed firms. Less leverage and financial distress among REITs undoubtedly contributed to the swift rebound in REIT prices after early 2009, whereas widespread financial distress is still haunting housing markets around the United States.

What are some of the other factors leading to the disproportionate influence of the REIT sector on commercial property markets? As publicly traded firms, there are more formal governance mechanisms in place, quarterly financial reporting, analyst calls and reports, any number of commentators featured in the media, and a general level of transparency that imposes a discipline on management. And perhaps most important of all is the price discovery that occurs through exchange-traded share prices. This information, which can also create a great deal of share price volatility, is a public good that is made available to all market participants. When market participants pay attention to these price signals and incorporate them into their day-to-day investment and financing decisions, they can, we conjecture, have a moderating influence on boom-bust tendencies in markets. For example, if new office construction is announced for Washington DC, and share prices of REITs that hold office property in Washington DC react negatively, this sends a signal to construction lenders and other market participants that the additional supply of office space may negatively affect rents going forward. This in turn may constrain additional construction lending. In contrast, private ownership markets only provide information with a time lag, implying that capital misallocations can persist for longer periods of time and result in boom-bust outcomes.

Table 2: Major REIT Markets – Size and Institutional Framework

	North America		Europe				
	US	CA	BE	DE	FR	GB	NL
Year first listed	1961	1994	1995	2007	2003	2007	1969
No of REITs	179	35	14	4	43	18	7
Mkt cap – US$b	446.8	38.1	7.8	1.9	71.7	44.1	12.0
Required real estate holdings – %	75	95	None	75	80	75	90
Required dividend payout – %	90	100	80	90	85	90	100
Leverage constraint – %	None	None	65	55	None	None	60
Management structure	Mostly internal	Mostly internal	Mostly internal	Internal	Internal	Mostly internal	Internal
Institutional holdings (2010) – %	67.4	29.7	31.0	7.9	26.9	96.2	na
	Asia-Pacific						
	AU	HK	JP	KR	MY	SG	TH
Year first listed	1971	2005	2001	2002	2005	2002	2003
No of REITs	57	8	34	4	14	24	6
Mkt cap – US$b	80.4	16.8	42.1	0.3	4.0	32.1	0.6
Required real estate holdings – %	Any	100	75	70	75	70	75
Required dividend payout – %	100	90	90	90	90	90	90
Leverage constraint – %	None	45	55–60	66	50	60–70	10
Management structure	Both	Mostly external	External	Both	External	External	External
Institutional holdings (2010) – %	33.4	39.4	65.2	29.1	16.9	44.4	24.8

Note: See Glossary for a listing of country codes
Sources: Bloomberg; Chan, Chen and Wang (2012); EPRA (2011); Ooi and Har (2010); authors' calculations

3.2 Other REIT markets around the world

While the US experience is in many ways unique, other economies have gone to great lengths – particularly over the last decade – to develop their REIT markets. Table 2 compares the institutional framework of major REIT markets in North America, Europe and the Asia-Pacific.

3.2.1 Institutional characteristics

Age. The REIT experience in other economies is short-lived compared to that of the United States, with the exception of the Netherlands and Australia, where the first REITs were listed in 1969 and 1971, respectively. In the rest of Asia and the Pacific, REITs are a recent arrival: Hong Kong, Japanese, Malaysian, Singaporean and Thai REITs were first established between 2001 and 2005. In Europe, legislation enabled REITs in France in 2003, and as recently as 2007 in the United Kingdom and Germany.

Legal requirements. Certain legal requirements of REITs, such as restrictions on leverage, as well as enforcement of high dividend payout requirements, are generally shared across the Asian economies and are as strict or, if anything, stricter than those in Europe and the United States. For instance Hong Kong, Japan, Korea, Malaysia, Singapore and Thailand all have dividend payout requirements of at least 90 per cent in order to receive favourable tax treatment. The minimum is similar to that applied in the United States and European countries, though in the case of Australia the typical distribution is 100 per cent. Singapore, Hong Kong, Japan and Korea have roughly similar limits on leverage, though in the case of Singapore, there is room for increasing REIT leverage if credit ratings are obtained. In Japan, however, limits on leverage are more a question of traditional corporate practice (most Japanese REITs (J-REITs) specify 55–60 per cent in their articles of incorporation). In Europe, the French regime does not have a leverage restriction, while the UK regime has an interest coverage test. By contrast, in the United States, there is no statutory or regulatory leverage limit for REITs.

Other requirements, such as the share that must be invested in real estate to receive tax benefits are fairly similar across jurisdictions.

Management structure. As discussed above, many US REITS came under internal management when regulations were changed in 1986, although in a comprehensive sample of listed US equity REIT filings between 1987 and 2009 analysed by Deng, Hu and Srinivasan (2011), 20 per cent were still externally managed. One clear institutional distinction in Asia is the tendency to manage assets through an external adviser structure. However, as can be seen in Table 2, Europe is similar to the United States in having the internal adviser management structure. Only Australia among the listed Asia-Pacific economies has significant internal management, in large part due to the introduction of stapled REITS, where the asset management is carried out by an entity within the overall REIT structure.

The academic literature, which focuses mainly on the US experience, suggests that external adviser arrangements suffer agency costs because of conflicts of interest between the adviser and the shareholders. However, there may yet be countervailing benefits to the external REIT structure. Deng *et al* (2011) document more favourable loan contract terms and less stringent collateral requirements and covenants among externally managed REITs, which suggests that these REITs are viewed as significantly less informationally opaque than internally managed REITs. Given the prevalence of the externally managed REIT structure in Asia, it appears that, in the case of these economies, the benefits of external advisers outweigh the agency costs.

Institutional holdings. A distinctive feature of US REITs relative to their continental European and Canadian counterparts is their high level of institutional holdings. With the exception of the United Kingdom, institutional REIT holdings in Europe are relatively low: French and Belgian REITs

have institutional ownership of 15–20 per cent, while Germany's are less than 10 per cent. The percentage of institutional holdings in REITs in many Asian economies is quite high, ranging from 30 per cent in Korea to 40 per cent in Hong Kong and Singapore to around 60 per cent in Japan.

Are these differences in institutional features associated with the pricing performance of REITs at issuance? One of the stylised facts of the REIT literature is that the IPOs of REITs in Europe and the United States have been significantly more underpriced than those in the Asia-Pacific. One reason offered for this is that European and US REITs are internally managed and more operational in nature, while Asian REITs are externally managed and fund-like in nature (Chan *et al* 2012). However, there does not appear to be a relationship between the degree of underpricing of REIT IPOs and institutional holdings of REITs.

3.2.2 Market characteristics

Market capitalisation and IPO volumes. The United States dominates the international REIT landscape, with nearly 180 listed REITs amounting to US$447 billion, or more than half of total global REIT market capitalisation. Far behind that, yet well above any other economy, Australia has 57 listed REITs with US$80 billion market capitalisation, occupying 10 per cent of total REIT market capitalisation. The markets in Europe are still slightly bigger than those in emerging Asia, with French and UK REITs (43 and 18 each) respectively accounting for 9 per cent and 5 per cent of total market capitalisation. There are 34, 24 and 8 REITs in Japan, Singapore and Hong Kong, respectively, roughly accounting for 5, 4 and 2 per cent of total REIT market capitalisation.

Despite the rapid growth of Asian REIT markets in the 2000s, the United States has still maintained dominance in the flow of new capital coming into REITs via IPOs. Between 2001 and 2010, the United States had 80 REIT IPOs for a total value of around US$21 billion, Japan had 42 for a total value of US$15 billion, Singapore had 21 for a total value of US$6 billion, Australia had 38 for a total value of nearly US$6 billion and Hong Kong had 7 for a value of US$5 billion (Table 2; Chan *et al* 2012). In France, the numbers were far lower, with 16 IPOs with a value of US$1.5 billion, while in the United Kingdom 10 REITs went public for US$1 billion, and in Belgium 7 REITs raised US$300 million. Clearly, the US market remains the biggest, and in terms of new IPO flow, the Asian markets have overtaken many European markets in size.

Returns. Table 1 reports the return performance based on the national REIT indices for the major REIT markets in North America, Europe and the Asia-Pacific. We examine the past decade of returns in two periods between mid 2002 (when the J-REIT index first became available) and 2012. Up until mid 2007, REIT markets globally were quite robust, as were financial markets generally; from 2007 to 2012, REITs performed nowhere near as well, due both to the global financial crisis and the bust in real estate markets.

Most REIT markets performed extremely well in the first period, and illustrated a great deal of co-movement, peaking in mid 2007. For example, from 2002 to 2007, the J-REIT index rose by more than 20 per cent on an annualised basis, while returns in the US market were a robust 13 per cent. The Australian market was more subdued with annualised returns of 9 per cent. A few European markets also saw remarkable returns, with France at 43 per cent. We also see exceptional performance in the truncated (from 2005) cases of Hong Kong and Singapore, of

around 30 per cent annualised return. In the cases mentioned above, REITs outperformed their respective national stock market indices, with the exceptions of Australia and Hong Kong.

However, during the global financial crisis subsequent to mid 2007, national REIT indices were extremely weak. In Australia, Germany, Japan, the Netherlands, Singapore and the United Kingdom, negative annual return rates ranged between –9 and –21 per cent – declines that were well in excess of those of the respective broader market indices. In addition to the United States, as previously discussed, two other important exceptions were Canada and Hong Kong, where the recovery in real estate values after the short-lived crisis led to an annualised increase in the value of REITS over the period of almost 2 per cent and 9 per cent, respectively.

Volatility of REIT, broader market and developer returns. In addition to return, investors are also concerned with the risk of an asset class. It comes as little surprise that the standard deviation of weekly returns, or volatility, was strikingly higher for REITs after mid 2007 across almost all of the sample economies (Table 1).

One of the stylised facts based on the empirical literature on REITs over the past few decades, at least for those in Australia, Japan and the United States, is that the volatility of REIT share prices tends to be lower than that of the overall market (see Newell (2010) for Australia; Sawada (2008) for Japan and Chan, Erickson and Wang (2003) for the United States). To check whether that has still been the case over a period of generally increasing volatility, we examine the weekly standard deviation of returns for various national indices, including the REIT index.

In fact, it appears that over the past 10 years REITs have generally experienced higher volatility than the major benchmark equity indices. REIT indices for Australia, Canada, France, Germany, Japan, Korea, Malaysia, Singapore, the United Kingdom and the United States have all been significantly more volatile than the benchmark market indices. In the cases of Australian and US REITs, this is in contrast to the behaviour documented in previous studies. The only exceptions are Belgium, Hong Kong and Thailand. For Japanese and Dutch jurisdictions, the higher volatility of REIT returns is a post-crisis (2007 to 2012) phenomenon, since these REIT indices show lower volatility than their respective national indices when the earlier period (2002 to 2007) is examined in isolation.

That said, the volatility of national REIT indices is less than the comparable indices for listed property market developers in around half of the comparisons in Table 1. For example, while in Australia the volatility of REITs and listed developed developers is roughly equal, REIT indices are significantly less volatile than listed property market developer indices in Japan, Thailand and the United States. For a number of European countries (for example, France and the Netherlands), as well as Hong Kong, REIT indices showed greater volatility than property developer indices ahead of the crisis, but then became relatively less volatile after mid 2007.

Correlation and market betas. Commercial real estate is thought to have attractive portfolio diversification qualities because it has a relatively low correlation with stocks and bonds. But these correlations have increased in recent years, at least in part due to the systemic nature of the financial crisis. With this in mind, we examine the degree to which REITs across the globe are correlated with broader market indices, in particular around the onset of the financial crisis.[7] We

7 For recent work documenting the time-varying correlation of REIT returns and stock returns in the US context, see Fei, Ding and Deng (2010) and Case, Yang and Yildirim (2012).

also consider the correlation between REITs indices and those of listed property developers, a less regulated sector that is presumably less transparent and contains greater idiosyncratic risk.

Table 1 reports the correlation between the REIT price index and a benchmark equity price index for each economy, with the returns divided into two periods as before. One fact that immediately stands out is that the correlation coefficients between the REITs and market indices went up for almost all economies after 2007. In the pre-crisis period, some economies, such as Belgium and France, had extremely low correlations of around 15–20 per cent, which soared to 55 per cent and 77 per cent, respectively, following 2007.

Neither the marked increase nor the high correlation of REIT indices with the equity market are limited to a single region. After the United States, which has a correlation of 83 per cent in the latter period, the next six highest correlation coefficients include three for Europe and three for Asia and the Pacific.

Relative to listed property market developers, REITs in Asia show less correlation with the broader market, suggesting attractive diversification benefits to investors seeking property market exposure. In fact, this was the case without exception among Asian economies. Economies where the correlation of the REIT with the market is significantly lower than the correlation of listed property developers' index with the market included Hong Kong, Japan, Malaysia, Singapore and Thailand.[8] However, the two biggest REIT markets of Australia and the United States did not follow this pattern, with roughly equal correlations. In Europe, the correlations between REIT indices and the broader market were generally greater than those between listed property developers and the broader market indices.

Overall, it appears that while REITs do have some diversification benefits, they were greatly diminished during the financial crisis. This in turn suggests that the conclusions drawn from the declines in correlation that were documented in earlier periods (for instance, in Australia, the correlation was 0.24 between 1994 and 2006, compared with 0.71 between 1985 and 1992 (Newell 2010)) were perhaps overstated. The time-varying results are consistent with the increased sensitivity of REITs to small cap equity returns during market downturns documented in Clayton and MacKinnon (2001). At the same time, REITs sometimes show lower correlations compared with listed property developers – this is particularly the case for the Asian REIT markets in our sample.

Table 1 also reports the REIT market beta – the coefficient estimated when excess returns of the national REIT index are regressed on a constant plus excess returns to the national equity market index – and compares this to the market beta of listed property development companies. REIT betas are, in general, less than those of listed property developers. Interestingly, this is clearly the case for all of the Asian markets, Canada and the United States. For instance, while the market betas for Hong Kong, Japan, Malaysia and Thailand REITs are all well below one, the comparable betas for listed property development companies are all above one. By contrast, the market betas for some of the European listed property development companies are below those for the REITs, suggesting that European REITs may be operating with higher leverage than listed property developers, consistent with a recent report by an industry adviser (Kirby 2012). Just as they had

8 The lower sensitivity of Thai REITs to the broader market returns compared with those of Hong Kong and Singapore recalls Zhu's (2006) results for a sample of Asian economies, where those with less flexible housing markets showed less sensitivity of house prices to broader market conditions.

with the correlation coefficients, Australian REITs showed market betas which are quite similar to those for listed property developers.

REIT office market share. Finally, we see in Table 1 that there is considerable cross-country variation in the degree of the office market securitisation via REITs. In this respect Australia stands out, with the latest estimate of around 19 per cent of its office market securitised via REITs – though that number is well below the share of 32 per cent before the global financial crisis. The United States is the second most securitised office market via REITs, with around 12 per cent of the office market accounted for by REITs. Some European countries make up a third group close behind the United States – with Belgium, the Netherlands and the United Kingdom estimated to have between 5 and 9 per cent of their office market securitised by REITs. Hong Kong and Japan join Germany and France in a group of economies with relatively less securitised office markets.

4. Office Supply Dynamics around the World: An Overview

In this section, we complement our earlier discussion of US office supply by examining the dynamics of office supply in selected European and Asian economies using data purchased from CBRE, alongside the price of prime office properties as suggested by REITs. We also use these data to construct a time series of REIT office market share.

Seven of the thirteen sample economies have construction data going back to the early 1990s. In the case of Japan the data go back to the late 1990s. For the remaining five economies, three of which are from Asia (Hong Kong, Korea and Thailand), construction data go back less than 10 years. In all of the sample economies, with the exception of Australia and the United States, neither the REIT index data nor the market share data go back beyond 2000. In five economies these data do not exist before 2005. In the case of the REIT indices, these constraints reflect the relative youth of the REIT markets.

The completion data suggest that, at least for those countries for which we have 20 or more years of data, the commercial property cycle has been much more subdued over the past 15 years. In the United States, as discussed previously, the peaks of net new supply of commercial office property over the past 20 years – 3.5 per cent in 1999 and 2.3 per cent in 2008 – were well below the peaks of the 1980s when completions occasionally exceeded 10 per cent of stock. In Australia, Canada, France, Singapore and the United Kingdom, net new supply offered in the early 1990s clearly exceed the peaks of later cycles, and the troughs in net new supply that followed were lower and longer lasting than those seen later. The Tokyo data from CBRE do not predate 1998, but from government data we know that annual investment in private sector (non-manufacturing) building construction between 1990 and 1992 exceeded that of 2002 and 2003 – the peak of Tokyo office construction over the past decade – by a factor of nearly three.

Vacancy rates tell the same story. As noted in Ellis and Naughtin (2010), vacancy rates can stay elevated well beyond the end of an economic downturn. This is because of the lags in commercial property construction and the time it takes for excess supply to be absorbed by the market. Vacancy rates in Australia, Canada, France, the United Kingdom and the United States remained high for a long period after the 1980s boom, hitting a peak over the past 21 years in the early to mid 1990s (see Figures 3, 5, 6 and 7 for the United States, Australia, Japan and France, and Appendix B for Canada and the United Kingdom).

Office construction cycles appear to be correlated across the country samples, but only imperfectly. Focusing on the last 10 years and the larger sample, there is some tendency for construction to peak around the financial crisis, but not exclusively so. The office construction completions of Hong Kong, Korea, Singapore and the United States all peaked in 2007–2008, while those in Canada and France peaked in 2009. However, in the same decade Australia, Germany, Japan (Tokyo) and the United Kingdom peaked well before the financial crisis in 2003–2004.

By contrast, the price of prime office real estate, as captured by REIT indices, is much more highly correlated across economies. All of the office REIT indices in the sample topped out around mid 2007, and most bottomed out in early 2009. The fall was sharp just about everywhere, with REIT markets collapsing by between approximately 60 per cent and 75 per cent in eight cases, and by more than that in two others. What has differed somewhat, however, has been the extent of the recovery from the collapse, with a minority of economies recovering significantly more than the others. While Germany and Singapore have gained back around half of the losses, Canada close to 100 per cent, and Hong Kong more than 100 per cent, all the other REIT markets in the sample (other than the United States) have stagnated since the collapse, gaining back only a small fraction or none of the losses.

Figures 3, 5, 6 and 7, and those in Appendix B also make clear that the penetration of REITs has not increased steadily. In the case of the United States, Australia, Japan, France, the Netherlands and the United Kingdom, REIT penetration declined during the sharp fall in prime office valuations after mid 2007. This suggests the valuation of assets securitised by REITs had fallen more than other office assets during the sell-off period. Such a pattern was not invariably the case, however: in Belgium and Germany, REIT share penetration measures rose even when REIT indices were declining in the late 2000s; and in Hong Kong, the degree of REIT penetration seems to have been inversely related to office real estate pricing.

5. Testing the REIT Market Penetration Conjecture

In this section we provide a formal empirical test of our conjecture that in the United States the presence of the REIT sector may have influenced commercial property construction activity. We also apply the test to a selected small sample of other economies with the largest REIT markets outside of the United States.

The baseline model we have in mind reflects the intuition expressed in our analysis of how the value of income-producing real estate compares with the cost of construction. In this model the propensity to develop new property increases when built property value increases relative to construction cost.[9] The standard reduced-form supply relationship is as follows (DiPasquale and Wheaton 1996):

$$S = f(P,C)$$

where S denotes the supply of new space, P is the value of built income-producing property and C is construction cost. In this model asset price, P, is a sufficient statistic that summarises relevant space and financial market conditions, such as the vacancy rate, relevant government policies,

9 An alternative formulation would be to examine the ratio of price to net asset value of REIT markets, that is, Tobin's Q. Since REIT markets were not fully developed in each jurisdiction under review, we consider this, more general, formulation, where construction costs are presumed to proxy for replacement value.

the expected growth rate in cash flows and the risk-adjusted discount rate applied to valuing expected future cash flows.

We augment the standard model in an attempt to identify the conjectured REIT market effect. Recall that we argued that a central reason why the REIT market tempered oversupply tendencies, while analogous markets on the housing side did not, is that commercial property market participants consider information contained in REIT share prices to be informative and therefore relevant when making investment and financing decisions. That is, we hypothesise that the mere existence of REIT share prices alone is not sufficient to moderate construction activity. Rather, we conjecture that an additional necessary condition is that market participants actually pay attention to the information content of prices and consider them to be relevant.

With this logic in mind, we propose to include REIT market penetration M – the degree to which the office market has been securitised via REITS – as a proxy for relevance of REITs to the broader market. REIT market share is calculated as the value of commercial property held by REITs relative to the total value of all commercial property. The augmented specification is therefore:

$$S = f(P,C,M)$$

After controlling for built-property prices and construction cost, the expected relationship between REIT market share and supply depends on whether we are in boom or bust periods. By this we mean that REIT market share, as a proxy for attention and relevance, is hypothesised to mitigate construction boom tendencies by reducing supply responses when asset prices rise. By contrast, when asset prices decline, the REIT market share effect is expected to be positive; that is it ameliorates the declines in supply that would otherwise occur in response to asset prices and construction costs.

5.1 Specification and specification tests

As a starting point we recognise that there are various types of income-producing property. These property types respond differently to movements in macroeconomic variables that determine the demand for space. For example, the demand for office space is most responsive to white-collar employment, while the demand for apartment space depends on factors such as home ownership rates, demographics and immigration. Because of this we will focus most of our attention for the rest of this paper on the office property market. The office sector is perhaps the most important commercial property type, in that it is large and has historically shown a propensity to boom and bust more than other property types (in the United States and elsewhere).[10] Even more critically for our immediate purposes, there are simply better and more complete data available on office property across economies.

The regressions are run using quarterly data to 2011:Q4, and begin at different points depending on the economy and specification. The dependent variable in our analysis is the change in the log of new completions of office space, as obtained from CBRE, measured in thousands of square feet. (Tables 3 and 4 indicate regression specifications; Appendix A contains a description of the variables and their sources.)

10 At the same time, office property investment tends to show less correlation with the broader economy than other forms of commercial property, show sluggishness of market adjustment, and be driven by longer-term investment oscillations (Wheaton 1999; Sivitanides, Torto and Wheaton 2003).

Reduced form explanatory variables are derived as follows. We use two alternative measures of the value of built income-producing property, *P*. The first comes from NCREIF, which provides an index of privately held office values. Because this measure relies in part upon appraised values in lieu of asset sales, it is known to suffer from appraisal-lagging and price-smoothing problems. Nevertheless, the index values are considered to be accurate barometers of office prices in the United States. The second measure is based on share prices of REITs that hold office property. REIT prices do not suffer from appraisal problems, but do potentially suffer from bias (and lower R^2 values) given that share prices reflect going concern values that differ from the net value of assets. Bias and noise may also result from share price movements based on capital market dynamics that are unrelated to commercial property market fundamentals. Nominal indexed office prices are converted into real values using the relevant CPI.

Construction costs come from Marshall & Swift's index of nominal unit construction costs, and are a simple average of eastern, central and western regions' costs for fireproof steel-frame buildings. These nominal average cost numbers are again converted to real costs using the CPI.

We develop three measures of REIT market penetration. The first is the sum of the book value of debt and preferred stock plus the market capitalisation of equity for listed REITs, all as a percentage of the investment value of the total stock of office space at its reported market value. Because this first measure uses REIT share prices, it will be correlated with the REIT price variable used to measure commercial asset values. This leads us to develop two other measures of REIT market share that depend on asset book value. The second measure is the net property investment of listed REITs at book value as a percentage of the investment value of the total stock of office space at its reported market value. The third measure is total real estate investment (see Appendix A) of listed REITs at book value as a percentage of the investment value of the total stock of office space at its reported market value. The REIT real estate investment data are obtained from quarterly financial statement filings accessed through SNL Financial. The investment value of the total stock of office space data is obtained from CBRE and is the multiple of the estimated total stock of office space in square feet in a given quarter and the average capitalised value of net office rents per square foot.

Finally, in order to consider the conjectured pricing effects of the REIT market on new supply, we create two dummy variables that are interacted with the REIT market share variable. One dummy variable equals 1 if in the current quarter the REIT price index exceeds that of the previous quarter, *Strong*, and the other dummy variable equals 1 if in the current quarter the REIT price index is less than that of the previous quarter, *Weak*.

For model estimation purposes, all variables are expressed as first differences except for the REIT market share variable, which is in levels because using first differences would change the economic meaning of market penetration as a measure of REITs' relevance and their ability to capture the attention of commercial property market participants. Asset price and construction cost variables are expressed as log differences. However, in the case of Australia, France and Japan, levels specifications are undertaken for the dependent and explanatory variables as the series are stationary and pass unit-root tests.

We also potentially include up to eight quarters of lags for all explanatory variables in recognition that it takes time to plan and build new office space. When lags are included, we present the sum

of the current value plus all lagged quarters, inclusive of all intermediate quarters.[11] The number of lags for any given variable is determined by maximising the adjusted R^2 jointly across all variables in the regression. To enhance comparability, the sum total of the current and lagged values is then divided by the number of lags plus one to produce an average quarterly value. Lastly we include a first-order autoregressive process in the specification of the error term to correct for residual serial correlation.

5.2 Estimation results for the United States

Estimation results for the United States are reported in Table 3. In column (1) of the table, we report estimates from the benchmark model that includes only asset price and construction cost as explanatory variables. Columns (2), (3) and (4) report specifications that include the three different REIT market penetration variables, described previously. As further robustness checks, daily volatility in asset prices of the previous quarter is included as an explanatory variable in column (5), and results using NCREIF asset price data instead of REIT price data are reported in column (6).

The benchmark model results reported in column (1) have variable coefficients of the expected signs and the coefficient on the asset price variable is statistically significant. The insignificance of the construction cost variable is similar to findings of other studies estimating commercial property supply equations in reduced form (see, for example, Holland, Ott and Riddiough (2000)). This result is often attributed to the aggregation in the Marshall & Swift index of construction cost. The number of quarterly lags in the price variable, *P*, is 7, which confirms that one to two year lags exist in property development (see also Ott *et al* (2008)). The estimates also imply that there is negative serial correlation in the error term if the correction is not applied. The Durbin-Watson statistics suggest that the models are not inappropriately specified in terms of their time series properties.

Now consider the comparative regression results reported in columns (2), (3) and (4), which incorporate REIT market share as a variable using the three different metrics discussed above. The results are generally consistent across the alternative measures, in that asset price and construction cost retain their signs and statistical (in)significance when compared with the benchmark model. Critically, we also see that the REIT market share coefficient is significant in rising markets. Given the negative sign on that coefficient, the economic interpretation is that REITs exert a significant moderating influence on the supply response in rising markets, and the strength of this moderating influence increases with market share. The positive coefficients on the REIT market share variable in falling markets are also consistent with a moderating influence on declines in construction supply, though those coefficients are not statistically significant.

11 For example, if five lags are included, the sum is composed of all lags up to the maximum of the fifth lag, plus the current value, for a total that includes six values.

Table 3: Regression Models for Construction Completions – United States

Sample period is 1994:Q1–2011:Q4 (72 observations)

	Models with REIT prices										Model with NCREIF index[a] (6)	
			Market share									
	Benchmark (1)		Definition 1 (2)		Definition 2 (3)		Definition 3 (4)		Volatility[a] (5)			
	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag
Constant	0.177** (0.083)		0.234** (0.099)		0.249** (0.102)		0.254** (0.101)		0.247** (0.103)		0.278*** (0.095)	
Sum of current and lagged ...												
ΔREIT_price	1.226** (0.164)	7	1.650** (0.655)	7	1.484** (0.686)	7	1.445** (0.694)	7	1.600** (0.741)	7		
ΔNCREIF index											3.838*** (1.212)	7
Δ*C* (constr cost)	−1.574 (2.265)	0	−1.088 (2.118)	0	−1.099 (2.096)	0	−1.126 (2.086)	0	−1.346 (2.116)	0	−2.379 (1.982)	0
mkt share x *Strong*			−0.026*** (0.009)	4	−0.038*** (0.013)	4	−0.035*** (0.011)	4	−0.038*** (0.013)	4	−0.029*** (0.011)	4
mkt share x *Weak*			0.018 (0.017)	4	0.019 (0.023)	4	0.017 (0.021)	4	0.012 (0.022)	4	0.014 (0.020)	4
Trading volatility of previous quarter									0.003 (0.006)			
ρ	−0.325*** (0.115)		−0.376*** (0.113)		−0.382*** (0.112)		−0.385*** (0.112)		−0.401*** (0.112)		−0.451*** (0.110)	
R^2	0.26		0.34		0.35		0.35		0.36		0.40	
Adjusted R^2	0.19		0.26		0.27		0.27		0.26		0.33	
s e of regression	0.32		0.30		0.30		0.30		0.30		0.29	
Durbin-Watson	1.96		2.04		2.06		2.07		2.10		2.17	

Notes: The dependent variable is the change in log square feet of construction completions for office. The regressors are change in the log REIT price index, change in the log NCREIF index, change in construction cost and the level of the three market shares as defined previously. The coefficients of seasonal dummies are not shown. Coefficient standard errors are in parentheses. *, ** and *** indicate statistical significance at at the 1, 5 and 10 per cent levels, respectively. ρ is the estimate of the coefficient of first-order autocorrelation in the error term.
(a) Market share is definition 3.

Given the relationship of the market share variable to REIT prices, it is conceivable that the significance of this variable is because it is picking up some non-linearity in the price effect. For example, it may be that agents that affect supply outcomes are reacting to the volatility in asset prices, along the lines of the impact of total uncertainty on commercial real estate investment documented in Holland *et al* (2000). As an additional robustness check, we add price volatility – calculated as the standard deviation of REIT index prices based on trailing daily returns realised during the previous quarter – to the specification in column (5). We find, however, that uncertainty has no statistical effect on supply outcomes; rather, its inclusion further strengthens the significance of the REIT market share variable. This suggests that something other than asset price volatility may be behind the REIT market share result.

As discussed above, the NCREIF data offer an alternative price index of office properties. Using this price variable does not change the main results (column (6)).

In summary, the results suggest that the conjectured REIT market share effect was operative over the sample period, in that the commercial property supply response in periods of high asset price returns was increasingly moderated as the share of assets held by REITs increased. The results are consistent with the view that increasing attention was paid to a sector with firms run by well-respected managers that owned higher quality assets, and that this attention had a moderating effect on the office construction supply cycle.

5.3 Estimation results for other countries

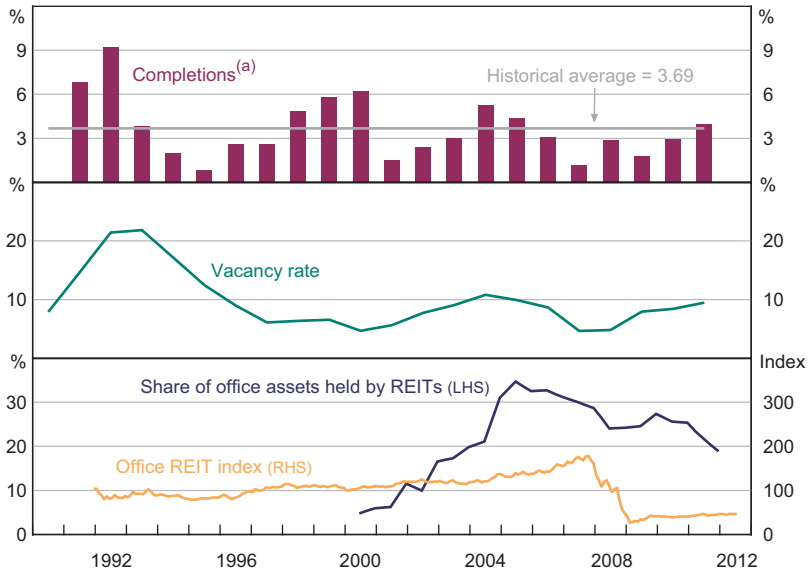
We also test the REIT market penetration conjecture for Australia, Japan and France by regressing new (office) construction completions on controls for office prices and construction cost, followed by the REIT market share variables. Before presenting the results, we briefly review the situation in each country.

Australia. The data for Australia go further back than for most other economies in the sample, to the tail end of the commercial property boom in the early 1990s. Construction completions in Sydney at that time were greater than the peaks of the two cycles that followed over the next two decades.

Australia is one of the oldest of non-US REIT markets and REITs there have had relatively significant penetration into the office market for a long time. Figure 5 demonstrates that the degree of securitisation of office markets via REITs increased markedly in the first half of the 2000s, rising from around 5 per cent in 2000 to over 35 per cent in 2005.

Indeed, Chan *et al* (2012) document a surge in Australian REITs coming to the market over that period, with 25 REIT IPOs amounting to US$3.3 billion. At the same time, there was a dramatic increase in so-called 'stapled' REITS, whereby the stock of the REIT was connected to the stock of the company that manages it. This effectively allows for an internal management structure that can take more property development risk, compared with the traditional limited property trust model in Australia that had involved external managers. According to Newell (2010), between 2004 and 2007, 'stapled' REITs grew from 29 per cent to over 75 per cent of the total capitalisation of Australian REITs.

Figure 5: Australia – Real Office Property Market
Sydney



Note: (a) As a per cent of its total stock, beginning of the period
Sources: Bloomberg; CBRE; SNL Financial; Thomson Reuters; authors' calculations

As was true across most economies, prices of prime properties as embedded in REITs fell from mid 2007, but the earlier rise in Australia had not been as dramatic. Between 2000 and 2007, the REIT index grew by around 70 per cent, a far cry from the many multiples of growth evident over the period in Canada, France, Japan, Singapore or even the United States. However, the collapse from June 2007 to March 2009 of around 75 per cent was among the sharpest of all the REIT markets under consideration in this study, and was much larger than the 50 per cent decline in the national stock market index over the same time period. At the same time, the share of properties securitised via REITs declined from above 30 per cent to around 20 per cent, largely reflecting the decline in the value of properties held by REITs relative to other more illiquid properties. By contrast, based on the movement of the ratio of construction completions to stock, the office construction cycle was not hit too hard by the decline in REIT prices for, by 2011, the completions ratio had snuck back over the 20-year average.

When we estimate the model of new construction completions for Australia, we find that the base case model with asset prices and construction fits fairly well – despite the regression having three fewer years of observations than in the United States. Nearly 30 per cent of the new construction is explained by the lagged asset price and construction cost variables (Table 4). Both explanatory variables have the right sign, and construction costs are significant. In the second reported specification, the asset price variable also becomes statistically significant.

The hypothesis that changes in the market share of securitised assets via REITs may have ameliorated the construction cycle is less strongly supported by the Australian data. Though the variables of the market share in boom versus bust periods have the signs that would be expected,

Table 4: Regression Models for Construction Completions – Other Countries

	Australia				Japan				France			
	Benchmark (1)		With share (2)		Benchmark (3)		With share (4)		Benchmark (5)		With share (6)	
	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag	Coeff	Lag
Constant	3.656***		2.962***		4.969*		4.776**		5.051***		5.087***	
	(0.267)		(1.008)		(0.159)		(0.214)		(0.186)		(0.327)	
Sum of current and lagged ...												
ΔREIT_price	3.188	3	10.032**	8	0.63	1	9.959**	5	0.378	1	2.685**	1
	(2.120)		(4.781)		(1.005)		(2.683)		(0.685)		(1.235)	
Δ*C* (constr cost)	–38.339**	1	–18.447	0	–3.806	6	–1.029	1	–0.548	0	–5.469	0
	(15.102)		(11.309)		(3.465)		(1.074)		(6.081)		(6.528)	
mkt share x *Strong*[(a)]			–0.032	8			–0.243*	6			–0.014	1
			(0.031)				(0.127)				(0.144)	
mkt share x *Weak*[(a)]			0.107	8			0.452**	6			0.183	1
			(0.076)				(0.181)				(0.158)	
ρ	0.640***		0.501***				–0.45**		0.797***		0.817***	
	(0.108)		(0.172)				(0.181)		(0.072)		(0.076)	
R^2	0.36		0.45		0.23		0.51		0.64		0.69	
Adjusted R^2	0.29		0.29		0.11		0.34		0.61		0.64	
s e of regression	0.65		0.57		0.48		0.36		0.31		0.31	
Durbin-Watson	1.55		1.64		1.64		1.79		1.84		1.85	
Sample (obs)	1997:Q2–2011:Q4 (59)		2002:Q3–2011:Q4 (38)		2002:Q2–2011:Q4 (39)		2003:Q4–2011:Q4 (33)		1993:Q3–2011:Q4 (74)		1997:Q2–2011:Q4 (59)	

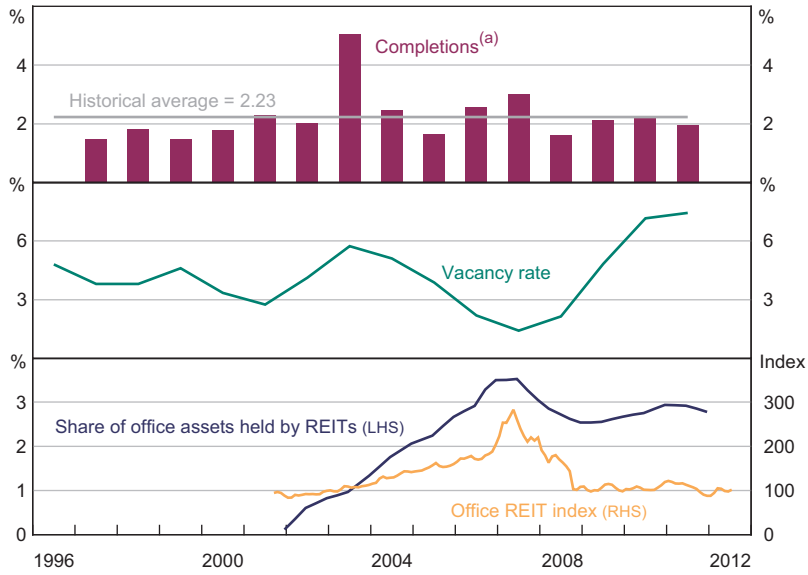
Notes: The dependent variable is the change in log square feet of construction completions for office. The coefficients of seasonal dummies are not shown. Coefficient standard errors are in parentheses. *, ** and *** indicate statistical significance at at the 1, 5 and 10 per cent levels, respectively. ρ is the estimate of the coefficient of first-order autocorrelation in the error term.
(a) Market share is definition 1.

they are not statistically significant, and the explanatory power of specifications including the market share variables is barely improved over simple base case specifications. This is in contrast to the United States, where the addition of market share variables adds significant explanatory power.

Japan. Though not reported in Figure 6, data on construction starts for Japan begin around 1996, just after the commercial property peak in Tokyo (as identified by Shimizu and Nishimura (2007)). The J-REIT market began in late 2001 and the index is available from 2002. Thus, we have roughly 10 years of data after the introduction of REITs.

The early period of office REITs corresponds to both relatively robust construction and rapid appreciation of REIT assets. After four years of relative stagnation from 1996, completions as a share of total stock picked up to well over 4 per cent in 2003, more than twice the period average (Figure 6). Though completions were more subdued subsequently, they did remain generally above average through to 2007, hitting the second highest share of new construction completions over the period in that year.

Figure 6: Japan – Real Office Property Market
Tokyo, 23 wards



Note: (a) As a per cent of its total stock, beginning of the period
Sources: Bloomberg; CBRE; SNL Financial; Thomson Reuters; authors' calculations

Similarly, REIT markets were quite strong in Japan over the period from their introduction in 2001 until 2007, with the index value rising from around 100 in the early 2000s to over 250 by mid 2007. From the IPOs of two J-REITs in September 2001, the total market size had increased to 41 J-REITs by March 2007. Total market capitalisation was more than 20 times the original size. By 2007, J-REITs had also grown to about one-third of the total market capitalisation of real estate related companies listed on Section 1 of the Tokyo Stock Exchange. As can be seen in the bottom panel

of Figure 6, we estimate that the amount of all commercial real estate (offices) securitised by REITs had grown to around 3.5 per cent of all securitisable office property at that time.

Price discovery appears to have improved considerably after the listing of J-REITs. According to a study group, real estate appraisal and end-of-period income and expenditures became common for all properties owned by J-REITs, which led to a large growth of information and data availability on commercial property (J-REIT Product Property Study Group 2007). This is consistent with the view that since the introduction of REITs in Asia more generally, liquidity and efficiency of the real estate markets have increased (Ooi, Newell and Sing 2006).

From mid 2007, however, the J-REITs market took a brutal tumble, with the index falling from a peak of around 285 in mid 2007 to around 150 by March 2008, and then to around 100 by March 2009 in the wake of the failure of Lehmann Brothers. The percentage fall in both cases, 47 per cent in the first and 43 per cent in the second period, was significantly greater than the falls endured by the Japanese equity market index of 30 per cent and 36 per cent, respectively. The recovery in the REIT index since early 2009 has been relatively modest by comparison. Concurrent with the J-REIT crash, there has also been some consolidation on the real side: office construction spending since 2007 has been subdued and below the period average for each year between 2008 and 2011, though the decline in spending since the collapse in REIT values was much less pronounced than that seen in REIT valuations.

Nonetheless, in October 2010, the Bank of Japan took the unprecedented initiative of announcing quantitative easing measures that included the purchase of the J-REITs. The total amount of J-REITs to be purchased was 110 billion yen, a relatively small amount compared with other assets being purchased, but this still gained considerable attention in the market.[12] In April 2012, the amount for J-REIT purchases was raised to 120 billion yen.

The justification for the action was to reduce risk premiums in financial markets. Indeed, the view of a number of analysts was that J-REITs were undervalued compared with other REITs, with price-to-net-asset values of 0.87 at the time of the intervention. To ensure that Bank of Japan purchases did not distort normal market functioning, the maximum amount of each J-REIT to be purchased was not to exceed 5 per cent of the total amount on issue. Purchases of J-REITs were promised to be roughly proportionate to the total market value of each J-REIT issued.

The announcement of Bank of Japan purchases in early October generated a recovery of around 3 per cent in J-REIT prices; in fact, by the end of the year, J-REITs had risen by nearly 20 per cent in value. Bank of Japan support was certainly good for J-REIT stocks, though it had much less impact on the wider equity market. As for land prices, they fell by about 2 per cent in Tokyo in 2011, much less than the 5 to 7 per cent drop seen in 2010. The extent to which the Bank of Japan action contributed either to this deceleration or the lack of a dramatic fall in construction spending over the period is not clear.[13]

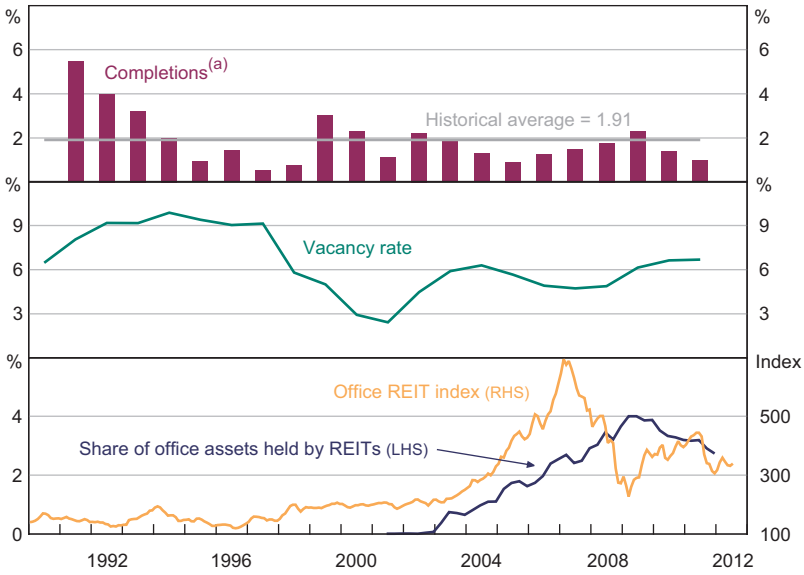
12 The Bank of Japan had also promised to purchase 1.6 trillion yen worth of Tokyo Stock Exchange index-linked exchange-traded funds (ETFs), 2.9 trillion yen of corporate bonds, 2.1 trillion yen of commercial paper, and 33.5 trillion yen of government bonds and notes. In April 2012, the amount for ETFs was raised by an additional 200 billion yen.

13 What is clear is that the Bank of Japan has thus far reported unrealised gains on its holdings of J-REITs, according to its publicly released earning reports. The Bank of Japan booked a 200 million yen unrealised gain on its holdings between April 2011 and March 2012, more than making up for the 100 million yen in losses a year earlier.

The estimates for the regression model of construction supply for Japan, where there are even fewer observations to work with than Australia (39 over the 10-year period from 2002), also present mixed results (Table 4). In the benchmark specification, while the signs on the asset price and construction cost coefficients are as expected, neither is statistically significant. However, the price variable gains statistical significance when the market share variables are added. And in tests of the market penetration conjecture, the market share of REITs does appear to be associated with subdued construction spending when office prices are rising, as well as increased spending when asset prices are falling. This is consistent with the view that the development of REIT securitisation – in spite of the sharp rise and fall in valuations – may have contributed to a stabilisation of office market supply.

France. Finally, we also estimate the model for France, the third largest REIT market in the world at US$72 billion, although the regime was introduced relatively recently in 2003. The degree of penetration of REITs increased steadily to around 4 per cent by 2010 (Figure 7). As for many other countries, commercial office supply cycles over the past two decades have peaked at much lower levels than during the late 1980s or early 1990s booms. Office prices as captured by the REIT index spiked as did many others in mid 2007, though construction completions as a percentage of the total stock continued to increase, peaking in 2009.

Figure 7: France – Real Office Property Market
Paris



Note: (a) As a per cent of its total stock, beginning of the period
Sources: Bloomberg; CBRE; Thomson Reuters; authors' calculations

Despite seemingly regular cyclical patterns in supply, the baseline regression model does not fit so well for France. Although the coefficients on asset prices and construction cost are the right sign, they are not statistically significant. The fit improves marginally when the market share variables are included, and the coefficient on asset prices become statistically significant. While the signs

for the degree of REIT penetration coefficients are consistent with the stabilisation of construction supply, the statistical insignificance of the coefficients deters strong statistical inference.

6. Conclusion

Conventional wisdom changes when the facts change. And facts associated with the recent financial market crisis implicate securitised real estate as a central cause of the crisis, particularly the mortgage-related securities produced in the United States. As a result, real estate-related securitisation is rather out of fashion at the moment.

In the face of current fashion, this paper asks the question of whether there are economic goods that can be generated by the securitisation of real estate interests. To address this question we consider the securitisation of commercial property equity interests through the so-called listed REIT market. Pulling together data from a large number of sources, we analyse commercial property construction and REIT markets from North America, Europe, Asia and the Pacific. We conduct several detailed case studies, with a particularly in-depth focus on the United States.

Our principal finding is that the US REIT market provides an excellent example of how a well-structured real estate securitisation market can generate positive spillover benefits to the economy at large by moderating construction boom and bust tendencies. The contrast between commercial property and housing markets leads us to conclude that financial market plumbing matters to the success of securitisation. The outperformance of US CMBS relative to private-label RMBS is another case in point.[14]

These results argue for the further development of CDS markets on RMBS. Well-functioning markets in such instruments can provide speculators the opportunity to short housing at low cost, and home owners and lenders the opportunity to better manage housing and mortgage loan risks (see, for example, Fabozzi, Shiller and Tunaru (2009)). To be sure, the financial crisis has taught us that market design should be carefully considered to ensure sufficient information production and price discovery as well as maintain incentives for creditors to properly screen and monitor borrowers (An, Deng and Gabriel 2011; Bolton and Oehmke 2011).

The impact of REIT markets on construction supply does not appear to be as strong in other economies. While these more tentative findings may in part be due to the relative youth of the non-US REIT markets and the resulting paucity of data, discussions with industry specialists suggest to us the deeper causes are due to structural differences. In the United States, many high-quality assets and management teams are located within the REIT sector, and US REITs have relatively straightforward business models that enhance transparency. Further documenting structural variation and assigning causation remains a topic for future research.

14 The CMBS market collapsed at the same time as the private-label RMBS, but since has re-emerged whereas the private-label RMBS market has not. Performance differences between CMBS and private-label RMBS in terms of default rates have also been stark. Analogous to the REIT market experience in commercial property, structural differences explain a lot. Unlike the private-label RMBS market, the CMBS market stuck to simple mortgage designs and first mortgage positions in the asset capital structure. It also had a dedicated special servicer whose only function was to address financially distressed loans. There was no robo-signing on the CMBS side of the business. And perhaps most importantly, for most of the CMBS market's history, a small dedicated group of 'B-piece buyers' existed that closely scrutinised the risk characteristics of the security structure and underlying collateral asset pool. This scrutiny both complemented and substituted for due diligence performed by credit rating agencies.

Appendix A: Data Description

Real estate price series

For the United States there are two price series: housing and commercial. For the housing index we use the Case-Shiller index of home prices (Figure 1). For commercial property prices there are several sources and series. The first is from NCREIF (National Council of Real Estate Investment Fiduciaries), which reports a price series for commercial (office) property (used in Table 3's regression analysis) and a nominal rents series (used in Figure 4). Nominal rents are converted to real rents using the CPI. Real rents are then capitalised to produce a property value series using the current (four-quarter moving average) estimated capitalisation rate. Another series used for commercial property is the index of real estate investment trust (REIT) share prices (used in Figure 1 and Table 3's regression analysis; see next data item for more details). Finally, a transaction-based index of commercial property prices from MIT and NCREIF is used for illustrative purposes in Figure 1.

REIT indices price and return

The time series of REIT returns in the various jurisdictions and the total return price index are collected for the various economies from different property price indices (Table A1).

Commercial property prices

The index for office property prices used in Figure 4 is sourced from NCREIF via Datastream. The series is available from 1990:Q1 to 2011:Q4. It is used to calculate the real capitalised property value of a very large pool of individual commercial real estate properties acquired in the private market for investment purposes only. All properties in the NPI have been acquired, at least in part, on behalf of tax-exempt institutional investors – the great majority being pensions funds. As such, all properties are held in a fiduciary environment.

Listed developer equity index series

Share prices of listed property development firms are used both as a proxy for real estate valuation and performance, and to assess the qualities of REITs as an investment class. For the United States, an index of home builder share price performance is examined in Figure 1, and a property market developer index is used in Figure 2. A distinction is also made between the equity indices of various sectors of commercial property: office, retail, and hotel properties (all used in Figure 2). For the remainder of the sample economies, general property market development indices are examined.

Other market series

Other market series are used as indicators of housing or commercial property market conditions in the United States – a credit default swap (CDS) index on AAA-rated subprime mortgage-backed securities, and credit spreads of AAA-rated commercial mortgage-backed securities to LIBOR (both used in Figure 1). Both of these are taken from JPMorgan Chase. National equity price

indices are used to assess REIT diversification properties as well as assess REITs' general sensitivity to market conditions.

Office supply and supply/vacancy rates for major cities

For each of the cities (economies) under investigation, the total stock of office real estate outstanding (area), as well as completions and vacancies are available (Table A2). Total stock represents the total completed space (occupied and vacant) in the private and public sector at the survey date, recorded as the net rentable area in thousands of square feet. Total stock should include all types of buildings regardless of quality, age and ownership (i.e. both leased and owner-occupied). The total stock includes purpose-built, space converted from other uses and independent space forming part of a mixed-use development.

Development completions represent the total net rentable area of completed floor space in thousands of square feet. This includes new and significantly refurbished (stripped back to shell and core) floor space that has reached practical completion and is occupied, ready for occupation or an occupancy permit, where required, has been issued during the survey period. The status of the building will have been changed from space 'under construction' to 'development completion' during the quarter. Vacancy rates are the total net rentable floor space in existing properties, which is physically vacant and being actively marketed at the survey date.

Using these supply data as input, time series of completion and vacancy rates in the office market in the various localities are then calculated as the share of completions over existing stock, and the share of vacancies over total existing stock, respectively. The ratio of completions over existing stock is a flow indicator of new supply coming on line, while vacancy rates can be viewed as an indicator of inadequate demand related to the existing stock of space.

Degree of securitisation of commercial real estate (office)

The market share of REITs is measured as asset capitalisation of listed REITs on each stock exchange as a per cent of investable office stock at the current market price.[15] Asset capitalisation is measured in three different ways. The first one is calculated as the sum of the current value of stock market capitalisation, the book value of debt and preferred stock. The second one takes net property investment at book value, while the third one takes total real estate investment (which also includes investments in associated companies, total mortgage-backed investments, and net mortgages and notes). REITs that can be identified as 'office REITs', and for which there is no indication of investing outside the cities of the sample, are focused on. Since not all the office REITs specialise only in office-related real estate, to calculate the degree of asset capitalisation in REITs that is accounted for by office assets, the asset capitalisation for each REIT is multiplied by the share of revenue in that REIT that is based on office business. The country aggregate is then the sum of each individual REITs' office assets. The US REIT stock market capitalisation and debt and preferred stock values are taken from SNL Financial (used in Figure 3 and Table 3's regression analysis). Similar estimates are taken and/or calculated for the other economies from Bloomberg. For the other major cities in the sample, the degree of securitisation is then calculated by dividing

15 We are aware of the existence of a significant number of private REITs in a number of jurisdictions (particularly Japan), but we are focusing on listed exchange-traded REITs in this paper, since we view transparency and information production to be greater in the case of listed REITs.

the asset market capitalisation of the REIT by the product of the average office stock value of each city and the total office stock area as related (used in Figure 5 for Australia; Figure 6 for Japan; Figure 7 for France; Table 4's regression analysis; and Figure B1 for Hong Kong SAR; Belgium; Germany; Netherlands; and the United Kingdom).

Construction costs

An index of construction costs – when possible for a category of non-residential buildings – are taken from national statistics, with a private vendor as the source for the United States (Table A3).

Table A1: Property Indices – Data Definitions, Time Periods and Sources

Used in Figures 3, 5–7, B1 and Tables 1, 3–4 (*continued next page*)

REITs – all property type				
Economy	Definition	Unit	Time period	Source
United States	FTSE, NAREIT US Real Estate Index, equity REITs index	2 Jan 1973 = 100	2002:M1–2011:M12	NAREIT
Australia	S&P/ASX 200 A-REIT index	31 Mar 2000 = 1 231.333	2002:M1–2011:M12	Bloomberg
Japan	Tokyo Stock Exchange REIT index	31 Mar 2003 = 1 000	2003:M3–2011:M12	Bloomberg
France	Datastream REIT index	8 Jul 1988 = 100	2002:M1–2011:M12	Thomson Reuters
Canada	Datastream REIT index	5 Jan 1994 = 100	2002:M1–2011:M12	Thomson Reuters
Hong Kong SAR	Datastream REIT index	25 Nov 2005 = 100	2005:M11–2011:M12	Thomson Reuters
South Korea	Calculated[(a)]	21 May 2001 = 100	2002:M1–2011:M12	Bloomberg; authors' calculations
Singapore	FTSE Straits Times RE Invest Trust index	2 Sep 2002 = 333.86	2002:M9–2011:M12	Bloomberg
Thailand	Calculated[(b)]	19 Nov 2003 = 100	2003:M11–2011:M12	Bloomberg; authors' calculations
Belgium	Datastream REIT index	16 Dec 1994 = 100	2002:M1–2011:M12	Thomson Reuters
Germany	Datastream REIT index	19 Dec 1988 =100	2002:M1–2011:M12	Thomson Reuters
Netherlands	Datastream REIT index	1 Jan 1973 = 100	2002:M1–2011:M12	Thomson Reuters
United Kingdom	Datastream REIT index	5 Jan 1965 = 100	2002:M1–2011:M12	Thomson Reuters

Table A1: Property Indices – Data Data Definitions, Time Periods and Sources

Used in Figures 3, 5–7, B1 and Tables 1, 3–4 (*continued*)

REITs – office indices				
Economy	Definition	Unit	Time period	Source
United States	Datastream office REIT index	18 Aug 1988 = 100	2002:M1–2011:M12	Thomson Reuters
Australia	Datastream office REIT index	6 Dec 1991 = 100	2002:M1–2011:M12	Thomson Reuters
Japan	Datastream office REIT index	10 Sep 2001 = 100	2002:M1–2011:M12	Thomson Reuters
France	Datastream office REIT index	4 Jan 1988 = 100	2002:M1–2011:M12	Thomson Reuters
Canada	Datastream office REIT index	26 Dec 1997 = 100	2002:M1–2011:M12	Thomson Reuters
Hong Kong SAR	Datastream office REIT index	24 May 2006 = 100	2006:M5–2011:M12	Thomson Reuters
Singapore	Datastream office REIT index	19 Nov 2002 = 100	2002:M11–2011:M12	Thomson Reuters
Belgium	Datastream office REIT index	16 Dec 1994 = 100	2002:M1–2011:M12	Thomson Reuters
Germany	Datastream office REIT index	2 Apr 2007 = 100	2007:M4–2011:M12	Thomson Reuters
Netherlands	Datastream office REIT index	31 Aug 1989 = 100	2002:M1–2011:M12	Thomson Reuters
United Kingdom	Datastream office REIT index	5 Jan 1965 = 100	2002:M1–2011:M12	Thomson Reuters

Notes: (a) Korea Real Estate Investment Trust Co, KOCREF REIT VIII, KR2 Development REIT Co Ltd and Golden Narae Real Estate Development Trusts Co Ltd; sum of the market capitalisations divided by the sum of the number of shares
(b) TICON Property Fund, Millionaire Property Fund, MFC Nichada Thani Property Fund and Bangkok Commercial Property Fund; sum of the market capitalisations divided by the sum of the number of shares

Table A2: Construction Supply Data – Data Definitions, Time Periods and Sources

Used in Figures 3, 5–7, B1 and Tables 3–4 (*continued next page*)

	Total stock		
Economy (city)	Annual period	Quarter period	Source
United States	1990–2011	1990:Q1–2011:Q4	CBRE
Australia (Sydney)	1990–2011	1990:H1–2011:H2	CBRE
Japan (Tokyo, 23 wards)	1996–2011	1996:Q4–2011:Q4	CBRE
France (Paris)	1990–2011	1997:Q4–2011:Q4	CBRE
Canada (Toronto)	1990–2010	1990:Q1–2011:Q3	CBRE
Hong Kong SAR	2005–2011	2005:Q1–2011:Q4	CBRE
South Korea (Seoul)	2005–2011	2005:Q1–2011:Q4	CBRE
Singapore	1988–2011	1988:Q1–2011:Q4	Urban Redevelopment Authority
Thailand (Bangkok)	2005–2011	2005:Q1–2011:Q4	CBRE
Belgium (Brussels)	1990–2011	2000:Q4–2011:Q4	CBRE
Germany (Frankfurt)	1998–2011	1998:Q4–2011:Q4	CBRE
Netherlands (Amsterdam)	2009–2011	2007:Q4–2011:Q4	CBRE
United Kingdom (Central London)	1990–2011	1994:Q4–2011:Q4	CBRE
	Development completions		
Economy (city)	Annual period	Quarter period	Source
United States	1990–2011	1990:Q1–2011:Q4	CBRE
Australia (Sydney)	1990–2011	1990:H1–2011:H2	CBRE
Japan (Tokyo, 23 wards)	1996–2011	1996:Q4–2011:Q4	CBRE
France (Paris)	1990–2011	2008:Q4–2011:Q4	CBRE
Canada (Toronto)	1990–2010	1990:Q1–2011:Q3	CBRE
Hong Kong SAR	2005–2011	2005:Q1–2011:Q4	CBRE
South Korea (Seoul)	2005–2011	2005:Q1–2011:Q4	CBRE
Singapore[(a)]	1991–2010	1991:Q1–2011:Q3	Urban Redevelopment Authority
Thailand (Bangkok)	2005–2011	2005:Q1–2011:Q4	CBRE
Belgium (Brussels)	1990–2011	2001:Q4–2011:Q4	CBRE
Germany (Frankfurt)	2003–2011	2003:Q1–2011:Q4	CBRE
Netherlands (Amsterdam)	2009–2011	2009:Q1–2011:Q4	CBRE
United Kingdom (Central London)	1990–2011	1990:Q1–2011:Q4	CBRE

Table A2: Construction Supply Data – Data Definitions, Time Periods and Sources

Used in Figures 1–3, 5–7, B1 and Tables 3–4 (*continued*)

	Vacancy rate		
Economy (city)	Annual period	Quarter period	Source
United States	1990–2011	1990:Q1–2011:Q4	CBRE
Australia (Sydney)	1990–2011	1990:H1–2011:H2	CBRE
Japan (Tokyo, 23 wards)	1996–2011	1996:Q4–2011:Q4	CBRE
France (Paris)	1990–2011	2008:Q4–2011:Q4	CBRE
Canada (Toronto)	1990–2010	1990:Q1–2011:Q3	CBRE
Hong Kong SAR	2005–2011	2005:Q1–2011:Q4	CBRE
South Korea (Seoul)	2005–2011	2005:Q1–2011:Q4	CBRE
Singapore	1988–2011	1988:Q1–2011:Q4	Urban Redevelopment Authority
Thailand (Bangkok)	2005–2011	2005:Q1–2011:Q4	CBRE
Belgium (Brussels)[(b)]	1990–2011	2001:Q2–2011:Q4	CBRE
Germany (Frankfurt)	2003–2011	2003:Q1–2011:Q4	CBRE
Netherlands (Amsterdam)	2009–2011	2009:Q1–2011:Q4	CBRE
United Kingdom (Central London)	1990–2011	1990:Q1–2011:Q4	CBRE

Notes: (a) Private and public sector office space under construction
(b) Availability rather than vacancy from 2008. The availability rate represents the total net rentable floor space in existing properties, which is being actively marketed, either for lease, sublease, and assignment or for sale for owner occupation as at the end of the survey period.

Table A3: Construction Cost – Data Definitions, Time Periods and Sources

Used in Tables 3–4

Economy	Definition	Unit	Time period	Source
United States	Class A fireproof steel frame building, average of eastern, central and western regions	1926 = 100	1991:Q4–2011:Q4	Marshall & Swift
Australia	Producer price index of non-residential building construction	Sep 1998–Jun 1999 = 100	1996:Q3–2011:Q4	Australian Bureau of Statistics
Japan	Japan building construction started, estimated costs – office	Per square metre	1991:Q4–2011:Q4	Ministry of Land, Infrastructure, Transport and Tourism
France	Construction cost index, residential buildings, except residences for communities	2005 = 100	1993:Q1–2011:Q4	Eurostat

Appendix B: Real Office Property Markets

Figure B1: Real Office Property Markets
(*continued next page*)

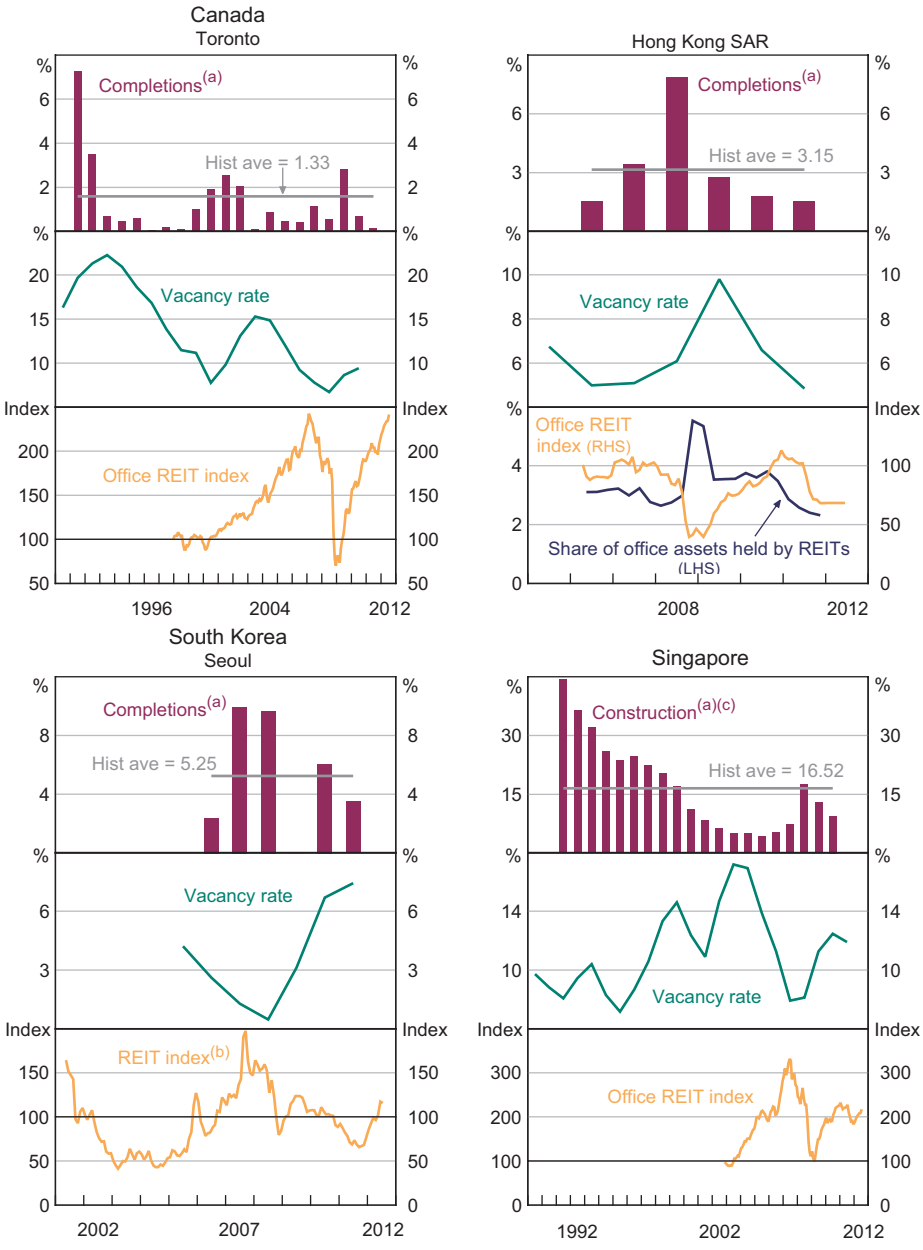


Figure B1: Real Office Property Markets

(*continued next page*)

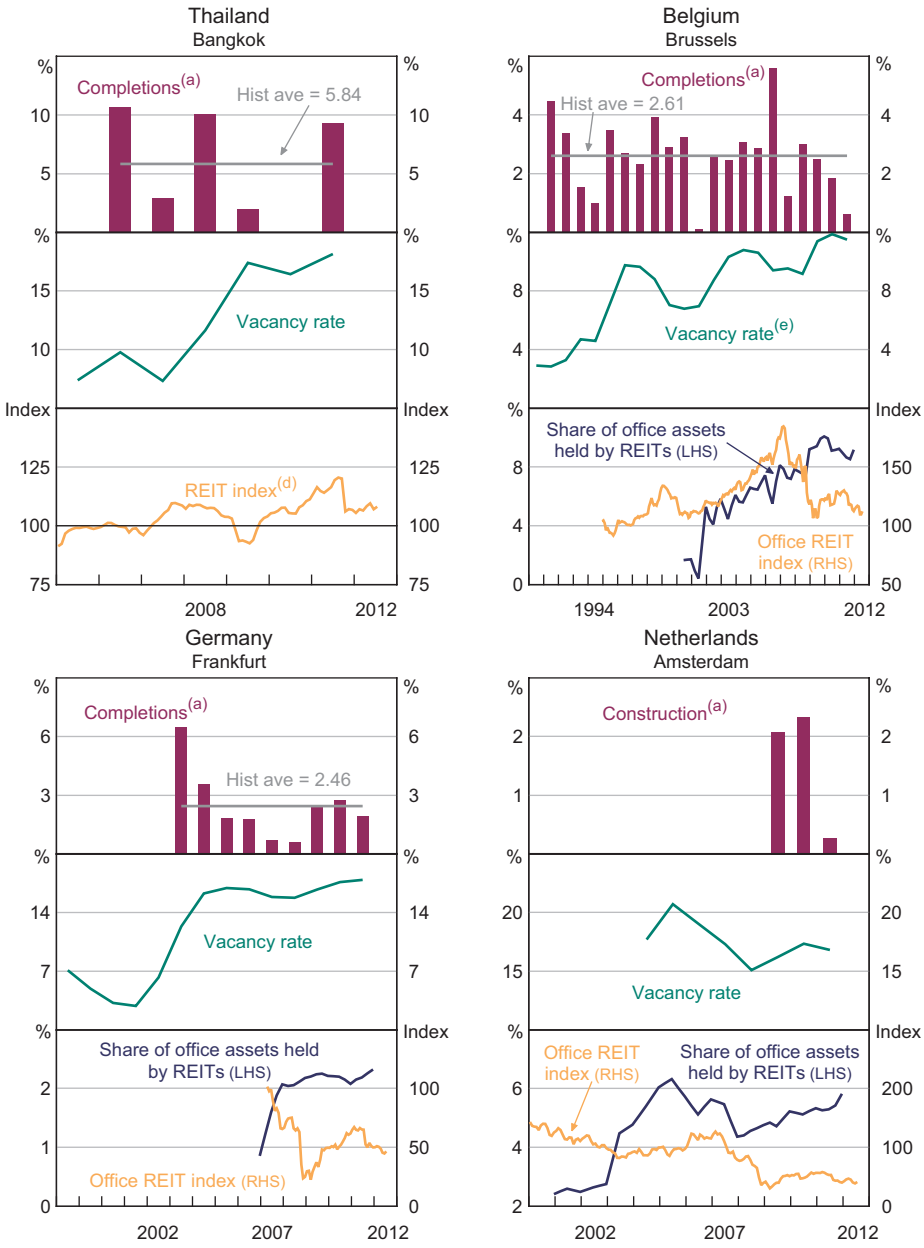
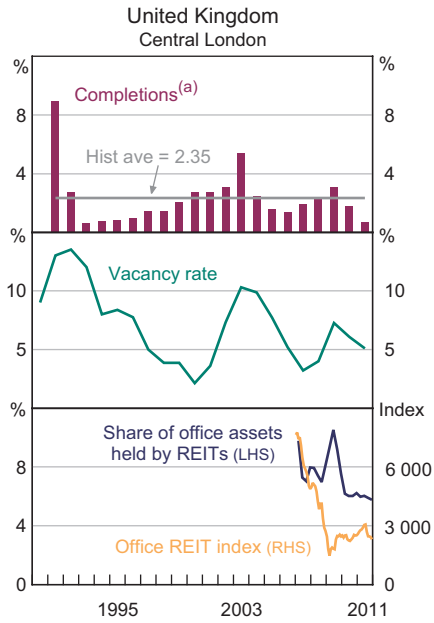


Figure B1: Real Office Property Markets
(*continued*)



Notes: (a) As a per cent of its total stock, beginning of the period
(b) Korea Real Estate Investment Trust Co, KOCREF REIT VIII, KR2 Development REIT Co Ltd and Golden Narae Real Estate Development Trusts Co Ltd; sum of the market capitalisations divided by the sum of the number of shares
(c) Private and public sector office space under construction
(d) TICON Property Fund, Millionaire Property Fund, MFC Nichada Thani Property Fund and Bangkok Commercial Property Fund; sum of the market capitalisations divided by the sum of the number of shares
(e) Availability rather than vacancy from 2008

Sources: Bloomberg; CBRE; Thomson Reuters; Urban Redevelopment Authority; authors' calculations

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Discussion

1. Jie Gan*

Securitisation and the Commercial Property Cycle

Frank Packer and Tim Riddiough have written an important paper on the role of securitisation in the recent commercial property cycle (or more precisely, a lack of it).

The paper starts from an insightful observation. That is, compared with residential property, the commercial property market has experienced a much milder cycle in the 2000s. This conclusion is well founded. First, compared with the 50 per cent to 75 per cent price drop in the residential market, commercial property prices declined by only 25 per cent from the 2007 peak. More importantly, prices had recovered to the 2007 level by the end of 2011, whereas the residential market has stayed at its lows. The second piece of evidence is based on property (over)supply. The supply of commercial properties has been growing consistently below 4 per cent, and the growth rate of the existing stock has been 1.6 per cent since the 1990s. This is barely enough to cover depreciation. I agree with the authors that there exist structural differences between the two markets and their price movements. This is a point worth making because many analysts, including some well-known ones, believe that a boom and bust in the commercial property market occurred parallel to the one in the housing market.

The authors propose an innovative explanation. That is, publicly listed equity real estate investment trusts (REITs), through analyst coverage and credit ratings, facilitate information discovery of the state of the commercial property market and thus guide the supply of commercial properties. The authors then argue that, to the extent that REITs are securitised equity interests, securitisation can work, and should not be out of fashion, as it is now.

This is indeed a refreshing view. My comments below focus on three questions. How general is the REITs/securitisation explanation? How can the US empirical evidence, the main analysis of the paper, be strengthened? And finally, how should we interpret the international evidence?

Generality of the REITs/securitisation explanation

One of the main points the authors attempt to make is that securitisation, if properly done, can facilitate rational or 'tamed' property supply. To make a case that this influence of REITs could apply to the residential market, one needs to answer this question: would the housing crisis have been avoided if there were equity REITs for residential property?

I first note a few key differences between residential and commercial markets.

* My thanks to the Reserve Bank of Australia and the Bank for International Settlements for the invitation to participate in this Conference.

First, there have been non-market forces in housing, namely political pressures to increase home ownership and to extend lending to 'underserved' markets since the early 1990s. Second, the US housing bubble was due to misaligned incentives in the system, including the incentives of investors (searching for high yield in a low interest rate environment), banks (seeking higher returns), and rating agencies (eager to generate fees). Lax regulation also made excessive risk-taking feasible. Third, securitisation in housing was about the demand side – securitisation led to lower lending standards and the resulting increase in lending fuelled housing demand and thus price run-ups. Even if there were price signals similar to those the authors describe in the commercial market, they would not have prevented a bubble. Finally, REITs in the commercial market hold equity interest in properties, whereas the notorious residential mortgage-backed securities are debt and households cannot generate funds through an initial public offering.

It should also be noted that securitisation in the housing market worked for 30 years in the United States prior to the 2000s. Thus, the important question is not 'can it work' but 'how to make it work'.

Main evidence for the REITs explanation

The authors provide both qualitative and quantitative evidence. The qualitative analysis is obtained through a process of elimination, which contains a lot of institutional details. I find this part of the analysis interesting and insightful. My comments are mainly on the quantitative analysis, which I believe can be improved. Let me start with the identification strategy. The authors identify the role of REITs in property supply through time series variation in REITs' market share. Specifically, they estimate the model below:

$$Y_t - Y_{t-1} = a\Delta P_t + b\Delta C_t + dSHR_t * UP_{t-1} + fSHR_t * DN_{t-1} + e_t \quad (1)$$

where Y is property supply, ΔP contains changes in REITs prices, ΔC is the change in construction costs, *SHR* is the market share of REITs, measured either by (i) total REIT market value (debt and equity included) over the total market value of office space; or (ii) net property investment of REITs over the total market value of office space. *UP* and *DN* indicate periods when prices were increasing and decreasing. The main coefficient of interest is *d*, which is expected to be negative. That is, higher REIT shares mean more attention, which moderates the impact of higher property prices (*UP*) on supply.

The paper estimates the model for each country separately and finds strong evidence of this effect in the United States, weak evidence in Japan, and none elsewhere. My main concern is: to what extent can quarterly variation in REITs' market share (which is rather small) affect supply? Indeed, there are at most 70 quarterly observations, where property supply takes a few years to complete. Further, quarterly variations in REITs' market share mainly come from two sources. One is changes in REITs' stock prices, due to changes in earnings, etc; the other is new investments made by REITs above the national average. Neither of these two measures captures 'attention' as the authors put it. Rather, they may pick up some other factors that affect property supply, for example, macroeconomic conditions, white-collar employment, etc. The authors need to at least control for these variables.

My suggestion is to explore other sources of variation. One source of variation is within-country cross-region variation, that is, do regions with greater REIT ownership exhibit less sensitivity of supply to prices? There is a challenge with this approach too: REIT ownership may not be exogenous if it is 'smart money'. But this is less of a problem if your focus is on the sensitivity of supply to prices, rather than the level of supply.

Another possible source of variation is cross-country variation. Is supply in countries with a greater REIT presence less sensitive to prices? Here the main challenge is that country-level institutional factors also matter for the sensitivity – one needs to be specific about how these factors work.

On model specification, the authors motivate their model with theories of property supply. Standard theory, however, is about equilibrium supply, which is unobservable. To make the theory operational, I suggest the authors use an adjustment model:

$$Y_t - Y_{t-1} = \lambda\left(Y_t^* - Y_{t-1}\right) \tag{2a}$$

$$Y_t^* = a\Delta P_t + b\Delta C_t + fX_t \tag{2b}$$

where Y^* is the (unobservable) equilibrium supply, λ is the adjustment speed, X contains other controls. Taking (2a) and (2b) together, one could estimate

$$Y_t = (1-\lambda)Y_{t-1} + a\Delta P_t + b\Delta C_t + fX_t + e_t \tag{3}$$

Another advantage of this structure is that it could easily accommodate different adjustment speeds during up and down markets.

International evidence

I find this part of the analysis a bit distracting. It is not clear what we want to examine here. Are there similar boom-busts (or a lack of them) in other economies? How does commercial property compare to housing?

The authors argue that the differences in results across economies are due to internal management in the United States versus external management, which is more common in other economies. But there are other possibilities.

First, the presence of REITs is very small in other economies. Other than Australia (19 per cent) and Belgium (9 per cent), 11 economies have shares that are below 6 per cent or have missing data, which probably indicates a less significant sector. More importantly, in other economies the property markets may have very different dynamics. For example, in Asian economies and some of the European cities, there are much more binding supply constraints. Further, in most Asian economies, real estate is more of a 'glamorous' industry. It may carry significant weight in stock market indices, for example the weight is 10 per cent in Hong Kong. This would affect beta comparisons. Most importantly, there might be structural differences in property valuation and thus REITs valuation and returns. For example, rentals are sluggish in Asia, and prices tend to be much more sensitive to fundamentals than rentals.

In these markets, property valuation is more about demand for properties, not for space. REIT valuation would have more emphasis on the ability to pick properties, rather than the ability to

manage them. Moreover, property markets may be segmented: there are multiple types and classes of properties, which makes price signals from REITs noisier. Overall, structural differences can hinder international comparison. It is thus imperative to sort through these differences in order to make any meaningful use of international data.

In closing, Frank and Tim have presented a very insightful piece of work, which I enjoyed reading. I believe the paper would benefit from some refocusing. It may be hard to draw parallels between publicly traded ownership (securitisation of equity interest) in commercial property and securitisation in housing. The identification of the role of REITs would be improved if the authors could (i) look for other sources of variation in supply and the presence of REITs both within country and across country; (ii) explore adjustment models of property supply; and (iii) examine cross-country institutional factors in more detail, particularly if they would like to pursue international comparisons. Nevertheless, the main point the authors are making is of first-order significance; that is, there is no parallel boom-bust in the commercial property market and housing. I predict that this will be an important paper for years to come.

2. General Discussion

Jie Gan's discussion prompted one participant to pursue the question of how the moderating effect of securitised equity interests in commercial property can be generalised to the housing market given that securitised equity interests do not work in the housing market. They indicated that although attempts have been made to devise ways to trade equity in housing, they have not gone beyond government pilots with government subsidies. In response, one of the paper's authors, Tim Riddiough, said the findings were applicable to the housing market because of the potential for the credit default swap (CDS) market to provide price information. Dr Riddiough said these swaps are an effective way of shorting housing and the price effect of these contracts could become a standard piece of information in the market. He said the current structure of the CDS market is, however, inappropriate, and that regulation would be necessary to ensure the CDS market has a moderating effect on housing supply analogous to the REIT market's effect on commercial property.

One participant agreed with the paper's message about the usefulness of securitisation and cautioned against using the recent US experience to conclude that securitisation was intrinsically bad. During the financial crisis in the United States there was a failure of a debt securitisation system, not an equity securitisation system such as REITs, they said. Part of the reason housing debt securitisation failed in the United States was because there were guarantees from the government that produced moral hazard. In the absence of these distortions, one way equity securitisation moderates the amplitude of cycles is that it can be shorted if agents think market pricing is too high.

Another participant sought to abstract from the supply-side effect of REITs and offered an alternative hypothesis for the subdued supply response in the commercial property market relative to the housing market in the most recent US cycle. They suggested a memory effect could be operating, with agents in the United States having learnt from the commercial property

market's boom-bust cycle in the early 1990s and instead choosing to focus their attention on the housing market in the most recent cycle. The participant said while the recovery has been faster in the US commercial real estate market relative to the housing market, the recovery in commercial real estate markets outside of the United States has not. From this they concluded that one could not draw a general proposition that commercial real estate is less risky.

There was also some discussion about the appropriateness of comparing an index of home builder share price performance to an index of REIT share prices as per Figure 1 in the paper. One participant said there were difficulties making comparisons because REITs are owner-operators and therefore have a long-term interest in the management of their properties. At the same time, there is little scope for further development and trading of these properties if they are to maintain their REIT status under US law. In contrast, home builders are more leveraged than their balance sheets show and this, in turn, makes the share price performance index for home builders potentially more volatile. Another participant asked for clarification on the comparability of the commercial property and housing prices series shown in Figure 1 of the paper. They did not recall that there had been a complete recovery in US commercial property prices based on a commercial property series that is most comparable with housing price estimates.

Picking up on the theme of measurement, another participant suggested the authors use an alternative measure for the peak in housing prices which should be dated at the time participants within the home building industry started selling shares outside pre-announced plans. They said data on this should be available because it is compulsory to declare these sales under US law.

Discussion then proceeded to the quantitative results. Abstracting from statistical insignificance, clarification was requested in interpreting the positive REIT market share coefficient in periods of relative price declines for the United States. Dr Packer said the economic interpretation was that REIT market share, as a proxy for market attention, moderates the decline in commercial property supply that occurs in response to asset price declines. The same participant suggested that it would make more sense to include the change in commercial property starts as a dependent variable rather than the change in commercial property completions, given lags in commercial property construction. Dr Riddiough said their model took account of this by including lags of up to two years for all of the explanatory variables. Finally, the interpretation given to the negative coefficient on REIT market share was questioned on the basis that if REIT market share reduces the supply response to prices then this should decrease rather than increase stability in commercial real estate markets. With a stickier supply response to prices it will take longer to converge back to equilibrium, they argued.

Alternative modelling strategies were then discussed. One participant wanted to see results for the United States within different markets. In particular, they were interested to compare the price cycle of REIT-owned properties within each of the office, retail and industrial markets, with the average for the particular market as a whole. Another participant suggested that a more specific mechanism through which securitised equity interests in a firm moderate the cycle should be introduced into the model. They suggested that a variable capturing the relationship between commercial property prices and firm-specific net asset values would be a possible candidate. The rationale is that the market disciplines this ratio to be greater than one and, therefore, suppliers will moderate activity when this ratio goes below one in anticipation of reduced demand.

Finally, on the topic of international comparisons, one participant questioned why the authors only focused on the listed REIT market. In Japan, for example, they indicated that the private REIT market was much larger than the listed REIT market and activity in this market picked up substantially in 2007 which coincided with an anecdotal increase in commercial property prices. In response, Dr Riddiough said there is also a large private REIT market in the United States, but that there are a lot of structural flaws associated with this market, making it inappropriate to put them in the same category as the US publicly traded REITs.

Property Prices and Bank Risk-taking

Giovanni Dell'Ariccia*

1. Introduction

Real estate boom-bust cycles can have far-reaching consequences. Booms are generally accompanied by fast credit growth and sharp increases in leverage, and when the bust comes, debt overhang and deleveraging spirals can threaten financial and macroeconomic stability. Banks have a critical role in this process and can amplify the swing by changing their lending standards over the cycle.

These dangers notwithstanding, before the crisis, real estate booms and the associated credit booms fell into a sort of policy no-man's land. First, there was the long-standing (benign neglect) view that it was better to deal with the bust than try to prevent the boom. Unhealthy booms were difficult to separate from healthy ones. And, in any event, it was believed that policy was well equipped to contain the effects of a bust (there were of course a few notable exceptions, including Sveriges Riksbank and the RBA; see Mishkin (2011), for more on the 'lean' versus 'clean' debate). Second, with the diffusion of inflation targeting, many central banks had increasingly focused on price stability as their main (sole) objective and viewed financial stability as the realm of bank regulation. Regulatory policy, however, typically focused on individual institutions and was ill-equipped to deal with the aggregate credit dynamics associated with real estate booms.

A similar gap existed in the economic literature. In models dealing with inflation and the macroeconomic cycle, there was little or no role for finance. And certainly little attention was paid to financial stability. Corporate finance models dealing with bank risk-taking focused on how to correct market failures stemming from limited liability and asymmetric information. They essentially ignored monetary policy and few explicitly considered real estate prices.

The crisis has both encouraged a reconsideration of the existing policy consensus and spurred academia towards research that fills the gap between macro and corporate finance models. Both processes are ongoing. Most central banks have maintained their pre-crisis policy frameworks. But many have altered their rhetoric and have made (timid) openings to the idea of having credit aggregates and real estate prices play a bigger role in their policy decisions (Bernanke 2011; Mishkin 2011). Similarly, we still lack a unifying theory of bank risk-taking over the cycle but several models have been developed that take into account the role of credit, leverage, and asset prices. And 'finance' modules are increasingly incorporated into the large DSGE models that central banks and other institutions use for policy guidance.

* The views expressed in this paper are those of the author and do not necessarily represent those of the International Monetary Fund (IMF) or IMF policy. The author would like to thank Deniz Igan for helpful comments and discussions. Roxana Mihet provided excellent research assistance.

This paper reviews theoretical stories and empirical evidence on the link between real estate price cycles and bank behaviour in terms of credit provision and risk-taking. And it discusses their implications for macroeconomic policy.

2. Real Estate Cycles and Bank Lending Behaviour

We lack a unifying theory of how banks behave over the business cycle and react to changes in asset prices, much less a theory about how banks react specifically to real estate market developments. We have, however, several distinct theoretical frameworks that can provide important insights into the relationship between real estate cycles, bank lending and risk-taking behaviour. Few of these are specifically about real estate. (And some do not even have banks!) Yet, we argue that they are all relevant for the issue at hand because of several characteristics specific to real estate assets (such as their intrinsic lumpiness and resulting reliance on bank lending, their critical role as a store of wealth and resulting macro relevance, their illiquidity, opacity and sluggish supply response, which results in their inclination to deviate from fundamentals).

2.1 Credit constraints

Finance is 'neutral' in standard textbook macro models. Real fundamentals determine long-term equilibria and the structure and conditions of financial markets are irrelevant. In these models, real estate prices (and any other asset price) reflect discounted future payoffs, and in themselves play no particular role in economic fluctuations.

Financial frictions change all this. Agency problems between borrowers and lenders stemming from the introduction of asymmetric information and/or limited liability generate macro-relevant deviations from the Modigliani-Miller outcome. A wedge appears between the costs of internal and external finance and changes to borrowers' net worth become a critical variable that amplifies fluctuations in investment and activity. For example, in the original Bernanke and Gertler (1989) model, a shock that lowers current cash flow reduces a firm's ability to fund investment from retained earnings (lowering future profits). This lower net worth widens the cost of external finance. At the macro level, this results in reduced aggregate investment to the further detriment of economic activity and future cash flows.

When loans must be collateralised, real estate prices can have real effects (beyond those reflecting changes in fundamentals) by affecting the balance sheet positions of potential borrowers. In Kiyotaki and Moore (1997) endogenous cycles emerge as a result of the interaction between firms' credit constraints and their use of productive assets as collateral. Changes in the value of collateral assets affect these credit constraints. This has an impact on investment activity, which feeds back onto asset prices. More recently (especially in the wake of the 2008 financial crisis), strides have been made to introduce such dynamics and the role of housing into DSGE models (see, for example, Iacoviello and Neri (2010)). Yet, in most of these models, there are no banks in any meaningful sense. The structure and behaviour of financial intermediation remains irrelevant and indeterminate.

The latest generation of DSGE models addresses this problem by explicitly allowing for a role for financial intermediaries (see, for instance, Gertler and Kiyotaki (2011)). These banks are subject to credit constraints (or more properly, leverage constraints) stemming from problems akin to

those that characterise borrowers. Fluctuations in their net worth (in addition to what happens to consumers and investors), originating for instance from a shock to their credit portfolio, affect their ability to raise deposits and extend credit, with large effects on economic activity. In this context, lower real estate prices may imply bank losses: borrowers' incentives to repay decline as the value of the equity they hold in the house declines; developers selling at a lower-than-expected price may not be able to service their debt. Losses reduce bank capital and the financial system's ability to raise and lend funds, potentially resulting in a credit crunch (Iacoviello 2011).

These models have built increasingly more powerful and comprehensive versions of a financial accelerator. By doing so, they are able to explain how small shocks to fundamentals, amplified by financial frictions, can lead to wide economic fluctuations (all in a general equilibrium environment that can be calibrated to guide policy decisions). This progress notwithstanding, these models say relatively little about bank risk-taking. Indeed, lending limits for both banks and borrowers are set exactly so that the incentive compatibility constraint is satisfied. The focus is on the quantity of credit, not its quality. The financial frictions considered entail an inefficiency that exacerbates cyclical fluctuations, but cannot explain discontinuous phenomena such as a crisis. In equilibrium, there is no bank default.

2.2 Leverage cycles

Capital regulation may amplify the effects of real estate price changes on bank lending behaviour. Rising property prices increase bank capital directly, through higher valuations of a bank's own real estate holdings, and indirectly, through increased mark-to-market values of real estate-backed securities and loans. Banks may respond to this higher capitalisation by increasing lending (although not necessarily real estate-related lending). In addition, under risk-weighted capital regulation, they may also take on more aggressive risk profiles. More credit in turn, may increase real estate prices further. A bust inverts this chain, possibly leading to a credit crunch. These swings can be even wider if leverage is procyclical (Adrian and Shin 2010; Geanakoplos 2010). Further, supervisors and regulators may also amplify this cycle if they react to a worsening real estate market by increasing capital requirements and by requiring stricter rules for classifying and provisioning against real estate assets (Herring and Wachter 1999).

2.3 Asymmetric information and bank strategic effects

The observation that banks change their lending standards systematically over the cycle (and with real estate prices) motivates several recent partial equilibrium papers. In these models, bank strategic interaction and information collection amplify marginal changes in the distribution of borrowers (generated, for instance, by better economic prospects) with large effects on bank lending standards. These models are generally static (although see Gorton and He (2008)), do not have the richness of DSGE frameworks, and cannot provide quantitative policy guidance. Yet, they provide important insights into the dangers associated with cyclical changes in banks' risk-taking behaviour. When acquiring information is costly, banks will adjust their information collection activities in response to changes in the distribution of borrowers (Ruckes 2004). In a recession, most applicant borrowers are bad. Banks obtain little benefits from individual screening and deny most applications based on aggregate conditions. In intermediate phases of the cycle,

there is a high variance in the quality of applicants, incentives for individual screening are high, and banks tend to acquire much more information and fund relatively high-quality borrowers. In booms, however, it may be optimal to save on screening costs and lend indiscriminately to the entire applicant population. Then, the upswing of a business cycle can be characterised by a sharp credit expansion and a reduction in lending standards. This provides a theoretical explanation for Alan Greenspan's famous observation that there is an unfortunate tendency among bankers to lend aggressively at the peak of the cycle and that is when they extend the majority of bad loans.

Bank competition exacerbates this tendency. When banks compete for borrowers, they face an adverse selection problem. There is always a positive probability that an applicant accepting a loan offer has been rejected by a competing bank; namely, the winner's curse (Dell'Ariccia and Marquez 2006). When the market expands and the proportion of new borrowers increases (or the expected screening intensity at other banks decreases), the distribution of applicants each bank faces improves, and banks may find it profitable to reduce screening and, at the limit, grant credit to all borrowers indiscriminately. An endogenous cycle in lending standards can emerge, independent of fluctuations in real fundamentals (Gorton and He 2008).

These models do not deal specifically with real estate cycles, but their predictions apply to real estate-related lending. When house prices are on the rise, banks have little incentive to discriminate across borrowers. Increasing prices allow even bad borrowers (for instance, those without sufficient income to service their debt) to refinance their mortgages or sell their properties. Thus, the expectation of further price increases reduces the importance of idiosyncratic borrower risk and banks may find it optimal to lower lending standards (for example, by increasing loan-to-value and debt-to-income ratios). Lower standards allow large numbers of previously untested borrowers to obtain credit (hence reducing adverse selection) and support house prices. Note that it is individually optimal for banks to follow this strategy as long as they believe their competitors will as well. More importantly, competitive forces may punish a deviation from this strategy toward more 'conservative' lending. Borrowers will switch to easier-lending competitors. Investors will punish managers not delivering high returns. And managerial compensation schemes may induce herding behaviour and strengthen these effects (Rajan 1994). It is the game-theory version of the then CEO of Citigroup, Charles Prince's, infamous 2007 quote: 'As long as the music is playing, you've got to get up and dance … We're still dancing'.

This equilibrium of reduced lending standards can also be welfare-efficient from a risk-neutral standpoint (i.e. it can maximise aggregate surplus for banks and borrowers). However, the associated reduction in screening and higher leverage ratios results in a banking system with a more fragile loan portfolio, increasing the probability of financial instability. It follows that in a 'less linear' context (e.g. one with a risk-averse social planner or one where crises are associated with non-linear social losses), this equilibrium would be welfare dominated by one with tighter lending standards.

2.4 Bubbles

Real estate markets seem to live under two possible regimes. Most of the time, prices follow fundamentals according to standard valuation principles. The value of an asset (in this case real estate) reflects the discounted stream of expected payoffs (in this case rental payments), adjusted

as needed for various risks, taxes and expenses. At times, however, housing prices can rise/fall sharply in ways that are difficult to reconcile with changes in the underlying fundamentals. These bubble episodes are generally accompanied by wide swings in bank credit and are often harbingers of financial crises. A few recent papers (generally based on agency-theory models of bubbles such as Allen and Gorton (1993) and Allen and Gale (2000)) have explored the role played by financial intermediaries in funding real estate bubbles.

In several markets land is scarce. And, even when it is not, it takes a relatively long time to plan and develop housing. It follows that, at least in the medium run, real estate price dynamics are primarily driven by fluctuations in the demand for housing. This can come from two sources: consumers, who purchase housing for their own use, and speculators, who purchase housing with a view to selling it at a higher price in the future (obviously, the two groups may overlap). In tranquil times, consumers (or more precisely, consumption motives) dominate the market and prices reflect an arbitrage condition between renting and owning a home. Essentially, the price today has to be equal to the discounted stream of rental payments plus the expected price change (based on expected changes in the supply of housing). In contrast, when leveraged speculators enter the market, a bubble can develop. Because of limited liability, these agents care only about the upper part of the distribution of future prices (the cases in which the supply of houses turns out to be too low). Thus, they can support valuations above what is justified by fundamentals. However, when the realised supply of housing is too high (and prices too low) they default (Allen and Carletti 2011a, 2011b).

In this context, banks may be willing to lend to speculators because of government guarantees, or because they are unable to discriminate between legitimate consumers and speculators. Banks may also adapt the financial contracts they offer in response to the emergence of speculation. Back-loaded products, such as interest-only and teaser-rate mortgages, can protect banks by forcing early repayment/refinancing, and are also preferred by speculators since they maximise leverage and defer equity repayment (Barlevy and Fisher 2010). The use of this kind of instrument may also reflect banks engaging in risk-shifting once they find themselves exposed to a bubble. If a sharp drop in housing prices can lead to financial distress, and banks find it too costly or impossible to diversify this risk, they will have an incentive to increase the correlation between their portfolio and housing prices. Further, the emergence of a bubble (and increased volatility in price this entails) can offer leveraged institutions an opportunity to increase risk-taking in a fashion that is more difficult to detect (and hence price) than in tranquil times. This is individually optimal for institutions protected by limited liability, but increases the cost of the crisis if and when the crash occurs.

Note, however, that (depending on the set-up) bubbles can also lead to expansions in capital stock and output. Essentially, higher asset valuations raise the net worth of entrepreneurs and reduce the effects of financial frictions, such as the credit constraints considered in DSGE models, hence improving aggregate welfare (Martin and Ventura 2011). This is akin to what happens in the low screening equilibrium described in the previous section.

2.5 Strategic complementarities

Banks' excessive exposure to real estate prices may also result from strategic complementarities. Implicit or explicit guarantees of government intervention in case of a systemic crisis, and externalities associated with large bank failures provide banks with incentives to correlate their portfolios. Put differently, banks may find it optimal to trade idiosyncratic risk for macro risk, increasing both the probability of systemic crises and their depth should one occur.

Governments are unlikely to rescue isolated banks in distress (we abstract from too-big-to-fail arguments here). And, when they do, they can impose harsh sanctions that help limit moral hazard. In a systemic crisis, however, authorities may find it optimal to resort to untargeted actions (such as drastic monetary policy easing, fiscal stimulus, or international bailouts in support of exchange rate pegs) for which they cannot administer immediate punishment. These policies are *ex post* optimal, but entail *ex ante* distortions. If a sufficiently large portion of the financial system engages in risky lending (e.g. real estate-related lending with massive maturity mismatches and interest rate exposure as in the United States, or with currency mismatches, as in eastern Europe), it is individually optimal for a bank to do the same. If things go well, profits will be high. If they go badly, a rescue will come. As in the low screening equilibrium described above, deviating from this strategy implies lower returns. It does not pay to play safe when everybody is taking risks (Acharya and Yorulmazer 2007; Diamond and Rajan 2011; Farhi and Tirole 2012). But here the result is an inefficient equilibrium in which authorities may be forced to take actions that distort the economy at large. For instance, the central bank may be forced to ease monetary policy to support the financial sector in a fashion inconsistent with its price stability objective.

Externalities associated with bank failures can lead to a similar equilibrium. Financial institutions are exposed to each other directly through the interbank market, and indirectly through the real economy, reputation channels and financial markets. Some of these risks can be diversified, others not. The resulting threat of contagion affects banks' risk-taking incentives. If a large portion of the banking system is exposed to real estate prices, and a systemic crisis would severely affect the economy (and thus the creditworthiness of all borrowers), it may be individually optimal for other banks to take that same exposure (Dell'Ariccia and Ratnovski 2012). The key mechanism is that when a bank can fail due to exogenous circumstances, it does not pay as much to invest to protect itself from idiosyncratic risk. Further, the threat of contagion generates a strategic complementarity: banks take more risk when other banks take more risk, because the risk-taking of other banks increases the threat of failure and hence contagion.

3. Evidence

There is a growing empirical literature exploring how real estate booms affect bank risk-taking and speculative behaviour. Papers can be roughly divided into two groups. First, there is a well-established body of empirical work linking boom-bust cycles to episodes of financial distress. This 'reduced-form' approach does not provide direct evidence of changes in bank risk-taking behaviour. But it does show that sharp increases in credit and leverage are at the core of the relationship between real estate booms and crises. Second, there is a recent, but growing, set of studies addressing directly the issue of how banks behave during real estate booms. These papers find evidence that real estate booms are associated with declines in lending standards, greater

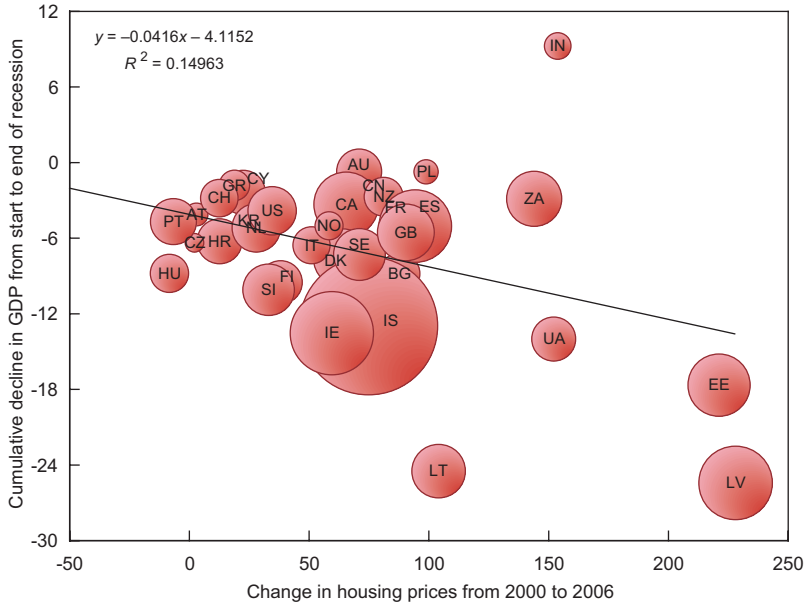
recourse to riskier contract structures, changes in leverage, and risk shifting. We review these two groups of papers in turn. A caveat before we start. Different linkages and effects identified by theoretical frameworks are likely to coexist in individual markets, lending institutions and even borrowers. As a result, empirical evidence can be consistent with multiple stories (theories) at the same time. That said, in what follows, when possible, we make an effort to link evidence to theory.

3.1 Real estate booms, credit booms and financial crises

The recent crisis has brought to centre stage the dangers to bank stability posed by real estate boom-bust cycles. The bursting of the real estate bubble in the United States led to the deepest recession since the Great Depression and quickly spread to other countries; in particular those with their own home-grown bubbles. Banking crises erupted in several countries (Laeven and Valencia (2012) document 17 systemic crises and an additional 8 borderline cases), at the cost of sharp increases in sovereign debt ratios and deep output contractions.

Yet, the pattern is not new. Recessions associated with housing busts have been typically deeper (output losses are two-to-three times larger) and longer (averaging 18 quarters versus 4 quarters) than 'standard' downturns (Claessens, Kose and Terrones 2008). The crisis confirmed these regularities. Across countries, the amplitude of housing price upturns prior to 2007 is statistically associated with the severity of the impact of the crisis across countries (Figure 1).

Figure 1: Severity of Crisis and Housing Price Run-up



Notes: Bubble size shows the change in bank credit from 2000 to 2006; see Glossary for a listing of country codes
Source: Claessens *et al* (2008)

Further, there is ample evidence that these negative effects are largely due to the role of the banking sector. The Scandinavian banking crises of the early 1990s and the Asian financial crisis were associated with boom-bust cycles in property prices (Herring and Wachter 1999), as were two of Reinhart and Rogoff's (2009) other 'big five' crises, Spain 1977 and Japan 1992. More generally, real estate boom-bust patterns preceded more than two-thirds of the 46 systemic banking crises for which housing price data are available (Crowe *et al* 2011). Similarly, 35 out of 51 boom-bust episodes were followed by a crisis. By contrast, only about half the crises follow a boom-bust in stock prices and only about 15 per cent of stock market boom-busts precede systemic banking crises (virtually all of these cases coincide with a real estate boom-bust).

Boom-bust episodes tend to have worse consequences when the booms coincide with rapid increases in leverage and exposure of households and financial intermediaries. In the global financial crisis, this occurred in more than half of the countries in the sample of 40 countries (Table 1). Almost all the countries with 'twin booms' in real estate and credit markets ended up suffering from either a financial crisis or poor performance (21 out of 23). Eleven of these countries actually suffered from both damage to the financial sector and a sharp drop in economic activity. In contrast, of the seven countries that experienced a real estate boom, but not a credit boom, only two went through a systemic crisis and these countries, on average, had relatively mild

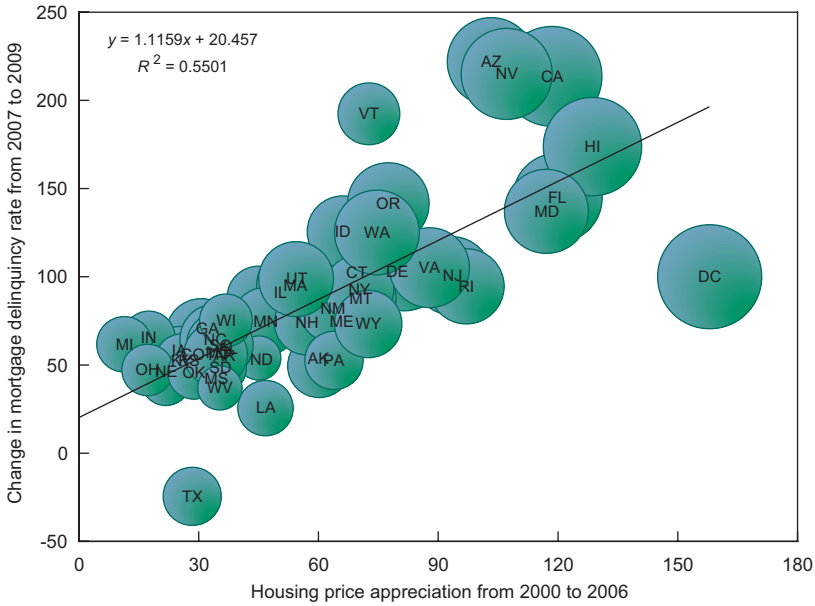
Table 1: Booms, Crises and Macroeconomic Performance

Boom	Probability of being followed by:				Number of countries
	financial crisis	poor performance	financial crisis or poor performance	financial crisis and poor performance	
	Per cent				
Real estate	53	77	87	43	30
Credit	67	78	93	52	27
Real estate but not credit	29	71	71	29	7
Credit but not real estate	100	75	100	75	4
Both	61	78	91	48	23
Neither	27	18	45	0	11

Notes: The sample consists of 40 countries. The numbers, except the last column, show the per cent of cases in which a crisis or poor macroeconomic performance happened after a boom was observed (out of the total number of cases where the boom occurred). The last column shows the number of countries in which a boom occurred. A real estate boom exists if the annual real housing price appreciation rate during 2000–2006 is above the *ad hoc* threshold of 1.5 per cent or the annual real housing price appreciation rate in the upward phase of the housing cycle prior to the crisis exceeds the country-specific historical annual appreciation rate. A credit boom exists if the growth rate of bank credit to the private sector as a per cent of GDP is more than the arbitrary cut-off of 20 per cent or it exceeds the rate implied by a country-specific, backward-looking, cubic time trend by more than one standard deviation. A financial crisis is a systemic banking crisis as identified in Laeven and Valencia (2012). Poor performance is defined as more than a 1 percentage point decline in real GDP growth in 2008/09 compared to the 2003–2007 average.

recessions. The role of the boom and associated leverage in explaining defaults was also evident in the recent US boom-bust cycle (Figure 2). Post-bust increases in delinquency rates were larger in regions that had experienced greater rates of housing price appreciation during the boom. Further, delinquencies increased more in regions with higher increases in household leverage (Mian and Sufi 2010).

Figure 2: Leverage – Linking Booms to Defaults



Notes: Bubble size shows leverage (calculated as mortgage credit outstanding divided by household income) in 2007; see Glossary for a listing of United States state codes

Sources: Bureau of Economic Analysis; Federal Housing Finance Agency; Mortgage Bankers Association; US Census Bureau

This confirms the critical role played by the interaction between real estate dynamics and bank behaviour. Indeed, while real estate booms (as with other asset price booms) have been identified as a predictor of financial distress (Borio and Lowe 2002; IMF 2011), they lose significance once one conditions for the presence of credit booms. Real estate prices do grow faster during credit booms than in tranquil times. But they grow at about the same pace in credit booms that end up badly as in those that have a soft landing (Dell'Ariccia, Igan, Laeven and Tong *et al* 2012).

3.2 Changes in credit standards

Lending standards generally refer to any of the various non-price lending terms in bank business loans or credit lines (collateral, covenants, loan limits) and to less observable bank activities such as borrower screening and information collection. Laxer lending standards are sometimes identified by a decline in collateral requirements or an increase in loan limits. But more often they are measured with summary statistics from survey data (such as the Fed's Senior Loan Officer Opinion Survey on Bank Lending Practices), or by looking at loan denial data after controlling for borrower fundamentals.

There is ample evidence that credit standards for mortgages and other real estate-related lending vary over the economic cycle: they are easier in the upswing and tighter in the downturn (Asea and Blomberg 1998; Berger and Udell 2004; Lown and Morgan 2006). However, while this evidence is consistent with the notion that standards change in a similar fashion over real estate cycles (the two phenomena are observationally equivalent to the extent that business and real estate cycles overlap), it does not address the role of real estate prices directly.

The recent global financial crisis offers greater insights into how banks alter their lending standards in response to changes in real estate market conditions.

Mortgage originations in the United States increased across the board in the run-up to the crisis. But they did more so in the subprime market, the segment characterised by less creditworthy borrowers. This was not necessarily a bad development. Rising housing prices contributed to the relaxation of credit constraints for the most marginal borrowers, who were able to leverage newly acquired equity in their houses to fund other expenses. For instance, home equity-based borrowing was stronger for younger households, households with low credit scores, and households with high initial credit card utilisation rates. However, after the bust, these households represented a significant share of new defaults (Mian and Sufi 2010).

Critically, the increase in loan volumes was not fully explained by improvements in the quality of the borrower pool or macroeconomic conditions. Instead, the analysis of mortgage performance adjusted for differences in borrower characteristics, loan characteristics and macroeconomic conditions shows that the quality of loans deteriorated for six consecutive years before the crisis (Demyanyk and Van Hemert 2011).

Rising real estate prices (which were partly fuelled by this credit expansion) had an important role in these developments. As the boom continued, rising prices allowed poorly performing borrowers to sell or refinance their properties. This provided support for loan performance and masked (temporarily) the 'true' riskiness of subprime mortgages. Indeed, lower-credit quality borrowers (with very high post-bust default rates) living in areas with fast-rising house prices experienced a relative decline in default rates from 2002 to 2006 (Mian and Sufi 2010). And housing price appreciation after origination, measured as the change in housing prices between the time of origination and the time of loan evaluation, was a critical determinant of loan performance (Demyanyk and Van Hemert 2011). Thus, rising prices helped interest rates remain low along the entire mortgage production chain.

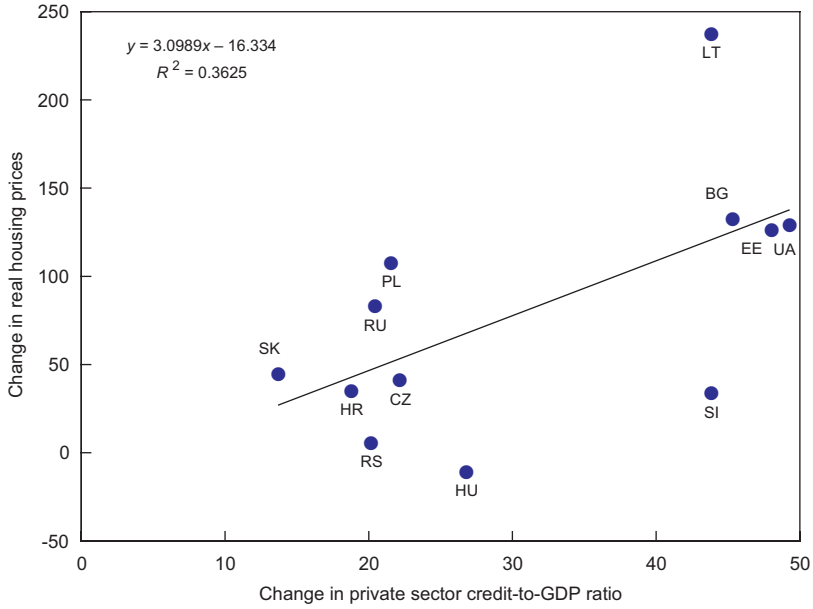
Rising prices also allowed for (and reflected) continued lax lending standards: loan denial rates (adjusted for borrower characteristics) declined more in regions with faster rising housing prices, even after controlling for their endogenous component (Dell'Ariccia, Igan and Laeven 2012). In itself, this might have reflected a 'legitimate' response on the part of lenders to the (unobservable) positive effect of higher borrower net worth on creditworthiness. However, it is also consistent with lenders 'gambling' on the real estate bubble through speculative borrowers. The fact that this effect was most pronounced in the subprime market, and evidence of a steady increase in loan-to-value (LTV) ratios (Demyanyk and Van Hemert 2011), support the latter hypothesis.

Also consistent with the 'speculative behaviour' hypothesis is the fact that lenders increasingly resorted to mortgage contract structures whose performance relied on continued favourable macroeconomic conditions.

In the US subprime market, the share of fixed-rate mortgages dropped from over 30 per cent to below 20 per cent between 2001 and 2006. Hybrid mortgages (including interest-only mortgages) rose accordingly. This development also holds cross-sectionally. For instance, back-loaded products such as interest-only mortgages were used primarily in areas that experienced large housing price appreciations (Barlevy and Fisher 2010). Hybrid contracts typically entail steep increases in payments and interest resets that most borrowers can satisfy only through refinancing or selling their property. Loan performance, then, depends critically on the continuing rise in house prices and low interest rates.

In Europe, a similar trend took the form of a sharp increase in the share of FX-denominated loans. In several eastern European countries, real estate booms were funded by credit booms associated with a rapid growth of foreign currency loans (Figure 3).

Figure 3: Selected Central and Eastern European Countries – Housing Prices and Private Sector Credit
2003–2008



Notes: As the boom in the Baltic states ended in 2007, data for the Baltics refer to 2002–2007; see Glossary for a listing of country codes
Sources: IMF, International Financial Statistics database; national statistical offices

In particular, Swiss franc borrowing, with its very low interest rates, became increasingly popular in countries with floating exchange rates (Croatia, Hungary, Poland and, to a lesser extent, Romania), while euro-denominated loans became more prevalent in countries with currencies pegged to the euro (such as Latvia and Estonia). The lower interest rate attached to FX-denominated contracts increased affordability and reduced idiosyncratic risk. But it exposed the entire system to massive exchange rate risks. Borrowers without foreign currency income would not be able to repay their mortgages in case of a sharp devaluation of the domestic currency.

The recourse to instruments that traded idiosyncratic risk for macro risk (FX loans in Europe and hybrid mortgages in the United States) is also consistent with risk-shifting associated with the expectation of government intervention should the macro risk be realised (as in Farhi and Tirole (2012)). In addition, to the extent that some financial institutions found themselves overexposed to real estate markets, seeking further exposure may have been a form of 'gambling for resurrection'. This second source of risk-shifting may have been particularly relevant in the 2004 to 2006 period, when the Fed's monetary policy tightening resulted in an adverse shock to highly exposed institutions (Landier, Sraer and Thesmar 2011). In the end, macro (and micro) bailouts happened in both cases: with massive monetary policy easing and fiscal stimulus in the United States and with international packages in support of exchange rate pegs in eastern Europe.

Lending standards also declined as banks reacted to large increases in the market for potential borrowers. (These dynamics were obviously associated with the increase in housing prices, but were not directly dependent on them. They could also occur in non-housing-related credit booms.) In the United States, denial rates were relatively low in areas that experienced faster credit demand growth and lenders in these high-growth areas attached less weight to applicants' loan-to-income ratios (Dell'Ariccia, Igan and Laeven 2012). This was in addition to the effect of housing price appreciation, mortgage securitisation and other economic fundamentals. Overall, this evidence is consistent with models of bank strategic interaction in which changes in the distribution of borrowers arising from changes in credit demand affect the standards that banks apply in lending (Ruckes 2004; Dell'Ariccia and Marquez 2006; Gorton and He 2008).

Finally, lending standards declined in response to the securitisation boom associated with the development of new products in the mortgage intermediation chain (Mian and Sufi 2009; Ashcraft, Goldsmith-Pinkam and Vickery 2010; Keys *et al* 2010). The increasingly widespread use of securitisation (especially for subprime loans) obviously contributed to the real estate boom. And, to the extent that rising real estate prices made mortgage-backed securities less information sensitive (including through reliance on credit rating agencies), the booms contributed to the development of this market.

4. Policy Options

Before the crisis, the consensus on the correct policy approach to real estate booms was one of 'benign neglect' (Bernanke 2002; Greenspan 2002). This view was based on two beliefs: speculative bubbles were too difficult to distinguish from price changes based on fundamentals; and policy (in particular monetary policy) was well equipped to deal with the consequences of a bust.

The crisis has shifted (at least in part) this consensus toward the notion that real estate booms are too dangerous to leave alone. In particular, partly reflecting the analyses reported above, a view is emerging that the interaction of large real estate price fluctuations with the volume and quality of credit (in particular bank credit) deserves far greater policy attention. To be fair, some of the dangers associated with boom-bust cycles were recognised before the crisis. But, with a few limited exceptions (for instance, Sveriges Riksbank and the RBA), monetary authorities took the position that controlling excessive risk-taking was in the realm of regulation (Mishkin 2008). And regulatory policy, with its focus on individual institutions, was ill-equipped to deal with asset-price fluctuations and aggregate credit dynamics.

Obviously, some of the rationale that backed the benign neglect approach is still valid. It remains difficult to separate (in real time) 'bubbles' from large or rapid movements in prices based on fundamentals. And, although better yardstick indicators (such as price-to-income and price-to-rent ratios, measures of credit growth, and leverage) can be developed to guide policy, just as with many other policy decisions, action may have to be taken under considerable uncertainty, when the costs of inaction can be prohibitively high.

The question then arises as to which policy lever is best suited to deal with the dangers associated with real estate boom-bust cycles. Based on the analysis above, the main risks appear to come from rapid credit expansions and the associated deterioration in bank and household balance sheets. Policies should thus aim at containing these risks rather than the price increases themselves. In that context, one could think of policies as targeting three (not mutually exclusive) objectives: (i) preventing real estate booms, to avoid the associated dangers altogether; (ii) altering lenders' behaviour over the real estate cycle to contain excessive credit expansion and risk-taking; and (iii) increasing the resilience of the financial system to a real estate bust. Table 2 gives a (non-exhaustive) summary of policy measures available towards achieving these objectives along with their pros and cons.

We should recognise at the onset that there is no silver bullet. Each policy entails costs and distortions. And effectiveness is limited by loopholes and implementation problems. Broad-reaching measures (such as a change in the monetary policy rate) are more difficult to circumvent but they typically involve greater costs. More targeted measures (such as maximum LTV ratios) may have more limited costs but they are challenged by loopholes, which may jeopardise their efficacy.

Table 2: Policy Options to Deal with Real Estate Booms
(*continued next page*)

		Potential impact	Side effects	Practical issues
Macroeconomic policy				
Monetary measures				
Interest rates Reserve requirements	responding to property prices and/or real estate loan growth	Potential to prevent booms, less so to stop one that is already in progress	Inflict damage to economic activity and welfare	Identifying 'doomed' booms and reacting in time; constraints imposed by monetary regime
Fiscal measures				
Transaction/ capital gains taxes linked to real estate cycles		Automatically dampen the boom phase	Impair already-slow price discovery process	Incentive to avoid by misreporting, barter, folding the tax into the mortgage amount
Property taxes charged on market value		(Could) limit price increase and volatility		Little room for cyclical implementation
Abolition of mortgage interest deductibility		Reduce incentives for household leverage and house price appreciation	(Potentially) inflict damage on the real estate sector by taking away a sectoral advantage	Little room for cyclical implementation

Table 2: Policy Options to Deal with Real Estate Booms
(*continued*)

	Potential impact	Side effects	Practical issues
Regulatory policy			
Macroprudential measures			
Differentiated capital requirements for real estate loans	Increase cost of real estate borrowing while building buffer to cope with the downturn	Costs associated with potential credit rationing	May get too complicated to enforce, especially in a cyclical context; effectiveness also limited when capital ratios are already high
Higher risk weights on real estate loans			
Dynamic provisioning for loans collateralised by real estate	Increase cost of real estate borrowing while building buffer to cope with the downturn	Earnings management	Data requirements and calibration
Limits on mortgage credit growth	(Could) limit household leverage and housing price appreciation	Loss of benefits from financial deepening	Shift lending outside the regulatory periphery
Limits on exposure to real estate sector	(Could) limit leverage and price appreciation as well as sensitivity of banks to certain shocks	Costs associated with limiting benefits from specialisation	Shift lending to newcomers for whom exposure limits do not yet bind or outside the regulatory periphery
Limits on loan-to-value ratio	(Could) limit household leverage and housing price appreciation while decreasing probability of default	Costs associated with potential credit rationing	Calibration is difficult, circumvention is easy
Limits on debt-to-income ratio			

4.1 Monetary policy

Since credit activity is at the centre of the problem, monetary policy seems like a natural place to start. After all, M2, a common measure of the money supply, is highly correlated with aggregate credit.

An increase in the policy rate makes borrowing more expensive and reduces the demand for loans. Higher interest payments lower the affordability index (the ratio of the median household income to the income necessary to qualify for a typical mortgage loan) and shrink the number of borrowers that qualify for a loan of a certain amount. Indirectly, to the extent that monetary tightening reduces leverage and risk-taking in the financial sector, it may alleviate the financial consequences of a bust even if it does not stop the boom (Borio and Zhu 2008; Adrian and Shin 2010; De Nicolò *et al* 2010).

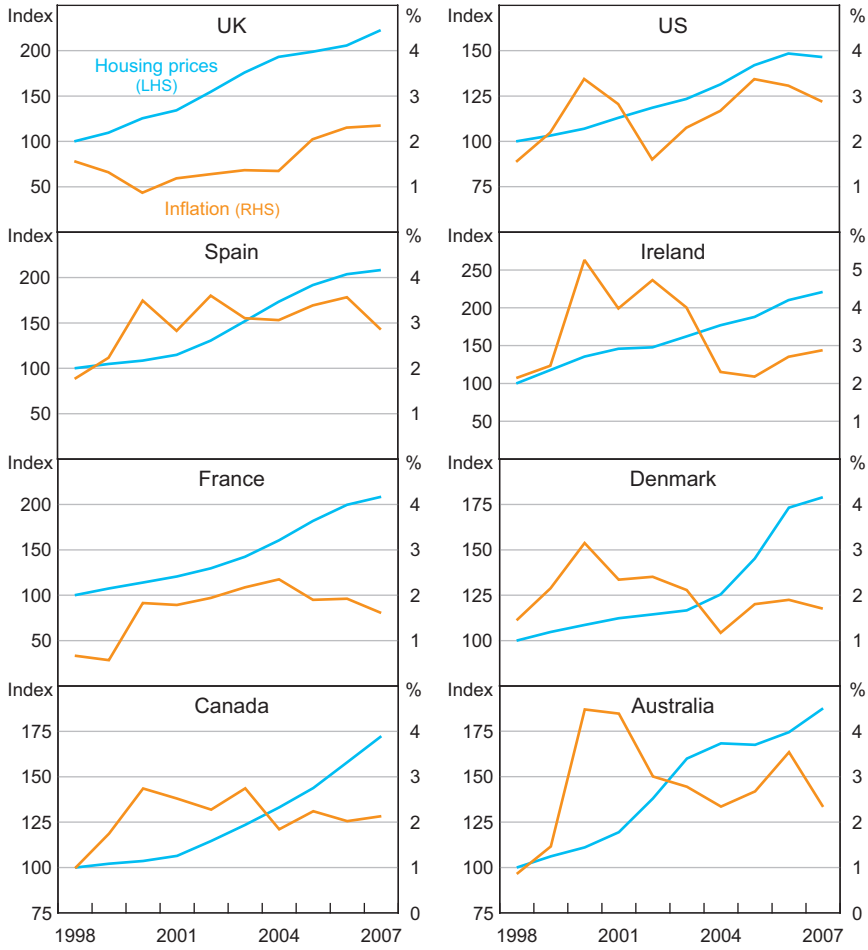
Yet, monetary policy is a blunt instrument for the task at hand. First, it affects the entire economy and is likely to entail substantial costs if the boom (and associated credit expansion) is limited to the real estate market. This may entail a conflict of objectives. Put differently, a reduction in the risk of a real estate boom-bust cycle may come at the cost of a larger output gap and a higher unemployment rate (and possibly an inflation rate below the desired target range). Indeed, in the run-up to the crisis, several countries experiencing real estate (and credit booms) were enjoying low and stable inflation rates and small output gaps (Figure 4).

Obviously, these concerns are diminished when the boom occurs in the context (or as a consequence) of general macroeconomic overheating. Then, the distortions associated with monetary tightening would be minimised. Indeed, when financial constraints are present and real estate represents an important vehicle for collateral, a policy rule reacting to real estate price movements and/or credit growth can dominate a traditional Taylor rule but only for booms that occur in the context of general macroeconomic overheating (Kannan, Rabanal and Scott 2009; Iacoviello and Neri 2010).

A second complication can arise when capital accounts are open and 'the impossible trinity' comes into play. Countries with a fixed exchange rate regime simply do not have the option to use monetary policy. Others float, but are seriously concerned about large exchange rate swings associated with the carry trade when monetary policy is tightened. Then, unless intervention can be fully sterilised, capital inflows attracted as a result of higher interest rates can undo the effects of a tighter stance. Moreover, credit funded by capital inflows brings about additional dangers, including an increased vulnerability to a sudden stop.

A third issue is that, during booms, the expected return on assets (in this case, real estate) can be much higher than what can be affected by reasonable changes in the policy rate. Then, tightening may not be effective in curbing the speculative component of demand. If that is the case, it may have the perverse effect of inducing borrowers (who would have otherwise qualified for standard mortgages) to employ more dangerous loan contracts (such as interest-only, variable-rate loans, and, in some cases, foreign currency loans).

Figure 4: Housing Prices and CPI Inflation



Note: Housing prices normalised at 100 in 1998
Sources: IMF, International Financial Statistics and World Economic Outlook databases

Finally, the effectiveness of a change in the policy rate will also depend on the structure of the mortgage market. In systems where mortgage rates depend primarily on long-term rates, the effectiveness of monetary policy will depend on the relationship between long and short rates.

Empirical evidence supports these concerns. There is little cross-country evidence that the pre-crisis monetary stance had much to do with the real estate boom. Inflationary pressures were broadly contained throughout the period and the extent of housing price booms do not appear to be correlated with real interest rates or other measures of monetary conditions, except in a sub-sample of euro area countries (Fatás *et al* 2009).

On the banking front, evidence lends very limited support to the notion that monetary policy can effectively curb credit booms. However, evidence supports the view that a tighter monetary policy stance deters bank risk-taking over the longer run (see Jiménez *et al* (2011) and Maddaloni

and Peydró (2011)). But it may lead to risk-shifting and riskier contractual structures (see Brzoza-Brzezina, Chmielewski and Niedźwiedzińska (2010) for the case of Europe, and Landier *et al* (2011) for the United States) in the short run if banks are overexposed to interest rate risk.

It should be noted that this evidence may underestimate the effectiveness of monetary policy due to an endogeneity problem. If central banks tightened their stance in reaction to credit or real estate booms, policy rates would be on average higher during booms than in normal times. Then, positive deviations from conditions consistent with a Taylor rule would stem from the booms themselves. In turn, this would tend to reduce the size and significance of the regression coefficients, that is, it would bias the results against monetary policy effectiveness. However, given the monetary policy framework prevalent before the crisis, this bias probably affects only a few countries.

The bottom line is that monetary policy can in principle stop a boom, but at a very high cost. According to most estimates (see Crowe *et al* (2011)), in a boom real estate prices and credit are unlikely to react significantly to marginal changes in policy rates. And policymakers would have to 'lean against the wind' dramatically to have a meaningful impact, with consequent large effects on output and inflation. That said 'open-mouth' operations aimed at warning the public of the dangers associated with real estate-related imbalances could be of value.

4.2 Fiscal tools

In theory, various taxes and fees could be adjusted in a cyclical fashion (with real estate prices, or aggregate credit, or some systemic risk measure) to alter bank and borrower behaviour. In practice, however, cyclically adjusted fiscal measures may be of limited use. First, the evidence on the relationship between the tax treatment of residential property and real estate cycles is inconclusive. Second, proposed taxes on certain bank activities or balance-sheet items (such as short-term liabilities) are likely to be circumvented and may entail undesired side effects. And, finally, technical and political economy problems may complicate implementation.

Empirical evidence supports these considerations. At the structural level, the tax treatment of housing does not appear to be related across countries to the amplitude of real estate cycles. In particular, tax structure was not likely to have been a main driver of housing price developments during the recent global housing boom (Keen, Klemm and Perry 2010). Real housing prices increased significantly in countries with tax systems that are highly favourable to housing (such as Sweden) as well as in countries with relatively unfavourable tax rules (such as France). On the banking front, fiscal tightening does not seem to be associated with either a reduced incidence of credit booms or a lower probability of a boom ending badly (details in Dell'Ariccia, Igan, Laeven and Tong *et al* (2012)).

Cyclical transaction taxes are, in theory, more promising in dealing with booms (Allen and Carletti 2011b). But it should be recognised that these taxes may induce considerable distortions in real estate markets and, indirectly, on labour markets through their impact on mobility. On the bust side, the use of time-limited tax credits linked to housing purchases in the United States and the suspension of stamp duty in the United Kingdom helped stabilise the housing market. And, especially in the United States, the stabilisation in prices and the revival of activity disappeared with the expiration of the tax breaks (Igan and Loungani 2010). On the boom side, China and

Hong Kong SAR have recently introduced higher stamp duties to dampen real estate prices and discourage speculation. Their experience, however, also indicates that transaction volume responds more than prices do (suggesting that the associated collateral costs are high) and the impact of the introduction of the tax may be transient.

Similarly, new fiscal tools aimed at specific components of bank balance sheets have been proposed in the aftermath of the global financial crisis. These could take the form of levies imposed on financial activities – measured by the sum of profits and remuneration (Claessens *et al* 2008) – or a countercyclical tax on debt aiming to reduce leverage and mitigate the credit cycle (Jeanne and Korinek 2010). These can have a direct impact on the externalities associated with leverage and risk-taking. Such 'financial activities taxes' or 'taxes linked to credit growth' could reduce the speed at which individual financial institutions can expand and prevent them from becoming 'too systemically important to fail'. The associated revenues can be used to create a *public* buffer rather than private buffers for individual institutions as do capital requirements. Moreover, unlike prudential regulation that applies only to banks, the proposed tools could contain the credit expansion of non-bank financial institutions as well.

Yet, practical issues with these newly proposed fiscal tools also exist. Incentives to evade the new levies may lead to an increase in the resources devoted to 'tax planning'. These incentives may actually strengthen when systemic risk is elevated because, as the possibility of having to use the buffers increases, financial institutions may attempt to avoid 'transfers' to others through the public buffer. A further complication may arise if there are provisions to protect access to finance for certain borrowers or access to certain type of loans: circumvention through piggyback loans or by splitting liabilities among related entities may generate a more complex and worse situation for resolution if the bust comes. In addition, in order for these new measures to be effective, they would have to take into account how banks react to their imposition. This is likely to mean a diversified treatment for different categories of banks (which opens up the risk of regulatory arbitrage) and progressive rates based on information similar to what is used for risk-weighted capital requirements (Keen and de Mooij 2012).

In summary, 'financial taxation' proposals make sense on paper, but remain to be tested. In the meantime, the best (most practical) shot for fiscal policy is likely to be in creating room in boom years for intervention to support the financial sector or stimulate the economy, if the bust arrives. Obviously, this is easier said than done. Political economy will make it difficult to sustain large fiscal surpluses for prolonged periods, especially when real estate booms do not fully overlap with macro cycles.

4.3 Macroprudential regulation

The limited effectiveness and high potential costs of macroeconomic policies in curbing real estate booms (and the associated credit booms) suggest the need for a different approach. At least in theory, macroprudential measures, such as higher capital requirements or limits on various aspects of mortgage credit, can target narrow objectives (for instance, household or bank leverage) and tackle (excessive) bank risk-taking associated with real estate booms more directly and at a lower cost than traditional macroeconomic policies.

Against the benefit of a lower cost, these measures are likely to present two shortcomings. First, they may be easier to circumvent as they target specific types of contracts or groups of agents. When this happens, these measures can be counterproductive, possibly generating liability structures that are more difficult to resolve/renegotiate in busts. Second, they may be more difficult to implement from a political economy standpoint. Over time, monetary policy decisions have come to be accepted as a 'necessary evil' and central banks have increasingly achieved credibility and independence. In contrast, macroprudential measures could be perceived as an unnecessary intrusion into the functioning of markets. Their more targeted impact would also complicate implementation, as winners and losers would be more evident than in the case of macro policies (although several countries seem to have dealt effectively with this problem).

In this review, we focus our analysis on three specific sets of measures. First, capital requirements or risk weights that change with the real estate cycle. Second, dynamic provisioning, that is, the practice of increasing banks' loan-loss provisions during the upswing phase of the cycle. And third, the cyclical tightening/easing of eligibility criteria for real estate loans through LTV and/or debt-to-income (DTI) ratios.[1] In principle, these tools may (indirectly) reduce the likelihood and/or magnitude of a real estate boom. But by directly targeting risk-taking, containing leverage and increasing provisioning, they are explicitly aimed at altering bank behaviour during booms and at strengthening the financial system against the effects of a real estate bust.

A caveat is in order before we start our analysis. Macroprudential policy frameworks are still in their infancy, and only a minority of countries have actively used them (Borio and Shim 2007; Crowe *et al* 2011). This limits data availability. In addition, these measures are typically used in combination with macroeconomic policy and direct interventions to the supply side of housing markets (such as in Singapore), which further complicates the challenge to attribute outcomes to specific tools (Table 3).

1 Other measures not discussed here include cyclical ceilings on portfolio exposure to real estate, speed limits on real estate lending, and restrictions on certain type of loans. These tools have been used even more sparingly.

Table 3: Survey-based Assessment of Policy Frameworks as at September 2010
Per cent of respondents giving a particular answer

	No	Yes		
		Directly[a]	Subject to restrictions	Cyclical
Monetary policy				
Credit growth explicitly considered?	78	22	14	
Property prices explicitly considered?	64	36	8	
Tax system				
Transactions tax?	6	94	64	
Mortgage interest deductability?	39	61	44	
Regulatory structure				
Restrictions on …				
which financial institutions can extend mortgage loans?	50	50		
type of mortgages?	81	19		
LTV ratio?	53	47		
DTI ratio?	50	50		
mortgage credit growth rate?	94	6		
Real estate-specific loan loss provisioning?	61	39		11
Real estate-specific risk weights?	56	44		11
Full recourse on mortgages?	25	75		

Notes: Compiled responses from 36 countries; country-by-country responses to this brief in-house survey are in Crowe *et al* (2011)
(a) That is, not through the rent component of the CPI
Source: Crowe *et al* (2011)

4.4 Higher capital requirements/risk weights

Capital requirements or risk weights linked to real estate price dynamics, force banks to hold more capital against real estate loans during booms to build buffers against losses during busts. Further, by increasing the cost of credit during booms, they might reduce demand and contain real estate prices themselves. Weights could be fine-tuned to target regional booms, potentially reducing the macroeconomic costs of the intervention.

A few caveats are in order. First, absent more risk-sensitive weights, an across-the-board increase in risk weights (or capital requirements) may push lenders towards riskier loans. Second, (as with any other measure targeting the banking system), procyclical risk weights may be circumvented through recourse to non-bank intermediaries, foreign banks and off-balance sheet activities. Third, these measures will lose effectiveness when actual bank capital ratios are well in excess of regulatory minima (as often happens during booms). Fourth, as for marginal changes in the policy rate, tighter requirements are unlikely to have the economic magnitude to stop a boom. Finally, there is a time-consistency issue: regulators may be reluctant to allow banks to reduce risk weights during a bust (when borrowers become less creditworthy).

Evidence on the effectiveness of these measures is mixed. Several countries have raised capital requirements and/or risk weights on particular groups of real estate loans during credit and housing booms (Table 3). Some attempts (such as the cases of Bulgaria, Croatia, Estonia and the Ukraine) failed to stop the boom; others (such as the case of Poland) were a partial success (Crowe *et al* 2011). In these countries, tighter capital requirements appeared to curb the growth of particular groups of loans, but real estate price appreciation and overall credit growth remained strong.

4.5 Dynamic provisioning

The mechanics and benefits of dynamic provisioning (mandating loss provisioning linked to aggregate credit growth) are similar to those of procyclical capital requirements. By forcing banks to build (in good times) an extra buffer of provisions, it can help cope with the potential losses that come when the cycle turns (see, for example, the case of Spain). It is, however, unlikely to cause a major increase in the cost of credit, and thus to stop a boom. That said, one advantage over cyclical capital requirements is that dynamic provisioning would not be subject to minimums as capital requirements are, so it can be used when capital ratios maintained by banks are already high. Provisioning for property loans could be made a specific function of housing price dynamics. In periods of booming prices, banks would be forced to increase provisioning, which they would be allowed to wind down during busts. As in the case of risk weights, provisioning requirements could depend on the geographical allocation of a bank's real estate portfolio.

As noted, this type of measure is primarily targeted at protecting the banking system from the consequences of a bust. Consequently, it is not meant to have a significant impact on credit and contain other vulnerabilities associated with a boom, such as increases in debt and leverage in the household sector. In addition, there may be practical issues with the calibration of rules with rather demanding data requirements and unintended effects such as increased earnings management (which may raise issues with tax authorities and securities markets regulators). There are also risks of circumvention similar to those of procyclical risk weights.

The experience with these measures suggests that they can help strengthen a banking system against the effects of a bust, but do little to stop the boom itself. Spain led the countries that have adopted counter-cyclical provisioning. Starting in 2000 and with a major (downward) revision in 2004, the Bank of Spain required banks to accumulate additional provisions based on the 'latent loss' in their loan portfolios (for more details on the Spanish dynamic provisioning framework, see Saurina (2009)). Dynamic provisions forced banks to set aside, on average, the equivalent of

10 per cent of their net operating income. Yet, household leverage still grew by a high 62 per cent in Spain. At the end of 2007, just when the real estate bust started, total accumulated provisions covered 1.3 per cent of total consolidated assets; certainly a help, but far too little to deal with the ongoing crisis. The questions are then how provisioning requirements relate to the general macroeconomic policy stance, and whether provisioning can be made 'sufficiently procyclical' to appropriately deal with major systemic crises.

4.6 Limits on LTV and DTI ratios

Limits on LTV ratios can help prevent the build-up of vulnerabilities on the borrower side (in particular in the household sector), and at the same time curb risk-taking on the lender side. Containing leverage will reduce the risks associated with declines in housing prices. Put differently, the lower the leverage, the greater the drop in prices needed to put a borrower into negative equity. In turn, this is likely to result in fewer defaults when the bust comes, as more borrowers unable to keep up with their mortgages will be able to sell their houses or refinance into loans with lower interest rates (assuming the monetary policy stance would be accommodative to the bust). In addition, in case of default, lenders will be able to obtain higher recovery ratios. On the macro front, a limit on LTV ratios will reduce the risk that a large sector of the real economy ends up with a severe debt overhang. In addition, it will reduce the pool of borrowers that can obtain funding (for a given price) and thus will reduce demand pressures and contain the boom.

Similar to limits on LTV ratios, DTI limits will rein in the purchasing power of individuals reducing the pressure on real estate prices. In particular, they will be effective in containing speculative demand (they will screen out borrowers that would only qualify for a mortgage on the assumption that the house would be quickly turned around). They will also reduce vulnerabilities as borrowers will have an 'affordability' buffer and will be more resilient to a decline in their income or temporary unemployment.

Circumvention may entail significant costs, as it may result in liability structures that can complicate debt resolution during busts. In addition, circumvention may also involve shifting of risks not only across mortgage loan products but also outside the regulatory perimeter through expansion of credit by non-banks, less-regulated financial institutions and/or by foreign banks (which may result in increased currency mismatches as the proportion of FX-denominated loans rises).

As with monetary policy, calibration of these tools will be a learning process and a clear communication strategy will need to be developed to improve their efficiency. Frequent intervention and excessively sharp changes in the limits may lead to confusing signals and increase the risk of generating policy-induced real estate cycles. The narrow target nature of these measures may increase obstacles related to the political economy (as happened in the case of Israel), particularly since the groups more affected by LTV and DTI limits tend to be those more in need of credit (poorer and younger individuals).

The scant existing empirical evidence suggests that these are promising measures. A review of country cases that experimented with changing mandatory LTV limits in response to real estate market developments indicates that they can be quite effective (see Crowe *et al* 2011). On the banking side, there is evidence that macroprudential tools (including LTV and DTI limits) can reduce the incidence of credit booms and decrease the probability of financial distress and below

par growth performance following the boom (see Dell'Ariccia, Igan, Laeven and Tong *et al* (2012)). This suggests that macroprudential policy can reduce the risk of a bust while simultaneously reducing vulnerabilities of the rest of the economy to troubles in the financial system.

5. Conclusion

The crisis has challenged the benign neglect approach to real estate (and other asset price) bubbles. That approach was backed by a theoretical framework that saw the structure and behaviour of financial intermediaries largely as macroeconomic-neutral and by the belief that policy was well equipped to deal with the consequences of a bust.

The theoretical work and empirical evidence reviewed in this paper suggest that both tenets were wrong. Banks alter their lending and risk-taking behaviour over real estate cycles with significant implications for macroeconomic fluctuations and financial stability. And massive policy interventions notwithstanding, the most recent bust triggered the deepest recession since the Great Depression.

This calls for the revision of both models and policies. The good news is that both processes are happening. The bad news is that both will take time.

With regards to theoretical frameworks, DSGE models increasingly deal with real estate prices and with the role of financial intermediation. Several partial equilibrium models have been developed that highlight different angles of the relationship between asset prices, monetary policy and bank risk-taking. Yet, it will take time for these building blocks to be incorporated into larger frameworks and calibrated to provide quantitative policy guidance.

On the policy front, a view is gaining ground that not all bubbles are alike and those that are funded through credit and leveraged intermediaries deserve close policy attention (Crowe *et al* 2011; Mishkin 2011). There is the associated recognition that imbalances relevant to the macroeconomy (such as real estate booms and the associated excessive increases in leverage and bank risk-taking) do not necessarily show up in traditional measures of inflation and output gaps (Blanchard, Dell'Ariccia and Mauro 2010). Yet, the question of how to deal with these phenomena remains largely an open one.

Central banks are becoming increasingly involved in financial stability issues. Looking forward, aggregate credit and real estate price developments are likely to play a bigger role than before in monetary policy decisions (especially, should new macroprudential tools prove ineffective). But monetary policy remains a blunt tool to deal with real estate booms (unless they happen to occur in sync with general overheating of the macroeconomy) and its effects on bank risk-taking are still only partly understood.

Macroprudential measures are a promising addition to the policy toolkit and regulatory frameworks have already started to adapt them. For instance, Basel III introduced a capital buffer range that can be adjusted 'when there are signs that credit has grown to excessive levels' (BCBS 2011). But it will take time to design and calibrate these new tools, understand their relationship with other macroeconomic levers, and build the institutions that will control them.

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Discussion

1. Piti Disyatat

The paper by Giovanni Dell'Ariccia provides a concise yet insightful review of the literature on the link between bank risk-taking and property prices. This is not a straightforward task since this link is not well developed, with only a handful of papers that directly deal with the issue at hand. As a result, the review must draw on several distinct fields of study to glean the relevant insights. In this respect, the paper does an excellent job in pulling together the key components from the theoretical and empirical literature on credit constraints, leverage cycles, asymmetric information and bubbles.

My comments are mostly suggestive, focusing on elements that are currently downplayed and which may usefully be included in the review. I also have some slight differences in emphasis in terms of the paper's policy prescription.

Starting with the discussion on bank risk-taking, it is important to be clear that the concern here is *excessive* risk-taking. Banks take risk as part and parcel of their business so risk itself is not the issue. In this respect, the paper could usefully lay down a precise notion of what constitutes excessive risk-taking. One working definition could be the degree to which banks take risks that are not compensated for by higher yields, that is, projects that *ex ante* have negative present value. This begs two key questions: (i) what motivates banks to take on excessive risk; and (ii) why was it allowed to happen?

With respect to the first question, the paper emphasises the macroeconomic backdrop and enablers of risk-taking and places relatively small emphasis on the underlying agency problem at the managerial level. The recent financial crisis has exposed a number of weaknesses in the compensation structure and corporate governance of financial institutions. As highlighted by Mehran, Morrison and Shapiro (2012), the unique feature of banks is the presence of a multiplicity of stakeholders (shareholders, insured and uninsured depositors, debt holders, subordinated debt holders, etc) and the complexity of their operations. This translates into a setting where stakeholders have less control than managers over the bank. In this situation, the incentive structure created by compensation arrangements plays a critical role in how much risk banks take on.

Evidence on compensation practices at US banks over 1996–2007 cited by Mehran *et al* (2012) indicates a structure that seems to favour short-term returns over the maintenance of long-term franchise value. For example, apart from the steady increase in reliance on cash compensation and bonuses, close to 50 per cent of options granted had a vesting schedule of less than a year. And once these options become vested, around half were exercised within a year. A by-product of such a compensation structure is the creation of a culture of risk in which risk-takers are accorded status and influence. The paper would do well to include a discussion of these issues in explaining bank risk-taking.

Moving on to the second question: why was risk-taking allowed to happen? Here one could think of three broad factors. The first is that excessive risk-taking was inadvertent. This may have reflected lax risk controls resulting from the opaque and complex nature of bank operations or, more importantly, overoptimism in judging future economic and asset price trajectories. Second, regulatory forbearance may have been at play to varying degrees. Certainly in the United States, political pressure in favour of 'affordable housing' mandates contributed to an environment in which housing credit was seen as a public good. Third, weak market discipline resulting from public safety nets and too-big-to-fail perceptions was likely to have contributed to an environment conducive to excessive risk-taking.

Personally, I am not convinced that market discipline can be relied on to keep risk-taking in check. If anything, experience suggests that market discipline works best when one would *not* like it to. That is, during crises banks that are perceived to be risky cannot obtain funding at almost any cost, exacerbating the systemic liquidity problem. At the same time, during normal times, market discipline seems to be such that highly profitable banks are rewarded with a good credit rating and easy access to funding. Given that high profits are often commensurate with high risks, prudent behaviour is simply not rewarded. The overall result of market discipline is then to boost markets in booms and intensify problems in busts.

Against this backdrop, the key question is what specific features of property markets make lending to that sector especially susceptible to excessive risk-taking. The key identifying feature is that property lending is heavily collateralised by the very asset that the borrowed funds are used to purchase. This can give rise to a sense of security and safety. In fact, banks often view mortgage lending as one of their safest activities. As long as property prices are not expected to fall dramatically, or at least not by as much as the amount of the down payment, banks will not worry so much about borrower default and the possibility of owning the underlying property. Thus in periods of sustained increases in property prices, banks may be tempted to neglect borrower characteristics in extending mortgage loans. The fact that real estate price increases tend to be persistent serves to reinforce such one-way price perceptions.

Turning to the policy prescription, overall, the paper seems to be quite guarded in discussing available policy options and, from a practical perspective, it would be helpful if the paper would come out more strongly one way or another in this regard. As it is, there are nevertheless things I agree with, things I disagree with, and issues that are left out but could be usefully added.

To start with the areas of agreement, the paper argues rightly that the aim of policy should be to address the underlying risks associated with rapid credit expansion rather than rising property or asset prices *per se*. This echoes the arguments forcefully made by White (2009) and need not be restated here. I also share the paper's generally positive perception regarding the potential of loan-to-value (LTV) limits to mitigate excessive risk-taking. Much of the regulatory reform efforts post-crisis have been focused on ways to increase banks' 'skin in the game'. In fact, many of the troubled banks had skin in the game, so much so that the losses overwhelmed them. Given the distortions in compensation structures discussed above, a more effective way to limit bank risk is to increase borrowers' own exposure. LTVs accomplish this and at the same time give banks more cushion on the downside. The experience of LTVs in Asia has also been generally positive (see, for example, Hong Kong Monetary Authority (2011)).

The key area of disagreement involves the paper's apparent argument that the role of monetary policy is limited. While the link between interest rates and asset price run-ups is indeed tenuous, it is hard to deny the critical role that monetary policy plays in influencing credit dynamics. After all, monetary policy sets the price of leverage. As the paper highlights, credit plays a crucial role in property price cycles and very much conditions the severity of the bust phase. Starting from the premise that monetary policy is a key determinant of credit growth, the relevant question is not whether monetary policy caused the boom or not – which inevitably leads to negative results given the many structural factors at play – but whether enough was done to restrain the boom. One should not look to monetary policy to prevent boom-bust cycles, just as one would not judge the worthiness of speed limits on the basis of whether all accidents are avoided or not. But it is important to make sure that monetary policy does its fair share in mitigating the amplitude of the cycle and, at the very least, abstains from fanning the boom.

I am also unconvinced by the argument that the combination of tame inflation and relatively small output gaps pre-crisis weakens the case for monetary policy action to contain credit growth since this would have led to large output losses. At its core, the goal of monetary policy is to foster sustainable economic growth. High inflation is a sign of overheating that threatens this goal and needs to be counteracted. But a credit boom also signifies potential overheating, in many instances even more so than does inflation. The growth sacrifice that comes from tightening policy to curb rapid credit growth is not any more superfluous than that associated with policy action to slow down inflation. Price stability is not an end in itself, but a means to achieving sustainable economic growth. Anything that threatens the latter and is amenable to monetary policy should elicit a response.

Moreover, it is important to keep in mind that prevailing output gap estimates are derived using inflation developments as the predominant indicator of overheating. The contribution of credit, and information about the financial cycle more broadly, are not considered. This can result in inaccurate assessment about the economy's sustainable output level and hence the perceived desirability of policy actions to moderate a credit boom. As illustrated in Borio, Disyatat and Juselius (forthcoming), incorporating information from credit growth into estimates of potential output yields significantly larger (positive) output gaps compared with standard measures in the run-up to the global financial crisis in a number of countries, including the United States and the United Kingdom. Based on such credit-adjusted output gaps, a stronger case for monetary action to counteract the credit expansion could have been made.

Finally, the discussion on policy options could be expanded to include a number of pertinent issues. First, a review of corporate governance reforms currently under consideration would be useful. In particular, suggestions have been made to amend bank compensation structures so that managers internalise the consequences of excessive risk-taking. Bolton, Mehran and Shapiro (2011), for example, propose tying part of a CEO's compensation to the bank's credit default swap spread. Leijonhufvud (2012) suggests remunerating executives in part with equity that carries double liability in case the institution becomes insolvent.

Second, the discussion on the implementation challenges of counter-cyclical rules could be extended. It has been noted that business cycle and credit cycles are not synchronised, with the latter tending to have much longer duration (Drehman, Borio and Tsatsaronis 2012). In this

context, calibration of counter-cyclical macroprudential tools may be difficult. Indeed, Repullo and Saurina (2012) show that deviations in the ratio of credit-to-GDP from trend can be negatively correlated with output growth, resulting in unintended changes in capital buffers under Basel III.

Third, the paper could usefully discuss possible synergies to be had from combining macroprudential tools. The variation of risk weights linked to LTV ratios, as has been done in Ireland and Thailand, represent examples. The use of various instruments in combination offers a way to mitigate the shortcomings specific to individual tools, potentially creating hybrid instruments with new properties that warrant further exploration.

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2. General Discussion

The discussion began with comments on the difficulty of comparing the dynamic relationship between housing prices and inflation across countries as shown in Figure 4 of the paper. It was suggested that in different countries there are different treatments of the housing service flow of owner-occupied dwellings and, as a consequence, there will be different patterns of inflation and housing prices across countries. It was highlighted that the European Central Bank's harmonised index of consumer prices does not include owner-occupied housing service flows while the US consumer price index (CPI) does. Indeed, one participant said the weight of housing service flows in the US CPI was in excess of 20 per cent and, accordingly, these measurement differences between counties were non-trivial.

The discussion then shifted towards whether or not owner-occupied housing service flows *should* be included in consumer price indices, with one participant suggesting these flows could be included using a user cost measure. They said this, in turn, links back to how housing prices are measured and highlights the importance of research such as Deng, Gyourko and Wu (this volume).

Against this background, another participant drew attention to their research for the United States showing that housing prices are a highly significant determinant of inflation in the long run. The paper's author, Giovanni Dell'Ariccia, agreed; however, Dr Dell'Ariccia noted that this finding is largely irrelevant for central banks, who are more concerned with two-to-three-year inflation forecasts. Notwithstanding this, he went on to say that low inflation was not a sufficient reason for central banks not to take action against unhealthy booms in housing prices. However, he emphasised that it is difficult to stop a boom in real estate prices and credit with monetary policy. To have any meaningful impact interest rates would have to be raised significantly with possibly very high costs to the real economy.

Abstracting from measurement issues, another participant argued that the coincidence of a real estate boom with low and stable inflation would be expected because low interest rates are always possible with low inflation rates, and low interest rates push banks to take more risk, particularly in the housing market.

On the link between real estate price cycles and bank behaviour, one participant expressed scepticism that banks, and indeed other corporates, could be disciplined by markets because the market incentivises leverage. It was noted that bank owners and managers effectively have a call option on their firms and the value of this option increases with volatility and the probability that the option will be 'in the money'. Moreover, it was argued that volatility and the probability of an option being in the money increases with leverage. Accordingly, the incentive to have a highly leveraged institution, particularly for banks, is a testing issue to face when trying to formulate regulation. In response, Dr Dell'Ariccia said he was sympathetic to the view that there should be rules on managerial compensation; however, he noted that before having an intrusion on private contacts one needs to see evidence of market failure. On the topic of market failure and the design of managerial compensation rules it was emphasised that one needed to distinguish between whether there was an inability of shareholders to discipline their managers or whether shareholders have the same conflict of interest as managers.

One participant also expressed scepticism about loan-to-value (LTV) ratios as a macroprudential policy tool. They said such tools could work in some systems but that they would never work in the United States or within systems where a ban on second lien mortgages cannot be enforced. Moreover, they said the problem of circumvention is difficult to prevent (for an example, see Kang (this volume)). In responding, Dr Dell'Ariccia said the jury is still out regarding the effectiveness of LTVs as a macroprudential tool and that it will be interesting to examine the incidence of circumvention as more countries adopt these tools.

Continuing on the theme of macroprudential tools, one participant said a challenge for central banks is convincing the public that such tools are effective policy instruments. They argued that central banks had convinced the public that interest rate adjustments were an effective policy instrument by positioning monetary policy beyond the political arena and thereby asserting its independence. Dr Dell'Ariccia agreed and said when you have an independent inflation target you

can demonstrate to the public the effectiveness of interest rate adjustments with counterfactual analysis (i.e. a policymaker can demonstrate that inflation would have been above the target if they had not previously increased interest rates). In contrast, if a policymaker is concerned with financial vulnerabilities and uses macroprudential tools, which have real costs to the economy, it is difficult to demonstrate their effectiveness with counterfactual analysis. This is the problem of taking the punchbowl away from the party, which is common to regulators and now to macroprudential regulation, he said.

More generally, another participant discussed what they referred to as the 'standard narrative' presented in the paper: that policymakers prior to the crisis took a benign neglect view about credit and asset price cycles. While the paper presented a few exceptions to this post-crisis narrative, the participant argued there were a lot more, including most of the countries represented at the Conference. The discussion proceeded by asking why some countries fitted the post-crisis narrative while others did not? The same participant suggested this was because, within some institutions, the prevailing view was that if the role of credit and asset price cycles cannot be incorporated into models dealing with inflation and the macroeconomic cycle (the contribution of Kiyotaki and Moore (1997) notwithstanding) then these factors do not have a role to play. By contrast, within other institutions such as the Reserve Bank of Australia, policymakers were more comfortable about responding to asset prices and credit booms even though it is difficult to incorporate these variables into standard models.

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Taming the Real Estate Beast: The Effects of Monetary and Macroprudential Policies on Housing Prices and Credit

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1. Introduction

Recent events have underscored the importance of asset price booms and busts as sources of financial instability. Unsustainable property price appreciation figured prominently in the 2007–2009 financial crisis, in the 1997–1998 Asian financial crisis, and in Japan's property market collapse in the early 1990s. Monetary policy has come under intense scrutiny as a possible factor contributing to the escalation in real estate prices, with some blaming the US Federal Reserve's low interest rate policy for creating a bubble in the US housing market.

These tumultuous experiences have generated a great deal of interest in two interrelated questions. The first is the extent to which housing price and credit movements are explained by changes in interest rates and, by extension, whether monetary policy would be effective in attenuating housing market excesses. The second concerns the effectiveness of non-interest rate policies, such as prudential regulation, as additional tools for stabilising housing price and credit cycles. This is a crucial issue for central banks seeking to ensure financial stability while simultaneously using interest rate policy in the pursuit of macroeconomic objectives. And it is especially pressing for countries with fixed or heavily managed exchange rates, where there is limited scope for interest rate policy to address property market imbalances.

This paper empirically addresses both of these questions using data from 57 economies going back as far as 1980. The scope is therefore considerably broader than most existing work, such as Girouard *et al* (2006), which has mostly been limited to a smaller set of industrialised countries. We focus in particular on the Asia-Pacific region where non-interest rate policy measures have been used more actively than elsewhere.

Our investigation focuses on three classes of policy measures intended to affect housing prices and housing credit. The first consists of non-interest rate monetary policy actions, primarily changes in reserve requirements. The second category includes five distinct prudential policy measures: (i) maximum loan-to-value (LTV) ratios; (ii) maximum debt-service-to-income (DSTI) ratios; (iii) risk weights on mortgage loans; (iv) loan-loss provisioning rules; and (v) exposure limits

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to the property sector. The third category consists of fiscal policy measures such as capital gains tax at the time of sale of properties and stamp duties. One of the contributions of this paper is the compilation of an extensive dataset on the implementation of these macroprudential policies for a wide range of economies.[1]

We assess these policies' effects using panel regressions of housing price growth and housing credit growth, with models that also include controls for other factors affecting the housing market, such as rent, personal income and institutional features of the housing finance system. With regard to housing prices, our main findings are that increases in short-term interest rates and in the maximum LTV and/or DSTI ratios have strong, statistically significant effects. These results hold for several alternative model specifications, and in sub-samples that exclude the period affected by the financial crisis. Regarding the impact on housing credit, our results consistently show that limiting LTV and/or DSTI ratios and increasing loan-loss provisioning requirements tend to slow credit growth. Tax policies and exposure limits were also found to have the desired effects, although these results are sensitive to sample period and model specification. Taken together, our results suggest that macroprudential policies can be effective tools for stabilising housing price and credit cycles.

The plan of the paper is as follows. Section 2 surveys the existing evidence on the effects of monetary policy, financial structure and regulation. Section 3 outlines the standard theory of property prices, which will be used as a framework for understanding the potential roles of monetary policy, financial innovation and regulation in contributing to (or attenuating) property market fluctuations. Section 4 sketches the empirical approach. Section 5 describes the data used in the analysis, whose unique feature is an exhaustive compilation of a range of policy measures aimed at influencing conditions in the housing market. Section 6 reports the results, and Section 7 concludes.

2. Existing Evidence

Research on the effects of monetary and regulatory policies on the property market tends to fall into one of two categories. One strand of the literature, surveyed in Section 2.1, emphasises the effects of interest rates. The second strand focuses on macroprudential policies, often making use of cross-country or event-study methods. This literature is summarised in Section 2.2. The analysis in this paper combines elements of both.

2.1 The effects of interest rates

Many studies have documented the cyclical co-movement between interest rates and housing prices. Claessens, Kose and Terrones (2011), for example, show that housing prices are strongly procyclical in most countries. Ahearne *et al* (2005) find that low interest rates tend to precede housing price peaks, with a lead of approximately one to three years. While these patterns are suggestive, discerning the impact of interest rates *per se* is complicated by the fact that other

1 Following FSB-IMF-BIS (2011), macroprudential policy is characterised by reference to the following three defining elements: (i) objective – to limit systemic risk; (ii) scope – the focus is on the financial system as a whole; and (iii) instruments and associated governance – it uses primarily prudential tools calibrated to target the sources of systemic risk. In this paper, we use the term 'macroprudential policy' to refer to non-interest rate monetary policy, prudential policy and fiscal policy designed to influence housing prices and housing credit.

macroeconomic factors affecting the demand for housing vary along with the interest rate. Moreover, it is impossible to tell from purely descriptive analysis whether the magnitude of the housing price variations are consistent with the effects implied by user cost theory.

Taking a more structured approach, Dokko *et al* (2009) use time series methods to construct housing price forecasts under alternative interest rate path assumptions in an effort to determine the extent to which low interest rates contributed to the housing price boom in the United States in the mid 2000s. They find that deviations from the Taylor rule explain only a small portion of the pre-crisis rise in property values, casting doubt on Taylor's (2007, 2009) assertion that overly expansionary monetary policy caused the boom.

A number of papers have used vector autoregressions (VARs) to gauge the impact of monetary policy shocks on housing prices. The four studies using this method summarised in Table 1 find a statistically significant impact of monetary policy on housing prices. Estimates of the maximum impact of a 25 basis point monetary policy shock on the level of housing prices range from 0.3 per cent to 0.9 per cent.[2] This is rather modest in economic terms, as it implies that a full percentage point contractionary shock would have reduced housing prices by less than 4 per cent. Table 1 also illustrates the sensitivity of the estimated dynamics to the identifying assumption: Del Negro and Otrok (2007) report a large contemporaneous response, while the other three papers' results suggest a more gradual adjustment process.

Table 1: VAR Estimates of Monetary Policy Shocks' Impact on Housing Prices

Per cent

	Impact of a 25 basis point expansionary shock		
	Immediate	10 quarters	Long run
Del Negro and Otrok (2007), Figure 5: United States, 1986–2005	0.9	0.2	≈ 0
Goodhart and Hofmann (2008), Figure 3: 17 OECD countries, 1985–2006	0	0.4	0.8
Jarociński and Smets (2008), Figure 4: United States, 1995–2007	0	0.5	≈ 0
Sá, Towbin and Wieladek (2011), Figure 4: 18 OECD countries, 1984–2006	–0.1	0.3	0.1

An alternative approach to assessing interest rates' contribution to housing price fluctuations is derived from the user cost model. As discussed in Section 3, this model is based on a relationship linking the price of a property to the present value of future rents. One key implication of the model is that rents and property prices should be cointegrated, a possibility that has been investigated by Girouard *et al* (2006) for OECD countries, Mikhed and Zemčík (2007) for the Czech

2 These VAR-based estimates are comparable to those obtained by Glaeser, Gottlieb and Gyourko (2010) using a simple regression of the log housing price on the real 10-year interest rate. The estimates of Glaeser *et al* indicate that a 10 basis point reduction in the mortgage interest rate (roughly the rate reduction associated with a 25 basis point expansionary monetary policy shock) would result in a 0.7 per cent rise in housing prices.

Republic, Gallin (2008) and Kuttner (2011) for the United States, Wu, Gyourko and Deng (2010) for China, and Glindro *et al* (2008) for Asia-Pacific economies.

The user cost approach also allows the variance in real estate prices to be decomposed into the contributions of fluctuations in interest rates, rents and an unobserved risk premium. Using the methodology developed in Campbell (1991), Campbell *et al* (2009) perform such a decomposition for housing prices in 23 metropolitan areas in the United States. They find that risk premia, rather than interest rates or rents, have been the principal source of variance in US housing prices.

Interestingly, the VAR estimates of interest rates' impact on property prices are considerably smaller than the effects implied by standard user cost theory sketched in Section 3. Specifically, the user cost model implies that for a plausible range of long-term interest rates, a 10 basis point decline in the long-term interest rate (a reduction that corresponds approximately to a 25 basis point expansionary monetary policy shock) would cause housing prices to rise by between 1.3 per cent to 1.6 per cent, far in excess of the 0.3 per cent to 0.9 per cent effect derived from VAR estimates.

2.2 The effects of financial structure and other policy measures

A few studies have looked at structural features as factors influencing the behaviour of housing prices. These include Iacoviello and Minetti (2003), which looks at financial liberalisation in Sweden, Finland and the United Kingdom; Calza, Monacelli and Stracca (2009), which considers the effects of institutional characteristics of national mortgage markets (such as mortgage equity withdrawal) and mortgage rate structure (fixed rate versus variable rate) in a group of advanced economies; and Glindro *et al* (2008), which investigates the implications of a range of structural features for housing price dynamics in Asia-Pacific economies. Moreover, Warnock and Warnock (2008, this volume) find that economies with stronger legal rights for borrowers and lenders, deeper credit information systems, easier property registration, and a more stable macroeconomic environment have deeper housing finance systems.

There is a growing literature documenting the use of macroprudential policy measures across countries and systematically examining the effectiveness of macroprudential policy measures on credit growth and housing prices. Before the recent financial crisis, Borio and Shim (2007) documented macroprudential and monetary policy measures taken by 18 economies to affect credit and housing prices. Using an event study methodology, they find that macroprudential measures reduced credit growth by 4 to 6 percentage points in the years immediately following their introduction, while housing prices decelerated in real terms by 3 to 5 percentage points. Hilbers *et al* (2005) focus on rapid growth of private sector credit in 18 central and eastern European (CEE) countries and document that 10 countries took measures in or before 2005.

More recently, Crowe *et al* (2011) select 36 economies which had experienced real estate booms and document that 24 had taken some policy measures. They provide a detailed discussion on the benefits and challenges associated with monetary, fiscal and macroprudential policy options. Using a dynamic stochastic general equilibrium model that includes a housing sector and credit markets, they show that tools that are narrower in focus and closer to the target, such as macroprudential measures, deliver the highest welfare. Also, Lim *et al* (2011) consider 49 economies which replied to an International Monetary Fund (IMF) survey conducted in December 2010, and document that 40 economies took macroprudential measures (broadly defined), including various prudential

instruments, reserve requirements and limits on foreign currency lending. Using a panel regression analysis, they find that: (i) reserve requirements and dynamic provisioning have been effective in reducing real private sector credit growth during booms; (ii) reserve requirements have been effective in reducing leverage growth during booms; (iii) maximum LTV ratios, maximum DSTI ratios, dynamic provisioning and reserve requirements reduce the procyclicality of credit growth; and (iv) a maximum DSTI ratio, dynamic provisioning, countercyclical capital requirements, reserve requirements and limits on foreign currency lending reduce the procyclicality of leverage growth. It should be noted that Lim *et al* (2011) focus on the effectiveness of policy measures on private sector credit and leverage, while our paper focuses on the effectiveness of policy measures on housing credit and housing prices.

Finally, at the country level, there is a small number of studies that specifically analyse the effectiveness of macroprudential policies in Asia. For example, Wong *et al* (2011) show that reducing the maximum LTV ratio has had a significant dampening effect on real property price growth in Hong Kong SAR, while Igan and Kang (2011) find that capping LTV and DSTI ratios has reduced the rate of housing price appreciation in Korea.

3. Understanding What Drives Housing Prices

The purpose of this section is threefold. The first is to highlight the role of fundamentals in determining property values. The second is to provide a metric for assessing the economic and quantitative significance of empirical estimates of the impact of interest rates on property prices. The third is to understand the channels through which intermediation, innovation and regulation could affect property markets.

3.1 The user cost framework

A natural starting point for analysing the connection between interest rates and property prices is the venerable user cost model which, as argued by Himmelberg, Mayer and Sinai (2005), provides a useful benchmark for gauging the importance of economic fundamentals. The model is based on the simple proposition that market forces should equate the cost of renting with the all-in risk-adjusted cost of home ownership. The equality is expressed as:

$$\frac{R_t}{P_t} = \left(i_t + \tau_t^p\right)\left(1-\tau_t^y\right) + \sigma_t + \delta - \frac{\dot{P}_t^e}{P_t}, \tag{1}$$

where R/P is the rent-to-price ratio, i is the relevant nominal interest rate, δ is the rate of physical depreciation, σ is the risk premium associated with owning a home, and $\frac{\dot{P}_t^e}{P_t}$ is expected nominal housing price appreciation. The property and income tax rates, τ^p and τ^y, also figure in the calculation, as in Poterba (1984). Equivalently, subtracting and adding the expected rate of inflation π^e yields an expression in terms of the real interest rate and the rate of real housing price appreciation:

$$\frac{R_t}{P_t} = \left[\left(i_t + \tau_t^p\right)\left(1-\tau_t^y\right) + \sigma_t + \delta - \pi_t^e\right] - \left(\frac{\dot{P}_t^e}{P_t} - \pi_t^e\right), \tag{2}$$

where the term in square brackets represents the real user cost, *UC*, excluding expected real house price appreciation.

The quantitative effects of interest rate changes on housing prices are easily calculated by differentiating Equation (2):

$$\frac{1}{P}\frac{\partial P}{\partial i} = -\frac{1-\tau_t^y}{UC}. \tag{3}$$

The expression shows that the effect, in percentage terms, of a 1 percentage point change in the interest rate depends on the user cost, which is in turn a function of i, δ, τ^p and τ^y and σ. An important implication is that the lower the user cost, the higher the sensitivity of the housing price to a given change in the interest rate. Starting from 7 per cent, for example, a 10 basis point reduction in the user cost would lead to an appreciation of approximately 1.4 per cent in the steady state. With the user cost initially at 5 per cent, the same 10 basis point reduction would lead to an appreciation of 2 per cent.

3.2 The role of financial intermediation

While useful for understanding the fundamentals underlying property valuations, the user cost model is limited in that it has no explicit role for financial intermediation or credit. Its implicit assumption is that there are no credit constraints or frictions, and consequently that households can move costlessly between the rental and owner-occupier markets. Needless to say, this is an unrealistic assumption.

An easy way to get intermediation into the user cost model is by way of the interest rate. The conventional way to think of intermediation is the process through which funds made available by savers are channelled to borrowers (in this case, prospective home buyers). As suggested by Woodford (2010), the supply of available funds is 'produced' by the financial sector, and this output is an increasing function of the spread between the rate paid by borrowers and that received by savers. In Woodford's framework, a positive 'intermediation shock' increases the amount of credit intermediaries are willing to supply for a given spread, which *ceteris paribus* decreases the interest rate paid by borrowers.[3] A plausible explanation of a housing boom is that it is the result of just such a favourable intermediation shock, transmitted through a reduction in interest rate spreads.[4] According to this view, it is the reduction in mortgage interest rates, via their effect on user cost, that accounts for the increase in housing prices.[5]

A natural way to model macroprudential and other policies in this framework is in terms of their effects on the supply of intermediated credit: presumably actions such as reductions in the maximum LTV or DSTI ratios would have a direct impact on the price and/or availability of credit. There are good reasons to believe that such measures may be preferable to the conventional interest rate instrument. First, changes in the short-term policy rate may have only small effects on the user cost, to the extent that the relevant interest rate is for a longer maturity. Second, unlike changes in the overall level of interest rates, macroprudential measures may be targeted more narrowly at the housing sector. The ability to intervene through these channels does not necessarily

3 In this framework, the 'risk-taking' channel described by Borio and Zhu (2008) and others could be interpreted as a mechanism through which the reduction in the risk-free rate also causes an outward shift in the supply of intermediated credit.

4 An increase in credit supply would not be fully manifested in spreads to the extent that credit became available to previously credit-constrained households.

5 It is worth mentioning that an increase in the supply of credit, if it increased the flow supply of new housing, could lead the housing market to adjust more quickly to changes in the demand for housing.

imply that it is optimal to do so, of course. That conclusion must rely on a more fully articulated macro model that links leverage with financial stability, such as that of Cúrdia and Woodford (2010).

4. Empirical Framework

This section describes the regression equations we will use to assess the effects of interest rates, institutional features of the housing finance system, and various policy actions on housing prices and credit. Our housing price specification is loosely based on the user cost model sketched above, extended informally to include variables capturing market structure and macroprudential policy changes. In the absence of a well-defined theoretical model, the housing credit regression is more of a reduced form. The regressions are intended to reveal answers to three questions: first, how sensitive housing prices are to the interest rate (and by extension, how much of the recent housing price boom is attributable to low interest rates); second, the importance of structural features in determining the effects of interest rates and demand; and third, the impact of macroprudential policies on housing prices and credit.

4.1 Modelling housing prices

The user cost model sketched in Section 3 is a sensible basis for any empirical assessment of the determinants of housing prices.[6] Specifically, our starting point is the basic static user cost relationship in Equation (2). Translating this equation into a regression model poses two challenges, however. The first is that a technically correct implementation requires tax rates, τ^y and τ^p, which may vary over time. The rate of depreciation, δ, could also be time-varying. Time series data for these variables are available for the United States, but obtaining the necessary information for our panel of 57 economies would be a herculean task. Furthermore, one would want to use expected inflation, π^e, rather than the actual rate. Empirical work for the United States, such as that of Gallin (2008), has used survey data on long-run inflation expectations, but again those data are unavailable for most economies. Data limitations therefore require that we work with a simplified version of the user cost relationship:

$$\frac{R_t}{P_t} = \mu_0 + \mu_1 i_t - \mu_2 \pi_t + \sigma_t - \left(\frac{\dot{P}_t^e}{P_t} - \pi_t^e \right), \tag{4}$$

which assumes constant depreciation and tax rates (subsumed into the intercept) and uses actual rather than expected inflation.

The second complication is that the risk premium, σ_t, and the expected rate of real appreciation, $\frac{\dot{P}_t^e}{P_t} - \pi_t^e$, are both unobserved. These terms are therefore subsumed into the error term. Since these are unlikely to be white noise, the model will have to incorporate some dynamics. If these terms and the interest rate are stationary, then the rent-to-price ratio will also be stationary; this in turn implies an error-correction model for R_t and P_t. This is conventionally expressed in log-linear form:

$$\begin{aligned} \Delta \ln P_t = {} & \alpha + \rho(L)\Delta \ln P_{t-1} + \omega(L)\Delta \ln R_{t-1} + \lambda\left(\ln R_{t-1} - \ln P_{t-1}\right) \\ & + \beta_1 i_t + \beta_2 \pi_t + \varepsilon_t, \end{aligned} \tag{5}$$

where P_t and R_t are real housing prices and rents, and $\rho(L)$ and $\omega(L)$ are polynomials in the lag operator.

6 This is also the approach taken in Girouard *et al* (2006) and Sveriges Riksbank (2011).

We will make five modifications to Equation (5) to capture the possibility of deviations from the simple user cost model and to incorporate the effects of regulation and financial structure.

First, in theory, shifts in the demand for housing services should be reflected in rent: a positive shift in demand, for example, would raise rents, and via the user cost relationship, housing prices should appreciate. This linkage is likely to be imperfect in practice, however. There may be frictions that lead to the sluggish adjustment of rents. In addition, the available rent data are imperfect, and probably do not accurately capture the rent that is relevant to households substituting between rental and owner-occupied housing. We therefore include lagged four-quarter-ended real personal income growth, $\ln y_{t-1} - \ln y_{t-5}$, as an additional regressor to proxy for shifts in the demand for housing not captured in the rent data.

Second, according to the user cost model, the interest rate that determines housing prices is the (after-tax) mortgage rate. This is hard to measure, however, and obtaining the necessary data is difficult for many economies. Using a single interest rate is even problematic for the United States, given the expanding array of financing options (variable rates, 'teaser' rates, points-versus-interest rates, etc). Moreover, the option of refinancing affects the true cost of carrying a mortgage. As a crude way to take some of these factors into account, we include as regressors the mortgage rate i^m and a short-term interest rate, i^s.

Third, we allow for the possibility that certain structural factors may affect the demand for housing, and/or the responsiveness of housing prices to interest rates. As discussed below in Section 5, one of these variables is the economy's typical LTV ratio. However, to the extent that this is constant over time, this effect will be subsumed into the country-specific constant term. Another is the structure of mortgages, that is, whether they are typically fixed or variable rates. This suggests interacting the short-term and long-term interest rate variables with a variable capturing the prevalence of one type of mortgage or the other. The vector of structural features is denoted z.

Fourth, in order to gauge the effectiveness of the macroprudential policies that are the focus of this paper, we include a set of variables intended to capture the effects of maximum LTV and DSTI ratios, risk weights, provisioning, exposure limits, reserve and liquidity requirements, and taxes and subsidies related to housing. The vector of policy variables is denoted x. Section 5 describes these variables in greater detail. A discussion of exactly how these variables enter the regression will be deferred to Section 6.

Fifth, taking into account the likely lag in the effects of these variables on housing prices, the regressors are all lagged by one quarter.

With these five modifications, our regression specification for housing prices is:

$$\begin{aligned}\Delta \ln P_{jt} = {} & \alpha_j + \rho(L)\Delta \ln P_{jt-1} + \omega(L)\Delta \ln R_{jt-1} + \lambda\left(\ln R_{jt-1} - \ln P_{jt-1}\right) \\ & + \beta_1 i^m_{jt-1} + \beta_2 \pi_{jt-1} + \beta_3 i^s_{jt-1} + \beta_4\left(\ln y_{jt-1} - \ln y_{jt-5}\right) \\ & + z_j' i^m_{jt-1}\theta_1 + z_j' i^s_{jt-1}\theta_2 + x'_{jt-1}\gamma + \varepsilon_{jt},\end{aligned} \tag{6}$$

where the subscript j indexes the country. A country-specific intercept, α_j, is included to capture time-invariant cross-country differences in housing price growth. To compensate for data imperfections, such as different rates of quality change for rental versus owner-occupied housing, the log of the rent-to-price ratio, $\ln R_{jt-1} - \ln P_{jt-1}$, is detrended on a country-by-country basis.

4.2 Modeling housing credit

Our regression specification for housing credit growth is analogous to the housing price regression, but substitutes housing credit growth for housing price growth:

$$\begin{aligned}\Delta \ln C_{jt} = {} & \alpha_j + \rho(L)\Delta \ln C_{jt-1} + \beta_1 i^m_{jt-1} + \beta_2 \pi_{jt-1} + \beta_3 i^s_{jt-1} \\ & + \beta_4 \left(\ln y_{jt-1} - \ln y_{jt-5}\right) + z'_j i^m_{jt-1}\theta_1 + z'_j i^s_{jt-1}\theta_2 + x'_{jt-1}\gamma + \varepsilon_{jt},\end{aligned} \tag{7}$$

where $\Delta \ln C$ represents the real growth rate of housing credit. Although not derived from an explicit theoretical model, Equation (7) can be interpreted as a reduced form of a model in which the volume of housing credit depends on the price of owner-occupied housing. The same factors influencing housing prices, such as interest rates and regulatory measures, should therefore also affect housing credit. Macroprudential policies may affect prices and credit differently, however, and so it will be interesting to compare the estimated $\hat{\gamma}$ with the results obtained from the housing price regression.

Needless to say, Equations (6) and (7) are susceptible to the critique that the regressors are likely to be endogenous. Specifically, policymakers may adjust interest rates or implement macroprudential measures in response to conditions in the housing market (or in response to omitted variables that are correlated with housing price or credit fluctuations). This is especially true in those economies, such as many in the Asia-Pacific region, where policymakers have actively changed LTV ratios, provisioning and reserve requirements in their efforts to curb housing market excesses. This endogeneity may bias the parameter estimates, making it problematic to interpret the $\hat{\gamma}$ coefficients as a reliable gauge of the policies' effectiveness.

Fortunately, there is reason to believe that the endogeneity problem will lead the estimates to *understate* these policies' effectiveness. Consider a tightening of the LTV requirement (a decrease in the maximum LTV ratio) for example. If the policy had the desired effect, it would reduce housing prices *ceteris paribus*. But if policymakers tended to tighten the LTV requirement when housing prices were already rising, this would give rise to a positive correlation between our LTV variable and housing prices, partially (or fully) offsetting the desired policy effect.[7] In the (implausible) limiting case in which policymakers managed to set the maximum LTV ratio in such a way as to completely stabilise housing prices, the estimated regression coefficient on the maximum LTV ratio variable would be zero. An accurate statistical assessment of the policies' effects would require some exogenous variation in the policy measures (regulatory 'policy shocks'). Unfortunately, it is hard to think of any circumstances that would give rise to such exogenous policy shifts.

5. Data

Our econometric analysis spans the period from 1980:Q1 to 2011:Q1, and covers 57 advanced and emerging market economies. These include 13 economies from the Asia-Pacific region (Australia, China, Chinese Taipei , Hong Kong SAR, India, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Singapore, South Korea and Thailand), 15 from central and eastern Europe (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey and Ukraine), 6 from Latin America (Argentina, Brazil,

7 Indeed, an interesting direction for future research would be to estimate a regulatory 'reaction function' for those countries that make active use of such measures.

Chile, Colombia, Mexico and Peru), 2 from the Middle East and Africa (Israel and South Africa), 19 from Western Europe (Austria, Belgium, Denmark, Germany, Finland, France, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and 2 from North America (Canada and the United States).[8] This section summarises the data sources and the criteria used for selecting the economies and sub-samples, and reports descriptive statistics for the key variables used in the analysis.

5.1 Data sources

One component of our dataset consists of time series data on housing and macroeconomic variables. In most cases, these data are available at a quarterly frequency. However, in some cases, annual or half-yearly data are interpolated to a quarterly frequency. A second component is a compilation of structural features of the housing market. The third is a compendium of all discrete macroprudential policy actions for each of the 57 economies.

Housing prices (*P*)

The primary source for housing price data is the BIS property price database. For economies not covered by BIS property price statistics, we also use housing price data from CEIC and national sources. For a few economies where official data on housing price indices are unavailable, we use housing price data from private sources. The definition of housing price indices varies across the economies. When multiple housing price indices are available for a given economy, for example nationwide versus major city indices, we use indices for major cities, as these are the areas that would be most susceptible to overvaluation and are often targeted by prudential and fiscal policy measures.

It goes without saying that these data are highly imperfect. Data construction methods (e.g. quality adjustment) vary greatly across the economies, as does the definition of the relevant housing market (e.g. apartments versus detached houses). Moreover, in some cases two or more series must be spliced together in order to yield an appropriate time series. In India, for example, we combined the Mumbai housing price series provided by the Reserve Bank of India, which ends in 2010:Q2, with a new price index from the National Housing Bank, which is available from 2010:Q3. Conclusions involving the *level* of property prices are therefore problematic, especially cross-country comparisons. Recognising these limitations, we will proceed on the assumption that these series can serve as informative indicators of cyclical swings in the residential property market, and that detrending the rent-to-price ratio compensates for data inadequacies, such as trend changes in housing quality.

Housing rent (*R*)

We use housing rental indices when available; otherwise, we use the housing rental component of the consumer price index (CPI) available from Datastream, Haver Analytics, Eurostat and other national sources. Needless to say, the construction of these indices varies across the economies.

8 We also have information on macroprudential policy measures taken in Uruguay, Saudi Arabia and the United Arab Emirates, but we currently lack other data, such as housing prices and interest rates, that would allow us to include these countries in the regression analysis.

And, as is always the case in analyses involving user cost calculations, one worries about whether the housing rental component of the CPI is a good proxy for actual rent data.

Housing credit (*C*)

The primary sources of housing credit data are BIS Data Bank, Datastream, CEIC and central bank websites. Data are available for all 57 economies, although the time series dimension is often limited. Moreover, the sources and definitions are not always consistent, even within a economy.

Interest rates (i^m and i^s)

The user cost calculation described earlier requires a representative mortgage rate, denoted i^m, or some suitable gauge of the opportunity cost of home ownership. The availability of mortgage rate data is limited, however, both in terms of economy and time coverage. The results presented in this paper use the bank lending rate from the IMF's International Financial Statistics (IFS) database and national sources, which are available for all 57 economies in our sample, as a proxy for the mortgage rate. Most of the short-term interest rate series, i^s, are the money market interest rates from the IFS database. Where the IFS' coverage was incomplete, we used interest rates obtained from national sources and Haver Analytics. These short-term interest rates tend to move closely with the policy rate, while long-term lending rates may only indirectly reflect changes in the policy rate.

The price level and inflation (π)

The price level used for calculating the inflation rate is the CPI obtained from the IFS database. The CPI is also used to deflate the rent, property price and personal income series.

Personal income (*y*)

Ideally, we would use national household disposable income data to capture effective housing demand in each economy. Obtaining household disposable income data is difficult for a large number of economies, however. We therefore used instead annual real gross national income (GNI) per capita, obtained from the World Development Indicators database of the World Bank Group, as a proxy for personal income.[9] Quarterly series are obtained by interpolation, using compound growth rates.

Structural features of the housing finance system (*z*)

Because the level of development of national housing finance systems is likely to affect housing price cycles and housing credit availability, it is important to control for cross-country differences in these institutional features. Considering data coverage across the economies and the expected impact on housing price and credit cycles, we collected data on four variables: (i) the typical LTV ratio; (ii) whether loans are recourse or non-recourse; (iii) the typical maturity of mortgage contracts; and (iv) the prevalence of fixed- versus variable-rate mortgages.[10]

9 A further refinement, not made in this analysis, would be to subtract debt service flows from household income, if necessary, by approximating debt service as the product of outstanding household debt and a relevant loan rate.

10 This is a subset of the range of variables considered in other studies such as Crowe *et al* (2011) and IMF (2011).

To the extent that they remain constant over time, these factors will be subsumed into the country-specific intercepts.[11] Consequently, we do not include the first three variables in the regression, on the assumption that they will get picked up in the country fixed effects.

Differentiating economies with fixed-rate mortgages from those with variable rates could be relevant, however, as housing prices and credit would be expected to respond differently to short- versus long-term interest rates. In particular, one would expect the short-term policy rate to have a larger effect on the housing market in economies with predominantly variable-rate mortgages. To capture this possibility, we will interact the interest rate variables i^m and i^s with a (time-invariant) variable reflecting the typical mortgage structure. The variable is assigned the value 1 for economies with predominantly variable-rate mortgages, 0 for those with fixed-rate mortgages, and 0.5 for those with a mix of the two types.

Policy measures (x)

One of the major contributions of the paper is the compilation of a monthly database on policy measures introduced to affect housing credit and housing price cycles. We consider both tightening and loosening policy actions. In particular, we collected the following three broad types of measures:

(i) non-interest rate monetary policy measures: average or marginal reserve requirements on domestic and foreign currency liabilities plus liquidity requirements,[12] and limits on credit growth;

(ii) prudential policy measures: maximum LTV ratios, maximum DSTI ratios, risk weights on housing loans, provisioning requirements (general loan-loss provisioning ratios and specific provisioning ratios applied to housing loans), exposure limits on banks to the housing/property sector; and

(iii) fiscal policy measures: capital gains taxes at the time of the property sale, wealth taxes, other taxes related to housing purchase or sale, such as stamp duties, and other legal fees and government subsidies related to housing purchases.

It should be noted that monetary and prudential policy measures mentioned in (i) and (ii) directly affect credit supply to the housing sector and thus housing demand by households. By contrast, fiscal measures in (iii) affect housing transactions through more or less cash payments.

Our database of policy actions draws on a variety of sources. The primary source is official documents from central banks and regulatory authorities, including annual reports, financial stability reports, monetary policy bulletins, supervisory authorities' circulars, ministry of finance

11 Of course, these features may have changed over time, especially in emerging market economies with rapidly evolving financial systems. Incorporating time-varying structural features in the regression is straightforward, but documenting the changes over time is difficult.

12 Liquidity requirements (typically, the minimum ratio of 'highly liquid assets on a bank's balance sheet' to 'certain types of liabilities') are a form of prudential regulation dealing with cash outflow shocks. Under minimum reserve requirements, banks are required to hold a fraction of their deposits/liabilities as liquid reserves. These are normally held at the central bank in the form of cash or highly liquid sovereign paper. When applied to deposits, the regulation usually specifies the size of the requirement according to deposit type (e.g. demand or time deposit) and its currency denomination (domestic or foreign currency). Reserve requirement rules also set the reserve maintenance period relative to the reserve calculation period against which reserve holdings are averaged for the purpose of satisfying reserve requirements, and specify whether they are remunerated or not. Reserve requirements are typically classified as monetary policy tools controlling the supply of credit by banks, not necessarily related to liquidity shocks. However, reserve requirements are very similar to liquidity requirements in terms of economic effects. Moreover, the number of observations related to liquidity requirements in our policy database is very small. Therefore, we merged the liquidity requirement observations into the reserve requirement variable.

announcements on tax changes and press releases from these institutions. We also consulted Borio and Shim (2007), a survey by the Committee on the Global Financial System (CGFS) on macroprudential policy conducted in December 2009, and IMF research papers. Where these secondary sources were used, we cross-checked the information against the information obtained from official documents.[13] We then used our database of policy actions to generate variables capturing the tightening and loosening of the policy instruments.

Heterogeneity is an inherent feature of this database. Even applying consistent selection criteria across economies, the specifics of policy actions differ across economies and over time. Naturally, including these data in a regression model requires some degree of standardisation and aggregation. Our solution is to create a monthly binary variable that takes on the value of 1 for tightening actions, and –1 for loosening actions.[14] A measure of the stance of policy can be calculated as the accumulation of past changes. This is analogous to looking at the level of the policy interest rate, which is the accumulation of past changes in the policy rate.

5.2 Sample selection criteria

The main limiting factor in the creation of our combined dataset is data availability. This is particularly relevant for housing price, rent and housing credit data, which have only recently begun to be collected in many economies. In a few cases, the binding constraint is the lack of interest rate data. Because personal income data are only available until 2010:Q4, our analysis ends in 2011:Q1.

Even where data are available, there are often good reasons to discard a portion of the sample. One is in cases of extreme macroeconomic instability, such as periods of very high inflation rates. This is a concern in seven countries: Argentina (in both 1990 and 2002), Brazil, Bulgaria, Croatia, Indonesia, Mexico and the Philippines, all of which experienced annualised inflation rates of 50 per cent or more (*much* more in the case of Argentina).

Data quality is another issue. While there is no good way to independently verify the reliability of the data, many of the series exhibit discontinuities or extremely high volatility (annualised changes sometimes in excess of 100 per cent). Some of the observed spikes may be the result of very rapid growth from a small base, a characteristic of several CEE countries. High property price volatility may be due to small samples and/or thin markets, which is surely an issue in the early part of the sample for many transition economies. Not all large changes in housing prices or credit are due to data anomalies, however. In Estonia, for example, housing prices fell by 22 per cent in a single quarter in 2009, reflecting the collapse of the real estate market. Similarly, the 45 per cent decline in Iceland's housing credit in one quarter of 2008 is consistent with that country's property market implosion. It would therefore be inappropriate to tag *all* large changes in housing prices or housing credit as outliers. Instead, we exercise our judgment in distinguishing between spurious and *bona fide* jumps in the series. Where anomalies occur only in the early part of the sample,

13 The dataset is still preliminary and incomplete at this point. We have so far compiled potentially relevant policy actions from the national sources for 52 economies. The results in this paper are based on relevant data for 42 economies, which were verified and selected under consistent criteria across economies, and provisional and/or incomplete data for the remainder.

14 Some of the policy measures that are more standard across economies, such as reserve requirements, would be more amenable to a numerical representation.

the start date is moved up; otherwise, either a break adjustment is added, or the observation is replaced with a missing value.

For some economies, data are available, but the time series are too short to be of any use. Brazil, for example, has only 4 quarterly observations of housing price data. And dropping the first few highly volatile housing credit observations leaves only 11 data points for Ukraine and Serbia. Economies with fewer than 18 usable observations are excluded from the regression analysis.

5.3 Data description

Table 2 shows a tally of the different types of policy actions, aggregated by region.[15] The key features of the dataset are the following:

- The dataset contains a total of 662 policy actions in all, of which roughly two-thirds are tightening and one-third loosening.
- As shown in Figure 1, a large share of the economies in the sample used macroprudential policies only occasionally, if at all. A handful of economies were very active users of these policies, with 30 or more documented policy actions.
- Most of the policy changes in the dataset were taken by these very active users. Nearly one-third of all the actions are attributable to the top 5 users. The top 18 economies (each with 15 or more actions) account for three-quarters of the sample.
- The most active users of these policies are the Asian and CEE economies. Among Latin American countries, Chile and Peru are the most frequent users; in Western Europe, Finland and Norway account for the majority of the actions.
- Reserve requirements are by far the most frequently used of the nine categories of policies, accounting for more than half of all the policy actions. Liquidity requirements and credit growth restrictions are seldom used. Among the prudential policies, LTV and DSTI restrictions are most popular, followed by risk weights, provisioning and exposure limits.

To give a sense of how these policies have been implemented in practice, Figures 2 to 4 display the relevant cumulative policy actions along with the short-term nominal interest rate for a few Asian economies. The figures convey the diversity of economies' deployment of these policies. They have been used to complement conventional interest rate policy during some episodes, while during others they have functioned as substitutes. Similarly, the various macroprudential tools have sometimes been used in concert, and independently at other times.

15 These figures are based on incomplete or unverified information, and are likely to change as new data are incorporated. See footnote 12.

Table 2: Summary of the Use of Macroprudential Policies by Region
1980:Q1–2012:Q1

	Prudential					
	LTV ratio	DSTI ratio	Risk weights	Provision	Exposure	Total
Asia-Pacific (13)	46	19	13	10	8	96
CEE (15)	11	15	16	7	5	54
Latin America (6)	1	0	3	3	1	8
Middle East/Africa (2)	0	0	3	1	0	4
Western Europe (19)	5	2	5	3	0	15
North America (2)	4	2	0	0	0	6
Total (57)	**67**	**38**	**40**	**24**	**14**	**183**

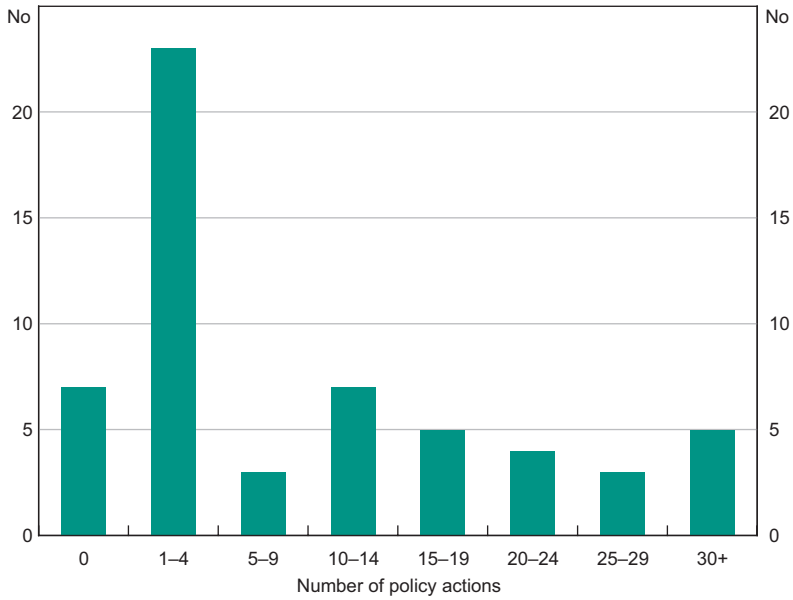
	Monetary				Fiscal	Total
	RR	Liquidity	Credit	Total		
Asia-Pacific (13)	129	3	3	135	41	**272**
CEE (15)	150	1	7	158	12	**224**
Latin America (6)	48	0	0	48	0	**56**
Middle East/Africa (2)	0	0	0	0	0	**4**
Western Europe (19)	70	5	0	75	4	**94**
North America (2)	5	0	0	5	1	**12**
Total (57)	**402**	**9**	**10**	**421**	**58**	**662**

Notes: Covers 57 economies; figures represent the number of discrete policy changes falling into each category, with a maximum of one count per month per measure; based on preliminary and incomplete data as of 11 August 2012; RR refers to reserve requirements

In China (Figure 2), for example, the short-term interest rate, reserve requirements, the maximum LTV ratio and DSTI requirements have all tended to move in the same direction: tightening in 2006–2008, loosening in 2008–2009, and tightening from 2010. The relationship between the LTV and DSTI measures is particularly close. Since 2002, there has been a steady trend towards more restrictive policy on all three non-interest rate dimensions.

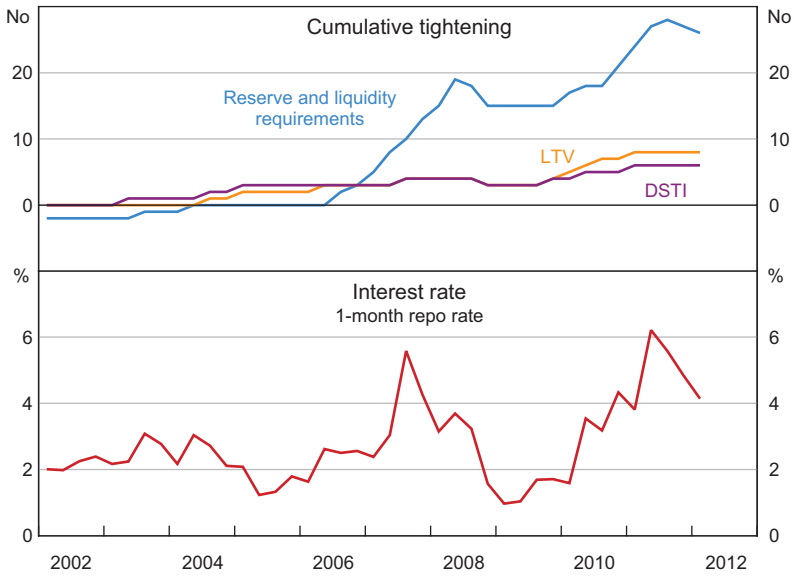
Figure 1: Frequency Distribution of Policy Changes

Number of economies



Sources: authors' calculations; national sources

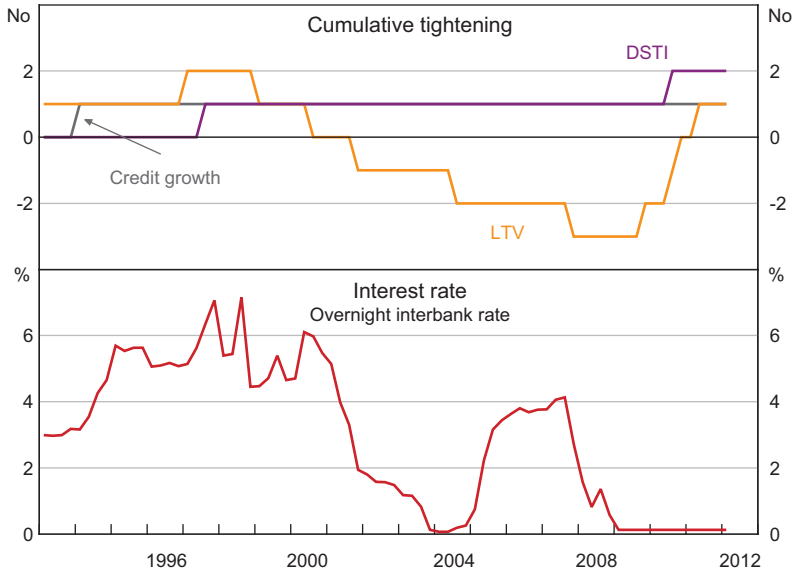
Figure 2: China – Macroprudential Policies and Interest Rates



Sources: Haver Analytics; People's Bank of China; authors' calculations; national sources

In Hong Kong SAR (Figure 3), the tightening of the credit growth limits was the only monetary tool used in 1993. Prudential measures (mostly changes in the maximum LTV ratio) were used actively from the mid 1990s, usually in parallel with the general direction of interest rates in Hong Kong (as well as those in the United States). The opposite has been true since 2009: the LTV requirements have been progressively tightened even as the short-term interest rate has remained around zero (tracking the US rate). Hong Kong authorities have also made more active use of tax measures since 2009.

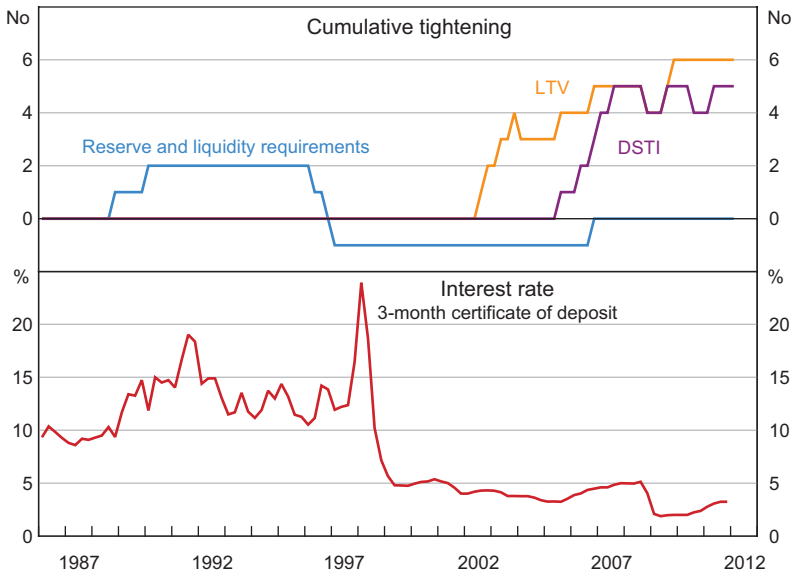
Figure 3: Hong Kong SAR – Macroprudential Policies and Interest Rates



Sources: Haver Analytics; Hong Kong Monetary Authority; authors' calculations; national sources

In Korea (Figure 4), reserve requirements were the primary macroprudential tool used throughout the late 1980s and 1990s, rising along with the short-term interest rate (except during the Asian financial crisis). Since 2002, the short-term interest rate has remained stable, but the DSTI and LTV ratios have been tightened considerably. Both ratios followed a similar upward trajectory, although the tightening in the LTV requirements started roughly three years prior to the tightening of the DSTI requirements. As in China, the LTV and DSTI requirements are both significantly more restrictive now than they were 10 years ago.

Figure 4: South Korea – Macroprudential Policies and Interest Rates



Sources: IMF, International Financial Statistics database; authors' calculations; national sources

Table 3 displays descriptive statistics for the seven housing and macroeconomic variables, calculated for the economies included in the subsequent regression analysis.[16] Clearly, there is a great deal of volatility in the housing price and credit growth data, even after deleting the obvious anomalies. (It may come as no surprise that Iceland is responsible for the minimum and maximum values of real housing credit growth.) Even rent growth has exhibited some very large swings in our sample.

16 Gaps in the availability of some of the data further reduce the number of economies used in specific regressions.

Table 3: Descriptive Statistics
Per cent

	Mean	Std dev	Fractiles					Obs
			Median	5%	95%	Min	Max	
Real housing price growth	1.6	12.8	1.4	–17.4	20.4	–100.8	82.3	3 650
Real rent growth	0.6	7.3	0.2	–7.3	11.1	–70.8	66.4	3 373
Short-term interest rate	5.9	4.8	4.7	0.5	15.2	0.0	39.5	3 956
Lending rate	9.1	5.5	7.6	3.2	19.5	0.5	45.9	3 956
Inflation	3.9	3.6	2.9	0.0	10.9	–6.3	27.8	3 932
Real personal income growth	2.3	3.3	2.4	–3.3	7.6	–19.3	14.8	3 703
Real housing credit growth	9.5	16.2	7.3	–7.9	37.1	–260.2	141.4	3 595

Note: Real housing price growth, real rent growth, real personal income growth, real housing credit growth and inflation are annualised quarterly growth rates

6. Results

Section 4 left unresolved the question of exactly how the macroprudential policy variables (x) would enter the model. Having provided details on the construction of those variables, we are now in a position to revisit that question.

One issue concerns the level of aggregation across types of policies discussed in Section 5. While we have collected data on nine distinct types of macroprudential policy actions, some of those policies have been used very infrequently. We observed only nine changes in liquidity requirements, for example, and eight changes in credit growth limits. Rather than try to estimate the effects of these rarely used policies, we combine them with the reserve requirement variable to create a composite measure of non-interest rate monetary policies. Each of the five prudential variables is included separately in the regression. These five prudential variables plus the fiscal and non-interest rate monetary variables make a total of seven variables comprehensively capturing important policy measures affecting housing markets.

Table 4 shows the pairwise correlations between the seven policy variables. Most are relatively low, indicating either that they have been used independently of one another, or that different economies tend to use different policy tools. A notable exception to this pattern is the correlation between the maximum DSTI and LTV ratios, which is 0.63. This suggests that these two tools in particular have often been used in tandem, as seen in the cases of China and Korea.

Table 4: Correlations between Policy Measures
1980:Q1–2012:Q1

	Monetary	Fiscal	LTV ratio	DSTI ratio	Risk weights	Provision	Exposure
Monetary	1	0.04	0.23	0.22	0.03	0.16	–0.13
Fiscal		1	–0.05	0.09	–0.04	0.03	–0.07
LTV ratio			1	0.63	0.03	0.19	0.09
DSTI ratio				1	0.07	0.26	0.11
Risk weighting					1	0.19	–0.10
Provisioning						1	0.15
Exposure limits							1

Note: See notes to Table 2

Another issue is how to count multiple policy changes occurring within a quarter. There are two ways to aggregate the monthly data into quarterly time series. The first is to accumulate *every* policy action, even when there are multiple actions within a quarter; three consecutive policy tightening actions would make the quarterly series jump by 3. Economies that took a large number of incremental actions, such as China, will therefore exhibit large changes in the index constructed in this fashion. An alternative is to assign the value 1 to any quarter in which a tightening action takes place, even when there are multiple changes within the quarter. The results presented below use the latter method, on the grounds that counting every policy action would give undue weight to economies, such as China, that made a large number of incremental changes.[17]

A more subtle issue concerns the way in which the macroprudential variables are included in the regression, that is, as dummies for each individual policy action, or as the accumulation of past changes (as shown in Figures 2 to 4). The choice will affect the estimated persistence of the policies' impact on the dependent variables, which are both expressed as growth rates. To see why, suppose the LTV requirement is tightened (i.e. the maximum LTV ratio is reduced) in a particular quarter, so that the LTV dummy takes on a value of 1 in that quarter, and zero afterwards. Using this dummy variable 'as is' in the regression implies that the policy action will have only a transitory effect on the dependent variable (real housing price growth or real housing credit growth); over time, the rent-to-price ratio will return to its previous level, *ceteris paribus*. If the regression includes a variable defined as the accumulation of past policy changes, on the other hand, then the rent-to-price ratio will be permanently affected by the tightening of the LTV requirements (in the absence of a subsequent reversal). Rather than choose between the two approaches, we remain agnostic about the persistence of the policies' effects by including the variable representing the change in the policy *and* the variable constructed by the accumulation of past changes.

All of the specifications allow for country-specific intercepts (country fixed effects).[18] In principle, the presence of the lagged dependent variable creates the possibility of bias. But given that the time series dimension of the data is relatively large, in practice this should not be a major problem.

17 We obtain similar results with both methods.

18 Results including time fixed effects are similar.

We therefore follow Goodhart and Hofmann (2008) in estimating the model via ordinary least squares (OLS).

As noted earlier, the samples over which the regressions are estimated are determined primarily by data availability, and some of the observations that appear to be unreliable are deleted. The full sample uses data going back as far as 1980 for Australia, Canada and the United States. Other economies' data start as late as 2007. Only those economies for which at least 18 time series observations are available are included. We also estimated the models on a sub-sample ending in 2007:Q2. The rationale for analysing the truncated sample is to ensure that the results are robust to the exclusion of the recent financial crisis, which of course was accompanied by a collapse of the housing market in many of the economies we analysed. The sample split could potentially shed some light on the possibility of asymmetries in the effects of policies during booms versus busts.

6.1 Housing prices

Table 5 displays the results for the housing price model (Equation (6)). The first column reports the estimates for the full sample, which includes 399 observations with non-zero values of the macroprudential policy variables.[19]

The results show that interest rates have statistically significant effects on housing prices. A 1 percentage point increase in the short-term interest rate is associated with a 0.7 percentage point reduction in housing price growth in economies with predominantly variable-rate mortgages, and a 0.9 percentage point reduction for those with predominantly fixed-rate mortgages. The coefficients on the lending rate variables are positive but comparable in magnitude to those on the short-term rate, suggesting that it is the spread between short-term and lending rates that is most closely associated with housing price fluctuations.[20] The magnitude of these effects is modest, however. Consistent with the research summarised in Section 2, the estimates are smaller than those implied by the user cost model, and suggest that interest rates cannot fully explain the observed booms and busts in housing prices.

Among the macroprudential policy measures, the LTV and exposure limit variables are the only ones with statistically significant effects. The coefficient on the cumulative LTV measure suggests that a permanent reduction in the allowable LTV ratio would slow housing price appreciation by roughly 1.5 percentage points. The coefficient of 0.6 on the lagged four-quarter-ended growth rate of housing prices suggests that the long-run impact of a permanent tightening could be in the order of –4 percentage points, assuming that none of the other right-hand side variables respond. This is a substantial reduction, and roughly twice the impact of a 1 percentage point rate hike. It should be noted that in our database on policy measures, a typical tightening or loosening of the LTV requirements corresponds to approximately a 10 percentage point change in the maximum LTV ratio. The estimated impact of a tightening is nonetheless quite modest relative to the double-digit growth rates in housing prices experienced in many economies during the height of the boom. The coefficient of –9.8 on the change in the exposure limit variable suggests a

19 Latvia and Brazil are excluded for lack of data, leaving 55 economies in the sample. Note that because of the limited availability of the other data used in the regressions (interest rates, housing prices, rent, etc) and the aggregation of multiple policy changes occurring within a quarter, this number is considerably smaller than the 662 individual policy actions in the policy database.

20 To the extent that the lending rate is a longer-term interest rate, this finding is consistent with a large literature on the effects of the term spread on economic activity.

large but transitory effect on housing price growth. But with a relatively small number of non-zero observations on this variable, one should not attach too much weight to this result.

The general lack of statistical significance among the other policy variables would seem to indicate that they have no effect on housing price growth. The statistical significance of individual parameter estimates does not give the complete picture, however; in fact, the five variables in the prudential category (maximum LTV ratio, maximum DSTI ratio, risk weights, provisioning, and exposure limits) are jointly significant (with a *p*-value of less than 0.01 per cent). One can therefore conclude that, taken together, changes in the prudential policies do have a discernible effect on housing price growth. However, because these policies are often deployed concurrently, as illustrated in Figures 2 and 3, it is hard to distinguish econometrically the effects of each one individually.

As noted above, economies differ greatly in their tendency to utilise macroprudential policy tools, and a relatively small number of economies account for the lion's share of policy actions in our database. To see whether the measured effectiveness of these policies varies on this dimension, we re-ran the regressions on data from a group of 18 active users, defined as those with 15 or more policy actions. Although the number of observations is only one-quarter of the full sample, this sub-sample includes over 70 per cent of all the macroprudential policy changes.

The second column of Table 5 reports the results from the regression on the sub-sample of active users. Reassuringly, the results are quite similar to those based on the entire sample, but there is stronger evidence of macroprudential policies' effectiveness: the coefficient on the cumulative LTV variable is now significant at the 1 per cent level. Fiscal measures and exposure limits also have more pronounced effects. One anomaly is the positive (but only marginally statistically significant) effect of tightening provisioning requirements.

Another interesting question is whether the effects of macroprudential policies have changed since the recent financial crisis of 2007–2009. We investigate this possibility by re-running the regression on a sub-sample ending in 2007:Q2. Because of the more frequent use of macroprudential policies in recent years, truncating the sample in this way reduces the total number of observations by 27 per cent, but cuts the number of policy actions used in the regression by 55 per cent (from 399 to 178).[21]

The third column of Table 5 displays the results from the pre-crisis regression. The results are generally similar to those from the full-sample regression. In spite of the smaller number of observations, the cumulative LTV variable remains significant at the 5 per cent level, and is somewhat larger in magnitude (–2.6 compared with –1.5). The exposure limit variable remains highly significant. Puzzlingly, tightening provisioning requirements again appears to be associated with more rapid housing price growth.

21 This also reduces the number of economies included in the sample, since, in several cases, the relevant data series only begin in the mid 2000s.

Table 5: Housing Price Regression Results

Regressor		Full sample	Active users	Through to 2007:Q2
Real housing price growth		0.59***	0.53***	0.56***
Real rent growth		–0.35***	–0.43***	–0.40***
VR x (Short rate)		–0.72***	–0.93***	–0.95***
VR x (Lending rate)		0.35*	–0.58	0.36**
(1 – *VR*) x (Short rate)		–0.91***	–2.05***	–0.19***
(1 – *VR*) x (Lending rate)		0.71*	3.78*	–0.34*
Inflation		–0.06	–0.28	0.54***
Real income growth		0.16	0.51	–0.07
Rent/price ratio		0.19***	0.33***	0.17***
Monetary:	Change	–0.03	0.40	2.75**
	Cumulative	0.08	0.21	0.39
Fiscal:	Change	3.43	4.05	2.96
	Cumulative	–1.41	–4.09***	–0.60
LTV ratio:	Change	–0.82	–0.37	–6.48
	Cumulative	–1.48**	–1.70***	–2.56**
DSTI ratio:	Change	2.88	1.80	4.59
	Cumulative	0.43	0.74	0.50
Risk weights:	Change	–6.29	–9.88	–3.72**
	Cumulative	–0.44	1.22	1.19
Provisioning:	Change	1.37	1.74	4.00
	Cumulative	2.26	6.32*	3.93**
Exposure limits:	Change	–9.84**	–7.73	–13.45***
	Cumulative	–3.45	–4.06***	–2.28
Prudential variables' joint significance		0.000	0.000	0.000
Number of policy actions		399	284	178
Observations		2 814	664	2 040
Standard error of housing price growth		13.3	19.3	10.4
Adjusted R-squared		0.241	0.268	0.276

Notes: ***, ** and * indicate statistical significance at the 1, 5 and 10 per cent level, respectively, based on robust standard errors. The regression also includes country fixed effects. The *VR* variable is set equal to 1 for economies with predominantly variable-rate mortgages, 0 for economies with predominantly fixed-rate mortgages, and 0.5 for economies with a mix of both types. The results are based on data from 55 economies for the period 1980:Q1–2011:Q1 (the time dimension varies by economy). The set of active macroprudential policy users includes the 18 economies with 15 or more documented macroprudential policy actions.

6.2 Housing credit

Table 6 displays the results from estimating the housing credit model (Equation (7)). The first column reports the results for the full sample of 55 economies through to 2011:Q1.[22]

Table 6: Housing Credit Regression Results

Regressor		Full sample	Active users	Through to 2007:Q2
Real housing credit growth		0.65***	0.82***	0.67***
VR x (Short rate)		–0.38**	–0.57	–0.48**
VR x (Lending rate)		0.08	–0.01	0.20
(1 – *VR*) x (Short rate)		–1.56**	–5.25*	–0.55**
(1 – *VR*) x (Lending rate)		1.43**	–1.51	0.50*
Inflation		0.07	0.15	0.04
Real income growth		0.40**	0.12	0.11
Monetary:	Change	–0.43	–0.99	–0.47
	Cumulative	0.24	0.04	0.08
Fiscal:	Change	–3.14	–0.53	–3.48
	Cumulative	–0.26	–0.26	0.14
LTV ratio:	Change	0.44	–3.10	–2.34
	Cumulative	0.51	–0.20	–0.04
DSTI ratio:	Change	–7.85***	–5.11*	–4.38
	Cumulative	–3.36**	–0.92	–5.24***
Risk weights:	Change	1.02	–1.63*	–1.85
	Cumulative	–1.94*	–2.54	–0.18
Provisioning:	Change	–2.28	–5.58**	–3.42
	Cumulative	–3.14***	–1.86***	–1.17
Exposure limits:	Change	0.68	3.33	–0.35
	Cumulative	–1.73	–0.87	–2.11
Prudential variables' joint significance		0.000	0.000	0.000
Number of policy actions		439	318	218
Observations		3 223	707	2 454
Standard error of housing price growth		15.6	18.7	9.0
Adjusted R-squared		0.502	0.654	0.635

Notes: ***, ** and * indicate statistical significance at the 1, 5 and 10 per cent level, respectively, based on robust standard errors. The regression also includes country fixed effects. The results are based on data from 55 economies for the period 1980:Q1–2011:Q1 (the time dimension varies by economy). The set of active macroprudential policy users includes the 18 economies with 15 or more documented macroprudential policy actions.

22 Serbia and Ukraine are dropped for lack of data, leaving 55 economies.

Income growth and interest rates have significant effects on credit growth in the full-sample regression. Increases in the short-term interest rate have a larger dampening effect than the lending rate in economies with variable-rate mortgages, while the spread between the short-term and lending rates appears to be most relevant for economies with predominantly fixed-rate mortgages. And as in the housing price regressions, the magnitude of the effect is small: in the order of a 1 percentage point reduction in annualised real credit growth for a 1 percentage point increase in the short-term interest rate.

With regard to the macroprudential variables, the most pronounced effects on credit growth are associated with changes in the DSTI requirements. The coefficient on the variable reflecting the policy change indicates that tightening the DSTI requirements reduces annualised credit growth by roughly 8 per cent in the following quarter, and the coefficient on the cumulative variable is consistent with a –3 per cent long-run response to a permanent tightening. Increasing provisioning requirements also seems to slow credit growth by roughly the same amount. These findings contrast with those from the housing price regressions, in which the DSTI and provisioning variables had little discernible impact in the expected direction. The coefficients on the fiscal variable have the correct sign, suggesting that property-related tax increases temporarily slow credit growth. The estimates are not statistically significant, however. The five variables in the prudential category are jointly highly significant, but this is entirely due to the inclusion of the DSTI and provisioning variables; the remaining three are not collectively significant.

Results from a regression limited to active users of macroprudential policies, those with 15 or more such actions, are shown in the second column of Table 6. The results are similar to those from the full sample, which is not surprising given that this set of 18 economies accounts for roughly three-quarters of all the policy actions. The coefficients on the provisioning variables are statistically significant at the 5 per cent level or better, but that on the DSTI variable is only significant at the 10 per cent level. This is again somewhat misleading, however, as the five prudential variables are again jointly significant at a very low level (a *p*-value of less than 0.001). In fact, the exclusion restriction on just the LTV and DSTI variables can be rejected at less than the 0.1 per cent level.

The third column of Table 6 reports the results from a regression with the pre-crisis sample ending in 2007:Q2. Reassuringly, the results are very similar to those from the full sample, despite the 50 per cent reduction in the number of observations with non-zero policy actions. The coefficient on the cumulative DSTI variable is again large and highly significant. Neither of the provisioning variables is individually statistically significant, but it turns out that they are *jointly* significant at the 1 per cent level. Finally, neither of the exposure limit variables is individually statistically significant, but they are jointly significant at the 5 per cent level, suggesting that exposure limits were associated with slower credit growth before the recent financial crisis. This finding is in line with the results from the housing price regression over the same period.

6.3 Discussion

Taken together, two general conclusions emerge from the housing price and housing credit regressions reported above. The first is that the policies categorised as prudential measures (maximum LTV and DSTI ratios, provisioning requirements, real estate exposure limits and risk

weights) collectively exhibit a strong link to housing price and credit fluctuations. This is evident from the fact that they are jointly highly statistically significant in every regression.

The exact form of that relationship is a little less clear, however. In some cases, it is because the level of the policy variables seems to matter, whereas in other cases the change appears to be more relevant. In addition, the tendency for some of the policies to be used in conjunction with one another – particularly the maximum DSTI and LTV ratios – makes it hard to disentangle the individual effects. The likely endogeneity of the policy changes further complicates the estimates' interpretation. It is therefore hazardous to read too much into individual parameter estimates.

Having said that, one interesting finding is that policy actions involving the LTV ratio appear to have had a more direct effect on housing prices than those involving the DSTI ratio, which have had a more readily discernible impact on the volume of credit. One explanation may simply be that the LTV requirements become more binding when housing prices outstrip appraised values, thus limiting the ability to finance purchases in an environment of rapidly rising prices. Measures limiting credit growth on the basis of other criteria would presumably have a less direct effect on prices.

The second general conclusion is that these prudential measures affect housing prices and housing credit, whereas non-interest rate monetary policy measures, including reserve requirements, do not – or at least not independently of interest rate policy. Given that the prudential policies are all aimed squarely at the housing market, this result should not be too surprising: all either affect borrowers' ability to obtain credit to finance housing purchases (DSTI and LTV requirements) or influence banks' cost of providing that credit (risk weights, exposure limits and provisioning requirements).

The same observation applies to fiscal tools, such as transaction taxes, which are also targeted specifically at the housing market. In principle, tightening these policies should make speculative activity more costly, and thus limit housing booms. Their efficacy should also be enhanced by the fact that they require relevant parties to pay tax in cash, affecting their cash flows directly.[23] The parameter estimates are consistent with this channel, although the regressions were unable to consistently establish a statistically significant impact.

7. Conclusion

The past decade's housing boom and bust has left central banks and regulators searching for non-interest rate policy tools capable of taming housing market excesses. Naturally, the focus has been on a variety of macroprudential measures, such as maximum LTV and DSTI ratios, that are targeted specifically at housing finance. Although some of these tools have been found to have had an impact in specific markets, until now there has been no global assessment of these policies' effectiveness. The goal of this paper has been to provide such an appraisal. The experiences of the Asia-Pacific economies are particularly salient in our analysis, as they have been in the forefront of the implementation of macroprudential policies.

In order to undertake our analysis, we constructed a comprehensive longitudinal database of the macroprudential policy actions by 57 economies taken over the past 30 years, and a

23 These policies' applicability may be limited by the fact that it is typically difficult to change the tax code countercyclically in time for or to keep up with fast-changing market conditions.

complementary database of structural features of the housing finance system. Combining these data with time series on housing prices, rent, housing credit and interest rates gives us a detailed picture of the key macroeconomic, institutional, monetary, and regulatory factors affecting housing markets globally.

The results establish a link between interest rates and macroprudential policy actions and subsequent fluctuations in real housing prices and real housing credit. Higher short-term interest rates tend to slow housing price appreciation and housing credit growth, although the magnitude of the effect is modest. Actions categorised as prudential measures (maximum LTV and DSTI ratios, provisioning requirements, real estate exposure limits and risk weights) are consistently jointly significant in our regressions. Decreases in the maximum LTV ratio are associated with reductions in the growth rate of housing prices. Similarly, reductions in the maximum DSTI ratio and increases in provisioning requirements are associated with reductions in the growth rate of real housing credit. We were unable to find any consistent relationship between changes in non-interest rate monetary policy measures and either housing price or credit growth, however. Taken together, our results suggest that certain types of macroprudential policies can be effective tools for stabilising housing price and credit cycles. This is good news for central banks seeking additional flexibility in their pursuit of macroeconomic and financial stability objectives.

The results reported in this paper are only a first step to understanding the effects of macroprudential policies on the housing market. One possible refinement will be to replace the tightening/loosening dummy variables used in the analysis with numerical variables. In particular, the policy measure database allows us to construct numerical variables of LTV ratios, DSTI ratios, risk weights, loan-loss provisions, reserve requirements, and tax code changes. We also intend to explore the possible effects of the central bank's balance sheet on the supply of credit by including the monetary base in the analysis. Investigating possible asymmetries in the responses of housing prices and housing credit to policy actions during booms versus busts is another promising direction.

A country-level event-study analysis could also be an informative complement to our panel regression approach. Such an approach would resemble the perspective of policymakers, who tend to focus on the current housing market cycle in their own jurisdiction, and closely track the policy's effects for a period of one to two years after its implementation. One advantage of this approach is that it would allow us to look into whether the same measures were effective in each economy. Another is that it could shed light on the circumstances that led the authorities to take particular actions.

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Discussion

1. Prasanna Gai

Kuttner and Shim take on a very ambitious and worthwhile task, for which they deserve to be congratulated. The questions that they pose, and the answers they seek, are central to the design of macroprudential policy in the post-crisis era. Their paper brings together a very large dataset, spanning more than 50 economies over three decades. And it carefully catalogues all the policy measures that might be deemed 'macroprudential' over that period – a major undertaking in itself. These policy measures fall into three groups: non-interest rate monetary policy measures, prudential tools and fiscal actions. Using an empirical variant of Poterba's (1984) user cost model, Kuttner and Shim uncover statistically significant effects on housing prices (and credit growth) when the authorities wield these tools.

Before taking too much comfort in the efficacy of macroprudential measures from such results, it is important to step back and ask what the aim of macroprudential policy really is. Gai, Haldane and Kapadia (2011) argue that macroprudential policy is about the *taming of systemic risk*, namely the externality that financial system participants, typically banks, impose on each other when undertaking their actions. Viewed in this light, we would want to decompose asset price movements into those due to (a) 'fundamentals'; (b) 'systemic' externalities; and (c) other factors. Indeed, this amounts to an elaboration of the decomposition that Haibin Zhu referred to in his earlier discussant remarks. A macroprudential tool is, thus, a form of Pigovian tax whose efficacy must be judged on how well it addresses the systemic externality and *not* on how well it affects housing prices *per se*.

The recent academic literature has attempted to pinpoint the externalities critical to systemic risk and guide our thinking on the role of housing markets in financial crises. The academic literature has gone beyond modelling housing prices as the discounted stream of housing services, and I would urge the authors to reflect on how these newer ideas may be incorporated into their work. Three contributions deserve particular mention. Allen and Carletti (2011), building on earlier work by Allen and Gale (2000), emphasise the role of agency considerations in driving the link between housing prices and systemic risk. They distinguish between people who borrow with their own money and property speculators with limited liability who are able to default without penalty. Burnside, Eichenbaum and Rebelo (2011) lay stress on the heterogeneity of expectations about fundamentals. In their model, some agents are optimistic about the future while others are less so. When these agents meet in a social setting, the stage is set for some of them to change their beliefs – network and infection-type arguments drive housing price dynamics. Finally, Brunnermeier and Pedersen (2009) and Plantin and Shin (2011) advance arguments in which the 'weight of money' in the housing market generates balance sheet interdependencies – investors piling into the housing market can change collateral valuations and hence the funding costs of others.

In addition to knowing what the systemic externalities are, the interaction of these externalities with the state of the financial system also governs the behaviour of housing price dynamics. Warnock and Warnock (this volume) remind us that different countries have very different abilities to transform assets, and the effects of financial innovation are important to take into account. An instance where such an interaction is especially germane is the connection between the so-called 'search for yield' and 'shadow banking' activity. In the years leading up to the crisis, central bankers warned against the growing 'search for yield' mentality of financial sector participants, many of whom took advantage of the 'originate and distribute' banking model to generate substantial systemic risk via housing markets.

As it stands, the Kuttner and Shim analysis is silent about such considerations – they rely on Woodford's (2010) notion of an 'intermediation shock'. Housing booms and busts, in this world, are a consequence of positive and negative shocks to intermediation that are transmitted through spreads. This is too simplistic in my view. It is possible to extend the Poterba framework to provide a more explicit treatment of the relationship between financial innovation and systemic risk externalities, albeit in an ad hoc manner. Such an approach would, nevertheless, enrich the role of financial intermediation in the analysis and I recommend that the authors extend their work in this direction.

It also seems worth emphasising that while housing is a systemically important sector, it is not the only one. The Texan banking crisis of the 1980s was, for instance, triggered by problems in the petroleum sector; railroads assumed centre stage during the US banking problems of the 1890s. Indeed, systemic crises seem to have their origins in a relatively small set of real sectors in which banking sector exposures have been particularly concentrated. Ellis, Kulish and Wallace (this volume) makes a start at identifying some of the characteristics of these sectors and their industrial organisation that deserve careful study. Key characteristics include high fixed costs, low marginal costs of production, intense competition, high leverage and uncertain cash flows. Although such issues are beyond the remit of Kuttner and Shim's analysis, it points to how broad macroprudential policy can become and opens up the question of whether the central bank should (and could) be tasked with this role.

Finally, the authors may wish to reflect upon whether macroprudential policy may, of itself, have supported property market imbalances during the sample period. McKinnon and Pill (1999) remind us how the moral hazard that was implicit in the fixed exchange rate regimes of economies like Thailand (and thus the macroprudential policies required to support the peg) created asset price bubbles in the lead-up to the Asian financial crisis. And policy may have asymmetric effects that need to be characterised. For example, expansionary policy settings can be effective in stimulating credit and growth in the property sector. But once oversupply conditions are reached, it is no longer clear whether policy (monetary or macroprudential) will be effective. Typically, during such periods, agency risk rears its ugly head and distorted incentives, in which management gets a larger share of the benefits but does not share proportionately in the losses, can drive excessive credit growth, despite the best efforts of the authorities.

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2. General Discussion

The effect of expectations on the model's results was the focus of initial discussion. One participant suggested the community's expectation that central banks do not to respond to asset prices could explain the modest effect of short-term interest rate changes on housing prices. It was noted that the low interest rate sensitivity of housing prices was evident in both the paper's model and in vector autoregressions that examine the impact of exogenous interest rate shocks. *A priori* the participant's expectation was that monetary policy would have a larger effect on housing prices under flexible inflation-targeting regimes. In response, co-author Kenneth Kuttner said the relative effect of monetary policy on housing prices under different monetary policy regimes could well be different. As an example, Prof Kuttner said that if a central bank was changing interest rates to target a certain level of asset prices, there would be a lot of variation in the policy rate and no movement in property prices yielding a regression coefficient of zero.

Another participant suggested that endogeneity was a possible explanation for the modest estimated effect of interest rates on property prices. They said in a world where central banks react to property price increases, interest rates are likely to be high when prices are growing fast due to a common third factor. And while the narrative and rhetoric of the Federal Reserve goes against the assumption that central banks react to property prices, in many economies this is not the case, and accordingly, the endogeneity problem would lead to estimates biased against finding monetary policy effectiveness. In responding, Prof Kuttner agreed and reiterated that the

paper's model was not trying to identify the effects of exogenous monetary policy shocks, much less exogenous changes in macroprudential policies.

Discussion of the interest rate sensitivity of housing prices prompted another participant to draw attention to the role of credit market liberalisation. They suggested that pricing becomes more important in the control of credit when moving to a more liberalised credit regime. As a result, they said not controlling for changes in credit conditions will result in a large downward bias on the interest rate effect.

More generally, another participant queried the policy applicability of conclusions drawn from linear models. The Australian experience in 2003 was proffered as an example. It was noted that around this time, the Reserve Bank of Australia had a policy of talking to the general community about the risks in the housing market, with the Governor giving many speeches about the unsustainability of current trends and talking about the risks in the housing market. It was suggested that this was part of a general strategy of bringing the community's attention to risks in the housing market. Then, at the end of 2003, the RBA increased interest rates twice for a cumulative increase of 50 basis points. The participant said, in retrospect, these increases had a very material effect on the housing market because the community understood the central bank's concerns and recognised that the Bank was prepared to raise interest rates to alleviate them. Against this background, the participant called for econometric work to be richer to capture these types of non-linear reactions to monetary policy, or if that is impossible, for research to be supplemented with case studies. In response, co-author Ilhyock Shim accepted that an individual central bank is not likely to use a large cross-country regression to inform their decisions and noted that adding an event study to the current paper would be a useful extension.

In the same vein as the previous comment, another participant noted that the estimated elasticities from the paper's model were conditional on central banks' communication strategies. They said that if central banks started to talk more about housing prices, larger elasticities with respect to the effect of monetary policy on housing prices may be estimated. To this end, it was suggested that one way to strengthen the paper would be to examine the stability of estimated coefficients over time. A further issue raised by the discussant was the generally insignificant effect fiscal policies were estimated to have on housing prices and credit. The participant was surprised by this result given their prior that some fiscal measures – such as the tax deductibility of interest rate payments – should have a large effect on housing prices and credit.

On the effect of macroprudential policy tools, one participant was puzzled by the different effects of loan-to-value (LTV) ratios and debt-service-to-income (DSTI) ratios on housing prices and credit, with the former significantly affecting housing *prices* and the latter significantly affecting housing *credit*. They noted that these macroprudential tools are mutually reinforcing in their effect on credit and thus if one of these tools was tightened then the level of housing prices should decline. Both authors acknowledged that this was puzzling and said they had tried to reconcile this puzzle. Prof Kuttner suggested one possible reason for the differing effects was that LTVs are tied explicitly to prices, and therefore, if prices are rising faster than appraisals, LTVs can become an important binding constraint on housing price growth. He also said it should be borne in mind that the DSTI ratio does affect credit and, in an extra link not reported in the paper, there is very strong Granger causality from credit to prices.

Another participant inquired about the incidence and effectiveness of excluding non-locals from purchasing homes as a policy tool for taming housing prices. The use of this instrument in China was said to be very effective, yet controversial. Dr Shim noted that such exclusions were in their database as policy instruments and there was probably one other country aside from China implementing these measures. Nonetheless, it was an uncommon occurrence and, as such, it was difficult to isolate the effectiveness of this policy tool.

Policy Panel

1. Carlos Araújo

Housing Policy in Brazil

Thank you to the organisers for the invitation – this is my second trip to Sydney and it is a pleasure to be here.

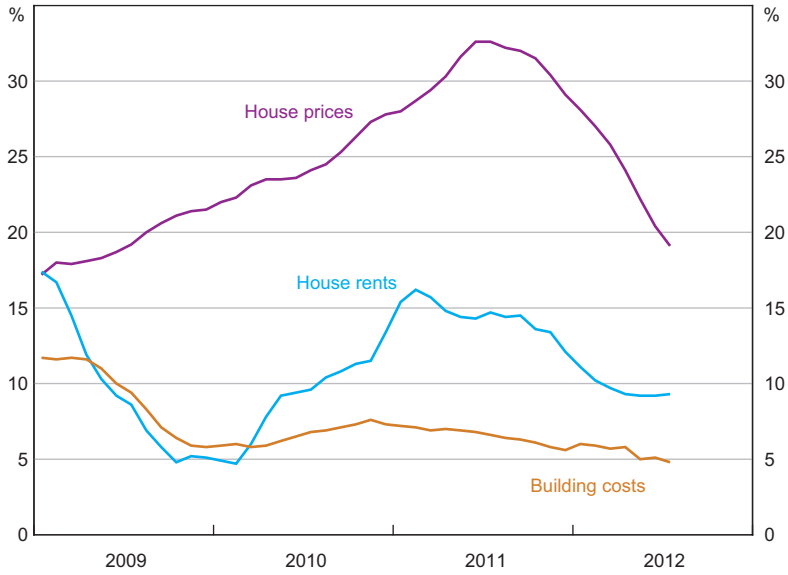
I shall start by presenting some developments in the Brazilian housing sector as well as in Brazilian housing credit. Then, considering that these developments have occasionally been seen as signals of overheating, I will place them in a broader perspective and, in doing so, will present two arguments. First, that developments in the housing sector have been supported by solid microeconomic foundations and institutional improvements. Second, that we have built solid lines of defence against excesses in the credit market.

Developments in the housing sector

Focusing on Rio de Janeiro and São Paulo, between January 2009 and January 2011 the year-ended growth rates in the asking price for houses nearly doubled from 17 per cent to around 32½ per cent (Figure 1). More recently, we have observed a substantial moderation in house price growth although it is still high. Likewise, the house rents line shows that after a period of high growth – reaching a local peak of 16.2 per cent in year-ended terms – growth in house rents has also moderated. Building costs have evolved roughly in line with overall prices in the economy.

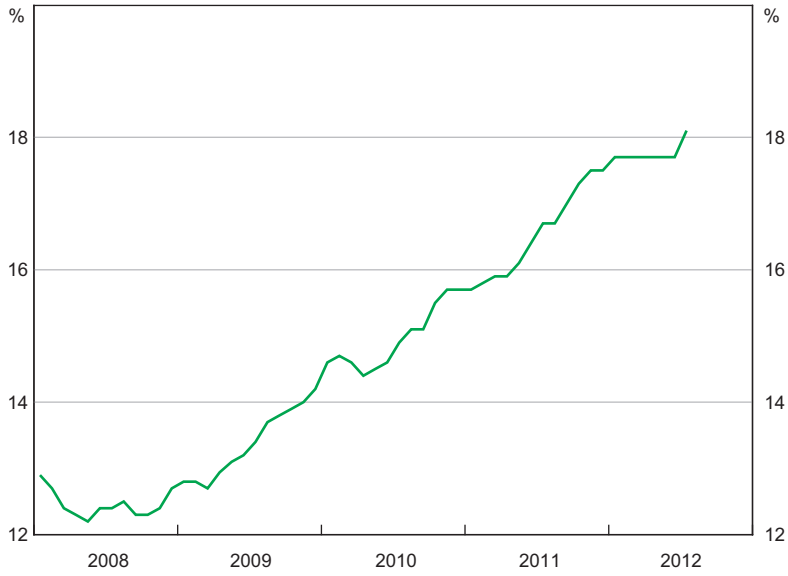
Putting together price and rent indicators, the price-to-rent ratio has gone up (Figure 2), but it has not moved away from international standards. In fact, if you consider Rio de Janeiro and São Paulo as good proxies for the whole country, price-to-rent ratios in Brazil would be placed above those recorded in other emerging economies in the Americas, but far below those recorded in the more developed economies of Canada and the United States (Figure 3).

Figure 1: Growth in House Prices, Rents and Building Costs
Year-ended



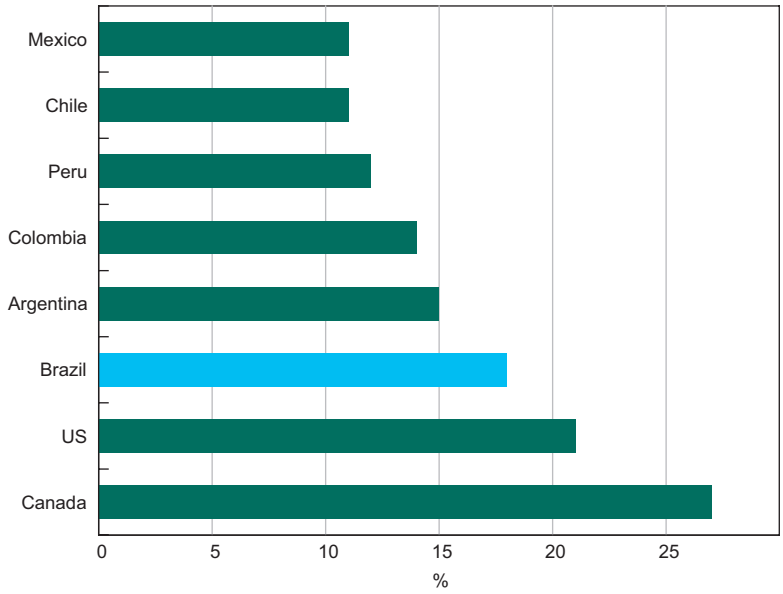
Note: House prices and rents show the asking prices for a large sample of houses in Rio de Janeiro and São Paulo
Sources: Fundação Instituto de Pesquisas Econômicas (Fipe); Instituto Brasileiro de Geografia e Estatística

Figure 2: Price-to-rent Ratio



Note: House prices and rents refer to asking prices for a large sample of houses in Rio de Janeiro and São Paulo
Source: Fipe

Figure 3: International Price-to-rent Ratios

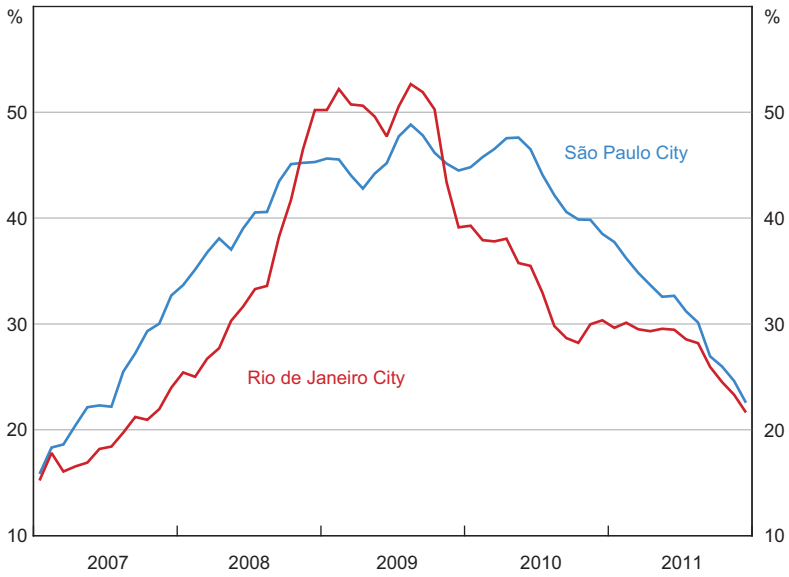


Notes: Price-to-rent ratio for Brazil is for Rio de Janeiro and São Paulo for July 2012; ratios for the remaining countries are for November 2011
Sources: Fipe; Global Property Guide

Turning to housing credit, we also see significant growth rates followed by some moderation (Figure 4). For Rio de Janeiro, the path was particularly steep in 2008, which may have been associated with the announcement of the Olympic Games and, perhaps more importantly, of major oil discoveries in the region. An examination of the flow of new housing loans shows that, after a phase of strong growth, the growth in the number of new loans fell and, today, is back to levels recorded in 2007–2008 (Figure 5). To a large extent, the same evaluation applies to the growth in the average value of new loans.

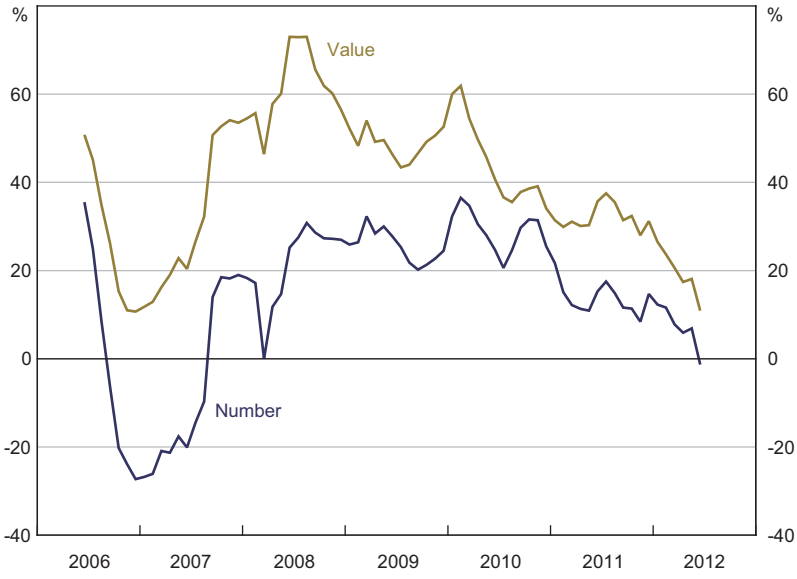
In sum, in Brazil a period of steep increases in prices, rents and credit was followed by a period of slowdown. Nevertheless, these three variables are still growing at a significant pace. What underlies this housing sector performance?

Figure 4: Growth in Housing Credit
Year-ended



Source: Banco Central do Brasil

Figure 5: Growth in New Housing Loans
Year-ended, five-month moving average



Note: New housing loans originated under the Housing Finance System (SFH)
Source: Banco Central do Brasil

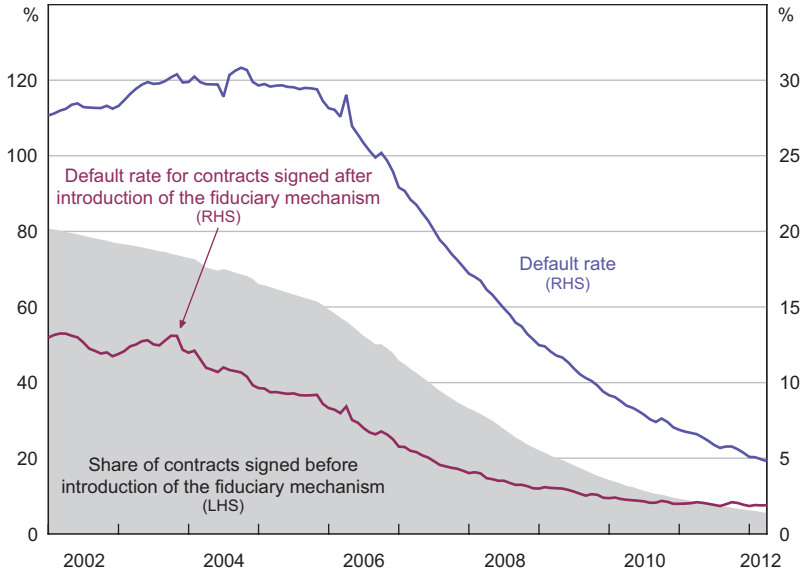
Fundamentals behind the housing boom

In their paper in this volume, Frank and Veronica Warnock assert that the Brazilian housing finance system is small, in part, because of four factors: first, its legal system still provides little protection for borrowers and lenders; second, its credit information systems are less informative than they could be; third, its property registration process is onerous and time consuming; and fourth, the economy still has remnants of past macroeconomic instability.

I am inclined to support their views; they make it clear they are referring to a situation which prevailed in the first half of the last decade. My understanding is that all these impairments – with the exception of the third, which is only partially resolved – are not present in Brazil today. Moreover, I conjecture, their removal helps to explain the boom observed over the last six or seven years in the housing sector.

Let us now examine what is behind the recent housing sector performance. Macroeconomic stability has been a major driver of growth in the housing sector. Higher GDP growth rates, lower unemployment, controlled inflation, fiscal discipline and the decline in interest rates have contributed to longer-run planning, borrowing and lending. Another important aspect is institutional improvements: recent years have seen the creation of a credit protection bureau, a credit protection law and a general reorganisation of the financial system. In 2002, the Banco Central do Brasil set up a comprehensive system of credit information. Today it covers 100 per cent of housing loans and 99 per cent of the stock of bank loans in general. More importantly, in 2004 the real estate fiduciary assignment mechanism, created in 1997 with the Real Estate Financing System, was incorporated into the civil code. Under this new arrangement, the ownership of the property remains with the lender until full repayment of the mortgage. As a result of these reforms, we have seen a dramatic decline in non-performing loans and the phasing out of contracts that were signed before the introduction of the fiduciary mechanism (Figure 6).

Figure 6: Impact of Creditor Protection Legislation



Source: Banco Central do Brasil

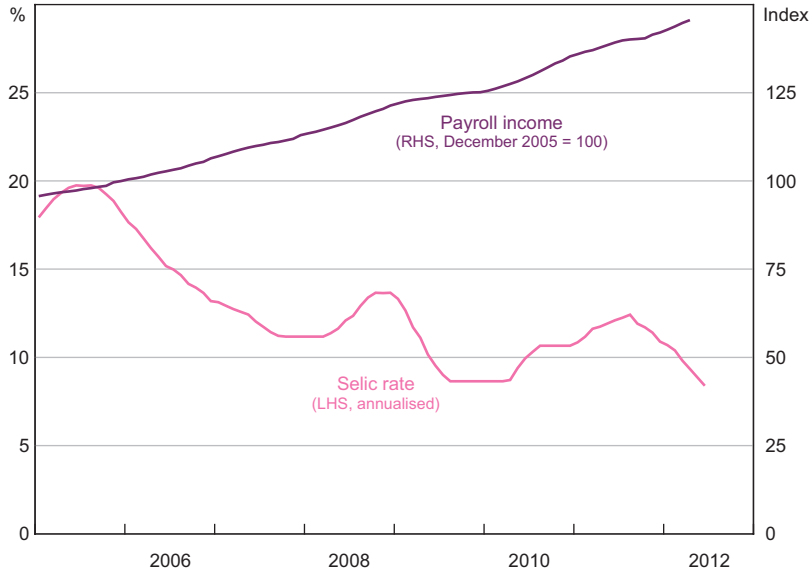
Another important determinant of recent housing sector developments is the size of the housing deficit, which means there is strong non-speculative demand for homes. This deficit is estimated to be 5.6 million homes for the country as a whole and 1.5 million homes in the metropolitan regions. This means that today 80 to 90 per cent of units sold are to first-time home buyers.

Affordability

I would also like to say a few things about affordability. First, mortgage payments in general represent less than 30 per cent of a family's income in Brazil. Second, according to estimates by JPMorgan, the ratio of house prices to income is relatively low in Brazil, at around 6 in the city of São Paulo against, for example, 13½ in Hong Kong and Singapore; 13 in Beijing; and 7 in Mumbai. Third, banks in general have strict policies, with a maximum loan-to-value (LTV) ratio at around 80 per cent (it can be up to 100 per cent but only for the cheapest segment and, in most cases, the buyer receives an up-front cash subsidy from the Federal Government to make the down payment).

In Figure 7 we see a combination of falling interest rates and increasing household income over the last six to seven years. This virtuous combination strongly supports the hypothesis of no affordability problems – at least so far.

Figure 7: Affordability



Note: Selic rate refers to the overnight rate of the Banco Central do Brasil.
Source: Banco Central do Brasil

A little more about the fundamentals behind the housing boom

Another pillar of housing sector performance is prudential policy. Brazilian regulations have been generally conservative with high capital adequacy ratios (the minimum level in Brazil is 11 per cent against the 8 per cent established by Basel II); high liquidity buffers, in particular high reserve requirements; origination practices that respect the recommendations of the Financial Stability Board; and a risk-based approach with a high degree of compliance with the Basel core principles.

With regard to housing finance, the primary source of loans in Brazil is the Housing Finance System (SFH), which is aimed at lower-income groups. Earmarked lending schemes assign 65 per cent of savings deposits to housing credit (the institutions have to assign no less than 80 per cent of it to the SFH, and the rest to market-based schemes). There are interest rate limits and price ceilings for eligible homes (financed with earmarked money). In the first quarter of 2012, 84 per cent of loans with controlled interest rate and price ceilings (68 per cent in terms of volume) were set with low-income clients; 58 per cent of loans with no constraints (74 per cent in terms of volume) were arranged with high-income clients. Another source of funding is securitised funding, which makes up around 20 per cent of the funds provided by savings accounts.

Conclusion

In summary, housing prices and housing credit have experienced a period of rapid growth. This has been driven by good macroeconomic and institutional fundamentals, growth and stability, information and creditor protection. And, importantly, Brazil has adequate regulation and supervision which provides lines of defence to protect against occasional excesses in the credit market.

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2. Per Jansson

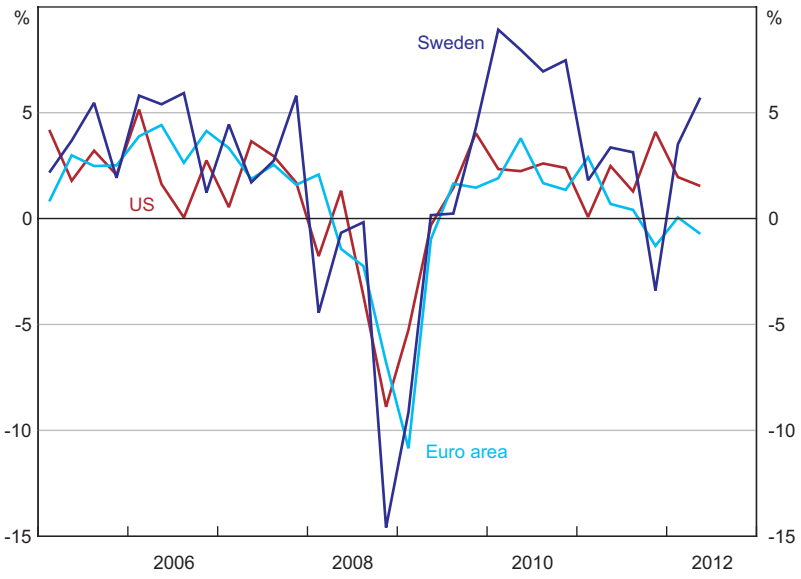
The Experience of Sweden

Sweden – relatively unscathed through the crisis

First I would like to clarify that the views I express here are my own and are not necessarily shared by my colleagues on the Riksbank's Executive Board. I do believe, however, that most of my colleagues share a similar view to mine in the issues I raise.

Sweden is one of the countries to have made it through the crisis relatively unscathed. After initially being hit quite hard – GDP shrank by 5 per cent in 2009 – the Swedish economy bounced back swiftly, with growth rates of around 6 and 4 per cent in 2010 and 2011, respectively (Figure 1).

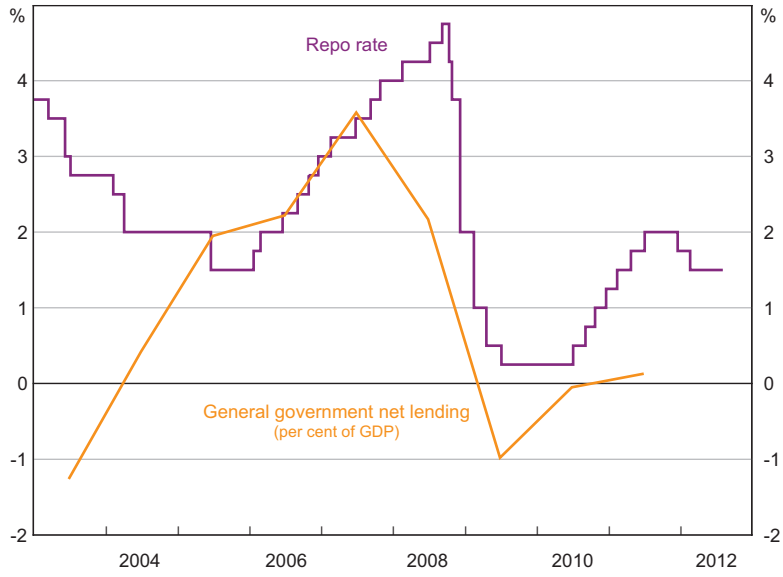
Figure 1: GDP Growth
Quarterly annualised terms, seasonally adjusted



Sources: Bureau of Economic Analysis; Eurostat; Statistics Sweden

Against this background, the Riksbank was one of relatively few central banks to raise its policy rate, increasing it from 0.25 per cent in July 2010 to 2 per cent by July 2011 (Figure 2). It was later cut by 0.25 percentage points in December 2011 and February 2012 but is still well above zero and higher than in many comparable economies. This, and the fact that the public finances are in good order, means that there is some 'dry powder' left, should any further stimulus be required.

Figure 2: Repo Rate and General Government Net Lending

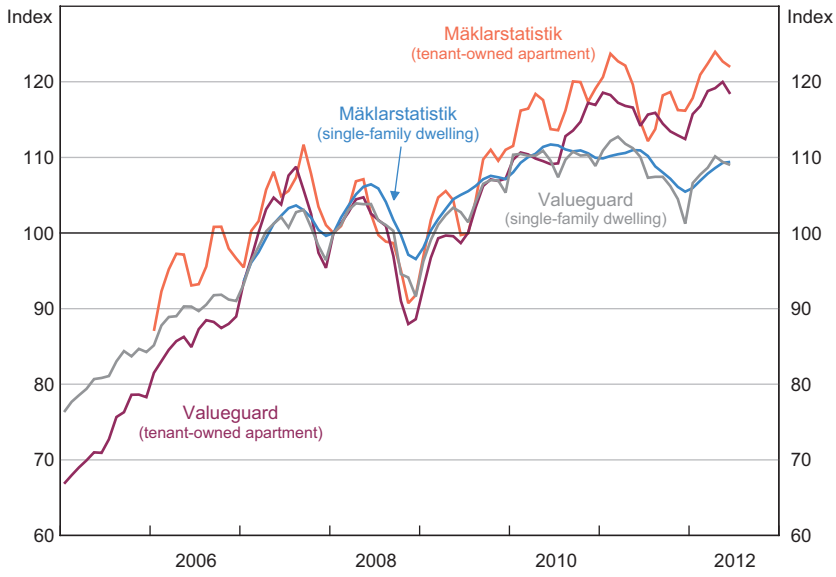


Sources: Reuters EcoWin; Sveriges Riksbank

In contrast to developments in many countries, housing prices have not fallen dramatically. However, due to factors such as higher interest rates and the introduction of a limit on the loan-to-value ratio of homes (or mortgage cap) by the Swedish Financial Supervisory Authority, the credit and housing markets have entered a calmer phase (Figures 3 and 4).

Figure 3: Housing Prices

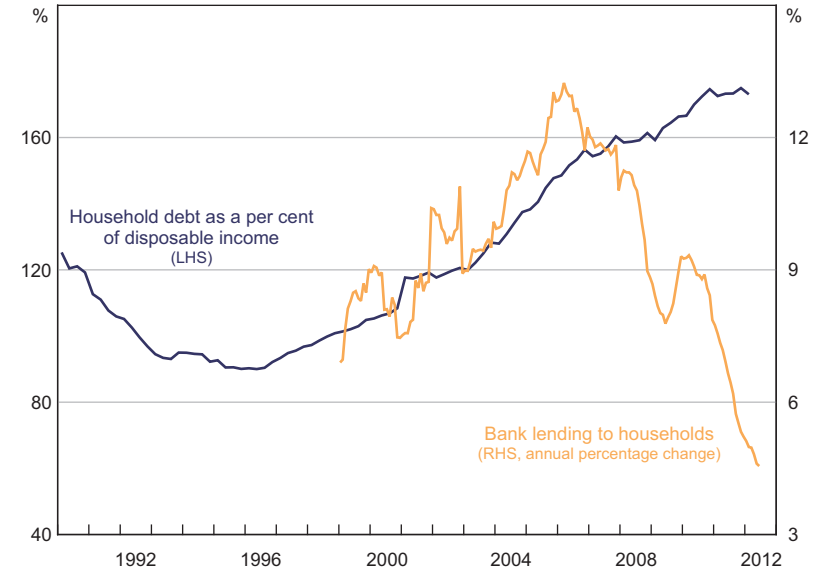
January 2008 = 100



Notes: Valueguard are hedonic price indices, Mäklarstatistik (tenant-owned apartment) is an index on price per square metre and Mäklarstatistik (single-family dwelling) is an index on the ratio of transaction price to tax assessment value

Sources: Mäklarstatistik; Valueguard

Figure 4: Household Borrowing and Debt



Sources: Statistics Sweden; Sveriges Riksbank

Lessons from the 1990s

There are several explanations for this favourable development. For my part, I believe that the fact that things went so well – comparatively – this time is largely because they went so *badly* at the beginning of the 1990s, when Sweden was going through a severe and largely 'homemade' crisis. Many of the lessons we learned then and the changes we made since have been useful in the current crisis.

During the crisis of the 1990s, the budget deficit rose to such high levels that Sweden had trouble borrowing money. To secure the future stability of our public finances, we reformed the budgetary process and put in place different fiscal policy targets which, on the whole, we have managed to fulfil. The fact that we have been able to keep our public finances in good order has granted us a larger degree of freedom in this crisis. It deserves to be emphasised that gaining credibility was a lengthy and difficult process; it took around a decade to eliminate the interest-rate premium on Swedish 10-year government bonds compared with German 10-year bonds.

Another result of the crisis of the 1990s was that the fixed exchange rate policy was abandoned and we instead introduced flexible inflation targeting. We have spent almost 20 years building credibility for this policy and I think we have succeeded quite well. So instead of raising the policy rate to defend the fixed exchange rate, as we did during the crisis of the 1990s (when the policy rate was briefly raised to an astonishing 500 per cent), the Riksbank was able, this time, to move aggressively to stimulate the economy during the downturn.

As for the Swedish banks, they have not come through the crisis without losses this time either. But, because of the scars they received in the early 1990s, they were, on the whole, probably somewhat more cautious than banks in many other countries. One piece of evidence that supports this is the Swedish banks' noticeable lack of involvement in businesses dealing with so-called structured products prior to the financial crisis.

Strokes of luck

But the Swedish economy has also benefited from some elements of luck. One such stroke of luck is that Sweden, unlike many other countries, did not have a boom in housing construction in the years prior to the crisis and hence avoided a build-up of an excess supply that would have made prices fall even more once the market turned. On the contrary, housing investment in Sweden has been surprisingly low for a long time despite increasing housing prices. The reasons for this are not fully clear – factors such as the lingering effects of excessive construction in the 1990s and weak competition keeping costs high have been suggested. Be that as it may, the fact that there was no excess supply in the housing market was more a coincidence than a result of an intentional and well-thought-out policy.

Another circumstance that, at least in part, must be considered a stroke of luck was that the Baltic countries did not devalue their currencies. If they had, the Swedish banking sector would have been hit much harder than it was due to the extensive lending carried out by Swedish banks in these countries. The loans the banks had granted were in euro and devaluations would have made the situation of the borrowers, who earned their income in the local currencies, problematic – and this would have caused bigger credit losses for Swedish banks.

Some reflections for the future

Of course, the fact that the Swedish economy has come through the crisis quite well this time does not guarantee that it will cope as well next time – all crises are different, after all. Like any other country, we need to do our uttermost to ensure that our domestic financial system remains stable and that we participate in the international reform process. Let me give some examples of issues that I, as a policymaker, find important to consider in this process, but that have perhaps not been the focus of all that much discussion.

Do not lose momentum!

One thing that I would like to stress is the importance of not losing momentum in the process of making the financial system more stable. This is, in fact, another lesson from the Swedish crisis of the 1990s – and, I suppose, from reform work in general. Even though Swedish policymakers learned a lot from the crisis of the 1990s and did make some important structural changes, some regulatory changes in the area of financial stability that, in retrospect, should have been made – and indeed were much discussed at the time – sank into oblivion as the economic situation improved. For example, a framework for crisis management was never put in place. In addition, much of the regulatory framework that was launched had sunset clauses; that is, it was decided that its effects would cease after a number of years.

As a result, there was no clear regulatory road map when the global financial crisis hit in 2008. In a few weeks, we had to put the whole regulatory framework back in place again. As there were enough people around who had done this work before, we knew where to start and we could rather quickly write up the draft legislation. But this was no ideal way to do things. It is, of course, much better to have a reasonable crisis management framework in place *ex ante*. Given that such events are rare, you cannot, in general, count upon having people with hands-on experience of crisis management around when a crisis occurs. This makes it important to be able to get guidance from some kind of existing regulatory framework, which tells you what you are allowed to do and who has the authorisation and responsibility to do it. In Sweden, a government inquiry is currently looking into how to revise and refine the framework that was rather hastily put in place a couple of years ago.

An important reason for why certain reforms were not implemented in Sweden in the 1990s, even though they should have been, was that the economy recovered relatively quickly from the crisis. The fact that the worldwide recovery from the recent crisis is taking place slowly may perhaps imply that there is less risk that the reform process will lose momentum and that proper regulatory frameworks will eventually be implemented at domestic and international levels. But, as we all can see, it is not so easy to make progress in this area and I still think a warning is warranted.

Macroprudential policy will not solve everything

Even if we are able to keep up the momentum of the reform process, we should probably not have too-high expectations of its final outcome. Ideally, of course, macroprudential policy will take care of all financial stability issues and monetary policy will be able to carry on pretty much as it did before the crisis – focusing on keeping inflation low and stable, anchoring expectations, and making the economy operate close to full capacity.

However, I personally doubt that this is the way things will evolve. I am quite sure that we will not be totally immune to financial crises in the future either. What we hopefully can achieve is to make crises rarer and less severe.

Nor do I think that we will reach a state where it will be possible to have such a strict division of labour between monetary and macroprudential policies. I suspect that it will not be possible to totally exclude the policy rate from the financial stability toolbox. There will probably always be situations in which a macroprudential policy will require support from a monetary policy that, to some extent, 'leans against the wind'. One reason is that it is difficult to construct regulations that cannot be circumvented in one way or another. The policy rate is certainly a blunt instrument, as it affects all lending in the economy. But, at the same time, this may be a strength compared with regulations, simply because it is difficult to 'circumvent' an interest rate increase.

I am also convinced that, regardless of the *formal* responsibility the central bank bears for financial stability, it will always receive a large share of the blame if a financial crisis arises. When all is said and done, the market interest rate is the price of credit and, as the central bank controls a component of this price, I believe that the general public will hardly absolve the central bank of blame if a financial crisis arises after a period of cheap credit.

Difficult political economy aspects

One reason why the reform process is complicated and may not go so smoothly is the difficult political economy aspects of financial supervision and regulation. Politicians often tend to be ambivalent. While they like to show that they are strong and able to act, in particular in critical situations like the present one, they are probably less keen to announce their willingness to 'take away the punchbowl' next time, by using the tools at their disposal to curb a credit boom – for instance by changing the ability to deduct interest rate payments on housing loans.

In addition, they are also likely to be reluctant to give away more power than they already have done. After all, not long ago, they gave away their power over monetary policy to the central banks. Even though this has been regarded as a success in that it achieved low and stable inflation, it did not prevent the global financial crisis. Should they now give away their power over macroprudential policy – and perhaps this too to the central banks? I can certainly understand that these are difficult issues for politicians to deal with. But this will not make the reform process easier.

How to best design the institutional arrangements regarding macroprudential policy is indeed a complicated issue with no easy answers. It is tempting to draw parallels to the literature on time inconsistency. In doing so, a seemingly straightforward conclusion would be that the responsibility for macroprudential policy should be delegated to the central bank, since it is already politically independent – at least more independent than most other institutional alternatives.

But a question that may be raised in the wake of recent developments is that of how independent central banks really are at the end of the day. Even though they were, perhaps, left with little option to do otherwise, many central banks have taken measures that, before the financial crisis, would have been regarded as more or less in direct conflict with the idea of being politically independent. Before the crisis, it was perceived as critical that central banks should not help to mitigate governments' fiscal problems, since this would relieve the pressure on governments to conduct fiscal policy in a sound and sustainable way. Today, some debaters even seem to be

suggesting that it is a *problem* if central banks' printing presses are not perceived by the markets and the public as a solution to governments' fiscal troubles.

This development suggests that central bank independence is a rather relative concept and that independence may well be surrendered if political pressure becomes sufficiently high. So the case for delegating macroprudential policy to the central bank may not be that strong after all. It may even be counterproductive if the probability that the central bank will be put under pressure increases if macroprudential policy is also added to its responsibilities. Under such circumstances, the overall credibility of the central bank may be called into question, including the credibility it has established for keeping prices stable. This would, of course, not be desirable.

Much remains to be seen

To somewhat offset the rather pessimistic message so far and conclude in a more optimistic tone, I would like to add that the very strong recent focus on macroprudential policy might, after all, have been excessively coloured by recent events. At the end of the day, problems from too much credit do not arise in every economic cycle – most cycles are 'normal' ones. Of course, one must remain vigilant and constantly assess the risks – and try to reduce them when necessary. But macroprudential tools, or the policy rate, will probably not have to be used all that often to subdue a credit boom and thus reduce the risk of a crisis.

It is, of course, difficult to say how often problems may arise. In Sweden, for instance, we have experienced two financial crises with around 20 years between them, and this is regarded as unusually often. So, most of the time, monetary policy will probably just be 'business as usual'. However, one thing that needs to be done in any event is to enlarge the flexible inflation-targeting framework to include a more elaborate analysis of various financial aspects. Examples include developing analytical tools that can help assess the probability of financial crises in the future and models that provide a more comprehensive picture of 'financial conditions' than just the shortest risk-free interest rate, that is, the policy rate (and the exchange rate in the case of a small open economy with currency autonomy).

Where the macroprudential policy agenda will eventually end up remains to be seen and it would certainly be wise to keep an open mind. What we can say for sure is that researchers, central banks, supervisory authorities and legislators will be kept busy for quite some time in trying to figure out, for example, how effective different macroprudential tools are and what the best institutional arrangements would be.

3. Tae Soo Kang

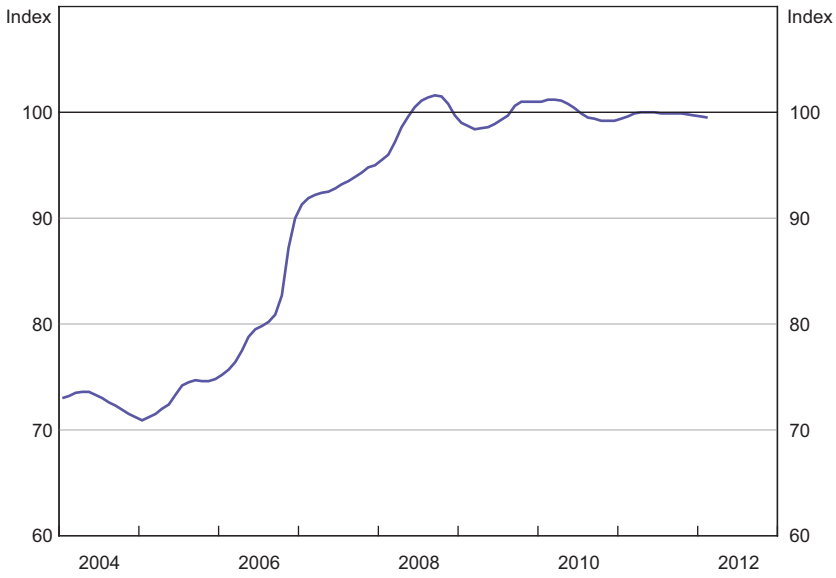
The Experience of South Korea

Review of real estate price movements over the past decade

First, I wish to express my gratitude and thanks to the Reserve Bank of Australia and the Bank for International Settlements for inviting me to the Conference. I would like to clarify that the views I express here are my own and do not necessarily represent those of the Bank of Korea.

During most of the past decade, housing prices in Korea rose continuously, surging especially rapidly between 2005 and 2008. The run-up in property prices was particularly prominent in the Seoul metropolitan area where housing prices increased by 33.4 per cent from the end of 2005 to the end of 2008 (Figure 1).

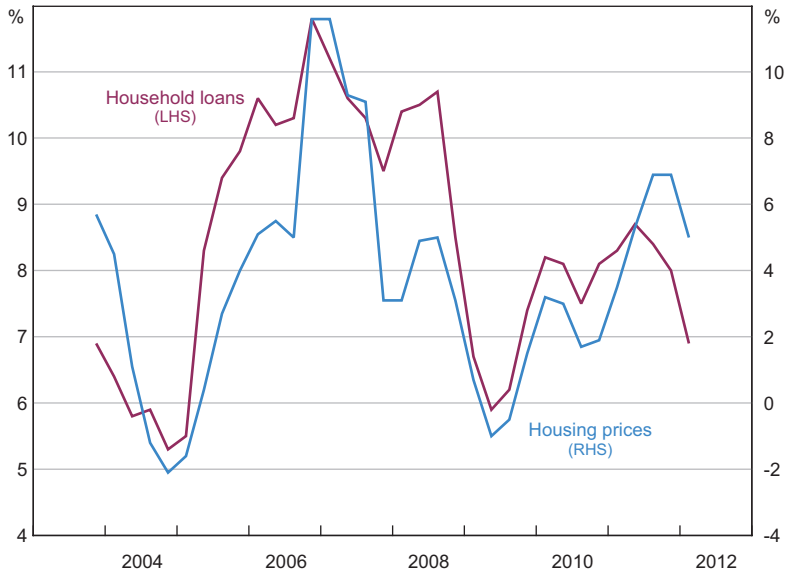
Figure 1: Housing Purchase Price – Seoul Metropolitan Area
June 2011 = 100



Source: KB Kookmin Bank

These increases in housing prices were driven mainly by the housing credit cycle. Housing price growth was closely accompanied by growth of household debt (Figure 2).

Figure 2: Growth in Household Debt and Housing Prices
Year-ended



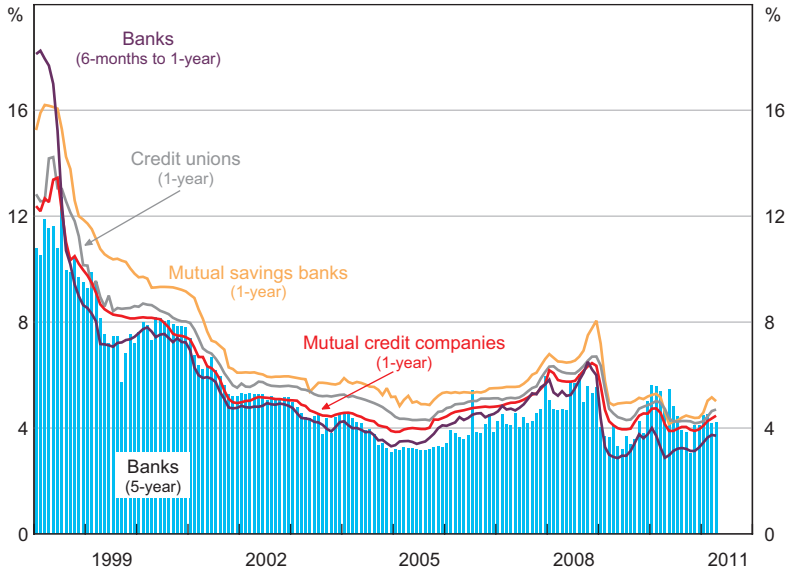
Sources: Bank of Korea; KB Kookmin Bank

There were two main factors that led to these significant increases in housing prices: low interest rates over long periods; and growth in the segment of the population aged 40 to 54 years, which comprises a major source of demand for real estate.

In the early to mid 2000s, inflation rates were low and there was abundant liquidity in the financial markets. These factors contributed to low real interest rates over a significant period of time (Figure 3). Low interest rates caused a reduction in financing costs for home buyers, who responded by increasing their borrowings from financial institutions. In addition, domestic banks had incentives to increase mortgage lending. As housing prices increased, the value of collateral rose, reducing banks' loan losses if borrowers defaulted. And banks could not expand loans to large corporates because these corporations preferred to fund themselves from the financial markets rather than using bank loans. At the same time, banks were reluctant to significantly increase loans to small- and medium-sized enterprises as the credit risk of these enterprises remained relatively high. Because banks faced difficulty in expanding their corporate lending, they focused on the household loan market, especially the mortgage loan market.

Changes in demographic structure are of similar importance to low interest rates in increasing housing prices and housing loans. The population group in their forties and early fifties are the main buyers in the housing market. The numbers in that group have increased and the share of this group in the total population reached its peak in early 2010 (Figure 4). As the numbers in that age bracket increased, the demand for housing expanded as well.

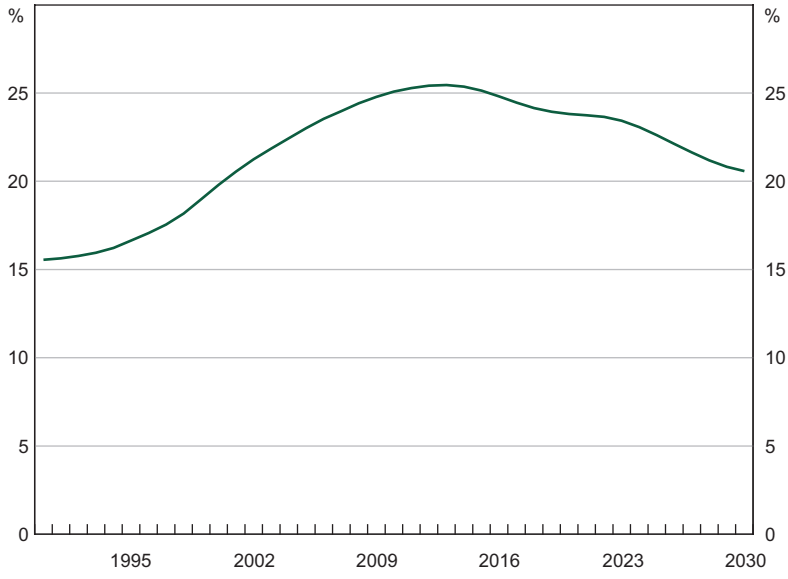
Figure 3: Bank and Non-bank Time Deposit Rates



Source: Bank of Korea

Figure 4: Demographic Change

Share of the population aged 40–54



Source: Statistics Korea

Prudential policy responses: fiscal and macroprudential policy

From the early stages of the increases in housing prices and residential mortgage loans, the policy authorities tried to dampen the exuberance of the markets by implementing various prudential policy measures. The policy responses can be divided into two categories: fiscal tools and macroprudential regulations (Table 1). As for fiscal tools, since 2003 heavier taxation has been levied on capital gains from real estate transactions by households owning more than one property. The introduction of the Comprehensive Real Estate Tax was rescheduled to 2005, earlier than the initially planned start date of 2006, to blunt housing price increases. In 2005 the tax base for the Comprehensive Real Estate Tax was broadened to capture purchases of more than 600 million won from more than 900 million won. As housing prices increased, an owner of an old apartment block could generate capital gains by constructing multiple new apartments, which prompted their prices to rise further. To restrain this, the Restitution of Development Gains was introduced in 2006, and a ceiling on the price of newly built apartments was introduced in 2007 to stabilise the prices of both new and existing apartments.

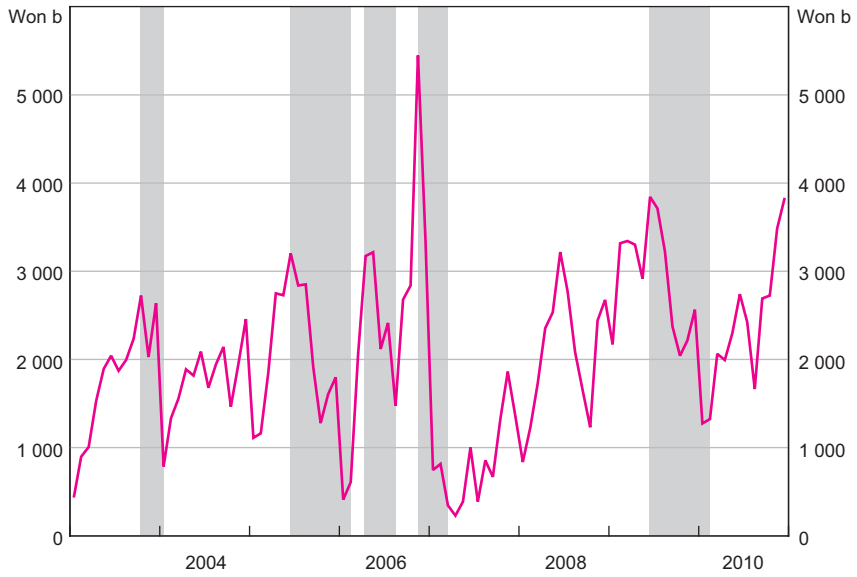
Table 1: Fiscal Tools and Macroprudential Regulations

	Fiscal tools	Macroprudential regulations
2003	Heavy taxation of capital gains by households that own more than one property	Lowering LTV ratio in speculation-prone areas from 50 to 40 per cent
	Announcement of early introduction of the Comprehensive Real Estate Tax (from 2006 to 2005)	
2005	Broadening of base for the Comprehensive Real Estate tax (900 million won to 600 million won)	DTI ratios introduced as a limit of 40 per cent in areas with significant speculative investments (August)
2006	Introduction of the Restitution of Development Gains (0 to 50 per cent of development gain)	Expansion of areas subject to DTI regulation to include the Seoul metropolitan area
		Lowering non-banking sector's LTV ratio from between 60 and 70 per cent to 50 per cent
2007	Ceiling on the price of newly built apartments imposed	Restriction of housing loans to one per person
2009		Expansion of financial institutions and areas subject to DTI regulation

The impact of fiscal tools on the property markets was reinforced by macroprudential regulations such as limits on loan-to-value (LTV) and debt-to-income (DTI) ratios. The LTV cap, introduced in the early 2000s, was lowered from 50 per cent to 40 per cent in speculation-prone areas in 2003. DTI limits were first introduced in areas where speculation was rife in 2005. In 2006, the areas subject to DTI limits were extended to the whole of the Seoul metropolitan area and the LTV regulation was applied to non-bank financial institutions as well as banks. Although housing markets in many countries were suffering in the aftermath of the global financial crisis, the Korean

housing market seemed to still be in a boom phase despite a slight decline in housing prices in early 2009. To stabilise the market again, DTI regulation was extended to non-bank financial institutions and a broader geographic area in 2009. Whenever such policies were introduced, mortgage loans decreased significantly (Figure 5).

Figure 5: Housing Credit Cycle
Mortgage loans

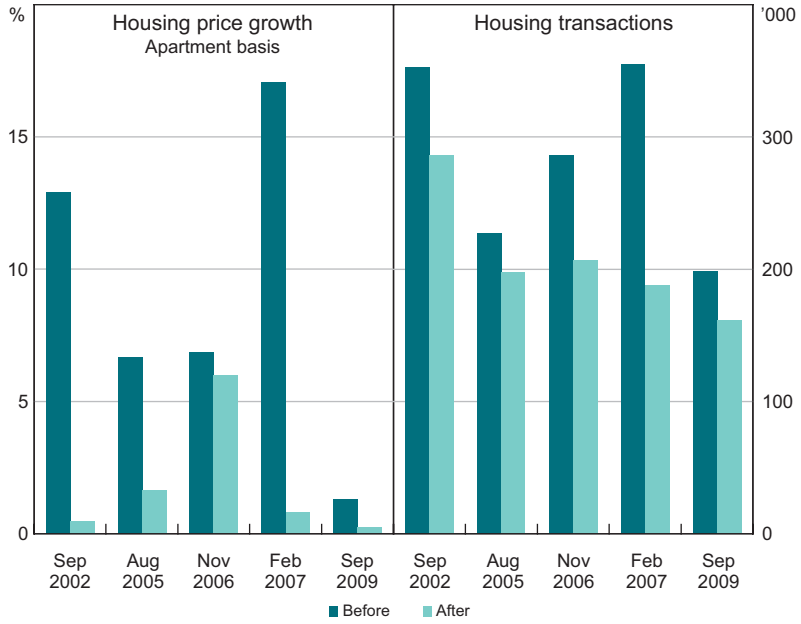


Note: Shaded areas show the decline in the value of mortgage loans following the introduction of fiscal tools and macroprudential regulations highlighted in Table 1
Source: Bank of Korea

Apparently these policy measures were effective in stabilising housing prices and the housing credit cycle. Housing price growth and the number of housing transactions decreased greatly after the tightening of regulations as property market sentiment was dampened (Figure 6).

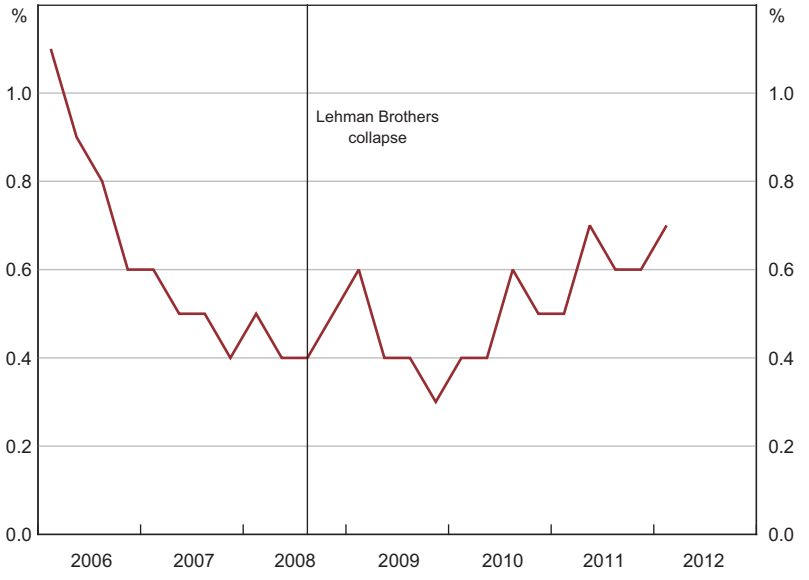
Helped by these policy efforts, the mortgage delinquency rate was kept at a relatively low level during the height of the global financial crisis around the time of Lehman Brothers' collapse, and thereafter (Figure 7). Thus, macroprudential measures, such as LTV and DTI ratios, contributed greatly to maintaining financial stability in Korea.

Figure 6: Housing Indicators Before and After Regulatory Tightening



Note: Comparison between six-month periods before and after tightening of loan regulations for Seoul metropolitan area
Sources: KB Kookmin Bank; Ministry of Land, Transport and Maritime Affairs

Figure 7: Mortgage Delinquency Rates



Source: Financial Supervisory Service

Unintended side effects and circumvention attempts

In reality, any policy measure will have some form of side effect. LTV and DTI regulations are no exception. In the Korean case, we can cite three unintended consequences of attempts made by financial institutions and borrowers to circumvent the policy measures undertaken by the Korean authorities.

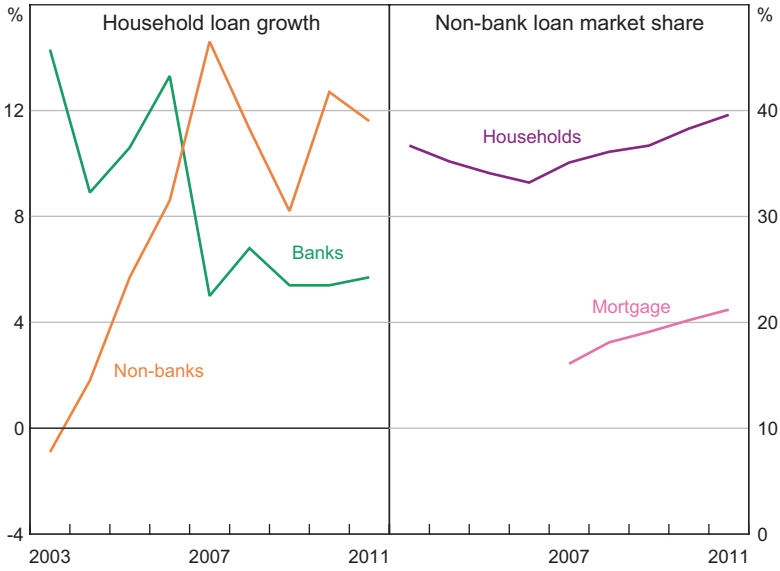
Marginal extension of maturity to get regulatory advantage

After the introduction of the 50 per cent LTV cap, the regulatory authority gave a 10 per cent LTV cap advantage to mortgage loans with maturities longer than three years. To take advantage of this, domestic banks offered mortgage loans with a 37-month maturity. However, these attempts to get around the regulations could not be sustained when the regulatory authority picked up on them and carried out special examinations to ensure compliance with the spirit of the regulation.

Balloon effect

Mortgage loans by banks were tightly regulated and the regulations were effective in containing rapid expansion of their mortgage lending. As the regulations mainly targeted the banking sector, mortgage lending tended to move instead to non-bank financial institutions. Reflecting this so-called 'balloon effect', since 2007 household loan growth in the banking sector has remained at a low level while that in the non-banking sector has been higher (Figure 8). As a result, the market shares of non-banks in the overall household loan market and the mortgage loan market were on an increasing trend after 2007. To deal with these unintended consequences, the regulatory authority extended the regulation to non-bank financial institutions and lowered the caps.

Figure 8: Lending by Banks and Non-banks



Note: Non-banks are mutual credit institutions (including credit unions and community credit cooperatives), credit-specialised financial institutions, mutual savings banks and insurance companies
Source: Bank of Korea

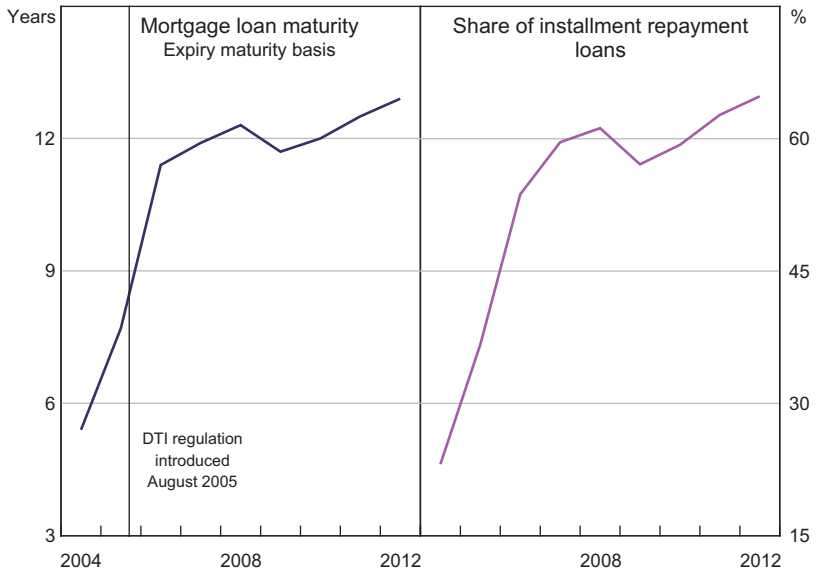
Maturity mismatch and de facto bullet payment loans

The LTV and DTI regulations in Korea were designed to advantage longer-maturity and installment-payment loans. To see this, consider the DTI ratio formula:

$$\text{simplified DTI ratio} = \left[\frac{\textit{annual redemption}\left(=\frac{\textit{mortgage loan}}{\textit{maturity}}\right)}{\textit{annual income}}\right]\times 100 \qquad (1)$$

The longer the maturity, the smaller is the annual redemption. This results in a lowering of the DTI ratio and an expansion of borrowing capacity. The policy authorities' effort was successful in that the average maturity of mortgage loans greatly lengthened following the measures. As shown in Figure 9, at the end of 2005, the year when the DTI regulation was first introduced, the average maturity of mortgage loans was 7.7 years, but by the end of June 2012, it was 12.9 years. And the proportion of installment-repayment loans to total mortgage loans increased from 23.1 per cent in 2004 to 64.8 per cent in June 2012.

Figure 9: Mortgage Loan Maturity and Repayment
Domestic banks

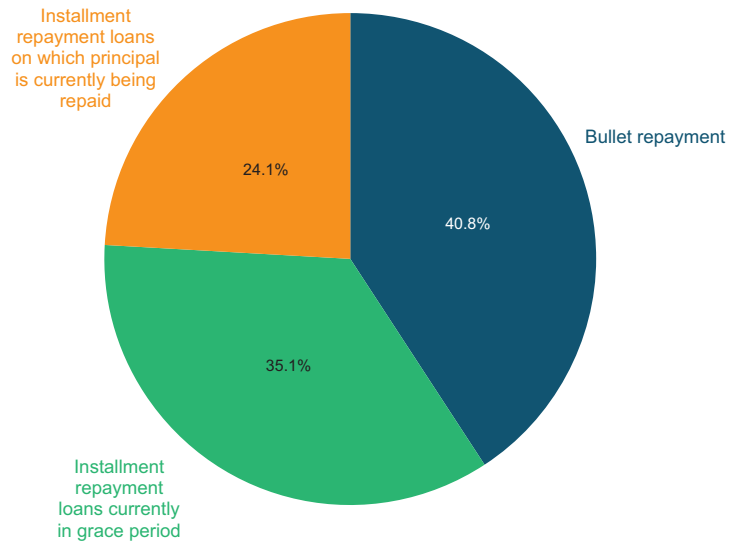


Note: Seoul metropolitan area home mortgage loan data for nine major commercial banks; annual data with the latest data as at 30 June 2012
Source: commercial banks

However, the maturity mismatch between funding and lending widened, resulting in an increase of liquidity risk in financial institutions. Partly as a result of the expansion of average mortgage loan maturity, the overall asset maturity of banks had increased greatly from 2.8 years at the end of 2005 to 3.5 years at the end of 2008. The liability maturity, however, had only increased slightly from 1.3 years to 1.5 years, widening the maturity mismatch between the assets and liabilities of banks from 1.5 years to 2 years over the same period.

The policy authorities tried to increase the use of installment-payment loans by giving them a 5 per cent LTV advantage so that borrowers' redemption burdens could be spread out over a longer period of time and borrowers' default risk could be reduced. However, as shown in Figure 10, the principal is currently only being repaid on 24.1 per cent of mortgage loans. A further 35.1 per cent of mortgage loans are installment loans that are currently in a grace period with zero principal repayment and the remaining 40.8 per cent are bullet repayment loans. When the expiration date arrives, domestic banks tend to either extend the grace period or to renew the bullet repayment loan. Therefore, a significant part of mortgage lending remains *de facto* bullet repayment type lending despite the policy efforts to expand installment loans.

Figure 10: Mortgage Loans by Repayments Type
As at 30 June 2012

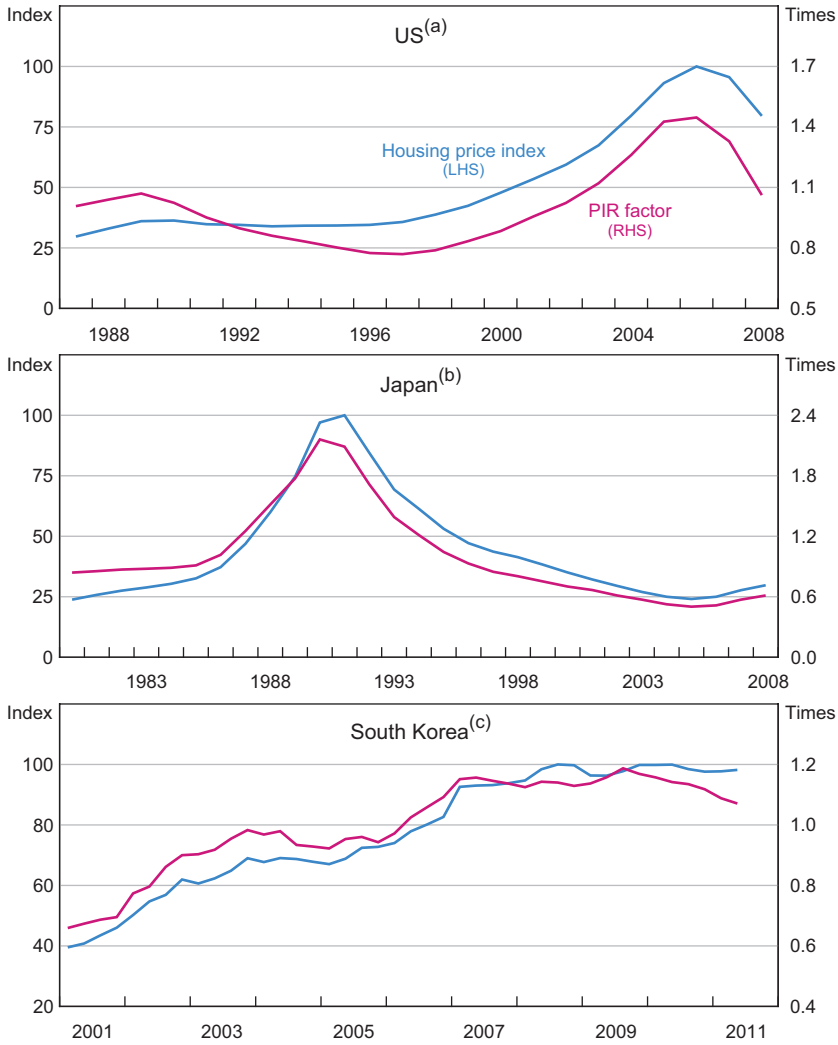


Note: Seoul metropolitan area home mortgage loan data for nine major commercial banks
Source: commercial banks

Recent concerns

From the experience of the United States and Japan, housing prices tend to decline over a significant period of time after the housing price-to-income ratio (PIR) has passed its peak (Figure 11). The housing price index and PIR reached their peaks in the late 1980s in Japan and in the mid 2000s in the United States and, shortly after reaching their peaks, they started declining sharply. In Korea, the housing price index and PIR had increased continuously up until 2010 but then dropped slightly. It is difficult to say whether they have entered a fully-fledged downturn.

Figure 11: Housing Markets

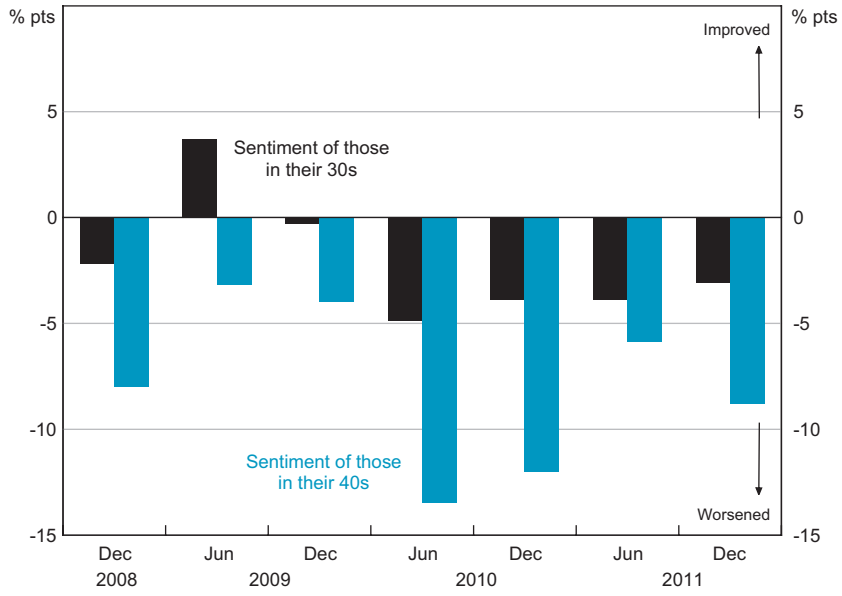


Notes: PIR factor is equal to the current PIR divided by the long-term average PIR, where PIR is defined as the ratio of housing prices to disposable income per capita
(a) S&P/Case-Shiller 10 Cities Home Price Index, peak (2006) = 100; long-term average PIR from 1987 to 2009
(b) Land price index (six major cities), peak (1991) = 100; long-term average PIR from 1980 to 2009
(c) Apartment purchase price index (Seoul area); peak (2008:Q3) = 100; long-term average PIR from 2001 to 2011

Sources: Japan Real Estate Institute; Standard & Poor's; Statistics Korea

Several factors are likely to be weighing on housing prices. First, there is weak home-buying sentiment among those in their thirties and forties, many of whom will be first home buyers (Figure 12).

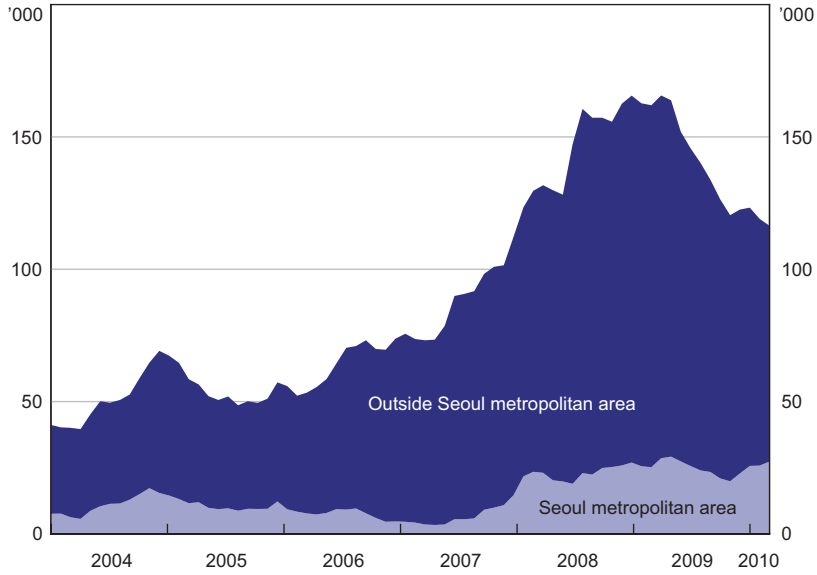
Figure 12: Home Buying and Selling Sentiment Indices
By age cohort



Note: The change in the percentage of hopeful buyers (sellers) that answer they currently have the intention to buy (sell) a home within the next six months compared with the previous quarter
Source: Budongsan 114

Second, the share of the population aged 40 to 54 years, which is most likely to join the housing market, is expected to decrease as mentioned earlier. Finally, a backlog of unsold houses has accumulated (Figure 13). Combining all these factors – weak home buying sentiment, demographic structural changes, and the large unsold housing inventory – housing prices are more likely to decline than to rise. This implies the need for a shift in the focus of current policy concerns toward reducing downside pressure on housing prices.

Figure 13: Inventory of Unsold Homes

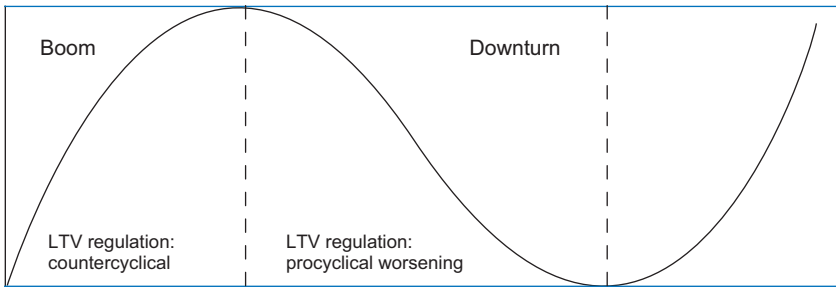


Source: Ministry of Land, Transport and Maritime Affairs

3.4.1 Asymmetric effects of LTV regulation

Declining housing prices cause significant concerns to authorities in charge of macroeconomic and financial stability. What is worse, in the downturn phase of housing prices, LTV regulations may contribute to further housing price declines. This is because the effects of LTV regulations can be inherently asymmetric (Figure 14).

Figure 14: Housing Price Cycle and the Role of LTV Regulation



As mentioned earlier, tightening LTV regulations in a boom period is likely to decrease borrowers' funding capacity, contributing to the stabilisation of housing prices. In short, the tightening of LTV regulations acts to dampen housing prices in a boom period. However, in a downturn when housing prices are falling, a borrower's LTV ratio is likely to move above the regulated level and the repayment burden can increase. Under this situation, borrowers may try to sell properties to repay the loans and this decision may cause a fire sale of housing and an oversupply in the

property market, resulting in a sharper decline of housing prices. This implies that in a downturn period, LTV regulations can amplify housing price movements, which may become a potential source of increasing systemic risk. Currently, borrowers' LTV ratios are relatively low in the domestic banking sector as overall housing prices have not decreased greatly, and thus selling pressure is not high. Nevertheless, as housing prices in some areas have decreased significantly, there is a growing number of cases where it is necessary for borrowers to repay some of their loans to meet the regulatory level of the LTV ratio. The increase in borrowers' repayment burdens can reduce household consumption, thus dampening economic growth and increasing the possibility of macroeconomic and financial instability. When housing prices start to decline rapidly, a temporary suspension of LTV regulations could be one of the policy options for sustaining financial stability.

4. Kiyohiko G Nishimura

How to Detect and Respond to Property Bubbles: Challenges for Policymakers

Let me begin by commending the impressive achievements of the BIS project, as exemplified by the presentations yesterday and this morning. In this regard, I am sure you will join me in applauding the efforts of Frank Packer and his accomplished colleagues at the BIS Asian Office In spite of this impressive progress, however, I still think that we are only at the starting line: many problems remain to be solved before this project can provide guidelines for policymaking. Learned academics may be experts in 'explaining' the causes and effects of past events that have shaken the world. To put it metaphorically, failures in the last war are always scrutinised thoroughly, and their lessons are presented. In contrast, we policymakers should be looking forward into the future. We should not be fighting the last war when things are changing rapidly, no matter how well we may have learned their lessons.

The two main questions from the policymaker's point of view are: how can we detect malign property bubbles, and how should we respond to them?

How to detect malign property bubbles

Let me start with the first question: how can we detect malign property bubbles? Here we should be aware that not all property bubbles lead to financial crises, and not all financial crises are preceded by property bubbles. International panel studies have shown that two-thirds of 46 systemic banking crises were preceded by housing price boom-bust patterns, while 35 out of 51 housing price bust episodes were followed by a crisis (Claessens, Kose and Terrones 2008; Claessens *et al* 2010). So there are both malign bubbles and benign ones.

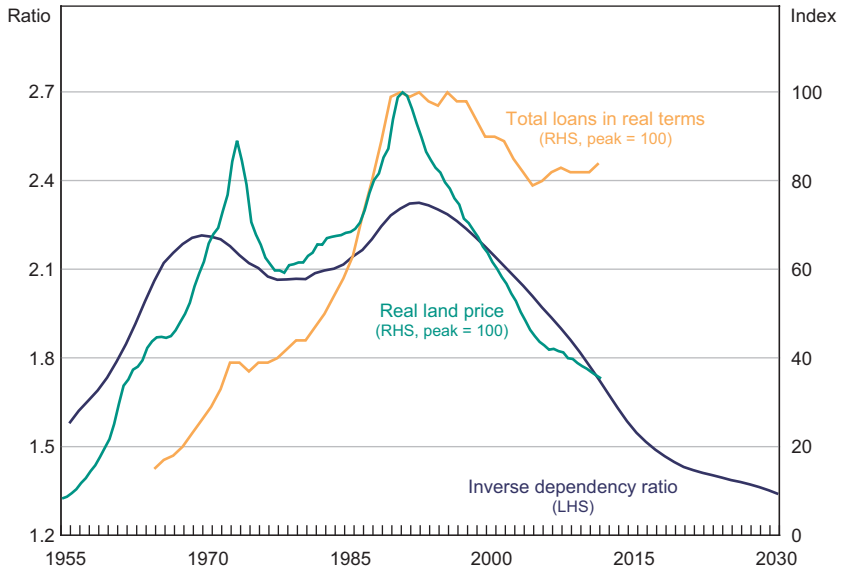
Then, what leads to a malign bubble? Looking back at the past experience of malign bubbles, we find another factor which has not been touched upon by the presentations so far: the demographic transition from a 'population dividend' to the 'burden of an ageing population'.

Let us compare the Japanese property bubble of the 1990s, the US housing price bubble of the 2000s, and the possible Chinese property bubble (Figures 1 to 3). In these three figures, I juxtapose,

first, the ratio of working-age population to the rest (the inverse dependency ratio, also referred to as the working-age population ratio), second, the real property price index, and third, total loans in real terms.

In Japan, we have two peaks in the working-age population ratio, accompanied by two peaks in the real property price index, which is the real land price index (Figure 1). Of these peaks, only the second one, around 1991 was a malign bubble which triggered a subsequent long period of stagnation. Then, what is the difference between the two? The volume of total loans in real terms may suggest an answer. Real loans were increasing at the time of the first peak, but their level was not as high as during the second peak.

Figure 1: Japan – Demographic Change, Credit and Property Prices

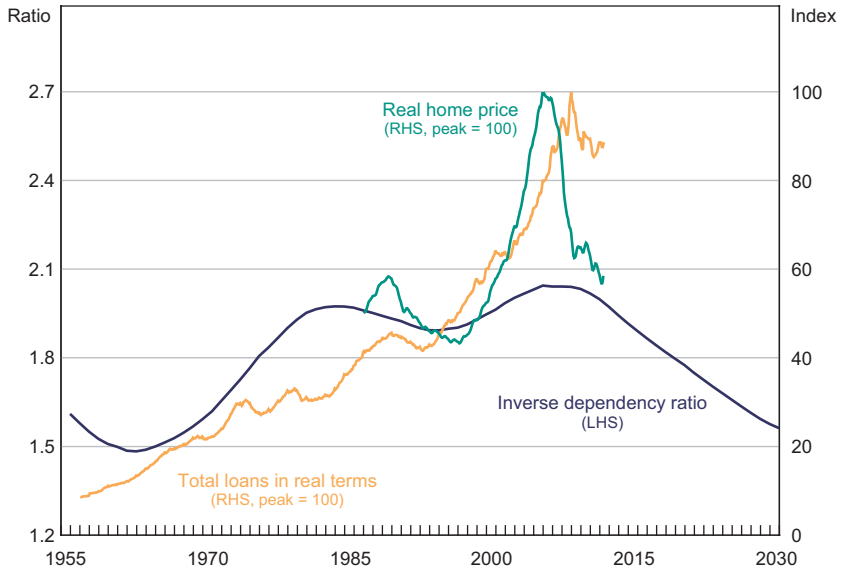


Notes: 'Real land price' is the total average urban land nationwide, urban land price index; 'Total loans in real terms' are the loans of depository corporations from the flow of funds, adjusted by the CPI

Sources: Bank of Japan; Japan Real Estate Institute; Ministry of Internal Affairs and Communications; United Nations

A remarkably similar picture is found in the United States (Figure 2). There we have two peaks in the working-age population ratio, though not as pronounced as in Japan. And the real property price index, which is the real home price index, seems to have two peaks, roughly coinciding with demographic change. Again, the second peak triggered the financial crisis of 2008, though the first peak coincided with the savings and loans crisis, which had a far less severe effect on the economy. Adding real total loans to the chart, we find quite a similar pattern to the Japanese case. The level of real total loans in the first peak was high, but far lower than in the second peak.

Figure 2: United States – Demographic Change, Credit and Property Prices

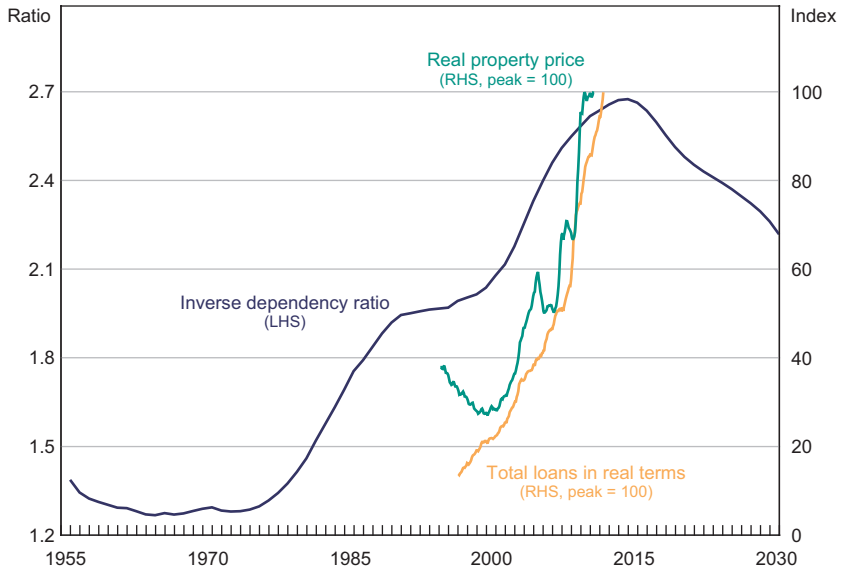


Notes: 'Real home price' is the S&P/Case-Shiller 10 Cities Home Price Index; 'Total loans in real terms' are the loans and leases in bank credit from all commercial banks, not seasonally adjusted, adjusted by the CPI

Sources: Board of Governors of the Federal Reserve System; Bureau of Labor Statistics; Standard & Poor's; United Nations

Figure 3 shows that China has not yet peaked with respect to the working-age population ratio, but it is close. The property price index was taken from the website of a Shanghai index provider, which unfortunately and unexpectedly shut down their site and vanished about a year ago (June 2011). I tentatively use this index since it has a longer span than other indices, although I am not entirely sure how it was constructed. Figure 3 shows a clear upsurge in property prices up to 2010. Again the level of real total loans shows a tremendous increase along with the working-age population ratio and the property price index.

Figure 3: China – Demographic Change, Credit and Property Prices



Notes: 'Real property price' is the Zhongfang Shanghai Residential Property Index; 'Total loans in real terms' are financial institution loans, adjusted by the CPI
Sources: National Bureau of Statistics of China; People's Bank of China; United Nations; Zhongfang Shanghai Real Estate Index Office

What lessons can we learn from this rather cursory examination of the recent history of two advanced economies and the present situation of one emerging economy? It is clear that not every boom-bust episode leads to a financial crisis. However, if demographic change, a property price bubble and a steep increase in loans coincide, then a financial crisis seems more likely. And China is now entering the 'danger zone'.

Although demographic factors are not the subject of the studies in this Conference, there is a growing body of cross-national evidence that compositional change in population has a significant effect on property prices (especially the land component).[1] This comes as no surprise since, in the population-dividend phase, young baby boomers want to buy more land and save more real money for their retirement. Since the supply of land is physically limited, the real price of land will go up. Similarly, if the nominal money supply is held constant, the 'price' of real money holdings, which is the inverse of the price level, should also go up, implying deflation. Being mandated to maintain price stability, the central bank is then likely to increase nominal money to keep prices stable. The result is an increase in property prices while general price levels remain stable (Nishimura and Takáts 2012).[2]

However, this raises the problem of quantitative significance. Although this hypothesis can explain 'correlation' qualitatively, it is not sufficient to explain these malign property price bubbles quantitatively. The magnitude of these bubbles is simply mind-boggling. Also, not every country

1 See, for example, Nishimura (2011b) and Takáts (2012).

2 This paper includes both theory and an empirical analysis of a panel of 22 advanced economies.

experiencing this sort of demographic change has a malign property bubble and a financial crisis. Therefore, we should not think of this strong positive correlation between demographic factors and malign bubbles as a strict causal relationship. Rather we should regard the demographic conditions of the population dividend as 'fertile ground' for malign property bubbles.

In the final analysis, malign property bubbles can be considered a manifestation of overly optimistic expectations at their extreme.[3] Since the financial crisis, many attempts have been made in the economics profession to explain malign bubbles as the consequence of rational economic agents acting under circumstances of asymmetric information and certain not-so-efficient regulatory conditions. These explanations are quite ingenious, using arrays of sophisticated neoclassical apparatus. However, from the practitioner's viewpoint, it is more helpful simply to admit the frailties of human nature whereby we are so prone to be overly optimistic in some cases (and overly pessimistic in others) and our decisions are so easily influenced by other people's opinions, especially the opinions of those in the higher realms of policymaking. I will come back to this point later.

How should we respond to a malign bubble?

Let me now turn to the second issue, which is how we should respond to a malign bubble. Fundamentally, we should distinguish two stages in the life of a malign bubble. The first is the early or prevention stage of the bubble, while the second is the late or collapsing stage.

When considering our response to the early or prevention stage of a bubble, a consensus seems to have emerged in favour of the so-called BIS view. First, use various macroprudential policies to rein in overly optimistic expectations in the market. Second, if the bubble is truly malign, we should not hesitate to use monetary policy as well. Third, in using macroprudential measures we should be aware of the long-run consequences of their distorting effects on resource allocation.

In practice, I have strong reservations about the effectiveness of some macroprudential measures in a malign bubble. Take the loan-to-value (LTV) ratio as an example. In the heyday of a ballooning bubble, the denominator of the LTV ratio, that is the market value of property, goes up higher and higher. Thus, the LTV ratio that seemed sufficient to cap loan volumes becomes grossly insufficient in a few months or even weeks. The same is true for quantitative constraints on loans, since instruments bypassing the constraints emerge, as exemplified in the experience of the Japanese property bubble of the 1990s.[4] Moreover, macroprudential measures are sometimes used to halt the advance of a bubble only temporarily, and it eventually comes to the surface again later with greater force than before. So an apparent success in the present may be an omen of failure in the future.

There is another issue which has been unfortunately overlooked in the discussion of dealing with a bubble, but is potentially most problematic of all: communication with the public. How can policymakers convince the public that we are facing a ballooning malign bubble when there is no apparently imminent threat to the system? It is extremely difficult to persuade people who

3 From this perspective, both the malign property bubbles of Japan and the United States, and the European sovereign crisis have a similar origin: overly optimistic expectations of the future during the population-dividend phase.

4 For more detailed discussion on macroprudential policies in the case of the Japanese property bubble, see Nishimura (2011a).

(want to) believe 'this time is different' and are convinced they are now on the foothills of eternal prosperity, just as long as their path is not blocked by some stupid policymaker. In retrospect, I have to point out, sadly, that the public sector is often partly responsible for nourishing such overly optimistic expectations in the public at large.[5]

Although I have expressed some reservations so far about the emerging policy consensus in the early or prevention stage of a malign bubble, these problems are almost trifling in comparison with the daunting policy difficulties faced in the late or collapsing stage. To my disappointment, there has been little discussion dealing squarely with these difficulties.

In the late stage of a bubble, there is, on the one hand, a danger of restraining policy being 'too little, too late', and just postponing the collapse until a later stage and on a larger scale. On the other hand, however, there is also the danger of too bold a policy leading to an 'overkill' of the economy.

Most difficult, however, is the appropriate response during the collapsing stage of malign bubbles. First, the magnitude of the collapse can be mind-boggling. Figure 4 shows first the real property prices in Japan during its build-up and collapsing phases. Here I use the Recruit Residential Price Index (RRPI) for greater Tokyo (roughly 10 per cent of the total population), which is the quality-adjusted condominium price index. Then I have added the US real property prices in 10 cities (again roughly 10 per cent of the total population), which is based on the S&P/Case-Shiller index. These series are positioned so that their peaks coincide. The magnitudes of the price declines are clear: Japanese real residential property prices at their lowest point were only one-third of their peak; in the United States, real residential property prices are currently less than 60 per cent of their peak. At this moment, it is not clear whether US prices have hit the bottom. In any case, a decline of this magnitude, while less than that experienced in Japan, still implies a severe balance sheet adjustment for the US economy.

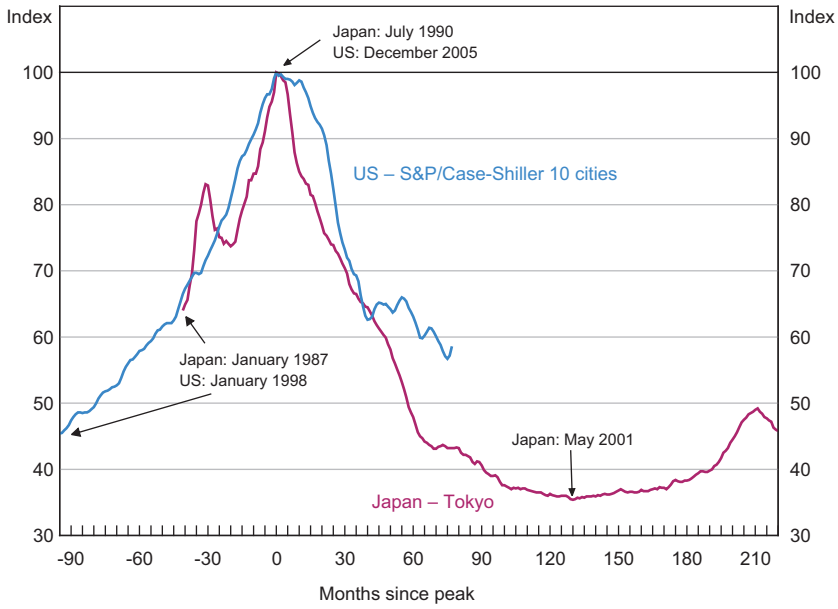
Moreover, this severe balance sheet adjustment in the United States, which is necessary for sustained recovery, is taking place when demographic factors are changing from positive (population dividend) to negative (burden of an ageing population), as they did earlier in Japan, as already shown in Figures 1 and 2. A severe balance sheet adjustment under population ageing hampers the effectiveness of conventional policy tools. Moreover, seemingly overly pessimistic expectations aggravate the problem of policy effectiveness.

The disturbing fact is that little is known about the appropriate policy for the late or collapsing stage of a malign bubble. What tools are available? What are the pros and cons of their use? These are the most pressing challenges for policymakers, and they should form the research agenda of the immediate future.

So in conclusion, I would like to reiterate that we are still only at the starting line. Thank you for your kind attention.

5 See Nishimura (2011a) about the report of one Japanese government agency which became the foundation of an overly optimistic view about office space demand in Tokyo in the late 1980s.

Figure 4: Real Property Prices
Peak = 100



Sources: Japan Real Estate Institute; Standard & Poor's; author's calculations

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5. General Discussion

The policy discussion began with the question of whether interest rates can be used pre-emptively to moderate strong credit growth and increasing asset prices in a low inflation environment. One participant said it would be difficult for a central bank to raise rates against this background, but not impossible or without precedent. The effectiveness of monetary policy in this situation depended critically on the central bank's communication strategy in the lead-up to an increase in interest rates. The Australian experience of the early 2000s was used as a case study. One participant said the RBA's two modest 25 basis point increases in November and December 2003 were more effective because they were preceded by open dialogue with the public on the dangers of an overheating housing market.

The importance of not lowering rates in a benign inflation environment with strong asset price growth was emphasised. One participant said the lowering of interest rates by monetary policy authorities in the decade before the crisis was a policy mistake. The participant argued that if central banks collectively had not lowered interest rates in the face of a global supply shock (caused by the emergence of China) and lower long-term interest rates (caused by higher net saving in Asia), then the credit and asset price boom experienced in many countries would not have been as damaging. They noted that communicating the decision not to lower rates in this situation was easy, particularly if the foundations for the public's understanding of monetary policy had been laid.

Another participant agreed, but sought to provide a more nuanced explanation for the rationale behind not lowering rates in a benign inflation environment with strong asset price growth. They said policymakers needed to take an extra step and show what negative externality higher property prices cause. Without this, they argued that any sensible monetary policy rule – be it inflation targeting or not – recommends that monetary policymakers should accommodate the decline in the natural interest rate (caused, for example, by higher net saving in Asia) by reducing nominal rates.

Another participant argued that it was very difficult to make the case that monetary policy was the prime driver of credit and asset price booms in the lead-up to the crisis. For example, it was noted that there were completely different real estate price dynamics across the euro area despite the presence of a common monetary policy. The participant acknowledged that low interest rates may help fuel an established boom.

The (perceived) difficulty in communicating the rationale for activist policy targeting asset prices (so-called leaning) was the next subject discussed. To begin, one participant highlighted two concerns they said made them pessimistic about the success of activist policy. First, they argued it would be difficult to communicate to the public that the market is not working while the public's wealth was increasing. Second, they argued that, assuming activist policy had worked in an earlier period, it would be difficult to convince the public that policy had been a success. In particular, real costs were borne by society with no observable change in the macroeconomic environment and no counterfactual analysis would be available to argue that the policy had worked. In light of

these communication problems, they said policymakers should focus on creating resilient systems and rely less on discretionary actions.

Several participants disagreed with this view. In regard to the first concern, one participant argued that when policymakers approach the public they are not saying they know asset prices are overvalued or that credit growth is too high. Instead, they are communicating about potential risks and bringing these risks to the public's attention with a view to changing private sector behaviour and, absent that, communicating the preparedness of the central bank to change policy. The Australian experience in late 2003 was again invoked as an example. Monetary policy was set higher than it otherwise would have been, imposing a cost on home buyers; however, from the perspective of history, macroeconomic conditions were satisfactory and the public accepted that this policy was prudent. Another participant added that in the Australian experience, the RBA was supported in its communications by the Australian Securities and Investment Commission as well as the Australian Tax Office.

Another participant agreed with what they referred to as the 'Australian position'. While accepting that creating a resilient system was vital, they stressed that the case put forth against activist policy was incorrect. In particular, the general public will realise what the risks would have been if policymakers had not pursued activist policy. More generally, another participant noted that central banking is not a zero-risk business. Policymakers have to take risks in setting monetary policy and macroprudential tools. They argued that policymakers taking bold decisions should be encouraged, all the while accepting that sometimes errors will happen and society will have to bear the costs.

Another participant suggested that policymakers need to continue working on coordinating communication across different policy agencies. They said a large part of the financial stability policymaking of a non-supervisory central bank is providing rhetorical support for the prudential regulator. A discussion of the institutional arrangements that best facilitate effective communication across agencies followed. One participant noted that institutional arrangements were particularly important for countries that are yet to establish their own macroprudential framework. In those countries, policymakers are being exposed to a very risky situation because monetary policy is set without any information about regulators' behaviour. In the case of Korea, it was noted that this problem is being addressed by establishing formal communication channels between the prudential regulator and the central bank. Another participant suggested informal communication arrangements were more likely to be effective. Another participant agreed, and noted that in Australia there are not a lot of formal rules of engagement between regulators, but rather informal communications guided by a common purpose. This arrangement had proved very useful, but participants noted that the historical legacy of institutional arrangements matter and, absent a history of informal communications, rules of engagement may be necessary to build relationships.

Looking forward, another participant cautioned policymakers not to learn the wrong lessons from the past and to take in to account heterogeneity across countries in the monetary policy transmission mechanism. To illustrate this point they referred to the US experience of the early 2000s, arguing that policy in the United States at the time was too heavily influenced by the Japanese lost decade. They argued that differences in the monetary transmission mechanisms

in Japan and the United States had not been taken into account. For example, the marginal propensity to consume out of wealth is absent in Japan and credit liberalisation only affected the corporate sector there. It was suggested that if the Federal Reserve had realised the lessons of Japan were not relevant they would have normalised interest rates more quickly in response to increasing credit growth and strong activity in housing.

Finally, one participant suggested two areas for further consideration in the policy sphere. First, they said policymakers need more understanding of the effect urban structure has on supply dynamics. For example, it was noted that in Korea the housing market is characterised by very different supply dynamics compared with countries such as Germany or the United States where urban centres are more diffuse. Second, they said macroprudential policymakers need to think more about financial stability policy in terms of specific targets or goal variables.

Closing Remarks: Property Markets and Financial Stability – Issues and Interpretations

Stephen G Cecchetti*

Introduction

Our understanding of financial stability and instability is improving. After being lulled into complacency, policymakers, academics and market participants in the advanced economies now appreciate that financial crises are more the norm than the exception – and that the US experience from 1934 to 2007 was the anomaly.[1] We now accept that in any given year, there is likely to be a financial crisis in at least one country in the world. This realisation leads us all to work on understanding how we might reduce the frequency of financial crises and their costs to the broader economy.

This is the motivation for research that concentrates on the role of banks and debt. And that research has yielded new and important insights. We now know, for example, that high levels of debt are bad for growth. We now know that when debt grows quickly it creates a drag on the real economy. We now know that financial systems, necessary to spur development, can become bloated and draw resources away from more productive activities.[2] And, most importantly, we now know that leverage in all of its forms creates financial instability.

Armed with this understanding that leverage is a major source of financial instability, we are immediately drawn to look at banks and real estate. Banks are not only the most highly leveraged institutions in the most leveraged sector of the economy, but also the source of the credit used elsewhere. And real estate is the single most credit-intensive good out there. In the United States, for example, 34 per cent of all credit market debt extended to the domestic non-financial sector is in the form of mortgages. And mortgage debt comprises two-thirds of personal debt.

As several Conference speakers noted, the combination of debt intensity and boom-bust cycles gives property markets a central role in financial crises. But they do more than that. Property market bubbles have some very real negative effects on the economies where they occur. First is the direct effect of too much building. Travelling only a few kilometres from the historic centre of Dublin in Ireland today, one will see empty buildings that are the consequence of the real estate boom from 2002 to 2007.

* I thank Frank Packer and Ilhyock Shim for their assistance in the preparation of these remarks. The views expressed here are those of the author and do not necessarily reflect those of the BIS.

1 See Gorton (2012) for a detailed discussion.

2 See Cecchetti and Kharroubi (2012).

Overbuilding is usually accompanied by overconsumption, as the wealth effect from the perceived increase in housing wealth leads to a fall in saving. This empirical fact is at odds with what theory tells us: there should be no consumption wealth effect from changes in house prices. In the aggregate, when the price of housing rises, the economy as a whole cannot consume more (except for housing services, but that's accounting). The point is that we all need to live somewhere, so the person to whom someone might sell their more valuable house will have to increase their saving to buy it. And that rise in saving by the prospective buyer must exactly match the dissaving of the prospective seller.[3] I should note that higher housing values can provide collateral for borrowing by liquidity-constrained households. But these loans will need to be repaid, so this is only a short-run effect (and on average it should be negative, not positive as we see in the data).

Before coming to the themes of the Conference, I have two more introductory comments. First is that booms in the prices of assets used as collateral create procyclicality. This obvious point is one of the things that makes property booms and busts so damaging. As prices rise, the collateral value of a property rises, allowing for more borrowing. Extrapolative expectations then lead to an actual increase in leverage, as pointed out by John Muellbauer in his keynote speech. When the bust inevitably comes, insolvencies are potentially enormous.

Second is the fact that property price booms are much worse than equity price booms. And they are worse in virtually every way.[4] This means that understanding property markets is a key to understanding when financial stability is at risk.

Turning to the RBA-BIS Conference, this marks the culmination of the two-year research program on property markets and financial stability carried out by the BIS Asian Office under the direction of the BIS Asian Consultative Council. Three major themes formed the core of the discussions:

1. Measurement of property prices: how should we assess valuation?
2. Financial structure: do some housing finance systems promote stability?
3. Policy: what should policymakers do about this?

The Conference and research program brought together experts on real estate markets and finance with experts on monetary policy and macroeconomics. This combination has improved our understanding of these issues.

Measurement

The starting point for any study of the relationship between property markets and the economy has to be measurement. To begin with, we need to know what is happening to the prices of both residential and commercial real estate. Unsurprisingly, the difficulties in measuring housing prices are really the same as those for measuring the prices of other goods and services.

To give a simple example of the latter, consider the case of washing machines. You would think that it would be straightforward to collect the price of a specific model of washing machine every

3 See Cecchetti (2008) for a discussion.

4 See Cecchetti (2006).

month and use this as the basic input into a consumer price index. Well, it turns out that models are changing all the time, making this very difficult.[5]

In the case of property, the difficulty is heterogeneity and the infrequency of transactions. As Yongheng Deng, Joseph Gyourko and Jing Wu describe in their paper, the solution is hedonics. But even then, there can be difficulties. As noted by Haibin Zhu in his discussion of the paper, for the case of Shanghai, the recent expansion of the subway system has taken property that was once remote and made it effectively much closer to the centre of the city.

Overall, the work discussed at the Conference documented clear progress on the measurement front. But it also clarified the need for internationally comparable data on property prices, something that is clearly missing today. And, because understanding financial stability and instability requires cross-country comparisons – crises may be frequent, but the true variation in the data comes from a panel of country experiences – it is important that we have consistency across countries.

Financial Structure

Several papers from the Conference examine mechanisms for property finance and the implications for financial stability. In particular, Frank Warnock and Veronica Warnock study the determinants of the relative size of housing finance systems across economies. Frank Packer and Timothy Riddiough analyse commercial property investment and the development of REIT markets in the United States and other economies to see if the disintermediation of property finance via real estate securitisation stabilises property prices. Luci Ellis, Mariano Kulish and Stephanie Wallace discuss the relation of various features of property loans, including amortisation requirements and maturity, and boom-bust cycles. And Giovanni Dell'Ariccia provides evidence that sharp increases in credit and leverage are at the core of the relationship between real estate booms and banking crises, and that real estate booms are associated with increases in banks' risk-taking.

At this point, it is worth saying that collateralised borrowing very clearly improves welfare. It allows for consumption smoothing, diversification and small business formation, among other things. And, as de Soto (2000) emphasises, the ability to use property as collateral spurs economic development.

Given that we need to be able to provide credit collateralised by property, the question is whether there are some mechanisms that are better for doing it than others. Put differently, would it make sense to shift all property financing out of banks and into markets?

There is surely no one-size-fits-all answer to this question. Among potential reasons is the fact that different economies have different legal systems. This, along with the path-dependence of most financial structures, will cause significant differences to persist.

But it is still worth asking what would happen if all real estate lending were fully securitised. Or, what if mortgage lending were peer to peer?[6] Yet a third option would be forms of Islamic banking where there is no net asset value guarantee for liability holders.

5 See Silver and Heravi (2003) for a detailed discussion on this point.

6 In some places, peer-to-peer lending has moved into some consumer areas. See, for example, www.prosper.com.

Put slightly differently, we might ask whether there is a natural supply among investors for the maturity transformation that we now tend to concentrate inside banks. To see what I mean, think about the fact that young people wishing to save for their old age are a natural market for long-lived assets. So, given population demographics, there is a natural maturity structure of saving portfolios. And there is also a natural maturity for the capital stock. Are these materially different? Do we really need financial institutions to provide additional maturity transformation?

The answer, I believe, is that if we could substitute market mechanisms for the bank provision of credit to the property sector, we would have a more stable financial system. But we would not eliminate boom-bust cycles and the problems of overbuilding and overconsumption that they create. These real problems are more fundamental than the financial structure itself.

Policy

This leads to the final theme of the Conference: the relationship of property markets to the design of financial stability policy.

Stepping back a bit, here is how I see the problem: the primary objective of economic policymakers is to stabilise real consumption growth at the highest sustainable level. Housing is a significant portion of consumption – something like one-fifth to one-quarter – so it plays a very important role. And because it is so durable (the building I live in was originally built in 1363) and costly to adjust, it is very important that we have the right amount of housing. That is, the big question for policymakers is: how can we ensure that we have the right amount and the right kind of housing? I say the right kind because one of the big questions in housing is the relative quantity of rental versus owner-occupied dwellings.

What tools do policymakers have to try to achieve this objective? The focus of much of the discussion in the central banking world is on the combination of monetary policy and prudential policy. The former is related to the debate over leaning against bubbles as they develop versus cleaning up after the bubbles burst, discussed by Glenn Stevens in his opening address to the Conference. And the second is about the question of whether to achieve goals by regulating and monitoring borrowers or lenders.[7]

On the former, I have little new to say beyond what I have written previously.[8] And on the latter, I firmly believe that we urgently need to know more. The paper by Kenneth Kuttner and Ilhyock Shim helps further our understanding of the effectiveness of various policy measures on housing prices and credit. We need to know still more about the impact of individual tools and more about their interaction. And, importantly, we need to understand this in the context of the long-horizon problem that is inherent in housing.

7 For an enumeration of the long list of policies being considered, see CGFS (2010).

8 See Cecchetti (2006) and the references therein.

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Glossary

Alphabetical List of Selected ISO Country Codes

ISO code	Economy	ISO code	Economy	ISO code	Economy
AR	Argentina	FR	France	NZ	New Zealand
AT	Austria	GB	United Kingdom	PA	Panama
AU	Australia	GH	Ghana	PE	Peru
BD	Bangladesh	GR	Greece	PH	Philippines
BE	Belgium	GT	Guatemala	PK	Pakistan
BG	Bulgaria	HK	Hong Kong	PL	Poland
BO	Bolivia, Plurinational State of	HR	Croatia	PT	Portugal
BR	Brazil	HU	Hungary	RO	Romania
CA	Canada	ID	Indonesia	RS	Serbia
CH	Switzerland	IE	Ireland	RU	Russian Federation
CL	Chile	IN	India	SE	Sweden
CN	China	IS	Iceland	SG	Singapore
CO	Colombia	IT	Italy	SI	Slovenia
CR	Costa Rica	JP	Japan	SK	Slovakia
CY	Cyprus	KE	Kenya	SV	El Salvador
CZ	Czech Republic	KR	Korea, Republic of	TH	Thailand
DE	Germany	LT	Lithuania	TR	Turkey
DK	Denmark	LU	Luxembourg	UA	Ukraine
DO	Dominican Republic	LV	Latvia	US	United States
EC	Ecuador	MX	Mexico	VE	Venezuela, Bolivarian Republic of
EE	Estonia	MY	Malaysia	ZA	South Africa
ES	Spain	NL	Netherlands		
FI	Finland	NO	Norway		

Note: Two-letter country codes from the International Organization for Standardization (ISO)

Alphabetical List of State Codes for the United States

Code	State	Code	State
AK	Alaska	MT	Montana
AL	Alabama	NC	North Carolina
AR	Arkansas	ND	North Dakota
AZ	Arizona	NE	Nebraska
CA	California	NH	New Hampshire
CO	Colorado	NJ	New Jersey
CT	Connecticut	NM	New Mexico
DC	District of Columbia	NV	Nevada
DE	Delaware	NY	New York
FL	Florida	OH	Ohio
GA	Georgia	OK	Oklahoma
HI	Hawaii	OR	Oregon
IA	Iowa	PA	Pennsylvania
ID	Idaho	RI	Rhode Island
IL	Illinois	SC	South Carolina
IN	Indiana	SD	South Dakota
KS	Kansas	TN	Tennessee
KY	Kentucky	TX	Texas
LA	Louisiana	UT	Utah
MA	Massachusetts	VA	Virginia
MD	Maryland	VT	Vermont
ME	Maine	WA	Washington
MI	Michigan	WI	Wisconsin
MN	Minnesota	WV	West Virginia
MO	Missouri	WY	Wyoming
MS	Mississippi		

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