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The RBA's Business Liaison Program*

The Reserve Bank meets regularly with businesses and associations in every state and across industries of the Australian economy. The information collected under the liaison program complements that available from official sources and helps the Bank to monitor cyclical and structural developments, as well as the effect of unusual events on the Australian economy. The broad messages gathered through liaison are incorporated into the Bank's policy discussions and public communications.

Introduction

Information provided by businesses can assist in understanding current and future trends in the domestic economy. In recognition of this, a formal program of business liaison was established by the Reserve Bank in 2001, though the Bank has had informal contacts with businesses dating back to the 1960s. This article describes how the Bank's liaison program is structured, how the information gathered is used to complement that from other sources such as the Australian Bureau of Statistics (ABS) and business surveys, and how the broad messages from liaison are incorporated into the Bank's communications.

The Business Liaison Program

While the Bank's headquarters is in Sydney, historically the Bank had branches in each of the state and territory capitals. As its banking business with state governments declined over time, these functions were progressively closed. In their place, State Offices were established in the capital cities of Queensland, Victoria (which also covers Tasmania), South Australia (which covers the Northern Territory) and Western Australia. Along with a unit in Sydney, the Bank's business liaison program is conducted through these offices. The program has around 20 staff, three-quarters of whom are economists.

The main focus of the business liaison program is to hold regular discussions with external contacts. Over time, Bank staff have established relationships across a broad cross-section of the business community, and there are currently around 1 000 active contacts across the country. This contact list is regularly refreshed to reflect structural changes in industries over time as well as emerging economic developments; for instance, the number of contacts in information technology and online retailing has increased in recent years. The Bank also has contacts with industry associations in each state. Participation by contacts in the Bank's liaison program is voluntary and company-specific information and perspectives are treated with strict confidence, though summary messages from liaison are incorporated into the Bank's publications.

How the information is gathered

Liaison meetings are undertaken continually rather than during a specific reference period, with around 70–80 discussions occurring monthly. Discussions with individual firms occur around every 6 to 12 months, with Bank staff usually meeting the chief executive officer, chief financial officer and/or operations manager. The staff speak with some business contacts on a more frequent basis, typically with firms in industries that are bellwether indicators of economic activity and consumer price pressures. Where practical, interviewees and interviewers are paired through time to support a consistent interpretation of the information discussed.

* The liaison program is managed by the Regional and Industry Analysis Section of the Economic Analysis Department.

While the Bank's contact list is broadly representative of the industry structure of the Australian economy, the concentration of the meetings tends to be on the more cyclically sensitive industries. The relative weight of different industries in the sample of meetings also tends to change month by month as economic issues emerge and recede. As a consequence, the Bank's liaison in a particular month or quarter will generally differ from that of a standard business survey, where representativeness of the sample in line with actual industry shares in the overall economy would be an important part of survey design.

Liaison meetings are held with firms of all sizes, although most discussions are with mid-sized and large firms where conditions are most likely to reflect economy-wide trends rather than firm-specific factors. Information on general conditions facing small businesses is often gathered through contacts with industry associations and at round table meetings of small businesses organised by local Chambers of Commerce.[1] The Bank also conducts liaison in regional areas in order to assess more fully the variability of conditions across each state.

The overriding motivation of the program is to build a better understanding about how each industry is structured, the current stage of its business cycle, the challenges and opportunities faced over the medium to longer term, and how companies are responding to the domestic and international circumstances they face. To this aim, the Bank has discussions with firms in the retail, wholesale, transport, manufacturing, utilities, mining, housing, construction, business services, agriculture, tourism and education export industries. The Bank also meets with firms in the household services sector, such as in the child care, domestic education, health and aged care industries. This sector has been a major driver of employment in the economy for an extended period. Nonetheless, the household services sector is usually underrepresented in the Bank's monthly sample since its activity is not very cyclically sensitive and there are a large number of small firms in the sector. While liaison is conducted in every state and industry, the share of the contacts in each industry varies between each state office depending on where industries tend to be concentrated geographically. For instance, liaison with firms in the mining industry is primarily undertaken by the Western Australia and Queensland State Offices, while liaison with manufacturers is most concentrated in the South Australia and Victoria State Offices.

The discussions are typically based around a set of common topics to ensure an economic picture is built up in a systematic and consistent way, both across businesses and over time. The range and depth of the topics covered are, however, quite flexible in order to cover in most detail the key economic issues affecting a particular industry at that time. The discussions are focused around recent developments in demand, investment, employment, wages, prices and margins, the main factors driving developments in these areas, and expected changes over the year ahead. While most of the discussion with contacts is qualitative in nature, some quantitative information is gathered during the discussion that can be used to help validate the strength of the signal from the official ABS data and other published surveys.

The Bank's approach to conducting business liaison is similar to that undertaken at other central banks. The most established liaison program, which has been in operation since the 1930s, is run by the Bank of England. In the United States, the regional Federal Reserve Banks conduct liaison. The Bank of Canada has been conducting business liaison since the mid 1990s. In contrast to the practices in many other countries, the Reserve Bank of Australia incorporates summaries of liaison information directly into its regular assessments of economic conditions and policy advice, rather than collating it into a separate product such as the Federal Reserve's 'Beige Book'. The Bank has assisted several central banks within the Asia region to establish their own business liaison programs.

1 The Bank also discusses the financial and economic developments facing these firms through its Small Business Finance Advisory Panel, which meets on an annual basis.

The State Offices play a key role in the Bank's communication with members of the public. Staff interact with a broad cross-section of the community, giving presentations on economic developments to businesses and community organisations, industry association meetings, teacher conferences, and university and school students in their respective states. Along with the liaison meetings themselves, this provides an opportunity for the public to highlight certain issues and discuss the key messages contained in the Bank's various communications.

How the information is used

The Bank uses liaison information in a variety of ways to complement the picture of economic developments obtained from official data sources and published business surveys. In essence, liaison is used to help fill information gaps to strengthen the Bank's capacity to assess current cyclical and structural trends in the Australian economy. This information provides an important input to understanding emerging developments in the main industries of the economy, which helps build a 'bottom-up' approach to the Bank's forecasts.

In particular, the Bank uses the timely information from liaison to keep staff and the Reserve Bank Board abreast of the latest developments. Businesses are able to describe the 'here and now', while information from official data sources such as the ABS is subject to a publication lag. The timeliness of the liaison information is especially useful when the Bank needs to make an assessment of the effect that natural disasters and other unexpected events will have on economic activity and prices.

Liaison information is also used to help understand the economic trends reported in official data, including for inflation. Business liaison provides an independent source of information that can be compared with official releases to assist the Bank in distinguishing signal from noise in economy-wide data, though the signals from the comparatively small sample underpinning the monthly liaison information are often quite noisy as well. In addition, liaison information can help resolve data puzzles, such as inconsistencies in recent trends between different economic variables as reported in the official data. Most importantly, the liaison discussions provide an opportunity to understand the factors that lie behind the latest trends as reported by the ABS in economic variables such as employment, activity and inflation and to assist the Bank in assessing whether these trends are likely to persist.

In addition, liaison provides insights about economic variables that are not directly observable or reported. For instance, liaison enables a closer focus on activities that are not reported separately in the national accounts, such as the tourism sector. The discussions with firms about their expectations over coming years are also useful in preparing the Bank's forecasts.

The information collected helps Bank staff understand how each industry is structured, the current challenges and opportunities faced by the industry, and how firms are responding to the circumstances they face. This can provide the Bank with a sense of, for instance, the degree of structural change that is occurring within each industry and hence in the national economy overall. Liaison discussions might cover firms' views on the availability of particular labour skills, specific strategies to deal with the high level of the exchange rate, and the regulatory framework. Much of the information gathered is qualitative, and there is clearly variability in firms' responses to the various issues discussed. Nonetheless, the Bank aims to discern overarching signals from the firm-specific messages, both in regard to the issues most commonly raised and the degree to which these issues appear to be important drivers of overall activity and pricing behaviour.

The summary messages derived from the Bank's liaison process are integrated with the advice provided to the Board and are communicated to the public through the Bank's regular statements and reports as well as speeches by senior staff. The Bank includes articles drawing on liaison in its *Bulletin,* covering developments across states and analysis of current developments and challenges in specific industries.

Some Examples from Recent Years

Through the contacts the Bank has built in all states and industries, the liaison program has been used to gather information when the economic momentum changes rapidly. For instance, the Bank was able to collect and assess information on the magnitude of the decline in consumption and the impact of tighter credit conditions during the onset of the global financial crisis in 2007–08, well before the economic slowdown was apparent in the official data.

Liaison was helpful following the widespread flooding in Queensland in 2010–11, which enabled the Bank to assess quickly the impact of the floods on coal production and exports from Queensland, the reduction in activity from the forced closure of businesses in Brisbane and elsewhere, and the magnitude of the damage to homes and state infrastructure that would need to be rebuilt. These estimates were included in the Bank's *Statement on Monetary Policy* published in early February 2011 (see RBA (2011a)).[2] The liaison program also helped the Bank to assess the effects on agricultural output and prices of the severe drought during the 2000s, as well as the effects of Cyclones Larry and Yasi in 2006 and 2011. The cyclones had important effects on economic activity, including the output and prices of bananas, which as it turned out had a very significant effect on overall CPI inflation.

Understanding and monitoring developments in the mining industry has been a focus in liaison over recent years. In its discussions, the Bank has sought to corroborate information from official sources such as the ABS and the Bureau of Resources and Energy Economics, including the projected magnitude and timing of the run-up and run-down in the level of mining investment, and the impact of mining and infrastructure investment projects on Australia's resource exports. Some issues raised in discussions with mining companies have been the share of investment that is imported over the life of a project, the availability of the required skilled labour, and the ability of labour to move into other industries as investment projects are completed. The Bank has discussed with a range of business service companies the degree to which the mining sector has affected demand for their services, which has highlighted in particular the importance of developments in the mining industry for employment services, engineering services and leasing activities. This information was incorporated in a recent *Bulletin* article (see Manalo and Orsmond (2013)).

The challenges in dealing with the high value of the Australian dollar has been a prominent part of the discussions with non-mining export firms and import-competing firms for several years. Liaison suggests that company responses to changes in the level of the exchange rate have varied considerably across industries. For instance, manufacturing contacts have highlighted a range of responses, including greater use of 'offshoring', reliance on imported products, and capital deepening. Tourism contacts generally report that the exchange rate does not have a large impact on the number of arrivals, but that it affects the amount of spending by tourists that come to Australia and the number of Australians that travel abroad rather than undertake domestic holidays.[3] The Bank has contacts with English-language course providers, TAFE institutions and universities, which report that trends in overseas student enrolments in recent years have been affected by policy changes more so than the varying level of the exchange rate. The Bank's discussions with companies have covered the willingness and ability of firms to pass on exchange rate changes to the intermediate and final prices of tradable goods and services. An article in the *Bulletin* estimating the degree of exchange rate pass-through drew on the insights provided by business, as well as formal econometric analyses (see Kohler, Manalo and Perera (2014)).

Given the cyclical sensitivity of housing demand to changes in interest rates, the liaison program has a range of contacts with exposure to the housing market, including builders, renovators, real estate agents, valuers and legal firms. These contacts have been helpful in understanding the extent to which housing supply can respond to upswings in

2 An update on these estimates was provided in RBA (2011b).

3 The issues facing the tourism industry were discussed in Hooper and van Zyl (2011).

housing demand in a timely manner. In this regard, contacts have highlighted the shortage of land availability, complexity of the planning system, high development fees and community resistance to new housing projects.[4] The Bank has discussed foreign ownership of real estate, and information in this regard was used in preparing its recent submission to a parliamentary inquiry into this issue.[5]

Wages and employment trends are a common topic in the Bank's liaison discussions. During the global financial crisis, companies indicated a marked change in the flexibility of labour markets compared with previous economic downturns, and the Bank was able to detect this change in behaviour before it became apparent in the official data. In particular, there was frequent recourse made by companies to wage freezes and reductions in working hours rather than outright job losses. Bank liaison indicates that only some of this reduction in average job hours has since been retraced, partly due to ongoing softness in the labour market and in some cases employee choice.[6]

Recently, the Bank has established contacts with a range of community service organisations, which can provide information on the economic conditions faced by economically disadvantaged members of society, many of whom are only marginally attached to the workforce. The discussion with these contacts combined with research undertaken by the Bank indicates that around half of the economically disadvantaged move out of disadvantage over a five-year period, primarily by obtaining and retaining full-time work. However the other half faces a range of structural impediments to obtaining employment (see Cunningham, Orsmond and Price (2014)).

Conclusion

Business liaison provides important perspectives on developments across industries and the state of the business cycle, and has become a valuable input into the Bank's assessment of the Australian economy. Liaison provides a timely gauge of developments that is often only provided by traditional sources of information with a delay or is not available at all from these sources. It also provides a deeper understanding of the longer-term structural changes that are occurring within industries. As the economic landscape changes, the Bank incorporates the information obtained from liaison into its regular assessments of economic conditions, forecasts and policy decisions. The broad themes derived from business liaison in this regard are incorporated in a timely fashion in the Bank's publications, such as the quarterly *Statement on Monetary Policy* and the *Bulletin*.

4 See Hsieh, Norman and Orsmond (2012) for a summary of around 50 contacts' views.

5 For a summary of the Bank's Submission to the Inquiry into Foreign Investment in Residential Real Estate, see Gauder, Houssard and Orsmond (2014).

6 For further details, see Plumb, Baker and Spence (2010).

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Unemployment and Spare Capacity in the Labour Market

Alexander Ballantyne, Daniel De Voss and David Jacobs*

The unemployment rate provides an important gauge of spare capacity in the labour market and the economy more generally. However, other factors also affect unemployment, which complicates its interpretation when informing monetary policy. Statistical methods can be used to estimate the extent to which the unemployment rate reflects spare capacity versus more enduring structural factors. This involves estimating the NAIRU. Information can also be gleaned from the composition of unemployment, as jobseekers with certain characteristics may be more indicative of spare capacity than others. These approaches suggest that spare capacity in the labour market has increased over the past few years but remains well below that which prevailed over much of the 1990s.

Introduction

An important consideration for monetary policy is the extent of spare capacity in the economy. This depends on the balance of demand for goods and services relative to the economy's potential to produce them. A shortfall of demand results in spare capacity and places downward pressure on inflation, while an excess of demand results in capacity becoming constrained, placing upward pressure on inflation.

A key indicator of spare capacity in the economy is the unemployment rate. A high unemployment rate means that there is a large pool of workers willing to work but not engaged in production, suggesting that the economy is operating below its potential. However, there are other reasons why someone may be unemployed, meaning that some individuals will be looking for work even when an economy is producing at its potential; for example, some people that wish to change jobs may spend time searching for the right role. The rate of unemployment that is consistent with the economy producing near its potential will be that associated with a stable rate of inflation, so it is known as the 'non-accelerating inflation rate of unemployment' (NAIRU). When unemployment deviates from this level, it suggests that the economy is producing above or below its prevailing potential.

It is difficult to know whether a change in the unemployment rate indicates a change in spare capacity, or whether it instead is due to a change in the NAIRU. This article investigates the drivers of unemployment and its relationship with spare capacity in the labour market. The following section expands on the factors that explain the existence of unemployment. Two approaches for extracting information about the extent of spare capacity reflected in unemployment are then examined. The first approach uses information on inflation in wages and prices to infer both the portion of the unemployment rate that is spare capacity and the portion that is the NAIRU. The second approach looks at whether some types of unemployment have more bearing on inflation than others.

The Causes of Unemployment

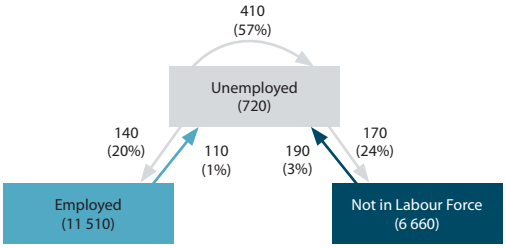
Each month, the Australian Bureau of Statistics (ABS) samples about 50 000 individuals to assess their labour force status. Individuals that have worked one hour or more in the survey's reference week are classified as 'employed'. Those that are not employed, but are actively searching for work and available to start, are classified as 'unemployed'. The remainder are considered to be outside the labour force.

* The authors are from Economic Analysis Department.

The level of unemployment is affected by the balance of flows into and out of unemployment (Figure 1). Individuals enter unemployment when they are 'separated' from a job, because they are retrenched or resign. In turn, individuals exit unemployment when they are successful in finding a job – that is, they are 'matched' with a vacancy. There are also flows between unemployment and outside the labour force, such as individuals that start or stop searching for work. Each month, flows into and out of unemployment are very large; nearly half of the pool of unemployed leaves unemployment, either finding a job or moving out of the labour force, while a similar number of new individuals enter unemployment.

Figure 1: Flows Into and Out of Unemployment*

Thousands of individuals, monthly average, 2013/14



* Number of individuals rounded to nearest 10 000; percentage figures are average monthly probability of transition; figures may not sum to totals due to rounding

Sources: ABS; RBA

These flows provide the basis for understanding the causes of unemployment. In principle, there are three causes of unemployment. In practice, these causes cannot be measured directly, and the margins between them may be blurred, but they provide a useful framework for thinking about unemployment:

- *Frictional unemployment* results from the regular movement of individuals in the labour market. The labour market is very dynamic; each year, around one million workers, or roughly 1 in 12, change jobs (D'Arcy *et al* 2012). In addition, many individuals transition into and out of the labour force according to their personal circumstances. This movement of workers is beneficial, as it facilitates the efficient allocation of labour across the economy. However, the labour market is characterised by a large degree of diversity – both in terms of workers and jobs. This means that workers must invest time and effort in searching for the right job, and firms do likewise in looking for suitable candidates. As a result, individuals are not matched immediately with vacant jobs and may experience a temporary period of unemployment.
- *Structural unemployment* results from a more fundamental mismatch between jobs and workers. For example, when the economy undergoes structural change, the industrial structure of activity evolves, the types of jobs change as technology advances, and the location of jobs also shifts. These changes can produce a more enduring mismatch between unemployed workers and available jobs, reducing the 'efficiency' with which they are matched and increasing unemployment. Those individuals with skills in declining industries may have little chance of finding work until they develop new skills or move to a region with better opportunities. Although the economy is always undergoing change, structural unemployment may tend to be higher in periods when such change is more substantial.[1]
- *Cyclical unemployment* is the result of changes in aggregate conditions in the economy over the course of the business cycle. A shortfall of demand in the economy will result in a lack of jobs relative to the number of people that want to work. Both flows into and out of unemployment will be affected as demand fluctuates over the business cycle. Firms experiencing weaker demand for the goods and services they produce will reduce the amount of labour they employ, laying off existing workers and hiring fewer new workers. As a result, involuntary flows into unemployment will rise while the unemployed will experience a lower probability of finding work. The opposite will occur when demand strengthens; firms will

1 One indication of changes in matching efficiency is the Beveridge curve. For a discussion of developments in the Beveridge curve in Australia over time, see Borland (2011) and Edwards and Gustafsson (2013).

look to expand their operations by hiring new workers and retaining existing staff, lowering unemployment and absorbing spare capacity in the labour market.

These classes of unemployment are not independent of each other. For example, a period of high cyclical unemployment might lift structural unemployment for a while – a phenomenon known as hysteresis. This occurs when individuals are unemployed for a long period of time and suffer lasting damage to their job prospects, reducing their probability of being matched to a vacant job. In particular, workers that have been unemployed for longer might see a deterioration of their skills and productivity (Pissarides 1992; Ljungqvist and Sargent 1998) or be regarded as less employable, reducing their chances of finding employment further (Blanchard and Diamond 1994).

Of the three causes of unemployment, cyclical unemployment is the real source of spare capacity in the sense that it indicates that the economy is producing below its potential. In contrast, frictional and structural unemployment do not represent unemployed persons who could easily be pulled into employment if demand was higher. These classes of unemployment exist even when labour markets are in equilibrium, such that an increase in labour demand would not reduce this type of unemployment.[2] Instead, these types of unemployment are largely tied to the process of productive resources (labour) moving around the economy and into and out of the labour force. While these other causes of unemployment do have social costs, detracting from households' incomes and welfare, they are best addressed with policies that focus on the supply side of the labour market, rather than by stimulating aggregate demand.

While unemployment is a useful measure of spare capacity, it does not capture all aspects of capacity utilisation in the labour market. Firms that are seeking to reduce their labour market input can adjust the hours worked by existing staff (resulting in 'underemployment'), and some individuals out of work may become discouraged and stop searching for a job (resulting in 'marginal attachment' to the labour force). These are important issues, but they are beyond the scope of this article.[3]

Spare Capacity, Inflation and the NAIRU

The extent of any spare capacity in the economy exerts an influence on prices and wages. Excess capacity in the market for goods and services will place downward pressure on inflation in their prices. Similarly, spare capacity in the labour market will place downward pressure on the growth of wages.[4] Conversely, an excess of demand in the economy will result in faster inflation in both wages and prices. Therefore, to the extent that the unemployment rate is a useful measure of spare capacity, it should have an inverse relationship with inflation in both wages and prices. This inverse relationship is known as the Phillips curve, and can be seen in Australian data for the past two decades. Periods with higher unemployment rates have tended to be associated with slower inflation in both wages and prices (Graph 1).

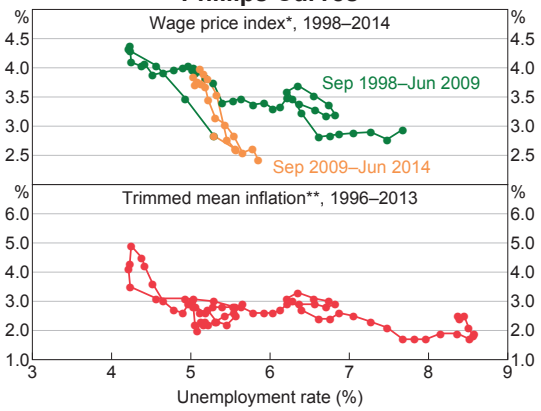
In principle at least, frictional and structural unemployment should not influence the course of prices or wages. Hence, these types of unemployment should be captured by the NAIRU – the level of unemployment that causes neither an increase nor decrease in inflation. While it is not possible to observe the NAIRU directly, it can be inferred from the position of the Phillips curve. For example, there is evidence that the NAIRU has fallen over the past 15 years because the basic Phillips curves for wages

2 To the extent that structural unemployment reflects hysteresis, a period of stronger demand might see some decline in structural employment.

3 For a recent discussion, see Kent (2014).

4 In turn, this will also place further downward pressure on price inflation, both because of more subdued growth in firms' labour costs, and because slower growth in household incomes and aggregate demand will weigh on firms' margins. Ultimately, low inflation may feed into expectations, further lowering inflation.

Graph 1
Phillips Curves



* Year-ended growth in the private sector wage price index and year-average unemployment rate

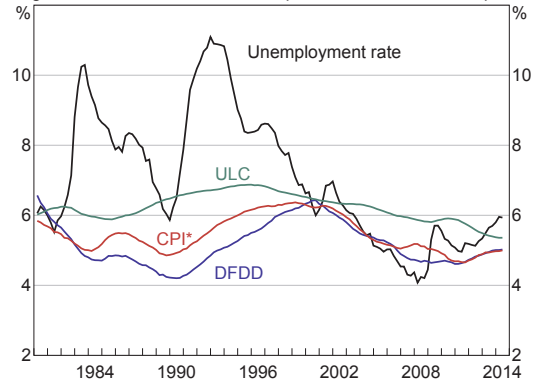
** Year-ended inflation and year-average unemployment rate; scatter plot shown at peak correlation; unemployment rate leads inflation by two quarters; inflation excludes GST and interest charges

Sources: ABS; RBA

and prices have shifted to the left.[5] In recent years, an unemployment rate of around 5½–6 per cent has seen slow wages growth, well below 3 per cent per annum. However, in the late 1990s, much higher rates of unemployment of almost 8 per cent did not see such slow growth in wages. This suggests that factors other than spare capacity were responsible for the higher unemployment rate at that time, meaning that the NAIRU is likely to have been higher.

Estimates of the NAIRU can be obtained with statistical models. Specifically, a Phillips curve is estimated as a function of two unobserved terms: the component of unemployment that does not affect inflation, the NAIRU, and the component that captures economic slack and, hence, does affect inflation. The particular model used here is set out in Gruen, Pagan and Thompson (1999), and the results are an update of their findings (for further details, see Appendix A). Three different estimates of the NAIRU are produced using different measures of inflation: underlying inflation as measured by the weighted median measure of inflation in the consumer price index (CPI); inflation based on the national accounts domestic final demand deflator (DFDD); and inflation of labour costs based on the national accounts measure of unit labour costs (ULC). The three NAIRU estimates have deviated substantially in some periods (Graph 2). A positive gap between the actual unemployment rate and the estimate of the NAIRU indicates evidence of spare capacity in the labour market, and vice versa.

Graph 2
NAIRU Estimates
Using alternative inflation measures, per cent of labour force, quarterly



* Weighted median

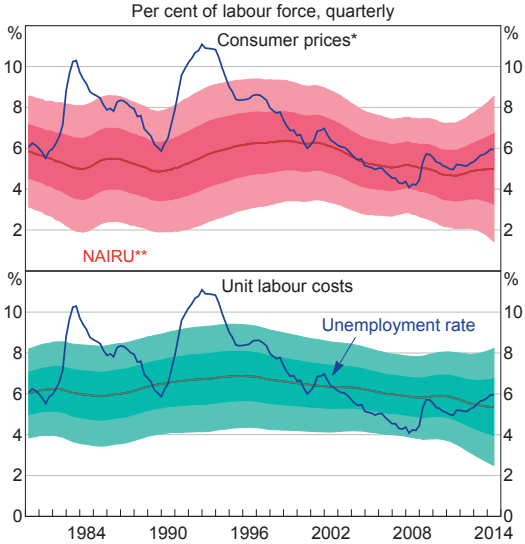
Sources: ABS; RBA

There are various conceptual and empirical reasons to be cautious about estimates of the NAIRU.[6] First, the figures are central estimates from a model and have wide confidence bands around them (Graph 3). These estimates are sensitive to the length of the period over which they are estimated. The estimates often also change as more data come to hand, with the profile toward the end of the sample period particularly prone to revision. This end-point problem detracts from the ability to use these estimates in real time. Finally, the estimates also rely on having a 'correct' model of inflation. If the model fails to control correctly for the factors that are important to inflation, or if the nature of the inflation process changes over time, then the estimates will not be accurate. Indeed, different specifications of the Phillips curve model can generate quite different estimates of the NAIRU.

5 Other changes can also shift the simple Phillips curve relationship, including changes in inflation expectations and import prices. In the statistical estimates of the Phillips curve set out in Appendix A, these influences are controlled for with additional regressors.

6 For example, see Espinosa-Vega and Russell (1997), Ball and Mankiw (2002), Connolly (2008) and Farmer (2013).

Graph 3
NAIRU Estimate Uncertainty
Per cent of labour force, quarterly



* Weighted median
** Shaded areas represent one and two standard error bands around central estimates

Sources: ABS; RBA

The Observable Characteristics of the Unemployed

A different approach to examining spare capacity in the labour market is to look at information in the composition of unemployment. Aggregate unemployment can be broken down according to various characteristics of the unemployed. Specifically, we examine differences in:[7]

- *Duration:* the length of time that an individual has been continuously unemployed.
- *Reason:* the reason for unemployment, such as retrenchment, resignation or joining the workforce.
- *Factors contributing:* the barriers that individuals perceive to finding a job.

In each case, the composition of unemployment – according to duration, reason, or contributing factors – could have implications for the extent of spare capacity in the labour market. To examine this possibility, aggregate unemployment is broken down according to each characteristic; for example, on the basis of duration, unemployment is divided into short, medium and long term. We then assess which components are most indicative of spare capacity based on their relationship with inflation. Components that are more indicative of cyclical unemployment should have a closer relationship with inflation, while components that are more indicative of frictional or structural unemployment should have a weaker relationship with inflation.

Econometric models are used to test the strength of these relationships with inflation (see Appendix B). Two issues with these tests are noteworthy. First, some components of unemployment move closely together, which makes it difficult to identify which is the more relevant for inflation. To address this issue we make use of data for individual states on unemployment, prices (CPI excluding volatile items) and wages (wage price index). The findings using these state-level statistics are much stronger than if national statistics are used because they incorporate much more data and they exploit differences not only over time but also across states at each point in time. A second issue is that the models cannot tell us whether components of unemployment cause differences in inflation, only whether they tend to move together. This co-movement could also result from inflation causing changes in unemployment, or there may be other factors that are omitted from the regression that cause both variables to move simultaneously.

Overall, the results suggest that looking at the composition of unemployment is informative. Moreover, this approach does not suffer from the end-point problem associated with estimating the NAIRU. However, it provides a less clean measure of spare capacity; individual components of unemployment are unlikely to be purely cyclical, structural or frictional, but are likely to be a mixture, albeit in differing degrees.

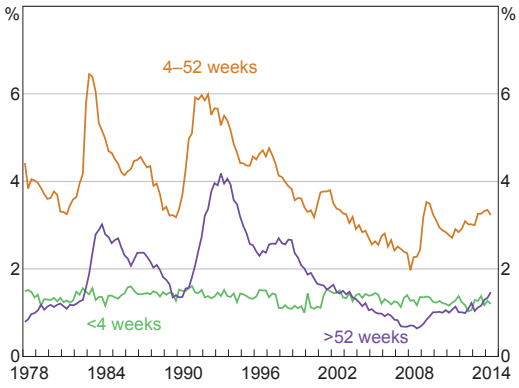
7 Previous work considering information contained in the composition of unemployment includes Connolly (2011). Unemployment data by duration and reason are published monthly and quarterly, respectively, in the Labour Force survey (ABS Cat No 6202.0), while factors contributing to unemployment are published annually in the survey of Job Search Experience (ABS Cat No 6222.0).

Duration of unemployment

The length of time that an individual has been out of work might reflect, or even have a direct bearing on, the nature of their unemployment:

- Individuals that are frictionally unemployed should make up a relatively large share of *short-term unemployment* (defined as one month or less). Indeed, short-term unemployment has been remarkably stable over the past 30 years, at around 1½ per cent of the labour force, and has not fluctuated with the business cycle (Graph 4).
- Individuals that face particular difficulty in finding a job, such as due to structural change, are more likely to become *long-term unemployed* (defined as over 12 months). In addition, spending a long spell in unemployment may reduce an individual's prospects for finding work, as discussed above.
- *Medium-term unemployment* (1–12 months) might be expected to be more representative of cyclical unemployment and spare capacity in the labour market.[8]

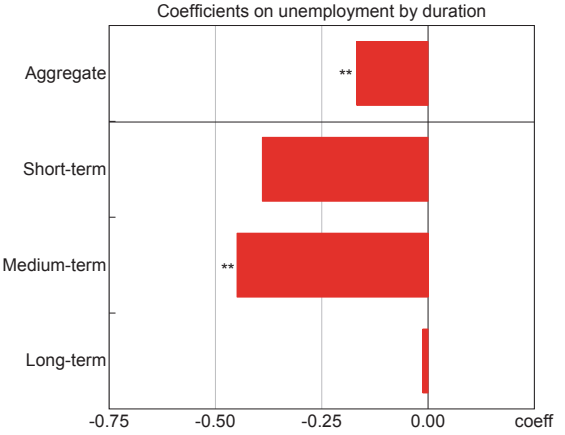
Graph 4
Unemployment by Duration*
Per cent of labour force



* Since last full-time job; seasonally adjusted by RBA
Sources: ABS; RBA

The statistical results appear to bear out these differences. Medium-term unemployment has a strong negative relationship with inflation, both in prices and wages (Graph 5 and Graph 6). On average, a 1 percentage point increase in the medium-term unemployment rate is associated with a reduction in both wage and price inflation of a little under ½ a percentage point (in annualised terms). In contrast, the long-term unemployment rate does not have a statistically significant relationship with inflation, which is consistent with these individuals having less of a bearing on wage setting. The short-term unemployment rate has a negative relationship with wage and price inflation, but it is not statistically significant and is less robust.[9]

Graph 5
Price Phillips Curve Estimates*
Coefficients on unemployment by duration

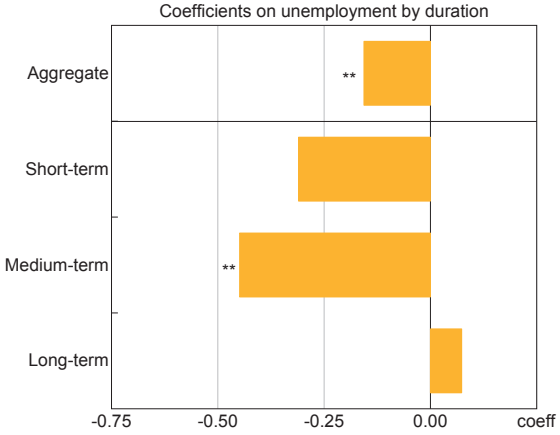


* Coefficients represent change in annual price inflation associated with a 1 percentage point increase in the respective unemployment rate; aggregate results use total unemployment at the national level, whereas disaggregated results use state level data
** Statistically significant at the 5 per cent level
Source: RBA

8 These data are for duration since last full-time job. A shorter time series is available for duration since last full-time or part-time job.

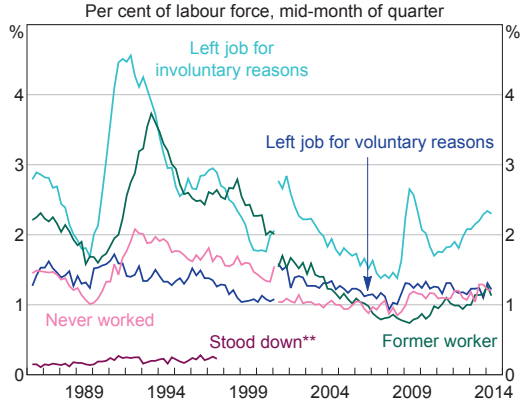
9 Some previous work for other countries finds duration of unemployment to be important for inflation (see, for example, Llaudes (2005)). In contrast, Kiley (2014) finds short- and long-term unemployment exert similar pressure on price inflation.

Graph 6
Wage Phillips Curve Estimates*
Coefficients on unemployment by duration



* Coefficients represent change in annual wage inflation associated with a 1 percentage point increase in the respective unemployment rate; agggregate results use total unemployment at the national level, whereas disaggregated results use state level data
** Statistically significant at the 5 per cent level
Source: RBA

Graph 7
Unemployment by Reason*
Per cent of labour force, mid-month of quarter



* Relative to last full-time job prior to May 2001; relative to last job thereafter; seasonally adjusted by RBA
** Series discontinued after August 1997
Sources: ABS; RBA

Reason for unemployment

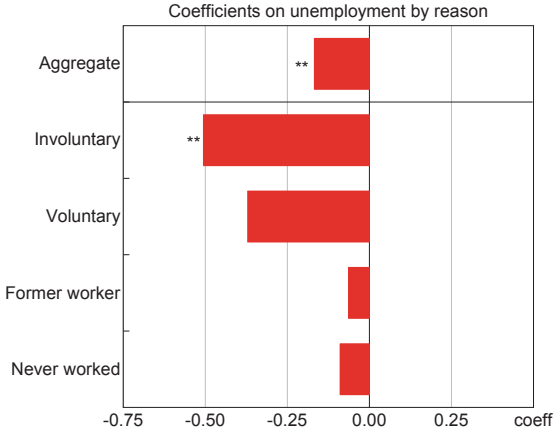
A drawback of the duration data is that they only provide information about the length of a continuous spell of unemployment. Short-term unemployment, for example, will include people that have recently resigned from their job in order to look for another job for frictional reasons. However, it will also capture people that have been recently retrenched, started looking for work for the first time, or have been out of work for a long time but were previously discouraged from searching. These groups are all likely to reflect spare capacity to differing degrees. Accordingly, it is useful to look at the reasons for unemployment, which include the following four categories:

- Those who worked in the past two years and left their last job *involuntarily* (e.g. were retrenched). This component may be a reasonable proxy for spare capacity in the labour market; as described above, when firms are looking to adjust to a fall in demand they will retrench more workers than usual, and vice versa. As would be expected, this component has been highly cyclical over time and is usually the largest group of those unemployed (Graph 7).
- Those who worked in the past two years and left their last job *voluntarily* (e.g. resigned). Voluntary job leavers are more likely to be frictionally unemployed, leaving a job to seek a better opportunity. This type of unemployment has been relatively stable over time, at 1–1½ per cent of the labour force.
- *Former workers,* who have worked previously, but not in the past two years. These individuals are more likely to be structurally unemployed and detached from the labour market for the reasons described above for long-term unemployment. Unlike long-term unemployment, this component will capture those individuals that have stopped searching for a job for a period while they have been out of work.
- Those that have *never worked* and are looking for a job for the first time.

As expected, unemployment for involuntary job leavers has a strong negative relationship with price and wage inflation, suggesting that it is more likely to reflect the extent of spare capacity (Graph 8 and Graph 9). Unemployment for voluntary job leavers also has a negative relationship with inflation, although this is not as robust or statistically significant across models. In contrast, unemployment for

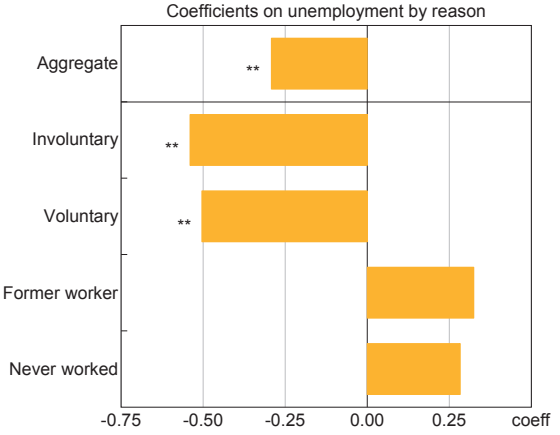
former workers and for those that have never worked before seems to have a relatively weak relationship with inflation, consistent with these people being less influential for wage outcomes.

Graph 8
Price Phillips Curve Estimates*
Coefficients on unemployment by reason



* Coefficients represent change in annual price inflation associated with a 1 percentage point increase in the respective unemployment rate; aggregate results use total unemployment at the national level, whereas disaggregated results use state level data
** Statistically significant at the 5 per cent level
Source: RBA

Graph 9
Wage Phillips Curve Estimates*
Coefficients on unemployment by reason



* Coefficients represent change in annual wage inflation associated with a 1 percentage point increase in the respective unemployment rate; aggregate results use total unemployment at the national level, whereas disaggregated results use state level data
** Statistically significant at the 5 per cent level
Source: RBA

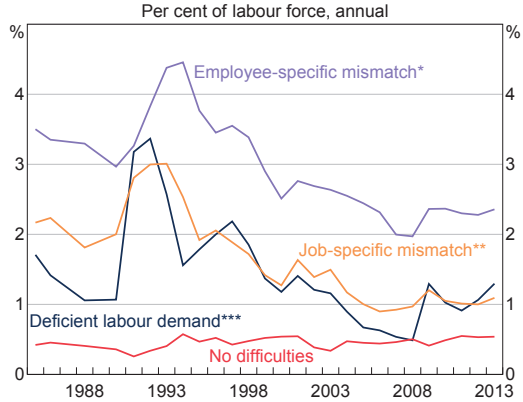
Factors affecting unemployment

Finally, we can break down unemployment by the obstacles that jobseekers perceive to be preventing them from finding a job. These can be grouped into three categories:

- A *lack of labour demand*, resulting in a general scarcity of vacancies or too many applicants for available vacancies. This category might be expected to be a reasonable measure of spare capacity in the labour market.
- A perceived *mismatch* between the individual and the available vacancies. In turn, this mismatch could be due to characteristics of the jobseeker, such as their experience, or due to the various requirements of the job. These individuals may face unemployment for more structural reasons, although they may be frictionally unemployed owing to the usual difficulties of searching for work.
- No *reported obstacles*, which might be indicative of frictional unemployment.

Unemployment influenced by a lack of labour demand has been particularly cyclical, rising sharply with the early 1990s recession, declining to very low levels by the mid 2000s, before rising again at the outset of the global financial crisis (Graph 10).

Graph 10
Factors Influencing Unemployment
Per cent of labour force, annual



* Age, inexperience, transport problems, ill health, language difficulties, family responsibilties, no feedback from employers, other difficulties
** Lack of skills, no vacancies in line of work, unsuitable hours
*** Too many applicants, no vacancies at all
Sources: ABS; RBA

Unemployment influenced by mismatches between employees and jobs increased somewhat after the early 1990s recession, perhaps due to hysteresis, but has declined steadily since and has been stable since the mid 2000s. Finally, jobseekers reporting 'no difficulties at all' have been remarkably stable over time. While these data are conceptually relevant to the causes of unemployment, reliable Phillips curve estimates are difficult to produce because the data are only annual.

Interpreting Unemployment over the Past 25 Years

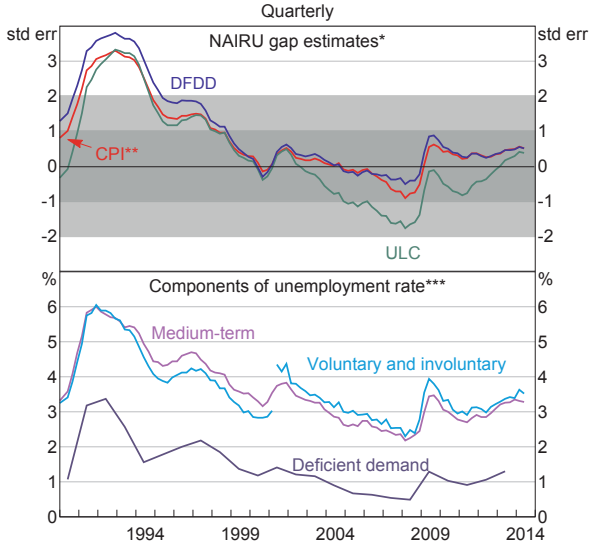
This article has outlined two approaches to assessing the extent of spare capacity in the labour market based on the unemployment rate. One is derived from statistical estimates of the NAIRU, the other comes from analysing the composition of unemployment. These approaches can be used to examine historical developments in unemployment.

At the outset it is important to reiterate that it is difficult to draw any strong conclusions. On the one hand, empirical estimates of the NAIRU are imprecise – the estimates have wide confidence bands, and the results can vary substantially depending on what measure of inflation is used and how the model is set up. On the other hand, the composition of unemployment is subject to uncertainty, as the observable components of unemployment do not provide conceptually 'clean' measures of spare capacity. In particular, the boundaries between the different causes of unemployment are inherently blurred. Finally, particular caution should be exercised when thinking about recent developments given the sensitivity of some of these indicators to new information and the propensity of model estimates to be revised.

With this in mind, the various indicators of cyclical unemployment suggest several distinct cycles in labour market spare capacity over the past 25 years (Graph 11).

- The 1990s saw significant spare capacity in the labour market. The unemployment rate was above several estimates of the NAIRU, particularly early in the decade. At the same time, the components of unemployment that are more indicative of spare capacity were also relatively high. Both of these approaches provide evidence of spare capacity, which is consistent with the relatively moderate domestic inflationary pressures and slow growth in labour costs seen over much of the decade. However, given the earlier experience of relatively high inflation, inflation expectations declined only gradually (Stevens 2003).
- The extent of spare capacity gradually moderated over the 1990s, and for much of the 2000s there was general evidence of labour market tightness. The unemployment rate fell below most estimates of the NAIRU, although not by enough to be considered statistically significant. At the same time, other indicators of cyclical unemployment were at low levels relative to their history. Consistent with this evidence of a tight labour market, the period ended with a rise in domestic wage and inflationary pressures (Lowe 2011).

Graph 11
Indicators of Cyclical Unemployment
Quarterly



* Unemployment rate less estimated NAIRU; expressed as the number of standard errors away from central NAIRU estimate, where standard error is the root mean squared error of the two-sided Kalman filter; shading indicates one and two standard error bands

** Weighted median

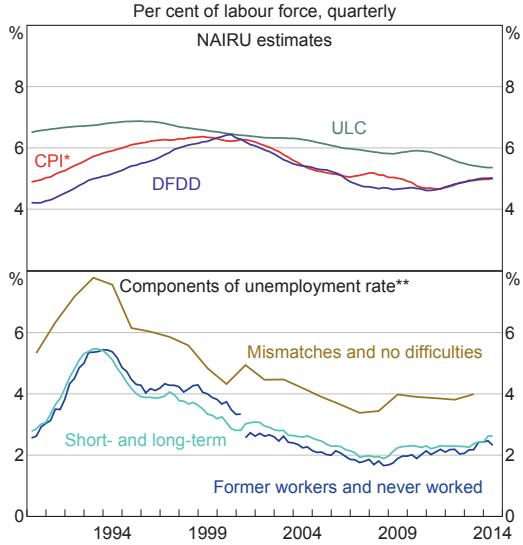
*** Per cent of labour force; seasonally adjusted by RBA; 'deficient demand' series is annual

- Since the global financial crisis, there appears to have been a degree of spare capacity in the labour market. However, this has been substantially less than was the case over much of the 1990s. The unemployment rate has recently been a little above several central estimates of the NAIRU (again these recent NAIRU estimates should be viewed with particular caution given their sensitivity to new information). At the same time, the more cyclical components of unemployment have also risen, accounting for most of the increase in the aggregate unemployment rate. This is consistent with evidence of subdued domestic inflationary pressures, including a slowing in wages growth and non-tradables inflation (Jacobs and Williams 2014; Kent 2014).

There is evidence that some changes in the unemployment rate have not been associated with a shift in spare capacity (Graph 12). Various estimates of the NAIRU increased over the course of the 1990s, and then declined over the 2000s. Similarly, components of the unemployment rate that are more structural also rose over the early 1990s, before declining gradually. More recently, estimates of the NAIRU and analysis of the composition of unemployment suggest that structural unemployment may have increased a little, but it remains low relative to history. There are various plausible reasons as to why structural and frictional unemployment might change over time, although again it is difficult to attribute changes to particular causes. Some possible contributing factors, which have been widely discussed in the past, include:

- *Hysteresis*. One important factor over time may have been hysteresis. Cyclically higher unemployment in the early 1990s might have had an enduring effect on the employability of jobseekers. Subsequently, an improvement in economic conditions over an extended period may also have worked to lower structural unemployment; a generation of individuals enjoyed good employment opportunities, meaning that relatively few endured a stint of damaging, longer-term unemployment.

Graph 12
Indicators of Structural and Frictional Unemployment
Per cent of labour force, quarterly



* Weighted median
** Seasonally adjusted by RBA; ?mismatches and no difficulties' series is annual

- *Economic reform*. The ongoing benefits of economic reforms may have lowered structural unemployment over the past decade or so. However, the timing and magnitude of this effect are difficult to assess empirically (Borland 2011).
- *Search technology*. An improvement in search technology might have improved the efficiency of matching over time, lowering the unemployment rate. However, evidence for this effect is not clear, as the more 'frictional' components of the unemployment rate do not appear to have fallen over time.
- *Changes in labour supply*. The nature of spare capacity in the labour market may have changed over this period. There is evidence that 'underemployment' and 'marginal attachment' have risen relative to unemployment over time (Borland 2011). As a result, a given degree of overall spare capacity in the labour market might have become associated with a lower unemployment rate than previously.

- *Structural change.* Working in the other direction, the past decade has seen an increase in the pace of structural change in the economy, associated with the terms of trade boom (Connolly and Lewis 2010). This might have reduced the efficiency of matching between workers and vacancies, placing upward pressure on structural unemployment.

In summary, while it is difficult to be definitive, these indicators can be combined to enhance our understanding of movements in the unemployment rate.

Appendix A
NAIRU Estimation Framework

The methodology of Gruen, Pagan and Thompson (1999) is used to estimate the NAIRU for Australia. The following two-equation system is estimated:

$$\begin{aligned}\pi_t - \pi_{t-1} &= \delta\left(\pi_t^e - \pi_{t-1}\right) + \gamma\frac{\left(u_t - u_t^*\right)}{u_t} + d\frac{\Delta u_{t-1}}{u_t} \\ &\quad + \alpha_1\left(\pi_{t-1}^m - \pi_{t-2}^m\right) + \alpha_2\left(\varphi_{t-1} - \varphi_{t-4}\right) + \psi_t \\ u_t^* &= u_{t-1}^* + \nu_t\end{aligned} \tag{A1}$$

where π represents the year-ended inflation rate, φ is quarterly inflation, π^m is year-ended import price inflation, u is the unemployment rate, and u^* is the NAIRU. Inflation expectations, π^e, are taken as the break-even rate on indexed bond yields for a constant 10-year maturity. The NAIRU evolves as a random walk process. Gruen, Pagan and Thompson (1999) use underlying inflation, as measured by the CPI excluding interest and volatile items, and unit labour costs to estimate Phillips curves. In this article, the weighted median CPI measure is used to represent underlying inflation and an additional measure of price inflation, in the domestic final demand deflator, is included to complement these measures. The unit labour cost specification has a number of slight differences to the CPI specification, as set out in Gruen, Pagan and Thompson (1999).

The equations are estimated using maximum likelihood with a Kalman filter. The Kalman filter takes an initial value of the NAIRU, and in each successive period it estimates a NAIRU which enables the Phillips curve to fit the data as closely as possible. After stepping through the sample, from the first observation to the last, the 'two-sided' Kalman filter employed here then steps backwards, from the last observation to the first, to generate a smoothed NAIRU series informed by the full sample.

Appendix B
Phillips Curve Tests for Components of Unemployment

Phillips curves are widely used by central banks (after Phillips (1958); for a retrospective, see Fuhrer *et al* (2009)). For Australia, Phillips curves have typically been estimated using national level data with the aggregate unemployment rate (Gruen *et al* 1999; Norman and Richards 2010). For this article, the following price and wage Phillips curve specifications are estimated:

$$\begin{aligned}\varphi_t &= \alpha + \beta u_{t-2} + \gamma\Delta^4 u_{t-3} + \Sigma_{k=1}^{12}\delta_k\varphi_{t-k}^m + \theta\pi_{t-1}^e + \varepsilon_t \\ w_t &= \mu + \rho u_{t-2} + \tau\Delta u_{t-1} + \sigma\left[\left(\frac{g_{t-1}}{g_{t-5}}\right)^{\frac{1}{4}} - 1\right] + \omega\pi_{t-3}^e + \xi_t\end{aligned} \tag{A2}$$

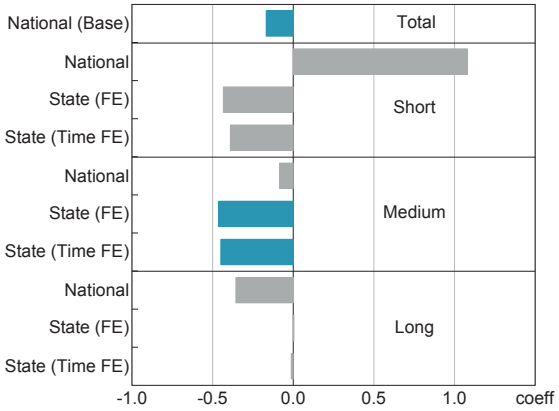
where φ is quarterly price inflation as measured by the headline CPI excluding volatile items, w is quarterly wage inflation as measured by the private sector wage price index, and u is the unemployment rate. Inflation expectations, π^e, are taken as the break-even rate on indexed bond yields for a constant 10-year maturity. The price Phillips curve includes terms to account for the lagged effect of quarterly import price inflation (φ^m) constrained to follow a quadratic polynomial function. The wage Phillips curve includes a four-quarter geometric mean of the GDP deflator, g, to account for changes in the relative price of firms' output with respect to wages.[10]

10 The specification used here imposes a linear relationship between unemployment and inflation. However, if the relationship also depends on the level of unemployment, then it may be non-linear (Debelle and Vickery 1997).

Baseline specifications are estimated for aggregate unemployment at the national level. To test for different effects of the components of unemployment, the aggregate variable, *u*, is replaced by the decomposed unemployment rates (by duration or reason), with separate coefficients estimated for each component. The availability of data also necessitates slightly different sample periods for each regression: March quarter 1991–June quarter 2014 for the duration and reason decompositions with price inflation; December quarter 1997–June quarter 2014 for the duration decomposition with wage inflation; and December quarter 2001–June quarter 2014 for the reason decomposition with wage inflation.

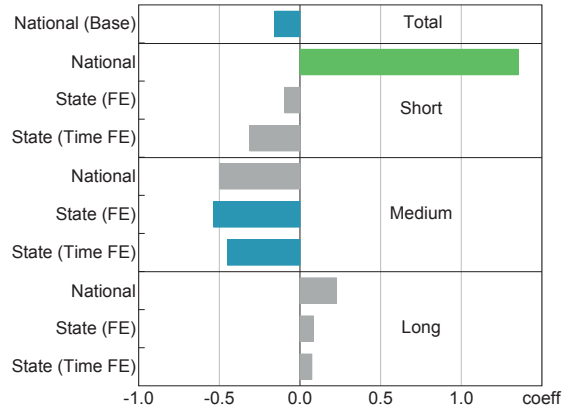
As discussed above, some components of unemployment move closely with one another, resulting in a problem of multicollinearity. To address this problem, we follow the approach of Kiley (2014) for US data and make use of data at a more disaggregated level, for individual states. This approach includes state-level prices, wages and unemployment, but retains national-level inflation expectations, import prices and output prices. Two different state-level specifications are conducted. The first controls for any permanent differences in the level of inflation between states (i.e. state fixed effects (FE)). The second controls for time-varying factors that may affect wage or price inflation across all states and correlate with unemployment levels, such as changes to industrial relations laws (i.e. time fixed effects). The full results are shown in Graphs B1 to B4. Multicollinearity is evident in the national results, with coefficients often statistically insignificant individually but jointly significant, and with the opposite sign to that expected. All of the results are stronger at the state than the national level, with coefficients more stable and more significant. The state results are relatively similar for both approaches, so only one of these models (the time fixed effects model) is presented in the main body of the article.

Graph B1
Price Phillips Curve Estimates
Coefficients on unemployment by specification and duration*



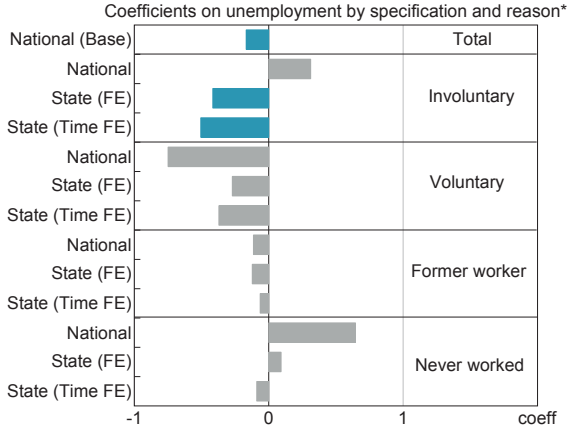
* Quarterly coefficients multiplied by 4 to represent annualised effects; blue bars represent statistical significance at the 1 per cent level
Source: RBA

Graph B2
Wage Phillips Curve Estimates
Coefficients on unemployment by specification and duration*



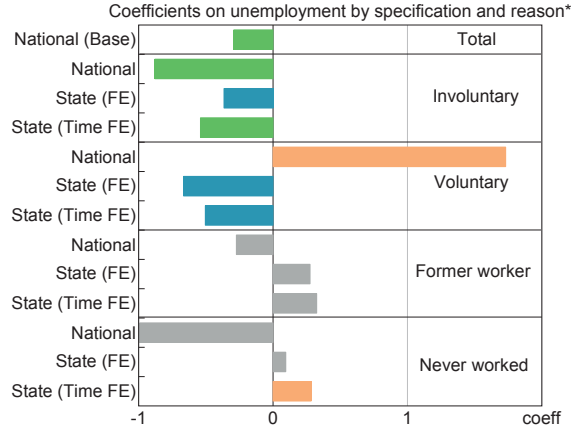
* Quarterly coefficients multiplied by 4 to represent annualised effects; blue and green bars represent statistical significance at the 1 and 5 per cent level, respectively
Source: RBA

Graph B3
Price Phillips Curve Estimates
Coefficients on unemployment by specification and reason*



* Quarterly coefficients multiplied by 4 to represent annualised effects; blue bars represent statistical significance at the 1 per cent level
Source: RBA

Graph B4
Wage Phillips Curve Estimates
Coefficients on unemployment by specification and reason*



* Quarterly coefficients multiplied by 4 to represent annualised effects; blue, green and orange bars represent statistical significance at the 1, 5 and 10 per cent level, respectively
Source: RBA

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Foreign Investment in Australian Commercial Property

Kevin Lane, Adam Sinclair and David Orsmond*

Foreign investors' demand for commercial buildings in Australia has been strong in the past few years, as captured by their rising share of transaction values. Foreigners have generally purchased established properties, although there has also been some interest in developing new commercial buildings or converting existing buildings to apartments. These purchases have probably boosted net financing to the sector and also construction activity.

Introduction

Commercial buildings comprise offices, shopping centres, industrial facilities and hotels, and are generally owned by commercial landlords and institutional investors rather than their occupants.[1] Investors own commercial buildings for their relatively predictable rental income and the typically low correlation of their values with those of other assets, such as equities and bonds.

Demand from foreigners for commercial property in Australia has been strong in the past few years. The available data suggest that foreign investment in Australian commercial property has increased significantly since the mid 2000s, both in gross terms and after accounting for divestments by foreign institutions. Since 2008, foreigners have accounted for around one-quarter of the value of major commercial property purchases, up from one-tenth in the previous 15 years. This article discusses the factors that underlie this trend, and the effects of foreign investment on commercial property and the Australian economy.

The Legislative Framework and Approvals for Foreign Investment

In Australia, foreign investors are allowed to purchase existing commercial buildings as well as vacant sites to develop. To purchase commercial properties, 'foreign persons' must first obtain approval through the Foreign Investment Review Board (FIRB) in any of the following circumstances:

- the land is vacant;
- the foreign investor is a foreign government investor; or
- the building is already developed and sells for $54 million or more (the threshold is lower for heritage-listed buildings and higher for investors from New Zealand and the United States).[2]

To date, nearly all proposals for investment in commercial property have been approved, although some conditions may have been applied regarding the subsequent development of vacant sites.[3]

* The authors are from Economic Analysis Department.

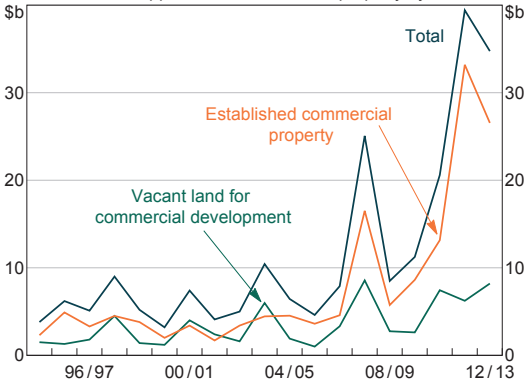
1 This article does not discuss commercial investment in greenfield land for residential development.

2 The monetary thresholds for established commercial property are indexed annually on 1 January (except for the $5 million threshold for heritage-listed commercial properties). South Korean and Japanese investors will also have access to the higher threshold once free trade agreements with South Korea and Japan enter into force.

3 For a full set of definitions and the legal restrictions and allowances, see the Foreign Investment Review Board website (www.firb.gov.au).

The FIRB publish data on approvals for proposed foreign investment on an annual basis. The value of these approvals has increased substantially in recent years, from $11 billion in 2009/10 to nearly $35 billion in 2012/13 (Graph 1). Approvals to purchase established commercial properties increased most significantly, while approvals to invest in vacant land also increased from a low base.

Graph 1
Approvals for Foreign Investment
Annual, value approved for commercial property by the FIRB



Source: FIRB

Approvals data do not, however, provide an accurate estimate of the value of actual direct foreign investment. The Bank's liaison with industry participants suggests that vendors often require interested foreign buyers to obtain foreign investment approval before bidding, and several approvals may be granted to different foreign investors for the purchase of the same building, which may then ultimately be sold to a domestic entity. In addition, purchasers of developed commercial properties do not need to seek foreign investment approval for properties valued at less than $54 million, or less than $1 078 million in the case of private investors from New Zealand or the United States. The FIRB data also do not provide information regarding the type of property for which approval is being sought – be it an office building, shopping centre, industrial facility or hotel – nor the type of foreign investors (e.g. sovereign wealth funds, pension funds) gaining approval or the country in which they are based. Furthermore, since foreign investors do not need approval before selling properties, the data provided by the FIRB cannot be used to estimate the value of net investment by foreign investors.[4]

Trends in Foreign Investment

Several real estate services firms collect detailed information on major commercial property transactions involving Australian and foreign institutions. Importantly, unlike the FIRB's data on foreign investment approvals, these data cover actual transactions. However, there are also a number of other differences between these data and those reported by the FIRB. Specifically, the transaction-level data provided by real estate services firms:

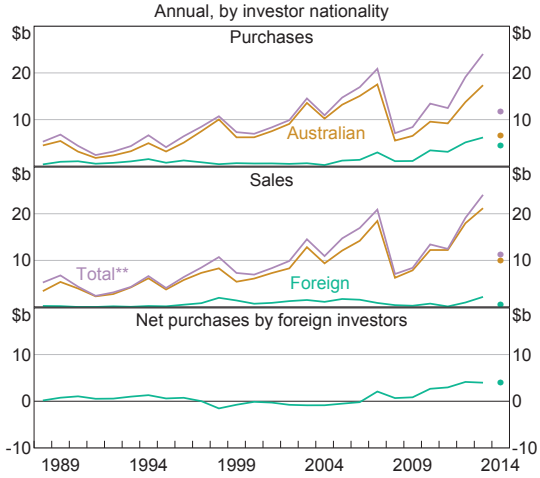
- record purchases valued at more than $5 million, thereby capturing transactions that fall below the thresholds enforced through the FIRB[5]
- classify investors based on the location of their headquarters, whereas the FIRB classify foreign investors depending on whether they have a foreign controlling interest
- relate to transactions of offices, shops and industrial properties, whereas the FIRB approvals data also include applications to purchase hotels and motels from 2009 onwards.

These transaction-level data show that while foreign investors have been purchasing Australian office, retail and industrial properties since the late 1980s, the purchases and sales by foreign investors were both around $1 billion per year for much of this period, resulting in negligible net investment by foreign investors. Foreigners' purchases of commercial property increased sharply in the mid 2000s, and have exceeded foreigners' sales in each year for nearly a decade (Graph 2). Foreigners have accounted for around one-quarter of the value of commercial property purchases in Australia since 2008, up from one-tenth in the previous 15 years. Foreign

4 See FIRB (2014, pp 15–19) for methodological and data caveats.

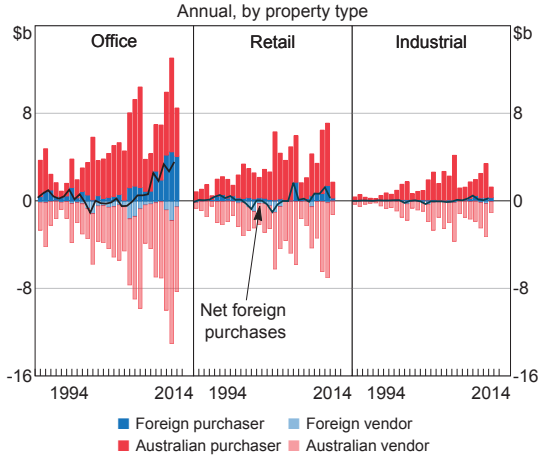
5 The transaction-level data may not record some purchases involving foreign investors if they are not well publicised or the entities remain confidential.

Graph 2
Commercial Property Transactions*
Annual, by investor nationality



* Data for 2014 are for the six months to June 2014
** Includes a small number of transactions for which the origin of the purchaser or vendor was not identified
Sources: JLL Research; RBA; Savills

Graph 3
Commercial Property Transactions*
Annual, by property type



* Data for 2014 are for the six months to June 2014
Sources: JLL Research; RBA; Savills

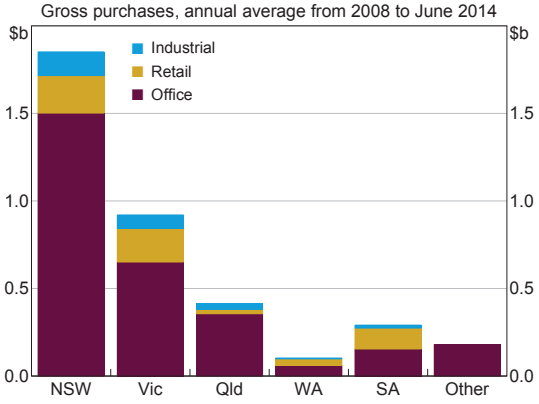
buyers were especially active in the first half of 2014, purchasing nearly $5 billion worth of commercial property, about 40 per cent of the value of properties that were sold. Net purchases (which also account for sales) by foreigners amounted to $4 billion in the first half of 2014, close to its level for all of 2013.

The recent increase in foreign investment has been most pronounced in the market for office property. Foreigners' purchases have accounted for around one-third of the value of turnover of office buildings since 2008, with purchases consistently exceeding the value of foreign sales (Graph 3). The value of foreign purchases of retail and industrial assets has also increased, although purchases by foreigners accounted for only around 15 per cent of the value of these transactions in the past few years. Foreigners' preference for office buildings partly reflects the greater availability of large, high-value buildings. Retail and industrial assets are generally smaller, with lower values, and are often owned by wealthy private investors rather than large institutions.

Foreigners have been most active in acquiring commercial properties in New South Wales, reflecting the larger size of its market and an apparent preference by overseas investors for property in the state. Since 2008, foreign buyers have accounted for 40 per cent of the value of purchases in New South Wales, compared with 20 per cent of turnover in Victoria, Queensland and Western Australia. Foreigners' preference for New South Wales reflects their strong appetite for office buildings in the Sydney CBD, which industry participants attribute to the greater liquidity of the market and the large amount of prime-grade office space (Graph 4). In contrast, foreigners' purchases of retail and industrial assets have been more evenly distributed across Australia. In liaison, analysts note that investors that purchase a building in one state often acquire buildings in other parts of Australia as well, partly reflecting the significant costs involved in researching a country's legal arrangements and market structure. As a result, many industry participants anticipate foreign investment broadening out beyond New South Wales in coming years.

The transaction-level data also provide information on the type of foreign investors and their nationality (based on the location of the investor's headquarters rather than the original source of funds). These data show that foreigners from many parts of the world have become more active in Australian commercial property markets, although much of the rise in net investment in the past few years reflects an

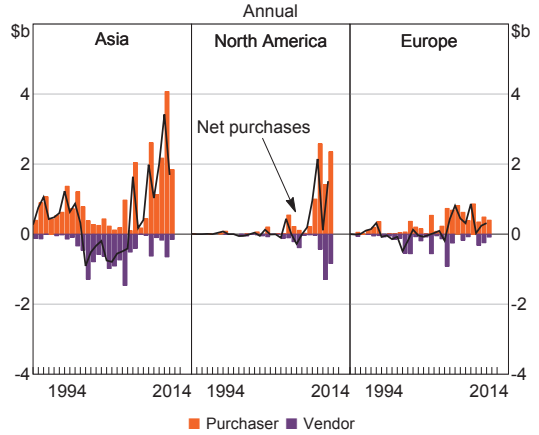
Graph 4
Foreign Investment by State
Gross purchases, annual average from 2008 to June 2014



Sources: JLL Research; RBA; Savills

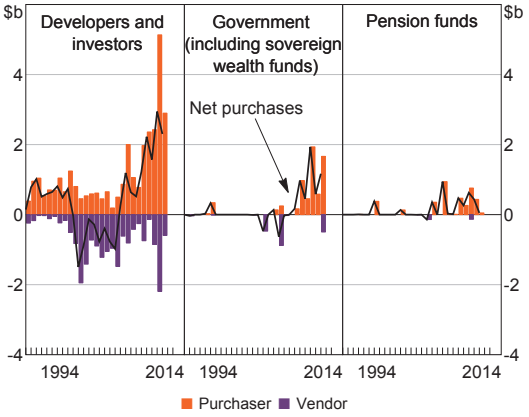
increase in purchases by investors based in Asia and North America. Net investment from Europe has also increased, albeit by much less (Graph 5). The recent increase in net foreign investment has been driven by private institutions such as listed trusts, investment firms and developers (Graph 6). Pension funds and government-related entities, mostly sovereign wealth funds, have also increased their exposure to Australian commercial property, accounting for nearly one-third of foreign purchases since 2008, following very little activity in the previous two decades.

Graph 5
Foreign Investment by Source*
Annual



* Data for 2014 are for the six months to June 2014
Sources: JLL Research; RBA; Savills

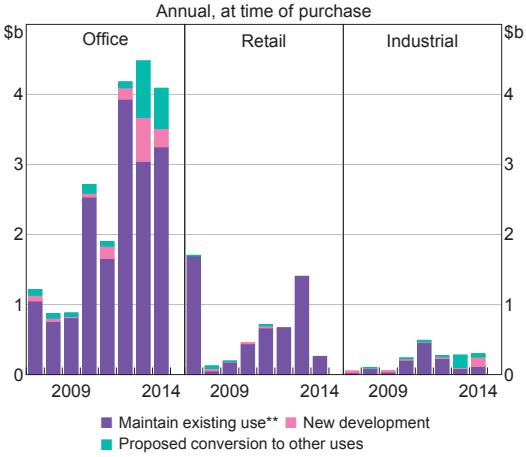
Graph 6
Foreign Investment by Type of Institution*
Annual



* Data for 2014 are for the six months to June 2014
Sources: JLL Research; RBA

Foreigners have tended to purchase existing buildings, with purchases of sites to develop less common (Graph 7). This preference reflects foreigners' desire for commercial buildings as passive investments, valuing both their relatively predictable income stream and the low correlation between their prices and those of other assets. In addition, foreigners may lack the country-specific expertise required to develop new properties. There have been some examples where foreigners have purchased sites to develop, although the direct effects on construction activity have been small. In 2013, for example, foreign buyers invested a little over $600 million in sites and buildings to develop as new office buildings, which was around one-tenth the value of office construction activity that commenced in the year. In cases where foreigners have been involved in developing new buildings, they have often partnered with a domestic firm, which was better placed to absorb the majority of the risk associated with construction costs and securing tenants. In recent years, foreigners, particularly from Asia, have also become more active in purchasing older office buildings to convert to other uses, especially apartments. Almost all of these investments have occurred in Sydney, where available and centrally located land is relatively scarce

Graph 7
Foreign Purchases by Intended Purpose*
Annual, at time of purchase



* Data for 2014 are for the six months to June 2014
** Includes property purchased for investment, refurbishment or by owner-occupiers
Sources: JLL Research; RBA

and demand for apartments has been particularly strong, from both domestic and foreign residential buyers.[6] Since demand for lower-quality office space has been weak, developers suggest in liaison that residential apartments represent the 'highest and best use' of these sites.

Industry participants point to a range of factors to explain the strength in foreigners' demand for Australian assets in recent years. Most notably, yields on Australian properties are high relative to those on comparable assets overseas, although differences in leasing conditions make direct comparisons difficult. In addition, even though conditions in Australian commercial property markets are weak relative to history, they are stronger than in many other advanced nations. Research analysts add that foreigners are attracted to Australia's exposure and proximity to Asia, combined with a transparent system of property rights. Nonetheless, Australia is not the only nation experiencing strong capital inflows into commercial property. Several other advanced nations have also recorded substantial investment from North America and Asia, owing to the low cost of capital, the low level of returns on alternative assets, particularly bonds, and the growing stock of available capital at pension funds and sovereign wealth funds. In general, analysts do not expect these factors to unwind soon, and so many expect foreign investment in Australia to remain strong in coming years.

Economic Effects of Foreign Investment in Commercial Property

The increased demand from foreigners has had several effects on Australian commercial property markets. As noted by analysts, the strength in foreign demand has contributed to the recent increases in capital values, which have occurred even as leasing conditions have remained subdued. This has probably helped to support construction activity, partly by allowing domestic developers to diversify their activities.

While not particularly active in leading the development of new buildings, foreigners have contributed financing, directly or indirectly, to new construction activity. As discussed above, some foreigners have purchased shares in sites and buildings that the existing owner was in the process of building or expanding. Foreigners have also purchased existing buildings from domestic firms that went on to 'recycle' this capital into the development of other new buildings in Australia. By providing funds and pushing up capital values, foreigners have effectively supported the financial position of domestic developers and enabled them to undertake additional construction activity. Foreign purchases have also enabled domestic firms to diversify their portfolios by purchasing or developing buildings in other regions or sectors.

Although foreigners have been most active in the New South Wales office market, these indirect effects on construction activity have been much broader, since many domestic developers operate across several states and sectors. The construction activity that has followed these sorts of transactions

6 See Gauder, Houssard and Orsmond (2014) for a discussion of foreign investment in residential real estate.

has contributed to the stock of commercial space available to tenants, placing downward pressure on the rental costs faced by occupying firms. As discussed above, foreigners have been active in purchasing lower-quality office buildings to convert to apartments, particularly in and around the Sydney CBD. This activity is likely to help alleviate the shortage of land, and raise the stock of housing in areas where demand for housing is strong. More generally, greater development activity overall also leads to more work and employment in the construction industry, and provides further benefits to domestic manufacturers of building materials.

Foreigners' appetite for Australian properties has also enabled domestic firms to limit their use of bank funding, which is useful given the risks commercial property can pose to financial institutions during downturns (Ellis and Naughtin 2010). The greater foreign presence potentially adds to the sensitivity of capital values to variations in economic conditions overseas. For example, an adverse shock overseas could cause foreigners to try to divest Australian assets to cover liabilities offshore. However, relative to other assets, commercial properties are less likely to be sold urgently, since the selling process can be protracted and incur substantial transaction costs. The effect of deteriorating international conditions could also be lessened to the extent that pension funds and sovereign wealth funds continue to account for a greater share of foreign purchases, since these institutions are less likely to be influenced by temporary changes in their own country's economic conditions. Also, the greater foreign ownership of commercial buildings may reduce the volatility of Australian property values to the extent that domestic business cycles are not perfectly correlated with those in other economies.

Finally, the recent increase in foreign investment in commercial property may have placed upward pressure on the value of the Australian dollar. However, these amounts have been small relative to total capital inflows (of $93 billion in 2013), and the effect will have been mitigated to the extent that some foreigners financed their purchases by borrowing from domestic banks in Australian dollars, in part to hedge currency-related balance sheet risk.

Conclusion

The available data indicate that foreign investment in commercial property has increased in recent years, with foreigners having accounted for around one-quarter of the value of commercial property purchases in Australia since 2008. The higher demand for Australian buildings has been broad based across a range of institutions from Asia and North America, although sovereign wealth funds and pension funds have accounted for a greater share of foreign investment more recently. Foreign buyers have typically purchased existing buildings, enabling domestic firms to sell assets for higher prices, supporting their financial position and freeing up capital to be used on new developments. To date, foreigners have shown a preference for purchasing office buildings in New South Wales, but analysts expect foreigners to spread into other markets as they become more familiar with Australia. In any case, foreigners' acquisitions have benefited developers operating in several states and sectors, and so the indirect effects on construction activity have not been constrained to the New South Wales office market. ✠

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The Determinants of Non-tradables Inflation

David Jacobs and Thomas Williams*

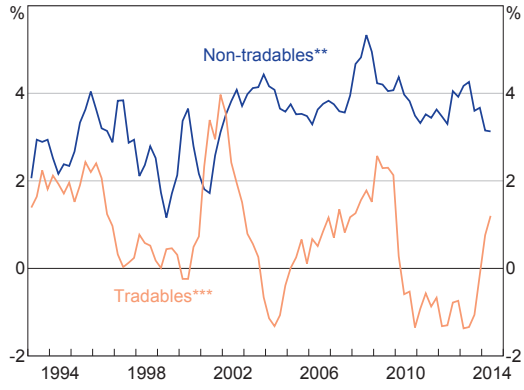
This article examines the factors that explain inflation in prices of non-tradable items in the CPI. Non-tradable goods and services by definition have relatively little exposure to international competition. Consequently, their prices are more likely to be influenced by developments in the domestic economy, particularly the extent of spare capacity in both production and the labour market. A more granular breakdown of prices highlights the importance of conditions in individual markets, such as housing, as well as non-market influences on prices.

Introduction

The Reserve Bank's inflation target is specified in terms of CPI inflation. However, in understanding and forecasting developments in overall inflation, it can be useful to examine separate components of the CPI basket. In a small open economy such as Australia, the basket of goods and services consumed by households can be divided into 'non-tradable' items and 'tradable' items. Non-tradable items are exposed to a low degree of international competition. This includes many services that can (in most cases) only be provided locally, such as hairdressing, medical treatment or electricity. The prices of these items should be driven mainly by domestic developments. Therefore, inflation for non-tradable items should provide a relatively good sense of the extent to which demand exceeds (or falls short) of supply in the domestic economy. In contrast, tradable items are much more exposed to international competition. This includes many imported manufactured goods such as televisions and computers, as well as some food items and services such as international travel. The prices of these items should be less influenced by conditions in the Australian economy, and more affected by prices set on world markets and fluctuations in the exchange rate.

Indeed, there have been large differences in inflation outcomes for non-tradable and tradable items over the past two decades (Graph 1). Non-tradables inflation has been higher and more stable than tradables inflation, although both series have cycled around their respective averages.

Graph 1
Consumer Price Inflation*
Year-ended



* Adjusted for the tax changes of 1999–2000
** Excluding interest charges prior to the September quarter 1998, and deposit & loan facilities to June quarter 2011
*** Excluding volatile items and tobacco
Sources: ABS; RBA

There is relatively little published analysis of the factors that influence non-tradables inflation in Australia, with more work having focused on the determinants of tradables inflation.[1] This article outlines the main characteristics of non-tradable items in the CPI. It then examines the factors that are relevant to inflation in the prices of non-tradable

* The authors are from Economic Analysis Department, and thank Alexander Ballantyne for assistance in preparing this article.

1 See, for example, Dwyer and Lam (1994), Norman and Richards (2010) and Chung, Kohler and Lewis (2011).

items from two complementary perspectives: a 'top-down', or macroeconomic perspective, and a 'bottom-up', or disaggregated perspective.

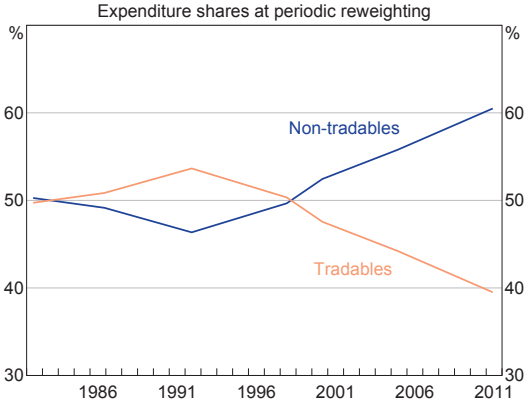
Which Items are Non-tradable?

In practice, drawing a precise distinction between a tradable and a non-tradable item is difficult. The exposure of an item to international competition is both complicated to measure and a matter of degree. The Australian Bureau of Statistics (ABS) classifies an item as tradable where the proportion of final imports or exports of that item exceeds a given threshold of the total domestic supply.[2] Any item not meeting this definition is classified as a non-tradable. In general, many goods are classified as tradable while nearly all services are classified as non-tradable.

Currently, non-tradable items make up around 60 per cent of household spending and tradable items comprise about 40 per cent (Graph 2). The share of spending on non-tradable items has risen noticeably over the past couple of decades. This reflects larger price increases for non-tradable items and a shift in consumer preferences towards non-tradable items (discussed in more detail below).

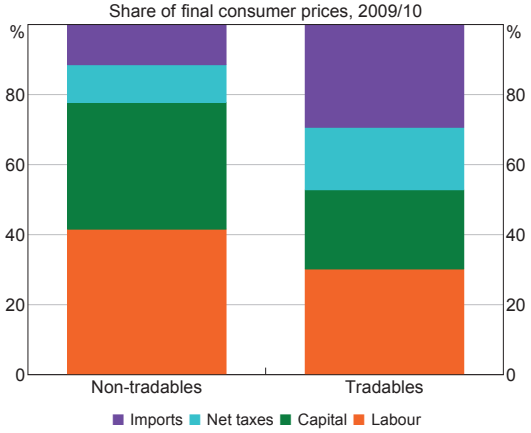
The importance of domestic influences for the prices of non-tradable items is apparent from looking at their cost structure. In particular, around 90 per cent of the final price paid for these items reflects domestic costs (Graph 3). This includes both wages paid to the local labour that is employed to produce and distribute the item, as well as margins paid to the owners of local capital used along the supply chain. In contrast, the domestic share of input costs is smaller for tradable items.[3]

Graph 2
CPI Basket Composition
Expenditure shares at periodic reweighting



Sources: ABS; RBA

Graph 3
Input Structure by Primary Input
Share of final consumer prices, 2009/10



Sources: ABS; RBA

Imported inputs account for only a small share of the prices of non-tradable items – about 10 per cent, compared with 30 per cent for tradable items.[4] This means that world prices and the exchange rate typically have a relatively small direct impact on prices of non-tradable items. However, the exchange rate has an indirect influence on the prices of non-tradable items. For example, a depreciation is likely to induce consumers to spend less on tradable items (e.g. books) and more on non-tradable items (e.g. dining out), providing scope for sellers to raise their prices.

2 The threshold applied is 10 per cent of domestic supply; see Dwyer (1992) and ABS (2011).

3 The details of these calculations are provided in Appendix A. Domestic costs also include net taxes. For tradable items, the domestic component of costs mainly reflects wages and margins in the goods distribution sector.

4 Note that these figures are not comparable to the 'threshold' figure of 10 per cent used to classify tradable and non-tradable items. The latter refers only to imports of final goods and services (whereas imported inputs to non-tradable items are primarily intermediate inputs), but also includes exports.

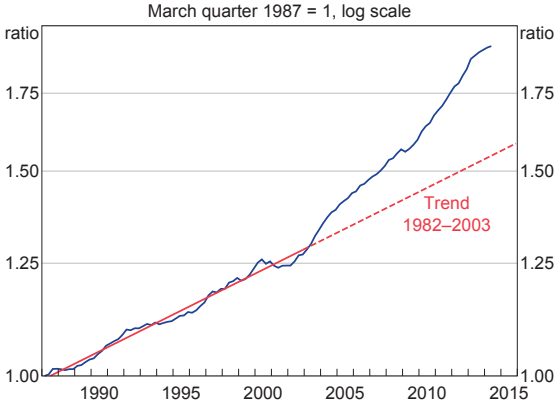
The Macroeconomic ('Top-down') Perspective

The top-down perspective focuses on two broad characteristics of non-tradables inflation: its higher average rate over the long-run compared with that of tradable items; and the fluctuations seen over the business cycle.

Long-run developments

Since the introduction of inflation targeting in Australia in 1993, CPI inflation has averaged around 2½ per cent, in the middle of the Reserve Bank's inflation target.[5] However, over this period the average rate of non-tradables inflation has been significantly above that of tradables inflation, resulting in a large rise in the relative price of non-tradables (Graph 4). This increase in relative prices is not unique to Australia; it is evident across a range of countries (Steenkamp 2013).

Graph 4
Ratio of Non-tradables to Tradables CPI*
March quarter 1987 = 1, log scale

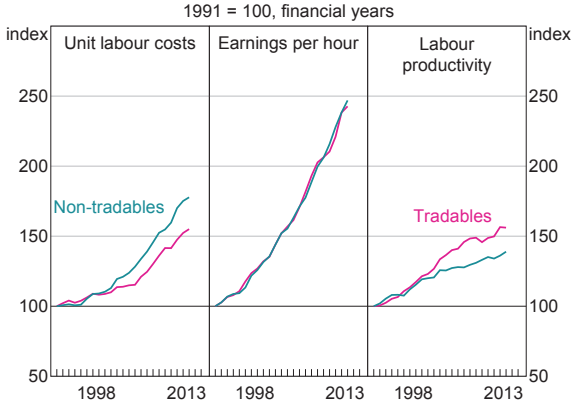


* Tradables prices exclude volatile items (fruit, vegetables and automotive fuel) and tobacco; non-tradables prices exclude deposit & loan facilities to June quarter 2011

Sources: ABS; RBA

Both supply and demand forces explain the relative increase in prices of non-tradable items. On the supply side, there is the Balassa-Samuelson effect whereby productivity in the tradable sector tends to rise more quickly than in the non-tradable sector (Balassa 1964; Samuelson 1964). This productivity growth pushes up demand for labour in the tradable sector, which tends to lift wages across the economy (assuming labour is mobile across sectors). Higher wages push up the prices of non-tradable items while prices of tradable items, which are determined in international markets, are not pushed higher. Over the past 20 years, this effect appears to have been present in the data – although not by enough to fully explain the shift in relative prices (Graph 5). An additional supply-side factor influencing relative prices has been the integration of China into the global trading system, which tended to lead to lower prices of a wide range of tradable goods.

Graph 5
Labour Costs and Productivity Growth*
1991 = 100, financial years



* Definition of tradable and non-tradable industries as per Plumb, Kent and Bishop (2013); tradables excludes mining and agriculture

Sources: ABS; RBA

A shift in consumer demand appears to have also contributed to a rise in the relative price of non-tradable items. This is because rising wealth is typically associated with a shift in demand towards services (which tend to be non-tradable) away from goods (which tend to be tradable).

Over the past decade, the increase in the relative price of non-tradable items in Australia has accelerated, as can be seen in Graph 4. This is likely to reflect the structural adjustment of the Australian economy over this period, associated with the boom in the terms of trade (Plumb, Kent and Bishop 2013). The higher terms of trade acted to bolster demand for labour while the addition to incomes increased demand for non-tradable goods and services.

5 Excluding the effect of the tax changes of 1999–2000 and deposit & loan facilities from 2005 to 2011.

In addition, the associated appreciation of the nominal exchange rate reduced demand for some domestically produced tradable items and also lowered import prices and tradables inflation. Over the past year, however, these forces have partially reversed, as the terms of trade declined and the exchange rate depreciated somewhat.

Business cycle developments

The rate of non-tradables inflation is also affected by the business cycle. When there is spare capacity in the economy, there tends to be slower growth in wages and firms are constrained in their ability to expand margins. For example, during much of the 1990s, slow growth in prices of non-tradable items coincided with a high unemployment rate and slow growth in labour costs (Table 1). Conversely, during periods of little spare capacity in the economy, there is upward pressure on wages and margins and firms face constraints in expanding production. As a result, growth in demand tends to result in higher prices rather than higher output. This was the case over much of the 2000s, with a lower unemployment rate and faster growth in labour costs and non-tradables prices on average.

An econometric model of non-tradables inflation can be estimated in order to better understand these relationships. Two frameworks often used to examine aggregate inflation are the Phillips curve and mark-up models (Norman and Richards 2010). The Phillips curve model considers inflation as a function of capacity utilisation, as measured by the unemployment rate. The mark-up approach is based on the theory that prices are set as a mark-up over costs, so it includes growth in unit labour costs and a proxy for pressures on margins, often in the form of an estimated output gap. Both approaches also include a measure of inflation expectations and inflation in import prices (as discussed above, movements in the exchange rate may have direct and indirect effects on non-tradables inflation). Further details are provided in Appendix B.

The models do a reasonable job of explaining movements in non-tradables inflation over the past two decades, with the fitted model explaining about two-thirds of the variation in the actual data (Graph 6). Again, three distinct periods are evident:

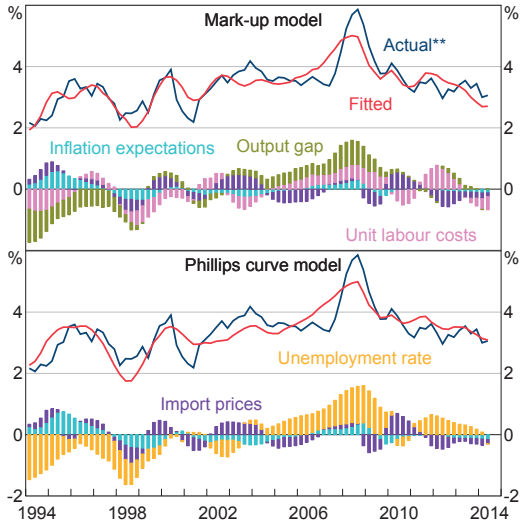
- Through much of the 1990s, spare capacity in the domestic economy weighed on non-tradables inflation; an elevated unemployment rate, negative output gap and slow growth in unit labour costs all contributed to relatively low non-tradables inflation. In large part, these conditions were a legacy of the early 1990s recession. Relatively fast growth in multifactor productivity also helped to contain labour costs. At the same time, however, inflation expectations remained relatively high until the mid 1990s, exerting an upward influence on inflation outcomes.
- In the 2000s, there was a noticeable step up in the pace of non-tradables inflation. This was consistent with evidence that the economy was operating closer to full capacity, while

Table 1: Non-tradables Inflation, Unemployment and Unit Labour Costs
Period average, per cent

	1993–1999	2000–2008	2009–Current	Inflation-targeting period
Non-tradables inflation[(a)]	2.8	3.7	3.4	3.3
Unemployment rate	8.6	5.5	5.4	6.5
Unit labour cost growth[(b)]	1.4	3.5	1.7	2.4

(a) Annualised; excludes interest charges and adjusted for the tax changes of 1999–2000 and deposit & loan facilities to June quarter 2011
(b) Annualised; non-farm
Sources: ABS; RBA

Graph 6
Non-tradables Inflation Models*
Year-ended inflation and contributions



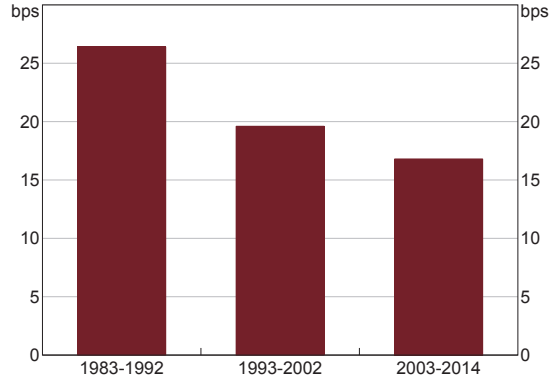
* Contributions relative to inflation-targeting average
** 30 per cent trimmed mean non-tradables inflation
Sources: ABS; RBA

multifactor productivity growth also slowed. The period culminated in the sharp increase in non-tradables inflation in 2007 and 2008. However, the models only partly explain this run-up in non-tradables inflation and their fitted values suggest that a build-up in inflation should have occurred earlier (Lowe 2011).

- Following the global financial crisis, there has been a decline in non-tradables inflation. This has been associated with an easing in capacity pressures, with unemployment, labour costs and the output gap all exerting less upward pressure on inflation, particularly over the past year. Accordingly, non-tradables inflation in year-ended terms has declined to around its lowest rate in over a decade.

Over the past few decades, non-tradables inflation appears to have become less sensitive to shocks. In particular, non-tradables inflation has become less sensitive to movements in the unemployment rate (Graph 7). This is the well documented 'flattening of the Phillips curve' that has also been observed for aggregate inflation in Australia (Kuttner and Robinson 2010; Norman and Richards 2010; Gillitzer and Simon forthcoming). Much of this change is thought to be due to the introduction of inflation targeting in the early 1990s and the associated anchoring of inflation expectations, although other factors may also have played a role.

Graph 7
Slope of Phillips Curve*
Change in annual non-tradables inflation for 1 ppt fall in unemployment



* Specification based on Norman and Richards (2010)
Sources: ABS; RBA

The Disaggregated ('Bottom-up') Perspective

The top-down macroeconomic perspective helps to explain non-tradables inflation using relatively few variables. However, in practice there are a wide range of other factors that may influence prices at an industry level, which may be more apparent when looking at prices for specific items or markets. Even so, a disaggregated bottom-up perspective also has drawbacks. In particular, it can be difficult to discern the effect of factors that have an economy-wide influence, such as wages or inflation expectations, amid the many other factors affecting individual prices from quarter to quarter.

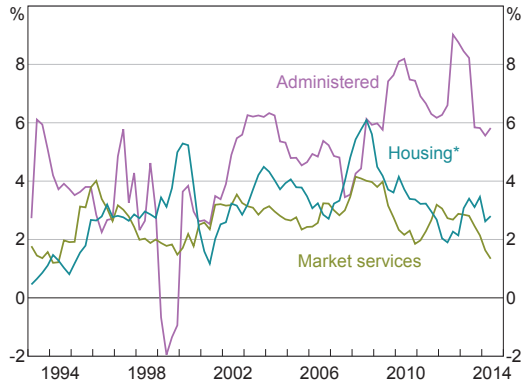
With these caveats in mind, it is useful to consider a breakdown of the non-tradable items into three components, each of which represents between

one-quarter and one-third of the aggregate non-tradables basket:[6]

- *Housing services:* the cost of new dwellings and rents (but excluding utilities prices, which are classified as administered items).
- *Market services:* other services for which pricing tends to be market-based, for example domestic household services (such as hairdressing), financial services, meals out & takeaway and domestic travel.
- *Administered items*: those for which prices are (at least partly) regulated or for which the public sector is a significant provider. This includes administered services, such as health, education and child care, as well as utilities.

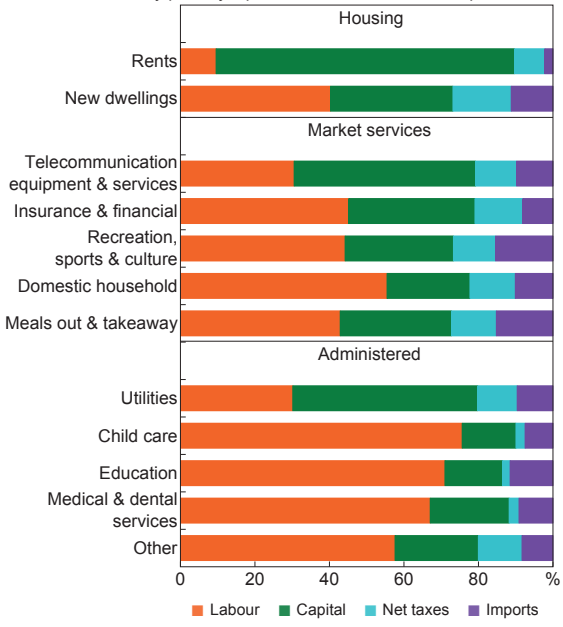
Inflation outcomes have varied substantially across these components (Graph 8). These differences partly reflect variation in cost structures, with some items more intensive in their use of labour and others of capital (Graph 9).[7] The most labour-intensive items are administered services, for which labour costs account for up to three-quarters of final prices. Market services are the next most labour-intensive category, while at the other end of the spectrum, prices of items such as rental services and utilities mainly reflect capital costs. Inflation may also differ because these items are exposed to different sectors of the economy, and so may be subject to different demand and supply shocks. And finally, they may also have different pricing arrangements, with some prices tending to be determined more by market forces while others are subject to a degree of regulation. The remainder of this section explores these issues in more detail.

Graph 8
Non-tradables Inflation
Year-ended



* Excluding utilities
Sources: ABS; RBA

Graph 9
Input Structure of Selected Non-tradables
By primary input, share of final consumer prices, 2009/10



Sources: ABS; RBA

Market services

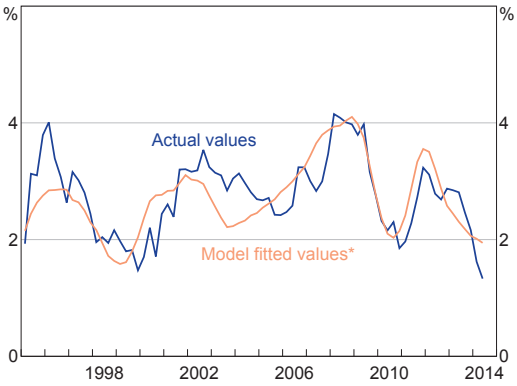
For market services, labour costs account for 40–50 per cent of final prices. As a result, inflation in this component is particularly sensitive to developments in the labour market. A mark-up model using unit labour costs is able to explain a

6 More specifically, these categories are defined as follows: *Housing services* – rents, dwelling maintenance and new dwelling purchases; excludes administered items. *Market services* – domestic household services, recreational, sports & culture, telecommunication equipment and services, insurance & financial and meals out & takeaway; excludes deposit & loan facilities to June 2011, housing services and domestic travel. *Administered items* – utilities, education, child care, health services, property rates, urban transport fares, postal services and some motor vehicle services. Together, these expenditure classes cover around 90 per cent of the non-tradables basket. The remaining 10 per cent is primarily comprised of pharmaceuticals, domestic travel services and food items that are classified as non-tradable.

7 The details of these calculations are provided in Appendix A.

substantial portion of the cycles seen in market services inflation over the past two decades (Graph 10). Indeed, labour market developments provide a better explanation of developments in this component than they do for overall non-tradables inflation, most notably when looking at the build-up of capacity pressures and inflation over 2007–08.

Graph 10
Market Services Inflation
Year-ended



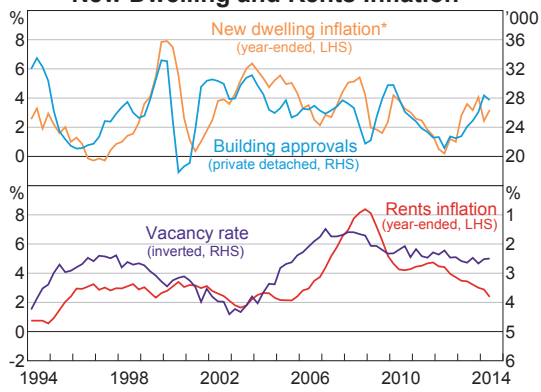
* Mark-up specification based on framework set out in Norman and Richards (2010)
Sources: ABS; RBA

Housing

Changes in new dwelling cost inflation have moved in line with changes in the level of building approvals for detached houses, a proxy of demand for new housing (Graph 11). Periods of rising building approvals have seen higher inflation, in part owing to rising materials costs and builder margins, as well as stronger wage growth for construction workers.[8] Inflation in rents (measured in real terms) has tended to increase when the vacancy rate for rental properties has been low. Inflation in both new dwelling costs and rents increased in the 2007–08 period, during which, as discussed, non-tradables inflation cannot be fully explained by developments in the labour market. Inflationary pressures in both of these markets subsequently eased over the next few years as capacity pressures abated, and in spite of a general pick-up in the growth of labour costs. More recently, new dwelling cost inflation has picked up, consistent with accommodative monetary policy and a shift in government incentives towards new homes, and despite historically slow growth in labour costs.

8 Changes to first home owner grants have also had an impact on price movements in this series.

Graph 11
New Dwelling and Rents Inflation



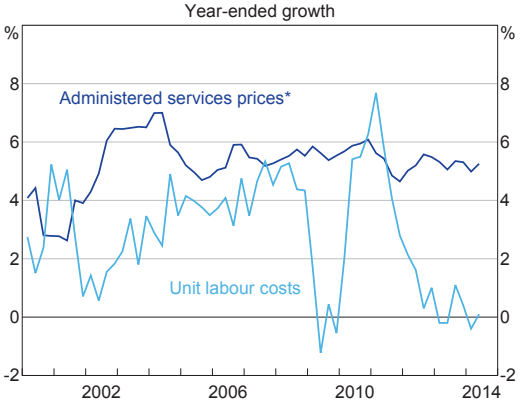
* Project home price index prior to December quarter 1998
Sources: ABS; RBA; REIA

Administered items

Despite being among the most labour-intensive items in the whole CPI, administered services prices have a weak relationship with labour market conditions. Some of this reflects the occasional, large effect on prices from one-off policy changes. But even after controlling for these, administered services inflation has had little relationship with growth in unit labour costs (Graph 12). Rather, administered services inflation has been remarkably stable over time, at a relatively high level, averaging 5 per cent over the inflation-targeting period. Accordingly, administered prices are an important reason for the relatively high and stable nature of overall non-tradables inflation. Several related factors may have contributed to this:

- *Strong demand.* Demand for administered items has grown particularly strongly over time, and is relatively insensitive to the business cycle. Strong growth in demand for health services partly reflects households' increasing propensity to spend on health care as they become more affluent and as they age (the latter effects are expected to be larger in coming years; see

Graph 12
Administered Services Prices and Labour Costs
Year-ended growth



* Excluding the effect of policy changes
Sources: ABS; RBA

RBA (2013)). Similarly, strong growth in real household incomes over recent decades may have also helped to ensure continued strength in demand for services such as private schooling.

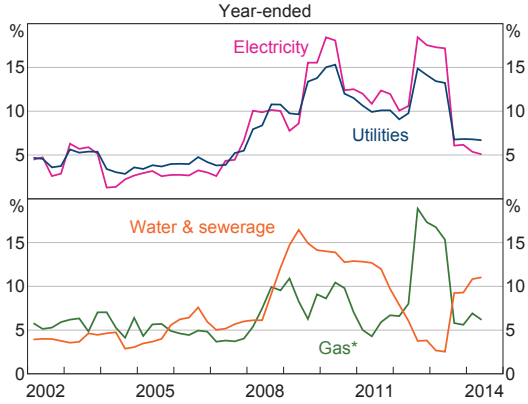
- *Measurement problems.* There are several factors that can impart an upward bias to measured price inflation over time and that are particularly pronounced for administered services (Jacobs, Perera and Williams 2014). In particular, it is difficult to assess and adjust for changes in the quality of services such as medical treatment and education over time.[9] Moreover, increases in measured health insurance premiums may have reflected greater utilisation of services (i.e. higher volumes) rather than higher prices (Biggs 2012).[10]
- *Faster growth in labour costs.* Growth in unit labour costs has been a little higher in administered services than other industries. This has reflected weaker productivity growth, which may be due to the difficulty in measuring productivity in this sector, but perhaps also because some firms in these industries may be less subject to competitive market forces.

9 However, this would be expected to also affect the measurement of labour productivity and unit labour costs.

10 There are other miscellaneous factors as well. For example, in the early 2000s medical indemnity insurance premiums rose rapidly due to a number of factors specific to that industry (Martin 2005).

Utilities prices have also made a large contribution to overall inflation, particularly since 2007 (Graph 13). This has been driven by a variety of factors not closely linked to overall economic conditions, including: a move towards cost-based pricing; an increase in investment to replace ageing infrastructure and improve capacity; and higher wholesale prices (Plumb and Davis 2010). In addition, incentives in the regulatory framework may have contributed to high levels of capital spending, while the introduction of the carbon price added to electricity and gas prices in 2012 (RBA 2012).

Graph 13
Utilities Price Inflation*
Year-ended



* Includes other household fuels
Source: ABS

Conclusion

The prices of non-tradable items are strongly determined by domestic influences, consistent with their lower exposure to international competition. From a top-down perspective, spare capacity in the labour market and in the economy more broadly appears to be a key determinant. Accordingly, non-tradables inflation can also be interpreted as providing information regarding the extent of spare capacity in the domestic economy, and perhaps more so than for the aggregate CPI, which also includes the prices of tradable items. However, at a more granular level it is apparent that there is a wide range of factors affecting non-tradables inflation, including the extent of spare capacity in specific markets, such as housing, and non-market factors.

Appendix A
Calculation of Input Cost Structures

This appendix sets out how input-output (IO) tables from the ABS are used to calculate the relative importance of different factor inputs as a share of final consumer prices. In particular, prices for different CPI expenditure classes (ECs) are broken down into capital (gross operating surplus plus gross mixed income), labour (compensation of employees) and imported inputs.[11] Some previous work has examined costs and margins along the supply chain.[12] However, little work appears to have linked these costs directly to final consumer prices, either in Australia or elsewhere.

The calculations combine information from two sources: the 'standard' IO tables and the 'product level' IO tables (Figure A1).[13] The standard IO tables can be used to look at the input structure of different industries and, in turn, groups of products that are produced by those industries. However, this information is not sufficient to determine the input structure of different expenditure classes in the CPI: it is not granular enough, and the prices are those received by producers. Unlike producer prices, consumer prices also include transport costs, margins and costs of retailers and wholesalers, as well as taxes and subsidies. The product level IO tables provide the additional information needed to tie the information in the standard IO tables to the CPI basket. In particular, they provide a mapping of individual products to expenditure classes in the CPI, as well as information on both producer and consumer prices. Various assumptions are required in making the calculations, meaning that the figures should be considered as indicative only. The calculations are made in a series of steps:

1. *Calculating input shares of domestic household consumption at the industry level.* The factor input shares for an industry's total output, from all industries (i.e. final and intermediate), as a share of basic prices are obtained from the standard IO tables. These include the first round effects on the production of intermediate industries from an increase in output in the final industry, as well as second-round and subsequent effects on production. Household expenditure on the output of each industry is then assumed to have the same input structure as total output from that industry.
2. *Splitting household consumption into domestic and imported components.* The standard IO release provides a breakdown of final use for product groups. The supply of product groups in this table includes both domestic production and imports. Imports that have gone to final use without any transformation by domestic industry are used to give the imported share of household consumption for each product group.
3. *Mapping industry input shares to product groups.* The weight of each industry in the domestic production of each product group is calculated using the standard IO release. These weights are used to convert the input shares of industry production consumed by households calculated in step 1 into input shares of product groups. The input shares are then scaled down by the share of total household consumption that is produced domestically (step 2). The imported share of household consumption calculated in step 2 makes up the remainder.
4. *Mapping product group input shares to CPI ECs.* The mapping provided in the product level IO release is used to convert product group input shares into more detailed product level input

11 This is not a 'pure' measure of capital, as gross mixed income includes the labour income of unincorporated enterprises. However, the IO tables do not provide separate gross operating surplus and gross mixed income figures.

12 For example, D'Arcy, Norman and Shan (2012). The breakdown here is different to that article, which was concerned with dividing the value of goods sold into the cost of the goods and margins earned by distributors. In contrast, this breakdown focuses on splitting the value of goods and services sold by their position in the supply chain. Imported goods that are sold to consumers without transformation by domestic industry are treated as an input in the distribution sector.

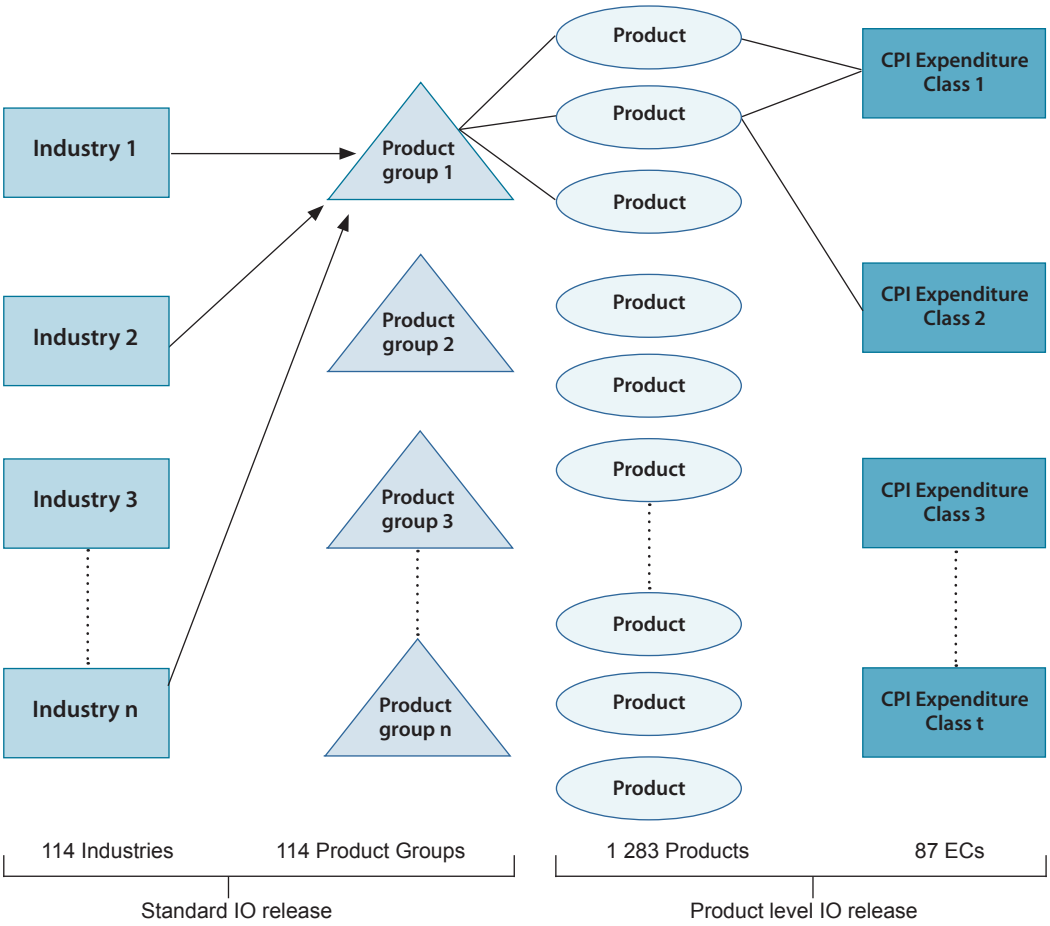
13 The 'standard' IO tables are published as *Input-Output Tables, 2009-10*, ABS Cat No 5209.0.55.001. The 'product level' IO tables are published as *Input-Output Tables (Product Details), 2009-10*, ABS Cat No 5215.0.55.001.

shares. These product input shares are mapped to CPI ECs, weighted by the amount of household consumption on each product. Where a product maps to multiple ECs, it is assumed that household consumption on that particular product is attributed evenly across the multiple ECs.

5. *Converting input shares from basic to purchasers prices.* The EC input shares calculated in step 4 are scaled down by the ratio of household consumption at basic prices to household consumption at purchasers prices (from the product level release). The input shares of the margin components (e.g. retailers margins) are then obtained from the relevant industry input shares from step 1 and added to the scaled down input shares from other industries to obtain the total contribution of each factor input to final consumer prices.

Figure A1: The Relationship Between Input-Output Classifications and CPI Expenditure Classes

The estimates are derived in a series of steps:



Source: RBA

Appendix B
Non-tradables Inflation Model Estimates

The econometric models of non-tradables inflation estimated in this article are specified in a similar fashion to those for aggregate inflation in Norman and Richards (2010). The estimated coefficients from the Phillips curve and mark-up models are presented in Table B1.

Table B1: Regression Results for Models of Non-tradables Inflation
March quarter 1990 to March quarter 2014

Mark-up specification		Phillips curve specification	
Variable	Coefficient[a]	Variable	Coefficient[a]
Constant	0.016***	Constant	–0.01*
Inflation expectations	0.38***	Inflation expectations	0.48***
Unit labour costs[b]	0.83**	Unemployment rate (inverse)[c]	0.16***
Output gap	0.28***	Change in unemployment rate[d]	–0.003***
Import price inflation[b]	0.13	Import price inflation[b]	0.12
Adjusted R-squared	0.64	Adjusted R-squared	0.63

(a) Percentage point change in non-tradables inflation for 1 percentage point increase in regressor variable; ***, ** and * denote statistical significance at the 1, 5 and 10 per cent levels, respectively; coefficients multiplied by 4 to represent annualised effects
(b) Sum of lagged coefficients
(c) Lagged two quarters
(d) Lagged three quarters
Sources: ABS; RBA

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Measures of Inflation in India

Graham White*

India has experienced persistently high inflation in recent years, despite a period of below-trend economic growth. As a result, controlling inflation has become a key objective for policymakers. The two main indicators of inflation in India are the wholesale price index (WPI) and the consumer price index (CPI). Although the WPI has traditionally been the most widely used measure for assessing inflationary pressures, the Reserve Bank of India (RBI) recently conducted a review of its monetary policy framework, which recommended adopting a flexible inflation-targeting regime, based on headline CPI inflation. This article outlines the two main price measures available for the Indian economy and discusses their role in India's monetary policy.

Introduction

Over the past few years, inflation in India has remained persistently high. CPI inflation was around 10 per cent up until the start of 2014 despite GDP growth declining from rates exceeding 10 per cent in 2009–10 to around 5 per cent more recently, which is below official estimates of potential growth. Accordingly, inflation has become an important focus of policymakers. On taking office in September 2013, the new RBI Governor, Dr Raghuram Rajan, highlighted the importance of 'low and stable expectations of inflation', and the RBI raised India's main policy rate in his first month in office. Furthermore, Dr Rajan announced a review into the RBI's monetary policy framework, led by Dr Urjit Patel (Deputy Governor of the RBI), which subsequently recommended the adoption of a flexible inflation-targeting regime based on headline consumer price inflation.[1] This contrasted with previous monetary policy statements that had focused on the WPI, and had even cited targets for WPI inflation.

The WPI and CPI are the main price indices in India. The WPI measures prices received by producers of goods, while the CPI measures prices facing consumers at the retail level. The weighting schemes, coverage of goods and the prices used are very different between the two indices, which can lead to quite different rates of inflation.

This article discusses these two price measures in detail and briefly reviews measures of 'core' inflation, before describing the role played by the main price measures in India's monetary policy.

Wholesale Price Index (WPI)

The WPI is produced by the Indian Ministry of Commerce and Industry. The data are collected at the first point of bulk sale in the domestic market. The prices used are 'wholesale prices for primary articles, administered prices for fuel items and ex-factory prices for manufactured products'.[2] That is, the WPI measures the prices of products at the factory or farm gate, prior to their sale to consumers in retail markets.[3] One advantage of the WPI is that it has a long history, dating back to January 1942, which makes it useful for assessing long-term trends in inflation. The WPI also covers a broad range of goods, from raw materials to finished manufactures, but notably excludes services.

* The author completed this work in Economic Group.

1 For the full report, see Reserve Bank of India (2014c).

2 See Kumar and Boopathy (2013, p 1).

3 As Reserve Bank of India (2014c) notes, this is not true for all items in the index, with prices for some important items such as milk being sourced from retail markets.

The WPI is calculated using the Laspeyres formula, which measures the change in the cost of purchasing the same basket of items in the current period as was purchased in a specified earlier period. This technique is simpler than other methods, since the weights are computed in the base period and, until this is updated, each subsequent calculation requires only an update of prices. A disadvantage of this type of index is that it will be biased if the composition of sales in the wholesale market is changing and the weights are not regularly updated. This is more likely to be an issue for a fast-changing, emerging economy such as India. As the Indian economy develops and household incomes increase, we would expect non-food items and services to account for a larger share of expenditure and the composition of production to evolve reflecting changes in demand.

The weights for components of the WPI are derived from their share of gross output in current price terms. The WPI has only been rebased four times in its history (Table 1). The weights for selected groups in the WPI changed significantly with each of the first two rebasings. Changes were relatively smaller at the latest rebasing in 2004/05. Over the past 40 years or so, a number of broad trends are apparent: the weight of primary articles (especially food) has fallen and the weight of manufactured items has increased.

Recent trends in wholesale price inflation

The headline measure of WPI inflation in India has generally remained above 5 per cent since late 2009 (Graph 1). Food items (both primary and manufactured) account for around a quarter of the WPI, and these prices can be quite volatile (Graph 2). The production of food in India is heavily influenced by the monsoon season and supply chain inefficiencies, both of which make food prices particularly susceptible to supply disruptions.[4] In addition, food prices are influenced by government policies, including subsidies and minimum support prices. They were also influenced by labour reform measures, such as the *Mahatma Gandhi National Rural Employment Guarantee Act 2005*, which have increased rural labour costs. In a recent speech, the RBI Governor suggested that rural wage increases had been a major contributor to higher food prices in recent years.[5]

Table 1: Wholesale Price Index Group Weights
Per cent of total

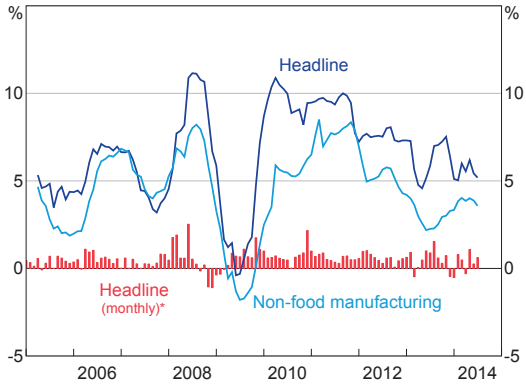
	1970/71	1981/82	1993/94	2004/05
Primary articles	**42**	**32**	**22**	**20**
Food	30	17	15	14
Non-food	11	10	6	4
Minerals	1	5	1	2
Fuel and power	**9**	**11**	**14**	**15**
Manufactured products	**50**	**57**	**64**	**65**
Food	13	10	12	10
Chemicals	6	7	12	12
Basic metals, alloys and metal products	6	8	8	11
Machinery and machine tools	5	6	8	9
Other	20	26	24	24

Sources: Ministry of Commerce and Industry; RBA

4 For further information, see Cagliarini and Rush (2011).

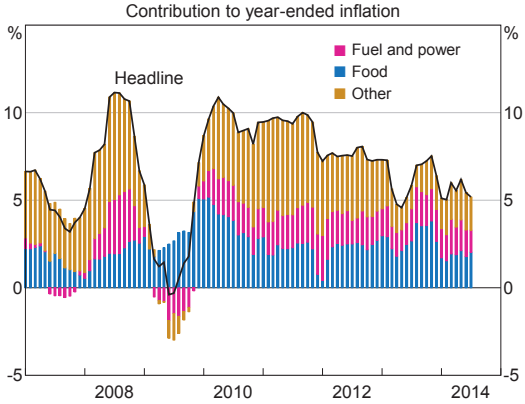
5 See Rajan (2014).

Graph 1
India – Wholesale Price Inflation
Year-ended



* Seasonally adjusted
Sources: CEIC Data; RBA

Graph 2
India – Wholesale Price Inflation
Contribution to year-ended inflation



Sources: CEIC Data; RBA

Also, a report by the Institution of Mechanical Engineers (2013) estimates that at least 40 per cent of India's fruit and vegetables are lost between the grower and consumer. Consistent with that, the International Monetary Fund highlights the need for agriculture reforms that reduce administrative inefficiencies in food distribution, pricing and storage, and boost productivity in agricultural production in its Article IV consultation (IMF 2014). A significant depreciation of the rupee in the first half of 2013 has also contributed to elevated WPI inflation over the past year and a half. Over 2014 to date, WPI inflation has moderated, consistent with a good harvest at the end of 2013 and the effects of relatively tight monetary policy.

The non-food components of WPI inflation are less affected by supply-side influences affecting food prices and are consequently less volatile than headline inflation. The fuel and power component – which accounts for 15 per cent of the WPI – has been relatively stable since 2010, although it had shown more volatility in previous years. Prices in this sector are affected by government subsidies for fuel and administered prices (e.g. utilities prices). Although they receive a smaller weighting in the index than food prices, the prices of non-food primary articles and minerals also contribute to the volatility of inflation, since these components are affected by fluctuations in global commodity prices.

Consumer Price Index (CPI)

An alternative gauge of price movements in India is provided by the CPI. As discussed below, a recent report to the RBI Governor by the Expert Committee to Revise and Strengthen the Monetary Policy Framework (the Patel Committee) recommended that the RBI adopt a flexible inflation-targeting regime with headline consumer price inflation as the target.

Two different government agencies, namely the Ministry of Statistics and Programme Implementation (MOSPI) and the Ministry of Labour and Employment, publish a number of consumer price indices (Table 2). Each index has its own set of weights and the base period used varies across measures. There are also methodological differences between the indices, such as the way in which prices are collected.

The urban, rural and combined CPIs produced by MOSPI have been published since 2011. In contrast, the measures of consumer price inflation computed by the Ministry of Labour and Employment have a much longer history; the time series of the CPI for industrial workers began in 1989. Although these indices have been used in wage determination and

Table 2: Consumer Price Indices

Ministry of Statistics and Programme Implementation	Ministry of Labour and Employment
Urban CPI	CPI – rural labourers
Rural CPI	CPI – agricultural labourers
Combined (urban and rural) CPI	CPI – industrial labourers
CPI – urban non-manual employees (ceased in 2011)	

Sources: Ministry of Labour and Employment; Ministry of Statistics and Programme Implementation

as a reference for the provision of welfare benefits, they use base period weights that are substantially out of date, and are unlikely to reflect the current Indian household consumption basket.[6] Moreover, the RBI has expressed a preference for the MOSPI CPIs. For these reasons, the rest of this article focuses on the recently developed urban, rural and combined CPIs produced by MOSPI.

Since these CPIs have only been published for a short period, reliable seasonal adjustment is not feasible.[7] This is problematic, as the monthly growth rates are likely to exhibit a notable seasonal pattern. In addition, these CPIs are relatively new in their current formulation and may undergo substantial changes as the calculation methodology is refined. Nonetheless, the combined CPI has become the main focus of policymakers, and the Patel Committee has recommended that the RBI focus on this measure in its deliberations about monetary policy.

The weights for the components of the combined CPI (hereafter referred to as 'the CPI') are calculated using data from the 2004/05 consumer expenditure survey conducted by the National Sample Survey Office. The most recent consumer expenditure survey was conducted over the year to June 2012, and the CPI is scheduled to be reweighted in 2014 to reflect these data. The headline CPI is compiled by weighting together state-level CPIs. The Patel Committee observed that this may make headline inflation quite sensitive to localised price growth and volatility, and suggested that compiling the CPI using national level weights for each commodity-level component might be preferable. Like the WPI, the CPI is calculated using a Laspeyres formula, so it has the same problems mentioned above whenever consumption baskets are changing relatively quickly.

The CPI places a much larger weight on food items than the WPI, since it is weighted on the basis of household expenditure. Food, beverages and tobacco have a combined weight of nearly 50 per cent (compared with around 25 per cent in the WPI). Also, the CPI includes components such as services (classified under the 'miscellaneous' category) and housing, which are notable omissions from the WPI.

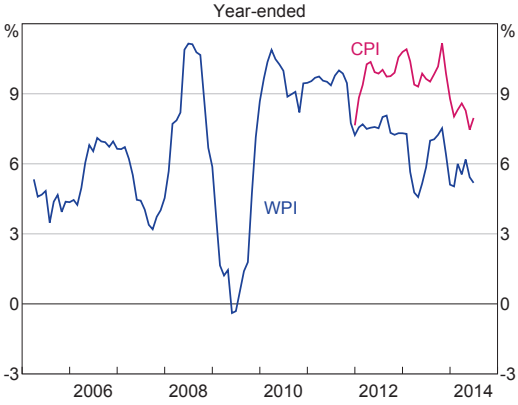
Recent trends in consumer price inflation

Consumer prices in India have been growing rapidly over the past two years, and at a much faster pace than wholesale prices (Graph 3). The substantially larger weight on food items in the CPI, as well as the inclusion of services prices, account for a large part of the difference between the rates of CPI and WPI inflation. Food items made a significant contribution to consumer price inflation over recent years, and also accounted for most of the volatility in consumer prices, with inflation remaining relatively stable for the other major components (Graph 4). While services have a smaller weight than food, the prices of services (e.g. education, medical and transport prices included in the 'miscellaneous' category) have been growing rapidly in recent years. In addition, the housing component has been growing at around 10 per cent since 2012, also a faster pace than overall CPI inflation.

6 See Kumar and Boopathy (2013, p 20) for a comparison of the different CPIs.

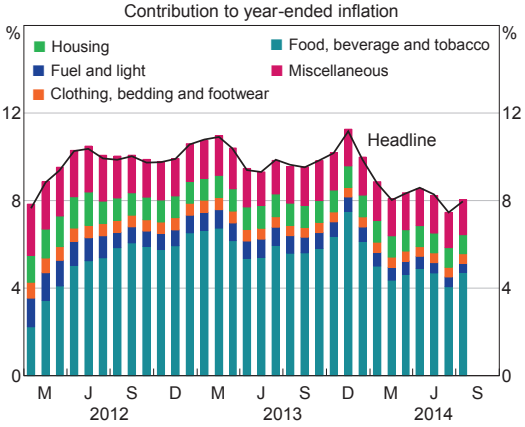
7 The Reserve Bank of India (2014c) suggests that a CPI with a longer time series could be constructed by applying the weighting pattern of the combined CPI to component indices of the CPI for industrial labourers. The weighting pattern needs to be applied at as high a level of disaggregation as possible, but only broad group indices are publicly available for the CPI for industrial workers.

Graph 3
India – Inflation
Year-ended



Sources: CEIC Data; RBA

Graph 4
India – Consumer Price Inflation
Contribution to year-ended inflation

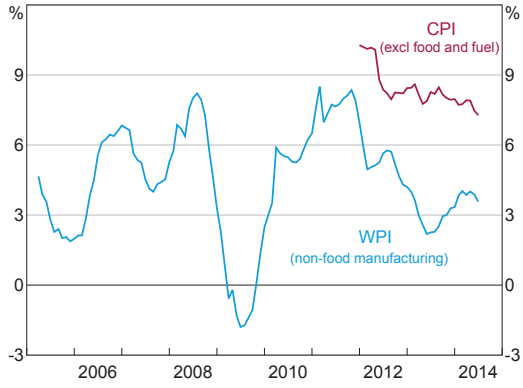


Sources: CEIC Data; RBA

Measures of Core Inflation

India does not publish an official measure of 'core' (or 'underlying') inflation, although such measures can be useful as an indication of underlying trends in economy-wide price pressures. In a 2011 occasional paper, the RBI assessed a number of alternative measures of core inflation and found that the 'non-food manufacturing' component of the WPI was the most suitable series.[8] Non-food manufacturing inflation is not published, although it can be estimated using the published WPI indices and weights. While headline WPI inflation and non-food manufacturing inflation have both trended lower since 2011, non-food manufacturing inflation has fallen to much lower rates (Graph 5). This may indicate a degree of downward pressure on inflation consistent with slow growth in industrial production and economic demand more generally. The RBI estimates that potential growth has slowed from around 8 per cent prior to the global financial crisis, to about 6 per cent at the end of 2013 (Reserve Bank of India 2014b). This implies that GDP (at factor cost) has been growing at about 1–2 percentage points below potential, in year-ended terms, for the past two years.

Graph 5
India – Core Inflation
Year-ended



Sources: CEIC Data; RBA

A measure of core CPI inflation can be compiled by excluding the food and fuel components. However, this only leaves around 40 per cent of the consumption basket, making it a rather narrow measure of consumer price inflation. A further drawback is that, according to the RBI's estimates, shocks to the food and fuel components have larger and longer-lasting effects on inflation expectations than shocks to the other components.[9] A measure of core inflation that has a weak relationship with

8 See Raj and Misra (2011) for further information.

9 The Reserve Bank of India (2014c) estimates that a 100 basis point positive shock to food inflation immediately raises one-year-ahead household inflation expectations by 50 basis points and that the effect of the shock persists for eight quarters. The effects of shocks to fuel prices are also large, but less persistent, lasting for around four quarters.

inflation expectations may be of limited usefulness for policymakers.

In general, the 'core' CPI and WPI measures have been less volatile than headline inflation over the past couple of years. The rate of core inflation, as indicated by the non-food manufacturing component of the WPI, has fallen to well below that of the headline rate. While the measure of core CPI inflation has also generally been below headline CPI inflation since 2012, it has remained at a high level.

The Role of Inflation in India's Monetary Policy

The WPI has been the main measure of inflation monitored by policymakers in India for several years, but the CPI is now assuming a more important role as the more widely consulted measure. In general, this shift reflects the fact that the WPI is not an ideal measure of inflation from the point of view of monetary policy.

In recommending that the RBI target headline CPI inflation, the Patel Committee cited a number of reasons. First, the fact that prices in the wholesale market are not purely producer prices or consumer prices makes the WPI difficult to interpret. Indeed, to the extent that there are significant variations in retailer mark-ups, wholesale prices may not provide a reliable gauge of aggregate inflation.[10] Second, the WPI does not capture movements in the prices of services, which constitute about 60 per cent of gross value added in the Indian economy. Third, the use of the CPI in wage contracts and negotiations, and as a reference for the provision of welfare benefits, means that it is relatively well known to the public and therefore more likely than wholesale prices to guide the formation of inflation expectations of workers and consumers. Finally, as it provides a measure of the cost of living, the CPI more appropriately captures the welfare implications of price changes.

10 Reserve Bank of India (2014c) also notes that the CPI is typically subject to fewer revisions than the WPI, which enhances the practical usefulness of the CPI as a measure of inflation both for the public and for monetary policy purposes.

The Patel Committee proposed the adoption of a target rate of consumer price inflation of 4 per cent (+/–2 per cent) over a two-year horizon, largely on the basis of empirical evidence suggesting that inflation above 6.2 per cent was harmful to growth and the observation that, historically, estimates of the output gap had been close to zero during periods when average CPI inflation had been around 4 per cent. It also drew on the experiences of inflation-targeting emerging economies, including those documented by Jonas and Mishkin (2003). However, India's rate of consumer price inflation is currently over 7 per cent, which is well above the target rate of 4 per cent, so the Patel Committee has recommended targeting a gradual reduction in inflation over the next two years (referred to as the 'glide path'). Specifically, it recommends targeting 8 per cent inflation by the start of 2015, 6 per cent inflation by the start of 2016, and formally adopting the 4 per cent target thereafter.

In its 'First Bi-monthly Monetary Policy Statement 2014–15', the RBI announced the official adoption of the CPI as its key measure of inflation (Reserve Bank of India 2014a). In the same statement, the RBI also adopted the 'glide path' for inflation recommended by the Patel Committee, although no announcement about adopting a formal inflation target has been made to date.

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Trading in Treasury Bond Futures Contracts and Bonds in Australia

Belinda Cheung*

Treasury bond futures are a key financial product in Australia, with turnover in Treasury bond futures contracts significantly larger than turnover in the market for Commonwealth Government securities (CGS). Treasury bond futures contracts provide a wide variety of market participants with the ability to hedge against, or gain exposure to, interest rate risk. This article discusses some of the features of the Treasury bond futures contract, and how the contract is used to facilitate hedging activities and management of bond inventories by bond dealers.

Introduction

Australian Treasury bond futures are interest rate derivatives traded on the ASX 24 market. Treasury bond futures contracts in Australia differ from government bond futures contracts in most other countries in that they are not settled at contract expiry by the delivery of a security, but rather are settled in cash. The settlement amount is based on the average price of a basket of CGS on the expiry date of the futures contract. Since they are highly liquid products that trade anonymously on an exchange, Treasury bond futures are widely used by investors to hedge interest rate risk or gain interest rate exposure. However, many participants replace this initial interest rate exposure with a position in a physical asset, such as CGS or another bond, through 'exchange for physicals' (EFP) trading. In an EFP trade involving a bond, one party buys the bond and sells an offsetting position in futures contracts referencing that asset to the same counterparty.

Characteristics of Treasury Bond Futures Contracts

A bond futures contract is a standardised, exchange-traded derivative contract to buy or sell bonds of a particular maturity on a future date for a price that is agreed today. When an investor takes a position in the market by buying a futures contract, the investor is said to have a *long* position. Conversely, if the investor's opening position is the sale of a futures contract, the investor is said to have a *short* position.

The Australian Treasury bond futures market consists of contracts representing two bond maturities: three years and ten years (Table 1). Consistent with most financial futures contracts, bond futures contracts expire in March, June, September and December. This means that at a predetermined time in the contract expiration month, the contract expires and a price for settlement of the contract is determined by the exchange. Contracts are created around six months before expiration, so there are typically two bond futures contracts available for each bond maturity. The settlement price that is determined by the exchange is based on the value of a hypothetical bond with a coupon of 6 per cent per annum (determined separately for 3- and 10-year maturities) (ASX 2013).

In determining the price of the hypothetical bond, ASX references a basket of CGS bonds, with the bond basket selected and announced by ASX before the contract is created.[1] ASX specifies the design of the

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1 For example, the 3-year bond futures basket expiring in September 2014 is composed of CGS that mature in February 2017, July 2017 and January 2018.

Table 1: Characteristics of Treasury Bond Futures Contracts

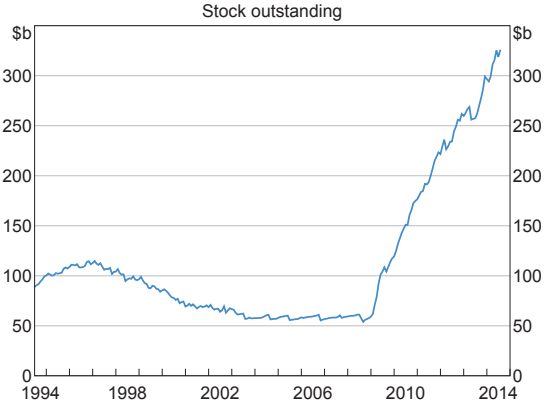
Bond maturity	3 and 10 years
Contract unit	Face value of $100 000 with a coupon of 6 per cent per annum
Contract months	March, June, September and December
Reference basket	Specified by ASX
Last trading day	Fifteenth day of the contract month
Settlement price	The price of a bond paying a 6 per cent annual coupon with a yield corresponding to the average yield of the underlying reference bonds
Settlement day	The business day following the last day of trading
Settlement method	Cash settlement only
Maximum number of open positions at expiry	28 500–37 500 contracts

Source: ASX

Treasury bond futures contract, such that there are at least three bonds in each basket and that the average term to maturity of the basket is close to the stated maturity of the futures contract. This enables the contract to be used as a hedge against several CGS bonds. As the bond futures price is a composite of the underlying bonds, the basket structure ensures that concentrated positions in individual securities do not unduly affect the pricing of the futures contract. This consideration was particularly important during much of the 2000s, when CGS on issue was low (Graph 1).

As noted previously, Treasury bond futures contracts are settled in cash rather than by the delivery of securities in the reference basket. On the contract expiration date, the final settlement yield is determined by reference to yields for the CGS contained within the relevant 3- and 10-year bond baskets. The average indicative yield of the reference bonds underlying the contract is taken at 9.45 am, 10.30 am and 11.15 am based on live market prices from recognised electronic trading venues (ASX 2014a). Prior to the September 2014 expiry, ASX based the settlement price on a survey of eight price makers in the CGS market. Survey participants each submitted the price at which they would buy and sell the basket of bonds for that contract month, with the two lowest and highest buying and selling quotes excluded from the calculation of the trimmed mean.

Graph 1
Commonwealth Government Securities
Stock outstanding



Source: AOFM

In other jurisdictions, bond futures contracts are typically deliverable (Table 2). This means that if a bond futures contract is held until expiry, the buyer must take delivery of any security in the reference basket (the seller of the contract chooses which security to deliver). Conversion factors are specified by the exchanges for each of the bonds in the reference basket with a view to market participants being indifferent as to which bond is delivered. However, because of the different durations of the deliverable bonds, these conversion factors never fully achieve this aim and one security becomes the cheapest-to-deliver (CTD) bond and is generally delivered at expiry.

Table 2: Settlement Conventions of 10-year Government Bond Futures Contracts

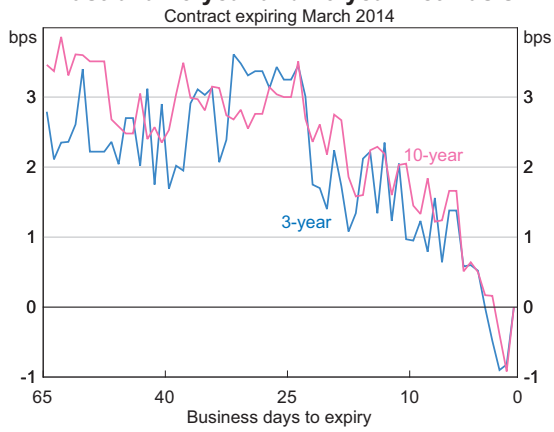
	Settlement convention
US Treasury note futures	Physical delivery
Japanese government bond futures	Physical delivery
Euro-Bund futures	Physical delivery
UK Gilt futures	Physical delivery
Australian Treasury bond futures	Cash settlement

Sources: ASX; Bloomberg

Since 2004, ASX has applied position limits to bond futures contracts in the period prior to contract expiry in order to minimise the likelihood that position concentration leads to market disorder at expiry. These expiry concentration position limits apply to the maximum number of net open positions in bond futures contracts that can be held by an investor (defined at an aggregated, corporate group level) from the close of trading on the day prior to expiry until the expiration of the contract. In March 2014, ASX increased these position limits by 50 per cent for both the 3- and 10-year bond futures contracts, mainly reflecting the increase in the amount of CGS outstanding (ASX 2014b).

Close to expiry, the difference between the price of the bond futures contract and the average price of the underlying bond basket – known as the net basis – tends to converge to zero, so that the value of the futures contract is equivalent to the value of the underlying CGS bonds. However, the net basis can remain non-zero even in the period immediately prior to contract expiry (Graph 2). This can reflect a number of factors, including the concentration limits noted above, wide variations in the prices at which dealers are prepared to buy and sell securities in the underlying bond basket (known as the bid-ask spread), low market liquidity and/or high transaction costs (e.g. trading or custody fees, or capital charges) (Lien 2012). Internal risk limits for each institution may also limit the ability of market participants to exploit arbitrage trading opportunities.

Graph 2
Australian 3-year and 10-year Net Basis
Contract expiring March 2014



Sources: RBA; Thomson Reuters

The Futures 'Roll'

Most market participants will not choose to hold the futures contract until expiry of the contract. The majority of participants will switch from their existing holding in the expiring or 'front' contract into the 'back' contract, in order to maintain this interest rate exposure.[2] To do so, an investor in an expiring futures contract must close out its position in the front contract and simultaneously execute an offsetting trade in the back contract. The process whereby open positions in the front contract are closed out and moved (or rolled over) to the back contract is known as the futures 'roll'. Reflecting this activity, the period leading up to the expiry of a contract is typically the time when futures trading, and therefore liquidity, shifts from the expiring contract to the next contract.

The value of a futures roll is determined by comparing the prices of both the front and back futures contracts, relative to the prices implied by the baskets of bonds underlying the respective futures contracts. If the futures price differential is lower than the price implied in the underlying physical market, the futures roll is considered to be cheap. The implied price is ascertained by computing the difference between the average yield on the basket

2 The contract with the closest settlement date is called the front futures contract; the back futures contract is the one that settles just after the front futures contract.

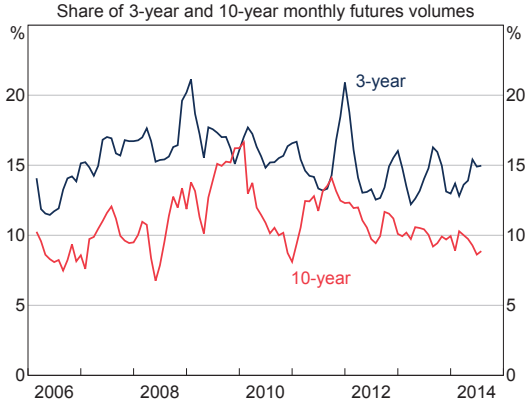
of bonds for the front contract and the average forward yield on the basket of bonds for the back contract. The use of the forward yield for the back contract reflects the need to take into account the net cost of funding the bonds until the expiry of the futures contract. Differences in the price of the front and back contracts can arise due to differences in the composition of the bond basket underlying the contract and the slope of the yield curve.

Exchange for Physical Trading

One consequence of the bond futures contract in Australia being settled in cash is that an investor wanting to convert a long futures position into an outright bond position cannot simply hold the futures contract until its expiry and expect CGS to be delivered. This means that having established their desired interest rate risk exposure in the more liquid futures market, the investor could then enter into an EFP transaction in order to take possession of the bond at the desired future date. An EFP is a bilateral transaction whereby one party buys physical assets and sells futures contracts, while the other party performs the opposite transaction. The physical asset in an EFP trade can be a debt security (such as CGS, semi-government bonds or corporate bonds) or another type of interest rate derivative, such as an interest rate swap.[3] An EFP transaction does not occur on the exchange, but is reported to ASX. Where the physical asset is a bond, EFP trading facilitates delivery of securities and, more importantly, simplifies trading between securities and futures contracts, otherwise known as basis trading.[4]

During August 2014, EFP trades represented around 10 per cent of turnover in 10-year bond futures, and 15 per cent of all 3-year bond futures turnover volumes (Graph 3). Much of the volatility in EFP volumes is associated with the quarterly futures roll.

Graph 3
EFP Trading
Share of 3-year and 10-year monthly futures volumes



Source: ASX

Market participants that wish to transact on an EFP basis must find a counterparty willing to take the other side of the EFP transaction. Usually this will be an interbank price maker in CGS, though it could be any counterparty with a futures account with which the market participant is able to transact. The market participant must execute the EFP transaction through a broker approved by the exchange.[5] The physical securities traded do not have to be the reference securities in the futures basket. Once negotiations for the exchange of offsetting physical and futures positions are complete, the trading participants must report the transaction to ASX. The futures leg of the EFP needs to be approved by ASX and is subsequently entered into the clearing process of the futures exchange, as well as being announced on the exchange. To be approved by the exchange, transaction details submitted by each counterparty must match, and the value of the offsetting physical and futures legs must be similar.

In the absence of EFP, basis trading could require trading of the entire CGS basket to replicate the futures settlement price exposure. For example, to close a basis trading position, an investor might have to buy or sell all of the relevant securities in the CGS bond basket in the secondary market. More generally, EFP trading involving bonds allows specific

3 For the full list of physical assets that can be traded against bond futures in an EFP trade, see ASX 24 Notice No 202/13, available at <http://www.sfe.com.au/content/notices/2013/notice2013_202.pdf>.

4 Basis trading is an arbitrage trading strategy that involves simultaneously trading a futures contract and holding an offsetting position in the underlying physical instrument.

5 A single trading participant can be the broker for both sides of the EFP transaction.

bonds or baskets of bonds to be traded against a single futures contract. Alternatively, a number of different futures contracts can be traded against a single bond.

While some market participants use bond futures in preference to investing in other assets to gain interest rate exposure, many use futures as a temporary source of interest rate exposure. For example, the investment manager of a fixed-income investment fund that has received a large inflow of funds could buy bond futures to efficiently gain the desired interest rate exposure; then later, unwind this position using EFP transactions to gradually establish the desired position in the underlying fixed-income securities. In addition, bond issuers (or their underwriters) can use bond futures to hedge moves in interest rates between announcing the issuance and finalising the price of the bond. In the interdealer market, EFP transactions are predominantly used for managing basis risk, which arises when there is a mismatch between the price of the bond being hedged and the price of the futures contract. For example, bond dealers may establish short futures positions to hedge the interest rate risk on their inventory of bonds. To reduce basis risk between holdings of bonds and futures, the dealer would need to enter an EFP trade to sell bonds and buy futures. In addition, bond dealers use quotes for EFP transactions to mark-to-market their end-of-day positions, since EFP quotations act as a pricing convention across which all products can be marked.

EFP use by bond issuers

Corporate issuers and state borrowing authorities can also use EFP trades as an alternative to interest rate swaps when locking in interest rates ahead of their bond issuance. If an issuer decides to raise funds by issuing a bond, an increase in interest rates between the day the issue is announced and the day the bond issue is actually priced leads to an implicit loss in the form of higher interest payments over the life of the bond (this gap between announcement and issuance may be up to one week or possibly longer). To mitigate this risk, the issuer might sell bond futures today that are equivalent to the planned issuance. On the day the issue is priced, the issuer then engages in an EFP trade with the bank (or syndicate) in charge of the sale of the bond, which would entail the bank buying physical bonds from the issuer and selling back the futures hedge. The bank would then own the issued bonds and also have a short futures position. Subsequently, the bank could then sell the issued bonds to investors, and buy futures in order to hedge this sale (either on an outright or EFP basis).

The issuer must determine the number of futures contracts that are required in order to hedge the issuance. It will aim to ensure that the dollar value of a 1 basis point change in the yield (DV01) of the issuance is matched by the DV01 of the futures contract. By equating the DV01 of the futures leg and the physical leg, the issuer is able to hedge much of its interest rate risk. The dollar change in the price of a bond (or a futures contract) for a 1 basis point change in yield can be calculated by first noting the price of the bond (or futures contract) at a given yield, and then recalculating the price given a 1 basis point change in yield. These amounts vary depending on the level of yields and the direction of the change.

While the issuer may not have a perfect hedge (owing to the lack of futures contracts on its own issuance) to the extent that changes in the yield of its own bonds move in line with changes in CGS yields, much of the interest rate risk can be hedged using Australian Treasury bond futures. For example, suppose that CGS yields have risen and that the market continues to price the corporate issuer's debt at the same margin to government securities. The rise in yields would generate an implicit loss on the corporate issuance. However, if the yield on the futures hedge has risen by the same amount as the yield on the benchmark CGS, an offsetting gain is generated for the issuer on its short futures position. On issuance, the issuer can unwind this futures leg via an EFP trade.

Managing dealer inventory

Market liaison suggests that EFP trading is most common in the interdealer market. Bond dealers execute trades by matching buyers and sellers of securities in the wholesale market. For example, should a client (such as a fund manager) wish to sell a large number of bonds, a dealer could buy these bonds for its own inventory or sell some of the bonds to other clients. Securities issued by the state governments ('semis'), for example, can be traded on an EFP basis. Although the underlying characteristics (e.g. credit risk) of semis differ from those of the CGS underpinning the Australian Treasury bond futures contract, futures are used by dealers to hedge the interest rate risk of the semis they hold in their inventory.

For example, a bond dealer may wish to reduce its position in the New South Wales Treasury Corporation (NSWTC) February 2018 bond, which has a coupon of 6 per cent. The bond dealer approaches another dealer in the market to sell the physical bond in exchange for buying futures. Suppose the NSWTC February 2018 bond is currently trading at a yield of 3.49 per cent, and the 3-year Australian government bond futures contract is currently trading at a price of 97.0 (implying a yield of 3.0 per cent). The dollar change in price for a one basis point change in yield on $10 million of the NSWTC securities is $3 683. Each contract has a DV01 of $29.95. Consequently, 123 contracts would need to be exchanged in order to hedge the sale of $10 million of NSWTC securities. The terms of the EFP transaction, from the dealer's perspective, are shown in Table 3.

In this case, the dealer has effectively reduced its position while simultaneously divesting (or squaring up) its accompanying futures hedge.

Conclusion

Well-functioning interest rate futures markets are beneficial for financial markets and the economy more generally as they facilitate the pricing of other financial instruments and the hedging of interest rate risk exposures. The characteristics of the Australian Treasury bond futures contracts are designed to deal with the relatively small size of the physical market for CGS. Treasury bond futures are widely used because they provide financial market participants with a relatively easy and cost-effective means of managing interest rate risk. EFP trading has evolved to deal with some of the idiosyncrasies of Australia's bond futures contracts, and it is commonly used by a broad range of market participants.

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Table 3: Stylised Example of Exchange for Physical Trade
Managing dealer inventory

Security	Trade	Coupon Per cent	Maturity	Price	Face value/ contracts	Effect of 1 basis point change in yield on price
Bond	Sell	6.00	1 February 2018	107.13	$10 million	$3 683
Futures	Buy	6.00	3 years	97.00	123 contracts	$3 683

Source: RBA

The Effective Supply of Collateral in Australia

Belinda Cheung, Mark Manning and Angus Moore*

High-quality assets play an important role as collateral for a wide range of transactions and activities in wholesale financial markets. Regulatory changes since the global financial crisis are increasing the demand for high-quality assets, thereby raising concerns about possible collateral shortages. This article attempts to quantify the 'effective' supply of collateral assets in Australia by using a measure of supply that adjusts outstanding issuance for two important features of the collateral market. One feature is that a large proportion of Australian high-quality assets is held by long-term investors that do not make these assets available for sale, loan or use in repurchase agreements. A second feature is the ability to re-use collateral assets, thereby allowing a single piece of collateral to meet multiple demands. Using a new survey that adjusts for these features, the current effective supply of Australian government debt for collateral purposes is estimated to be around $128 billion, comprising around $80 billion of active supply that is re-used on average 1.6 times. This amount would appear to be sufficient to support current demand for collateral.

Introduction

Fundamental changes are under way in the functioning of wholesale financial markets. These are driven in part by regulatory reforms since the global financial crisis, as well as by behavioural changes in response to lessons learned during the crisis. One important change has been an increased emphasis on high-quality assets, both within the regulatory framework and in market conventions and practices. A range of new regulations, such as those that require banks to maintain higher levels of liquidity and those that promote increased collateralisation in derivatives markets, are likely to increase market participants' demand for high-quality assets substantially.

These changes have raised concerns about localised collateral shortages. The focus of most studies of collateral supply and demand to date has been the level of outstanding issuance of high-quality assets. But it is important that policymakers and market participants understand the extent to which some of these assets are held by investors that do not make them available to meet collateral demands. They also need to consider how changes in regulation and market practices could alter the way that collateral assets circulate through the system. Adjusting for these factors will deliver an estimate of the 'effective' supply of collateral assets.

This article focuses on the use of high-quality assets for collateral purposes. It first introduces the role of collateral in financial markets and describes some of the changes occurring. With particular reference to Australia, it examines current and potential future developments in collateral use and considers the effective supply of high-quality collateral assets to meet current and future demand. To better understand the functioning of collateral markets in Australia, and to help to quantify the current effective supply of collateral assets, the RBA surveyed the 20 largest securities dealers in Australia on their institutions' collateral market activity.

* Belinda Cheung is from Domestic Markets Department, Mark Manning is from Payments Policy Department and Angus Moore is from Economic Research Department. The authors would also like to acknowledge the valuable input to this article from a number of colleagues, and in particular Matthew Boge and Nicholas Garvin.

Collateral Use in Wholesale Markets

The basic role of collateral is to manage counterparty credit risk. Several typical attributes of collateral make it an effective tool for doing so. Collateral provides reliable and timely protection in the event of a default and provides a senior claim in bankruptcy. Compared with an unsecured exposure, collateral alleviates the information asymmetry between the borrower and lender regarding the borrower's creditworthiness, because the lender's principal interest is in the quality of the collateral. Relatedly, collateral helps to align the incentives of borrowers and lenders: unsecured borrowers may have an incentive to take riskier decisions since the risk is ultimately borne by the lender; secured borrowers, by contrast, risk losing their collateral.

Accordingly, collateral assets in wholesale markets are typically of high quality – that is, assets with low credit, market and liquidity risks – so they would be expected to retain their value and could be liquidated on a timely basis should the counterparty default. For instance, repurchase agreements (repos), the most common form of collateralised lending in wholesale markets (see 'Box A: The Legal Basis for the Exchange of Collateral'), are typically contracted against a defined set of high-quality assets. In Australia, most repos are contracted against 'general collateral', which includes Commonwealth Government securities (CGS) and securities issued by the states and territories ('semi-government' securities). Currently, around 85 per cent of repos outstanding are backed by government-related securities and most repos have maturities of less than 14 days.

The repo market is the most significant venue for the exchange and circulation of high-quality assets in the domestic financial market, and it plays an important role in institutions' funding and liquidity management activities. Active participants in the domestic repo market include securities dealers – typically large domestic and international banks that are market makers in domestic government securities – as well as some smaller institutional non-dealer participants and the RBA (Wakeling and Wilson 2010). Two of the most significant areas of repo market activity in Australia are:

- *RBA operations*. Repos offer a flexible instrument for the RBA to manage the total amount of outstanding Exchange Settlement Account (ESA) balances in the banking system so as to keep the cash rate as close as possible to the target set by the Reserve Bank Board. By executing repos with its counterparties, principally as a cash provider, the RBA manages the aggregate of institutions' ESA balances. As at August 2014, repos with the RBA accounted for around 30 per cent of outstanding repo market positions.[1]
- *Market making in government securities*. Securities dealers are major participants in the Australian repo market. As market makers in domestic government securities, dealers match buyers and sellers of the same security, or – when timing mismatches arise – buy and sell for their own account. The repo market facilitates this activity. In particular, dealers are able to fund their inventory of securities by selling them under repo. Selling securities under repo allows dealers to raise funding without having to liquidate outright positions; alternatively, a dealer can source funding internally from its treasury desk. The principal provider of cash to the Australian repo market is the RBA. Dealers may also use repos to borrow securities they have agreed to sell to their customers. Much of this activity – around 20 per cent of outstanding repo positions – occurs between securities dealers. Investment funds and other non-dealer institutions are also providers of securities to securities dealers. These institutions typically use repos to manage their short-term funding without selling their high-quality assets outright.

1 This excludes banks' 'open repos' with the RBA for the purpose of meeting settlement obligations.

Securities lending activity also supports the circulation of high-quality assets in wholesale markets. While in many ways similar to repo activity, securities lending is typically driven by the need to hold a particular security – often to meet a margin requirement or to cover a short sale or a failed settlement. Loaned securities are usually sourced from investment funds or superannuation funds. These funds typically operate via custodian banks that act as securities lending agents. In the Australian securities lending market, most loaned securities are equities, with only around a third of securities loans involving fixed income securities (Markit 2013). Loans may be collateralised by cash or other non-cash assets (subject to a haircut). Securities lending agents then reinvest cash collateral received.

Clearing via central counterparties (CCPs) is another source of collateral demand. CCPs help to manage counterparty credit risk in a wide range of markets, including equity, fixed income and, increasingly, over-the-counter (OTC) derivatives markets (see section below).[2] To manage the financial exposure it assumes in carrying out its function, a CCP collects collateral from its participants: variation margin, to cover observed changes in the mark-to-market value of participants' open positions; and initial margin, to manage potential future price changes before an exposure to a defaulted participant's position can be closed out. CCPs also typically collect collateral from participants to fund a buffer of pooled financial resources in case a defaulted participant's margin proves insufficient.

The collateral used to meet CCPs' margin requirements may take the form of cash or non-cash assets. Variation margin is generally always met in cash, since it is typically passed through from the participant with a mark-to-market loss to the participant with a gain. Initial margin requirements, on the other hand, may be met using cash or high-quality assets.[3] In Australia, cash is commonly posted to meet initial margin requirements at the two domestic CCPs (ASX Clear and ASX Clear (Futures)).[4] In the year to the end of June 2014, on average, 57 per cent of initial margin obligations at ASX Clear were met with non-cash assets, primarily liquid equities; at ASX Clear (Futures), only 2 per cent were met with non-cash assets.

Collateral can also be exchanged between counterparties to non-centrally cleared OTC derivative contracts. To date, this has typically involved only the exchange of variation margin. Initial margin has not been widespread, although this is changing (see section below).

The Increasing Demand for High-quality Assets

Non-regulatory demand for high-quality assets has been increasing as investors have shifted towards more collateralised lending. However, recent and upcoming regulatory changes are also driving an increase in the demand for high-quality assets for both collateral and non-collateral purposes (Heath and Manning 2012).

Increased demand for collateral purposes

The most significant regulatory changes relate to the way counterparty risk is managed in the OTC derivatives market. While central clearing has long been a source of collateral demand, the range of products covered by CCPs' activities is expanding. Since the global financial crisis, the move to central clearing of OTC derivatives has accelerated following the G20's commitment in 2009 to ensure that all standardised OTC derivatives are centrally cleared. Mandatory central clearing of certain interest rate

2 A CCP stands between the buyer and seller in a financial market transaction. The CCP guarantees that if one party was to default on its obligations to the CCP, the CCP would continue to meet its obligations to the other.

3 Recently introduced international standards clarify requirements around the size and composition of CCPs' pooled financial resources, and also set expectations around eligible non-cash collateral and the reinvestment of cash collateral (CPSS-IOSCO 2012). The Australian Securities and Investments Commission and the RBA have implemented these standards in Australia.

4 ASX Clear provides CCP services for equities and equity options; ASX Clear (Futures) clears exchange-traded futures and OTC derivatives.

Box A
The Legal Basis for the Exchange of Collateral

There are several mechanisms by which collateral is exchanged in financial markets. The particular mechanism used may have implications for the rights and obligations of contracting parties and also for how collateral assets then flow through the system.

- *Repo*. Under a repo contract, one party sells a security to another at a price today, committing to repurchase that security at a specified future price and date; the difference between these prices reflects the interest rate paid by the securities provider to borrow cash. Legal title to the collateral passes to the cash provider for the duration of the repo agreement, while the economic benefits are retained by the securities provider. Since legal ownership of the security is transferred, the cash provider has an automatic right to re-use the securities. Repo transactions are generally agreed under industry standard documentation, typically the Global Master Repurchase Agreement. The master agreement governs the transaction, establishing the rights and obligations of the contracting parties.
- *Securities lending*. In a securities lending transaction, legal title to the security is transferred from the lender to the borrower for a specified period of time in exchange for collateral and in return for a fee. Economic benefits reside with the securities borrower. In many ways, where a securities loan is supported by cash, the transaction is economically equivalent to a repo. Securities lending transactions are, however, governed by different industry standard documentation. In Australia, securities lending transactions are typically governed by the Australian Master Securities Lending Agreement. This documentation details matters such as the lender's right to recall the securities and any voting rights attached to the loaned security.
- *Security interest*. The mechanism for securing derivatives transactions differs among jurisdictions. However, a common approach is to grant a security interest over collateral assets. As an example, a pledge is a type of security interest under which the security giver, the pledgor, creates an interest over the collateral in favour of the security taker, or pledgee. The pledge agreement may impose certain duties, conditions and restrictions on the pledgee's use of the collateral. For example, since the pledgee only has a partial and limited security interest, collateral may need to be held in a segregated account. It is often the case that the pledge is governed by a bilateral contract between the pledgor and pledgee.

The term 're-use' covers a broad category of transactions, where securities delivered as collateral supporting one transaction are then used to collateralise another transaction. The term 'rehypothecation', a form of re-use, is used in a narrower context to refer to the right of a financial intermediary to sell, pledge, invest or perform other transactions using a client's assets.

As discussed later in this article, whether or not collateral is re-used is important for how high-quality collateral assets circulate through the system. In particular, this has implications for the 'effective' supply of collateral assets.

and credit derivatives is already in place in some jurisdictions, including the United States. And, under the Basel bank capital regime, there are incentives to centrally clear derivative positions. Almost two-thirds of the outstanding value of interest rate derivatives globally (the largest segment of the OTC derivatives market) is therefore now centrally cleared. Since non-centrally cleared trades typically did not previously involve either side posting initial margin, the transition to central clearing has been accompanied by an increase in the demand for, and use of, high-quality assets.[5] In Australia, in response to recommendations from the Australian Prudential Regulation Authority (APRA), the Australian Securities and Investments Commission (ASIC) and the RBA, the government has consulted on a proposal to adopt mandatory clearing for interest rate derivatives denominated in the major currencies and the Australian dollar (Australian Treasury 2014).

The proportion of non-centrally cleared derivatives transactions that is collateralised, at least with variation margin, has also increased significantly over the past decade. This has occurred both in Australia and internationally, particularly since the global financial crisis. A recent survey by the International Swaps and Derivatives Association reports that, globally, around 90 per cent of non-centrally cleared transactions in credit, fixed income and equity derivatives are subject to a collateral agreement (ISDA 2014). From December 2015, collecting both variation and initial margin on non-centrally cleared transactions will become a mandatory requirement globally for transactions between certain counterparties. The government, in consultation with APRA and ASIC, is considering how these requirements may be implemented in Australia.

Increased demand for non-collateral purposes

At the same time, regulatory changes are increasing the demand for high-quality assets for purposes other than collateral requirements. Such competing demands are relevant for the availability of high-quality assets to meet institutions' collateral needs. In particular, the Liquidity Coverage Ratio (LCR) introduced under the Basel III reforms requires that banks hold an amount of specified high-quality assets sufficient to withstand 30 days of outflows in stressed market conditions. In the Australian context, APRA has defined these high-quality 'liquid' assets (HQLA) to comprise reserve balances with the RBA, CGS and semi-government securities. Banks have already begun to adjust their high-quality asset holdings in anticipation of the regulations formally taking effect in 2015. The share of liquid assets on Australian banks' balance sheets has risen to more than 10 per cent of banks' total assets since the global financial crisis, with the proportion of these held in CGS and semi-government securities increasing from just 10 per cent to almost 45 per cent.[6]

Estimates of increased demand for high-quality assets

There have been a number of attempts to quantify the implications of some of these regulatory developments for the demand for high-quality assets in a range of markets globally. Estimates of the implications of central clearing and margining of non-centrally cleared derivatives are sensitive to assumptions about the volatility of cleared products, the proportion of OTC derivatives trades that will eventually transition to central clearing, and the extent to which trades will be fragmented across multiple CCPs (Table 1). Several studies have emphasised the greater scope for collateral efficiency if trades are centrally rather than non-centrally cleared (Heath, Kelly and Manning 2013). These studies also

5 In addition, the international standards for CCPs require segregation of client assets. These additional protections have the effect of increasing collateral demand, since they reduce the scope for netting against client positions.

6 This is based on data for March 2014 from the Australian Bureau of Statistics, APRA and the RBA. In this context, the definition of liquid assets is wider than APRA's definition of HQLA.

Table 1: Estimates of International Demand for High-quality Assets

Source	Coverage	Range of Estimates
Duffie, Scheicher and Vuillemey (2014)	Subset of the OTC credit derivatives market: initial margin.	4.5–8 per cent of net notional outstanding, depending on the market structure used. A number of alternatives are considered.
CGFS (2013)	Global: LCR; initial margin for (centrally cleared and non-centrally cleared) OTC derivatives.	Estimated increase of US$4 trillion.
Capel and Levels (2012)	Euro area: LCR; initial and variation margin for (centrally cleared and non-centrally cleared) OTC and exchange-traded derivatives; Eurosystem operations; repo market activity.	€4.7 trillion by the end of 2014. This reflects an estimated increase of €2 trillion between 2012 and 2014.
Heller and Vause (2012)	Largest 14 global dealers: initial margin for centrally cleared OTC interest rate and credit derivatives.	Separate CCP for each asset class (high volatility scenario): US$107 billion for credit derivatives; US$43 billion for interest rate derivatives. The estimates vary significantly according to the chosen volatility level.
ISDA (2012)	Global: initial margin for non-centrally cleared OTC derivatives across all asset classes.	US$800 billion–US$1.7 trillion in normal market conditions, with firms using internal margin models to calculate requirements.
Sidanius and Zikes (2012)	Global: initial margin for centrally cleared and non-centrally cleared OTC interest rate and credit derivatives.	Between US$200 billion and US$800 billion, depending on the netting efficiency achieved by central clearing. This reflects an estimated increase of US$130 billion to US$450 billion from pre-reform levels of central clearing.

Source: RBA

highlight the efficiencies of concentrating clearing in one CCP or a few CCPs, rather than clearing in several CCPs operating in different markets or products (Duffie and Zhu 2011).

The same factors will determine the magnitude of the increase in collateral demand associated with the clearing and margining of OTC interest rate derivatives in Australia.

The notional value of Australian dollar-denominated interest rate derivatives outstanding is around $11 trillion, with Australian-headquartered participants accounting for around half of this amount. While the notional value outstanding is large, the increase in collateral demand arising from clearing these derivatives may be relatively small.[7] Indeed, since most new trades are already being centrally cleared ahead of a mandatory requirement, the increase in demand has to an extent already been accommodated. Some participants, particularly non-dealers, may nevertheless face greater liquidity constraints. Non-dealers may also be more likely to have directional positions that cannot easily be netted. Accordingly, the Australian

7 Most global OTC interest rate derivatives are currently cleared by the SwapClear service operated by LCH.Clearnet Ltd. SwapClear currently holds around US$36 billion in initial margin against more than US$200 trillion in notional outstanding exposures, suggesting an effective initial margin rate of less than 0.02 per cent. Even allowing for less netting efficiency or higher market risk in Australian market positions than the average in SwapClear, the effective margin rate may be relatively low.

regulators' recommendation to the government was that the proposed scope of mandatory central clearing requirements should not extend beyond internationally active dealers.

The proposed coverage of international standards for initial margining of non-centrally cleared derivatives may limit the ultimate effect on collateral demand in the Australian market. The largest segments of the currently non-centrally clearable component of the Australian OTC derivatives market are foreign exchange derivatives and cross-currency swaps. Heath and Manning (2012) estimate that if initial margin requirements were imposed on foreign exchange derivatives positions, the additional collateral demand in the Australian market could be as much as $35 billion. An increase in collateral demand of this magnitude could impose costs and liquidity risks that would outweigh the benefits. Accordingly, consistent with treatment elsewhere, the RBA and ASIC argued that foreign exchange derivatives should be exempt from margining requirements under the international standards. These products were ultimately excluded from the scope of the new standards. Effective margin rates on positions in the other non-centrally clearable asset classes (credit, equity and commodity derivatives) will be much higher than for interest rate derivatives and the scope for netting potentially lower. However, Australian market positions in these asset classes are currently relatively small (APRA, ASIC and RBA 2014).

The Effective Supply of High-quality Collateral Assets

While the range of estimates is quite wide, the studies in Table 1 have typically concluded that a global shortage of high-quality assets is unlikely. CGFS (2013), for instance, notes that while demand for high-quality assets could increase by an estimated US$4 trillion as a result of regulatory changes, between 2007 and 2012 the supply of high-quality government securities increased by US$10.8 trillion.

Nonetheless, it is acknowledged that while the total supply of high-quality assets is important, the geographical distribution of that supply also matters. Localised shortages could arise. This may be particularly important for markets, such as Australia, that have a smaller supply of government debt outstanding. Furthermore, looking solely at the supply on issue will not fully capture the availability of high-quality assets to meet collateral needs.

The 'effective supply' of collateral is more indicative of both the availability of high-quality assets to support collateral dependent activities and the way these assets are used. Determining effective supply requires two important adjustments to a measure of the total supply of high-quality assets, with partially offsetting effects:

- *Active supply*. Many high-quality assets are 'locked away' in buy-and-hold portfolios and are unavailable for sale, loan or repo. They may alternatively be unavailable because they are held to meet certain minimum regulatory requirements. These assets may therefore be considered 'inactive' for collateral purposes.
- *Collateral re-use*. In many collateralised transactions, the collateral receiver has the legal right to re-use the collateral, particularly where the legal basis for provision of collateral is a transfer of title. Re-use allows a single piece of collateral to simultaneously support multiple demands and assists in intermediation between source providers of collateral assets and the ultimate users of those assets. The source provider of a collateral asset may be thought of as the starting point in a 'collateral chain', with the ultimate user the end point. For instance, CCPs do not typically re-use collateral received, other than in exceptional circumstances, such as the default of a clearing participant. While collateral re-use helps a participant in a CCP to access the collateral that it needs to meet the CCP's margin requirements (through, for instance, repo markets), the delivery of the collateral to the CCP is the end point in the collateral chain. Singh (2013) describes the important role of collateral re-use – which he terms 'collateral velocity' – in supporting wholesale financial market activity.

Securities dealers have traditionally relied significantly on their ability to re-use collateral received under repo from institutional investors for a range of activities, including: supporting their market-making activity in the government bond market; raising short-term funding and managing short-term liquidity needs; meeting other market participants' demand for high-quality assets; and matching repo or derivatives trades between clients.

Taking into account these two adjustments, the effective supply of collateral may be calculated by first subtracting the inactive component from the total supply of high-quality assets on issue to yield the 'active supply', and then multiplying this active supply by an estimate of the number of times that each piece of collateral is re-used on average:

$$\textit{Active supply} \times \textit{re-use of collateral} = \textit{Effective supply}$$

$$\text{where } \textit{re-use of collateral} = \frac{\textit{(Total collateral use)}}{\textit{(Total source collateral)}}$$

Of course, even if there is sufficient effective supply of high-quality assets, accessing these assets may be more challenging or more costly for some institutions. For instance, where non-financial corporations or investors use derivatives markets only to hedge illiquid assets or future cash flows, increased collateralisation could be a source of liquidity risk (APRA *et al* 2014).

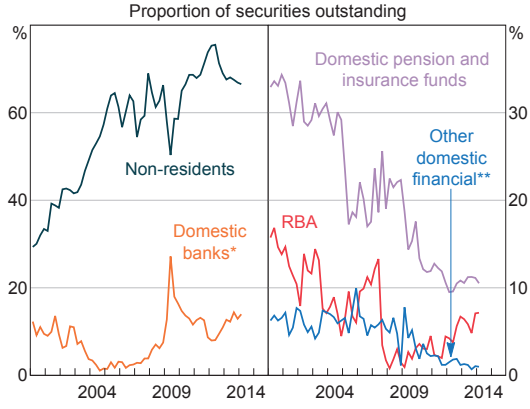
The Effective Supply of Collateral in Australia

Applying the concepts introduced above, this section attempts to estimate the effective supply of high-quality assets to meet collateral demands in Australia. This analysis focuses on the highest quality collateral issued in Australia: CGS and semi-government securities. As noted, these assets are currently the most commonly used form of non-cash collateral in Australia. This section begins with a discussion of the holders of Australian high-quality assets, which shows that a large proportion of Australian high-quality assets are held for non-collateral purposes and are not made available for collateral purposes. They are therefore not part of the 'active supply'. It then introduces data from a survey of Australian securities dealers' collateral market activity to help estimate the active supply of CGS and semi-government securities and the rate of collateral re-use.

Holders of Australian high-quality assets

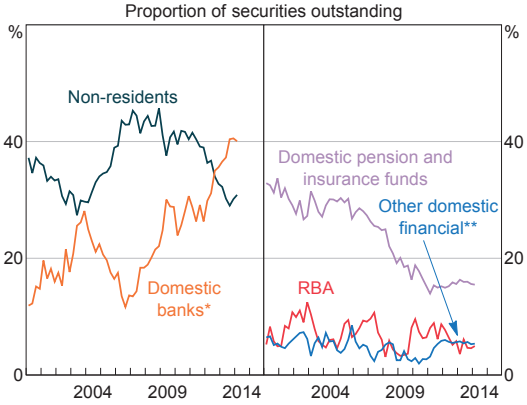
The majority of Australian high-quality assets are held by non-resident entities and domestic banks. The proportion of total CGS outstanding that is held by non-resident entities has grown substantially over the past two decades, to around two-thirds, or almost $230 billion of the more than $340 billion on issue, as at the end of March 2014 (Graph 1). Around 30 per cent of total issuance of semi-government securities, or more than $80 billion, is also held by non-resident entities (Graph 2). These entities typically do not use these assets for collateral-related activities and generally do not make them available for such activities. As a result, a very large proportion of Australian high-quality assets are inactive for collateral purposes.

Graph 1
Holders of Federal Government Debt
Proportion of securities outstanding



* Includes other domestic depository institutions
** Includes domestic investment funds
Source: ABS

Graph 2
Holders of State and Local Government Debt
Proportion of securities outstanding



* Includes other domestic depository institutions
** Includes domestic investment funds
Source: ABS

As noted, domestic banks' holdings of high-quality assets have risen markedly in recent years in anticipation of new liquidity regulations; banks' holdings of CGS have increased over tenfold from June 2008 – just prior to the height of the global financial crisis – to almost $48 billion, and their holdings of semi-government securities nearly fivefold to more than $100 billion. Given the dominance of non-resident investors and domestic banks, other domestic private sector investors (such as pension, insurance and investment funds) collectively hold only around 12 per cent of total issuance of CGS and around 20 per cent of semi-government debt.

A survey of Australian securities dealers' collateral use

To better gauge the effect of the developments described in this article on the functioning of the Australian collateral market and to assist in estimating both active supply and the rate of collateral re-use, the RBA surveyed the 20 largest securities dealers in Australia on their collateral market activity as at June 2014. A particular focus was collateral re-use.

To the extent that most collateral market activity involving Australian high-quality assets is intermediated by major securities dealers, a survey of these entities should provide a reasonable estimate of collateral use and re-use in the Australian market as a whole. The survey sought a breakdown of dealers' counterparties and also separately identified dealers' activities using the highest quality general collateral (GC 1) (Table 2).

As Table 2 shows, a material proportion of the collateral used by dealers draws on assets that these institutions own outright. Consistent with data cited

Table 2: Collateral Use and Re-use by Securities Dealers in the Australian Market[a]
Outstanding positions, $ billion, GC 1 securities,[b] June 2014

	Other survey respondents	Institutional investors	Other banks	Central banks[c]	Total[d]
Owned outright and pledged/repo'd/loaned to:	12.8	2.9	1.7	17.5	**35.0**
Received as collateral from:	20.7	17.1	11.7	0.3	**49.8**
Of which:[e]					
Received as collateral and pledged/repo'd/loaned to:	7.5	1.9	3.0	24.6	**37.1**

(a) Based on a survey of 20 securities dealers in the Australian repo market. Due to non response by some smaller entities, the reported numbers do not capture all collateral activity; as a result, the collateral received by survey respondents from other survey respondents does not balance exactly the collateral pledged/repo'd/loaned by survey respondents to other survey respondents.
(b) Includes actively traded CGS and semi-government bonds, Treasury notes and Commonwealth and state government indexed bonds; note that GC 1 assets are a subset of APRA defined HQLA, in that only actively traded CGS and semi-government securities are eligible for GC 1
(c) Includes the RBA and, to a small extent, foreign central banks
(d) Components may not sum to totals due to rounding
(e) Of total collateral received
Source: RBA

elsewhere (Wakeling and Wilson 2010), Table 2 confirms the high level of activity between securities dealers. Also, as expected, more than half of the collateral received by respondent securities dealers is provided by institutional investors and other banks, which includes securities lending agents acting on behalf of institutional investors. Table 2 also reveals that survey respondents used around $42 billion in CGS and semi-government securities in June 2014 to support their participation in the RBA's operations.[8]

The survey additionally sought information on collateral activities using the broader second tier of general collateral (GC 2), which includes some non-government-related securities. By comparison with the data on GC 1 assets, the use of GC 2 assets as collateral is much lower (less than $10 billion in total). This may reflect the tendency for haircuts on these assets to be higher. Of this, around $6 billion was used to support central bank operations.

Active supply of high-quality assets in Australia

Adjusting for the inactive component of the stock of high-quality assets may be particularly significant in the Australian context. This is because a large proportion of high-quality assets on issue is held overseas and understood to be held by long-term investors – largely official sector investors – that typically do not make their assets available for sale, loan or repo.

The survey data provide a basis for estimating how much of the outstanding supply of CGS and semi-government securities is currently 'actively used' as collateral – either under pledge, repo or a securities lending agreement. This is outlined in Table 3.

According to the survey data, banks and securities dealers currently actively use around $47 billion of CGS and semi-government securities that they own outright. Institutional investors, such as

Table 3: Holdings and Use of Australian Government Debt
'Holdings' data as at end of March 2014, 'actively used' data as at June 2014

	Holdings[(a)]		Actively used[(b)]
	$ billion	Per cent of total outstanding securities	$ billion
Banks and securities dealers	155.9	25.5	46.7
Institutional investors	95.6	15.6	17.1
Non-residents	310.9	50.8	
Other[(c)]	49.7	8.1	na
Total[(d)]	**612.0**	**100.0**	**63.8**

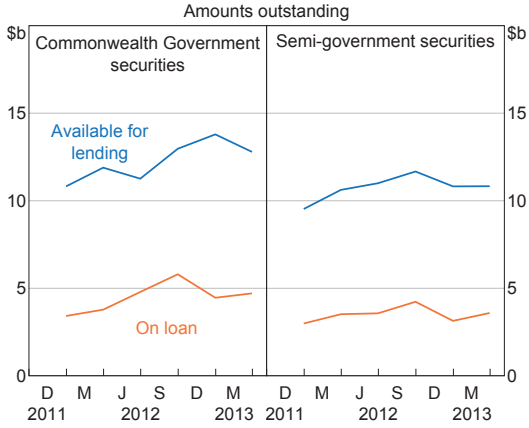
(a) Holdings refers to the securities held by the institution as at the reporting date. To the extent that securities have been pledged/repo'd/loaned to the institution, these would be included in the holdings figures. Accordingly, these data do not capture the sources of actively used high-quality assets, but rather the final end points of collateral chains.
(b) The data are drawn from data in Table 2 on securities owned outright and pledged/repo'd/loaned by respondent securities dealers, and securities received as collateral by respondent securities dealers (other than from other respondent securities dealers). Note that the breakdown of institution types in the survey data does not match precisely the breakdown in the data on holders of high-quality assets. Also, data on active use by institutional investors may be higher, and those for banks and securities dealers correspondingly lower, to the extent that use by banks and securities dealers captures intermediation of collateral use by institutional investors (e.g. banks acting as securities lending agents for institutional investors).
(c) Includes RBA, federal, state and local government, and public and private non-financial corporations
(d) Components may not sum to totals due to rounding
Sources: ABS; Data Explorers; Markit; RBA

8 The sum of the first row and third row of the fourth column of Table 2.

superannuation or insurance funds, provide around $17 billion of high-quality assets for collateral purposes. The current actively used supply is therefore around $64 billion, which is small relative to the outstanding supply of these assets.

The actual available supply of high-quality assets is, however, greater than that which is currently actively used. This includes securities committed to securities lending programs that are not currently on loan. The utilisation rate of government securities committed to lending programs is only around a third (Graph 3). These committed, but unutilised, securities should also be regarded as part of active supply.

Graph 3
Securities Lending in Government Debt
Amounts outstanding



Sources: Data Explorers; Markit

Adding the unutilised component of securities committed to lending programs to the $64 billion of currently actively used supply yields a total current active supply of around $80 billion, or around 13 per cent of total CGS and semi-government securities outstanding.

Collateral re-use and effective supply in Australia

Table 2 may be used to estimate the current rate of collateral re-use. The relevant metrics are:

- *Total source collateral*. This is equivalent to the current actively used supply, calculated above as around $64 billion.
- *Total collateral use*. This may be estimated from the sum of total source collateral (above) and total collateral received and then re-used by respondent dealers (i.e. the 'Total' in the third row of Table 2): around $101 billion.

The rate of collateral re-use may then be estimated by dividing total collateral use by total source collateral. This returns a rate of current re-use of a little under 1.6 times.

Applying this to the estimate of active supply derived earlier, $80 billion, yields a current effective supply of $128 billion. This is around 20 per cent of total outstanding issuance.

Changes in the Effective Supply of Collateral

Importantly, neither active supply nor re-use are fixed quantities. The regulatory changes identified above will have implications not only for demand, but also for the way that collateral circulates through the system and is ultimately used. Increased use of CCPs and greater segregation of derivatives-related client margin, for instance, will reduce the rate of re-use of collateral. More generally, market participants' responses to changes in relative prices, loan terms and repo rates will influence their investment and asset allocation decisions, potentially altering both active supply and the rate of re-use.

Potential changes in active supply

Active supply could, of course, change as the total issuance of high-quality securities changes, depending on how new supply is absorbed into the market. Over time, adjustments in relative asset prices could also create an incentive for some existing holders of high-quality assets to reallocate their portfolios. However, there is traditionally 'stickiness' in many investment mandates. Even price-sensitive investors may adjust with a considerable lag. Furthermore, some investors will naturally react slowly to price changes, perhaps because their fixed income investments are hedging long-term cash flows or other liabilities. Nevertheless, if loan terms or

repo rates on high-quality assets became attractive, some of these assets could be encouraged into securities lending programs or repo markets, and thereby become 'active'.

Although it is not possible to reliably predict how active supply will change over time in response to changing relative prices or changing loan terms and repo rates, some observations may be made:

- In the case of banks and securities dealers, there may be limited scope for additional government-related asset holdings to be actively used as collateral. As noted, the increase in these institutions' holdings is largely in anticipation of the formal introduction of the LCR. Accordingly, to the extent that relative prices encouraged banks to retain these holdings in government-related securities rather than ESA balances, they would need to remain unencumbered on banks' balance sheets. APRA has estimated that the LCR could generate a total demand for LCR-eligible assets in excess of $400 billion. If met entirely with government-related securities, this would require a substantial further increase in banks' holdings of these securities, to more than two-thirds of the total outstanding supply. Such an increase, if it was even possible, would cause significant disruption to the functioning of the market and adversely affect the liquidity of the market. Hence, it would be self-defeating. Given this, authorised deposit-taking institutions (ADIs) will be able to establish a committed liquidity facility (CLF) with the RBA to help meet these requirements (Debelle 2011). A related justification for the CLF is that, if a supply-demand imbalance left government securities too expensive, banks would meet the LCR using ESA balances with the RBA. This would have the potential to affect monetary policy implementation by making the demand for ESA balances unstable. With the CLF, the RBA commits to making available a pre-agreed amount of liquidity under repo against any securities that are eligible in the RBA's normal operations. This extends beyond CGS and semi-government securities.[9]
- Given the current very low active use of CGS and semi-government securities by institutional investors/non-residents as a proportion of their holdings, the release for loan or repo of a small additional proportion of these holdings could materially increase the active supply of these securities.

Potential changes in collateral re-use

Similarly, the rate of collateral re-use is not fixed. Faced with tightness in collateral markets, financial institutions could seek to re-use the collateral they receive more effectively. This may be supported by the emergence of centralised collateral management services and other technological or institutional advances that assist market participants in optimising their collateral use.

The scope to increase the rate of collateral re-use may at the same time, however, be limited by regulatory and behavioural developments. As noted, increased use of CCPs (and segregation of client assets at CCPs) will reduce collateral re-use since CCPs are end points in collateral chains. Restrictions on re-use in the forthcoming international standards for margining of non-centrally cleared derivatives will have a similar effect.

In addition, behavioural changes are important. With the experience of the default of Lehman Brothers there is increased awareness of the risks of rehypothecation and re-use of collateral. Some investors no longer permit the practice; others are restricting it and are requiring greater transparency of the activity. In a similar vein, investors are increasingly seeking better segregation of client assets and managing exposures to their agents more carefully.

9 ADIs will be charged a fee of 15 basis points for this commitment. The fee has been set to reflect the typical liquidity premium between assets eligible for the CLF and high-quality liquid assets, thereby leaving ADIs indifferent between meeting the LCR using high-quality liquidity assets to the extent available and doing so by establishing the CLF.

The effect of these developments has been observed in other markets. Singh (2013) reports that collateral re-use in the United States has fallen sharply since the global financial crisis. This has coincided with an observed decline in repo activity.

Discussion

At present, the current effective supply of high-quality assets would seem to be sufficient to support collateral demand. Current repo rates do not suggest that there is a shortage of securities available for repo and the utilisation rate of government-related securities committed to lending programs is relatively low. The Australian collateral market should be able to adapt to regulatory and market developments, including the incremental collateral demand arising from initial margining of non-centrally cleared derivatives, as well as both increased demand and potentially reduced re-use due to central clearing of OTC derivatives. Again, however, the distribution of eligible collateral holdings is important, and some market participants may still face liquidity constraints.

The analysis in this article supports the measured approach taken by the Australian authorities to the implementation of new regulations. The decision to permit ADIs to establish a CLF with the RBA to assist in meeting the new LCR requirement when it comes into force next year acknowledges the potential implications of these new requirements for the active supply of high-quality assets. The analysis also supports the Australian authorities' opposition to applying initial margin requirements to non-centrally cleared foreign exchange transactions, and the recommendation that mandatory central clearing requirements should not be extended to non-dealers. More generally, the RBA's collateral eligibility criteria for its market operations permit a broader range of assets to be used than the CGS and semi-government securities that are currently typically used. If market participants faced material collateral constraints, greater use could potentially be made of RBA-eligible non-government securities.

Finally, the article highlights the important role of collateral re-use in boosting effective supply, particularly in markets such as Australia with relatively low active supply. Seeking to address concerns around the financial stability risks associated with collateral rehypothecation and re-use by placing tight restrictions on such activity could therefore be counterproductive. This lends support to the findings of recent work by the Financial Stability Board, which instead focused on greater transparency of securities lending and repo activity and better disclosure to clients about the extent to which their collateral would be rehypothecated (FSB 2013). Data such as those collected by the RBA to inform this article could be a useful addition to policymakers' information set in this area.

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A Century of Stock-Bond Correlations

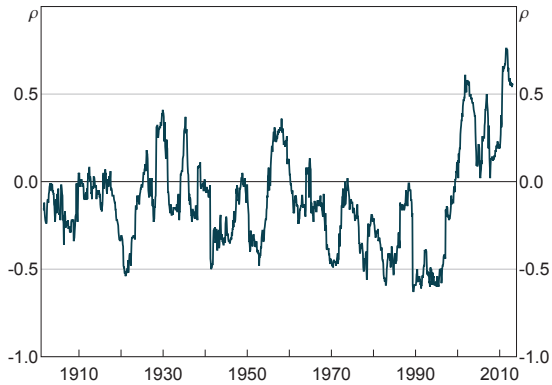
Ewan Rankin and Muhummed Shah Idil*

The correlation between movements in equity prices and bond yields is an important input for portfolio asset allocation decisions. Throughout much of the 20th century, the correlation between equity prices and government bond yields in the United States and other countries, including Australia, fluctuated but tended to be negative. However, stock-bond yield correlations have been largely positive since the late 1990s, rose strongly during the global financial crisis and have since remained at a high level for a prolonged period. The more recent period of positive correlation in part reflects the pronounced and persistent effect of the financial crisis on the economic outlook, though it may also owe in part to an increase in the importance of uncertainty about real economic activity in driving both government bond yields and stock prices. Changes in US monetary policy look to have exerted an opposing force on the correlation at times, driving it lower.

Introduction

Imperfect correlation of asset returns is a fundamental assumption used in portfolio theory and is the basis for construction of diversified investment portfolios (Markowitz 1952; Sharpe 1964). However, correlations of returns on various risky and risk-free assets do change over time and have at times switched signs. For instance, the correlation between US equities and long-term US Treasury yields was negative over much of the 20th century but has been strongly positive in the 2000s to date (Graph 1).[1] The recent period of positive correlations has been commonly ascribed to the emergence of a 'risk-on, risk-off' paradigm, whereby US Treasuries and equities have served as proxies for 'safe-haven' and 'risk' assets, respectively, and broad shifts in risk sentiment have had an unusually large role in determining asset price movements. However, it is notable that the stock-bond yield correlation had already been positive for most of the decade before the global financial crisis. Similarly positive stock-bond correlations have also been apparent in other developed countries, including Australia, over this time. This article considers how the fundamental drivers of asset prices have affected the correlation between equity prices and bond yields over the past 100 years.

Graph 1
US Stock-Bond Correlations
Correlation of changes in 10-year government bond yields and S&P 500*



* Three-year rolling centred correlation of monthly changes; Standard Statistics' 90 Stock Composite Index used prior to 1957

Sources: Global Financial Data; RBA

* Muhummed Shah Idil is from International Department and Ewan Rankin completed this work while in International Department.

1 We generally depict stock-bond correlations based on monthly changes over a rolling three-year window. A similar historical pattern is observed at alternative frequencies and windows.

Fundamental Drivers of Stock Prices and Bond Yields

Yields on longer-term government bonds are determined by the expected path of the risk-free rate (over the life of the bond), plus a term premium that compensates investors for uncertainty about potential future changes in the value of the bond stemming from changes in real interest rates and/or inflation. A firm's stock price is determined by the present value of expected future dividend payments, with future payments discounted by the expected path of the risk-free rate and an equity risk premium (the additional return over the risk-free rate that investors require in order to hold riskier stocks).

At a more fundamental level, these variables reflect expectations for, and uncertainty about, growth and inflation. In particular, changes in investors' central expectations for growth and inflation determine their forecasts for dividends and interest rates; stronger economic growth and higher inflation increase interest rates (via actual or expected future policy tightening) while also raising dividends via increased corporate profits. The extent to which there is uncertainty about these variables influences stock prices and bond yields via the equity risk and term premia. An increase in uncertainty about growth raises the equity risk premium while plausibly lowering the term premium, whereas increased inflation uncertainty raises both premia.[2]

Whether these shocks cause equity prices and bond yields to move in the same, or the opposite, direction is theoretically ambiguous. While positive growth or inflation shocks raise bond yields, they have an uncertain impact on stock prices given that expected dividends and the discount rate should both rise. As a result, the expected sign of the correlation following a growth or inflation shock largely depends on the extent to which expected dividends change by more or less than the discount rate, with:

- growth shocks arguably raising the correlation, since stronger economic growth will have a direct positive effect on expected dividends but only an indirect effect on interest rates, hence possibly boosting stock prices
- inflation shocks plausibly lowering the correlation, since higher inflation directly raises interest rates while the positive effect on expected dividends could be muted to the extent that the increase is attributable to supply factors or that inflation has a negative impact on growth.

In contrast, the impact of changes in uncertainty on the correlation is, at least in theory, less ambiguous as:

- an increase in uncertainty about the outlook for growth will raise the correlation, as the equity risk premium increases, depressing stock prices, while the bond term premium declines
- an increase in uncertainty about the outlook for inflation will reduce the correlation by raising the discount factor for stocks and the term premium in bond yields.

While both stock prices and bond yields are typically influenced by multiple, coincident shocks, making identification difficult, the existing literature provides some empirical support for this framework. Shiller and Beltratti (1992) argue that negative correlations between equities and bond yields over the century to 1989 are due to changes in a common interest rate factor, while Andersson, Krylova and Vähämaa (2008) find that negative (positive) stock-bond yield correlations coincided with periods of high (low) inflation expectations, influencing asset prices through the interest rate component. Results from D'Arcy and Poole (2010), using a more recent sample, suggest that the relative importance of shocks to the discount factor may have diminished. They find that between 2001 and 2010, positive US employment data surprises tended to increase earnings growth expectations by slightly more than they increased the discount rate on equities. As a result, positive US employment data surprises tended to increase both stock prices and US Treasury yields. There is also

2 The impact of uncertainty about growth on the term premium is not well established but the literature suggests that the term premium falls as uncertainty about growth increases, consistent with the 'flight-to-safety' phenomenon (Dick, Schmeling and Schrimpf 2013).

an empirical literature looking at the relationship between uncertainty and stock-bond correlations; for example, Li (2002) finds that uncertainty about expected inflation and real interest rates has led to stronger negative stock-bond correlations, while d'Addona and Kind (2006) show that inflation volatility weakens correlations.

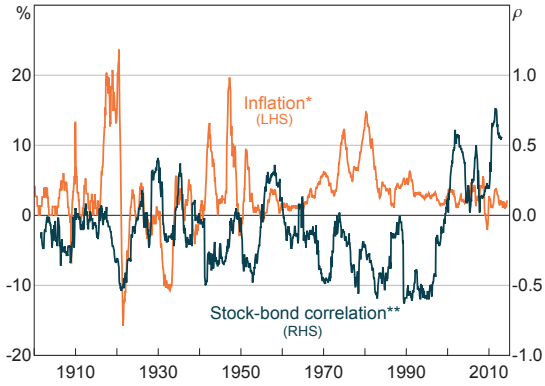
With this framework in mind, the following sections look at the factors that have contributed to the observed stock-bond yield correlation over history. Due to the size of US stock and bond markets, the analysis will focus first on US stock-bond yield correlations, before briefly examining developments in other countries, including Australia.

The Evolution of US Stock-Bond Correlations

Inflation shocks and uncertainty

The US stock-bond correlation has fluctuated around a slightly negative average level over most of the 20th century, with periods of high and variable inflation generally coinciding with strong negative correlations (Graph 2). This was especially the case between the 1970s and late 1980s, amid persistently high inflation, in part a result of significant increases in global oil prices. These developments also underpinned increased inflation uncertainty, as seen in relatively volatile inflation expectations over most of those two decades and the years that followed. These factors, in aggregate, were likely to have contributed to negative correlations via their influence on the common interest rate factor that drives equity prices and bond yields (consistent with the findings of the literature mentioned above).[3]

Graph 2
US Inflation and Stock-Bond Correlations



* Year-on-year change in the consumer price index; Federal Reserve Bank of New York's Index of General Prices used prior to 1913

** Three-year rolling centred correlation of monthly changes in 10-year government bond yields and S&P 500; Standard Statistics' 90 Stock Composite Index used prior to 1957

Sources: Global Financial Data; RBA

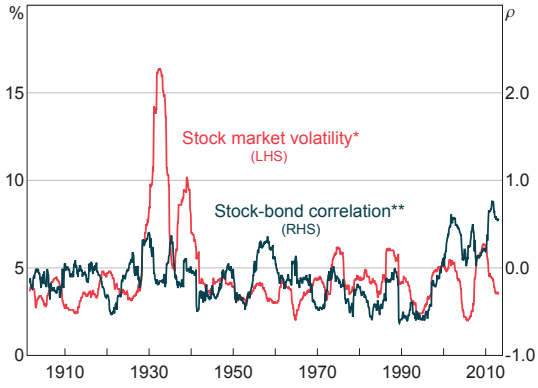
Real shocks and uncertainty

While shocks to inflation appear to have been particularly important over much of the past century, contributing to negative correlations between equity prices and bond yields, the correlation rose into positive territory on a number of occasions. For example, it rose around the time of the 1930s Depression and the 1970s recession, the 1987 stock market crash and the late 1990s Asian and Russian financial crises. The correlation also rose during the early 2000s recession, the more recent global financial crisis and the European sovereign debt crisis. Each of these periods corresponds to an episode of heightened equity market volatility and economic recession (Graph 3).[4] These correlation shifts may reflect the possibility that uncertainty in earnings expectations over some of these periods raised the equity risk premium, thereby lowering equity prices, while reducing the term premium on bonds and hence pushing correlations upwards. These observed rises in stock-bond correlations could also result from adverse growth shocks. Such shocks depress the expected path of short-term interest rates, thereby lowering US Treasury yields, and will cause stock prices to decline if expected dividends

3 Existing work lends further support to this view: Ilmanen (2003) posits that changes in the common interest rate factor tend to dominate stock and bond volatility during periods of high inflation, while Li (2002) finds that high inflation and inflation volatility often results in strong negative stock-bond correlations.

4 Similarly, Connolly, Stivers and Sun (2005) find that correlations between stock and bond returns tend to approach zero when the VIX index of expected US equity market volatility is high, while Gulko (2002) finds evidence between 1987 and 2000 that stock-bond correlations tend to swap from negative to positive following stock market crashes. Andersson *et al* (2008) also suggests that at times of elevated uncertainty, non-fundamental (and uncorrelated) changes in asset prices may be more likely.

Graph 3
US Stock Market Volatility and Stock-Bond Correlations

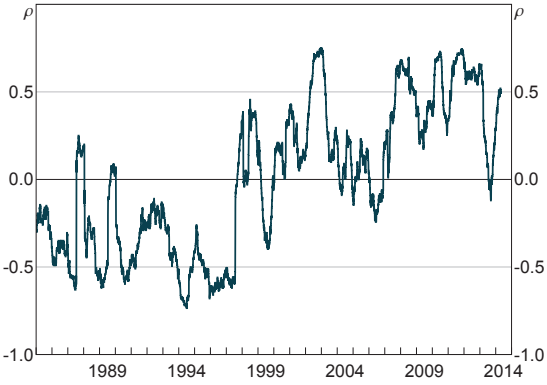


* Three-year rolling centred standard deviation of monthly changes in the S&P 500

** Three-year rolling centred correlation of monthly changes in 10-year government bond yields and S&P 500; Standard Statistics' 90 Stock Composite Index used prior to 1957

Sources: Global Financial Data; RBA

Graph 4
US Stock-Bond Correlations
Correlation of changes in 10-year government bond yields and S&P 500*



* Six-month rolling centred correlation of daily changes

Sources: Bloomberg; RBA

fall by more than the decline in the discount rate (as a result of lower expected short-term interest rates).

Stock prices and bond yields have been generally positively correlated since around the end of the last century, marking an unusually prolonged period of positive correlation (Graph 4). One reason for this has been the magnitude and persistence of the global financial crisis, which saw correlations become strongly positive in response to an increase in uncertainty about the economic outlook. This is consistent with the pattern that was evident in other major downturns throughout the past century, for example around the 1930s Depression. However, the positive correlation predates the onset of the crisis in 2007.

Two other developments are likely to have contributed to this unusually high level of stock-bond correlations. First, there are indications that the term premium has become increasingly sensitive to uncertainty about growth (Dick *et al* 2013), implying that the same degree of uncertainty about real activity led to stronger positive correlations as bond yields became more sensitive to the outlook for growth. This is consistent with US Treasuries increasingly being viewed as a 'safe-haven' asset for global investors, and the substantial rise in foreign holdings of Treasuries over the past 50 years. Indeed, foreign investors' purchases of US Treasuries have historically been negatively correlated with the VIX index of expected US equity market volatility, which tends to rise during periods of elevated real uncertainty. However, in recent years foreign purchases have tended to increase in response to higher equity market volatility.[5] Consistent with this, Treasury yields and the VIX index have historically been uncorrelated but have displayed a strong negative correlation more recently (Graph 5). As a result, the positive impact of heightened uncertainty about real growth on the stock-bond correlation has increased since 2000 (Table 1).

A second possible factor behind the unusually persistent positive stock-bond yield correlation relates to the rise in estimates of the equity risk premium (Duarte and Rosa 2013).[6] This has occurred

5 Since the global financial crisis, foreign investors' net purchases of US Treasuries have had a modest positive correlation with the VIX index, indicative of fluctuations in safe-haven demand. In contrast, a negative correlation was observed over much of the two decades prior. Foreign net purchases of US equities have, if anything, become more negatively correlated with the VIX index since the financial crisis.

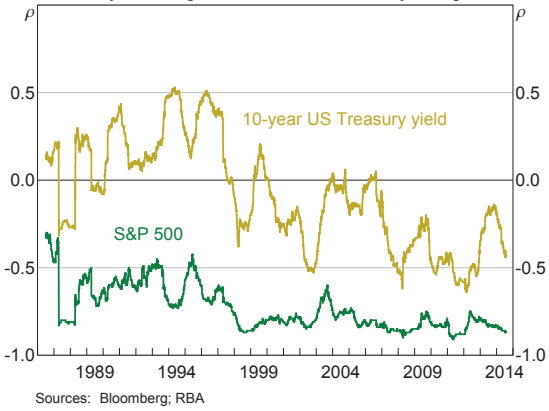
6 Duarte and Rosa combine information from 20 models to show that the equity risk premium has trended upwards from its 2000 trough to a 50-year high in July 2013. However, we remain cautious about these estimates due to the well-known uncertainties about the equity risk premium and its estimation, as characterised by Mehra and Prescott (1985).

Table 1: Expected US Equity Market Volatility and Average US Stock-Bond Correlations
Three-month rolling correlation[(a)]

	1986 to 1999	2000 to 2014
Low expected equity market volatility	–0.42	0.13
Average expected equity market volatility	–0.40	0.34
High expected equity market volatility	–0.14	0.50

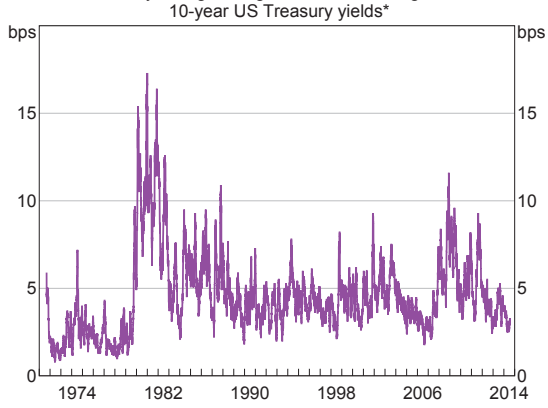
(a) Low, medium and high volatility refer to levels of the VIX index below the first quartile, between the first and third quartile, and above the third quartile of its historical distribution, respectively
Sources: Bloomberg; RBA

Graph 5
Correlation with VIX Index
One-year rolling centred correlation of daily changes



Sources: Bloomberg; RBA

Graph 6
US Interest Rate Volatility
30-day rolling average of absolute change in 10-year US Treasury yields*



* Yields are on zero-coupon US Treasury bonds
Sources: Gürkaynak, Sack and Wright (2006); RBA

alongside a decline in short-term rates and has probably led to the equity risk premium having a proportionally larger influence on the discount rate for equities. As a result, equity prices may have become more sensitive to uncertainty about real growth, and thus more positively correlated with bond yields.

Monetary policy

Shifts in monetary policy regimes can result in the stock-bond yield correlation declining, given that higher interest rates raise bond yields but reduce future earnings. This was likely to have been one driver of the strongly negative correlation in the early 1980s, a period in which volatility in interest rates was especially high due in part to efforts by the US Federal Reserve to lower the level of inflation (Graph 6).

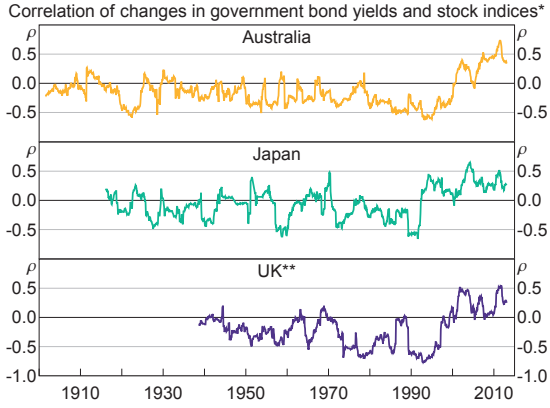
More recently, there is evidence that the US Federal Reserve's asset purchase program (or 'quantitative easing') depressed the level of Treasury yields (Bernanke 2013; Krishnamurthy and Vissing-Jorgensen 2013), while it was likely to have raised equity prices. As a result, stock-bond yield correlations fell towards zero briefly in 2009 and 2011 at times that roughly coincided with the Fed's first and second rounds of asset purchases (Graph 7). However, identifying the impact of monetary policy on the correlation is difficult given that these programs occurred in response to developments in growth and inflation. There was a clearer negative impact on the correlation following former Federal Reserve Chairman Bernanke's May 2013 Senate testimony, which caused investors to reassess the timing of the reduction in asset purchases (despite

Graph 7
US Stock-Bond Correlations
Correlation of changes in 10-year government bond yields and S&P 500*

* Six-month rolling centred correlation of daily changes; MEP refers to the 'Maturity Extension Program'; assumes QE3 ends in October 2014 in accordance with the June 2014 FOMC minutes

Sources: Bloomberg; RBA

Graph 8
Stock-Bond Correlations
Correlation of changes in government bond yields and stock indices*



* Three-year rolling centred correlation of monthly changes

** Change in five-year Gilt yields used prior to July 1959

Sources: Global Financial Data; RBA; Thomson Reuters

there being no explicit policy change at that time). Over subsequent months, positive US data surprises – in particular those related to the labour market – brought forward market expectations for the pace of 'tapering' and increases in interest rates. Such events tended to increase US Treasury yields sharply, but often lowered US equity prices as the positive impact on expected future earnings from strong data was offset by the impact of higher expected interest rates. As a result, the stock-bond yield correlation declined to around zero, though it has since risen again as investors' expectations for the future path of the federal funds rate stabilised.

Developments in Other Countries

An unusually prolonged period of positive stock-bond yield correlations has also been apparent in other developed markets, with the explanations above also relevant (Graph 8). For example, the stock-bond yield correlations in Australia and the United Kingdom also tended to be negative prior to the late 1990s, and tended to increase at times of heightened uncertainty about real economic activity (though more notably so in the United Kingdom than Australia, perhaps reflecting a perception that Australian government bonds were less of a 'safe haven' historically than they are now). The average correlation has also risen in recent years, with the shift in both countries' stock-bond correlations largely mirroring that in the United States. In Japan, bond yields and equity prices were typically slightly negatively correlated until the mid 1990s, and have since been slightly positively correlated as heightened growth uncertainty was followed by a prolonged period of low inflation and subdued growth. Japan's early experience of low inflation is a possible reason why its stock-bond correlation turned positive prior to those in Australia, the United States and the United Kingdom.

Conclusions

The stock-bond yield correlation has been positive for an extended period over the past 15 years, in contrast to the negative correlation observed throughout much of the 20th century. An important factor underlying the recent, relatively long period of positive correlations has been the considerable and lingering uncertainty created by the global financial crisis, which saw correlations rise in a continuation of the pattern observed during other recessionary periods over the past century. The relatively long

period of positive correlation is consistent with an increase in the importance of uncertainty about future economic activity in driving investor asset allocation decisions. Shifts in US monetary policy regimes have been associated with reduced stock-bond yield correlations, although it is difficult to distinguish between the impact of recent unconventional monetary policies and the economic developments that have underpinned such policies. ✠

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Financial Stability Review

These reviews, issued in March and September, assess the current condition of the financial system and potential risks to financial stability, and survey policy developments designed to improve financial stability.

Annual Reports

- *Reserve Bank of Australia Annual Report*
- *Payments System Board Annual Report*
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- *Liquidity and Funding Markets*, December 2013
- *Property Markets and Financial Stability,* December 2012
- *The Australian Economy in the 2000s,* December 2011
- *Reserve Bank of Australia 50th Anniversary Symposium,* July 2010
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- *Lessons from the Financial Turmoil of 2007 and 2008,* October 2008

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- *Supplementary Submission to the Financial System Inquiry*, August 2014
- *Submission to the Inquiry into Financial Related Crime*, July 2014
- *Submission to the Inquiry into Foreign Investment in Residential Real Estate,* May 2014
- *Submission to the Financial System Inquiry,* April 2014
- *Submission to the Inquiry into Public Governance, Performance and Accountability Act 2013 Rules Development,* March 2014
- *Payment Card Access Regimes: Conclusions*, March 2014
- *Submission to the Inquiry into Affordable Housing,* February 2014
- *Submission to the Inquiry into the Reserve Bank Amendment (Australian Reconstruction and Development Board) Bill 2013*, February 2014

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