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The Recent Economic Performance of the States

Thomas Carr, Kate Fernandes and Tom Rosewall*

Economic growth in Australia's south-eastern states has underpinned a gradual strengthening in the non-mining economy in recent years. In contrast, economic conditions have been weaker in Western Australia and Queensland as the large-scale mining investment in these states has concluded. Differences in investment have been a key source of regional variation in activity, but there are also common themes across a range of economic indicators, such as growth in the services sector.

Introduction

It is important to consider regional variation in economic activity to understand aggregate activity and the transmission of monetary policy. This is particularly the case during periods of significant structural adjustment in the economy, as has occurred in Australia since the mid 2000s. The Reserve Bank analyses a wide range of data on the states and territories, as well as input from the Bank's liaison program conducted by staff across Australia, to inform monetary policy decisions.[1]

Large movements in commodity prices and mining investment have been key forces shaping the Australian economy since the mid 2000s, and in turn help to explain much of the variation in economic outcomes across the states and territories over this period.

Investment in the mining sector grew strongly as businesses responded to the historically high level of commodity prices. The contribution to economic growth was most pronounced in Western Australia and Queensland, which have the highest concentration of mineral and energy resources. Other states benefited directly through smaller mining operations and indirectly through business services activity and positive income effects such as higher government revenues.

As the mining investment cycle concludes, other sectors have strengthened, supported by low interest rates and the depreciation of the exchange rate since 2013. Easier financial conditions have supported economic growth across the country, though the pick-up has been most pronounced in the south-eastern states, where non-mining business investment and household dwelling investment have been stronger. Sustained growth in the large and diverse household and business services sectors has been common across the states.

Growth in the non-mining economy has sustained a gradual improvement in labour market conditions and the unemployment rate

* The authors are from Economic Analysis Department, and would like to thank John Boulter for his contribution to the article.

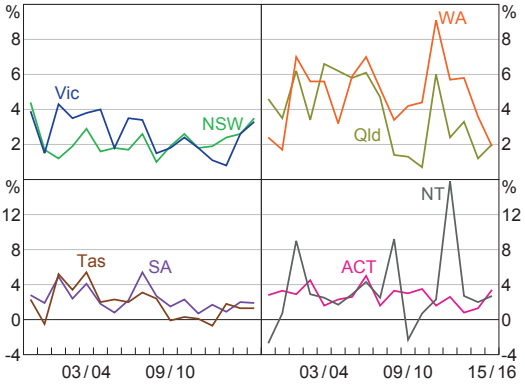
1 The Reserve Bank business liaison team conducts around 70–80 discussions each month with firms, agencies and community groups. Discussions with any individual contact typically occur every 6 to 12 months. Bank staff usually meet with the chief executive officer, chief financial officer and/or operations manager. Liaison meetings are held nationally with firms of all sizes, though most discussions are with mid-sized and large firms, where conditions are somewhat more likely to reflect economy-wide trends rather than firm-specific factors. For more information, see RBA (2014) and Heath (2015).

has declined in most states since 2014. A degree of labour market flexibility has meant that the unemployment rate in the resource-rich states has increased by less than would otherwise have been the case.

Economic Growth

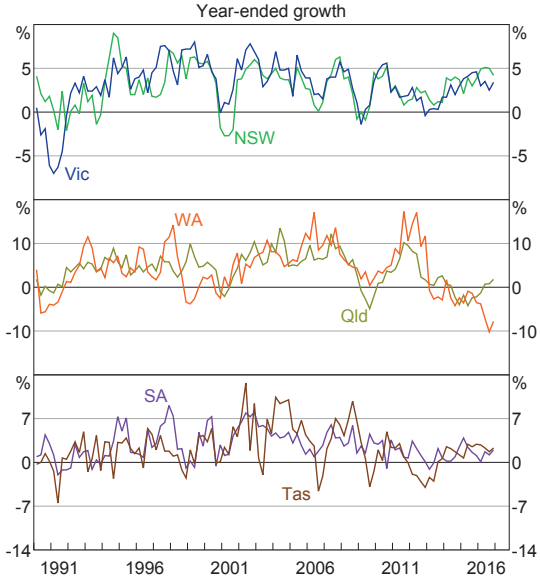
Economic growth in New South Wales and Victoria, the two largest state economies, has strengthened over recent years.[2] Gross state product (GSP), the headline measure of state economic activity, increased in both states by 3½ per cent in 2015/16 (Graph 1). This was the fastest rate of growth in well over a decade for New South Wales, and for several years for Victoria. Less comprehensive measures of activity, such as state final demand, indicate that this improvement continued in the second half of 2016 (Graph 2).[3] Economic growth in South Australia and Tasmania has also picked up modestly in recent years, but has been lower than the other states, consistent with lower rates of population growth.

Graph 1
Gross State Product Growth
Chain volume



Sources: ABS; RBA

Graph 2
State Final Demand
Year-ended growth



Sources: ABS; RBA

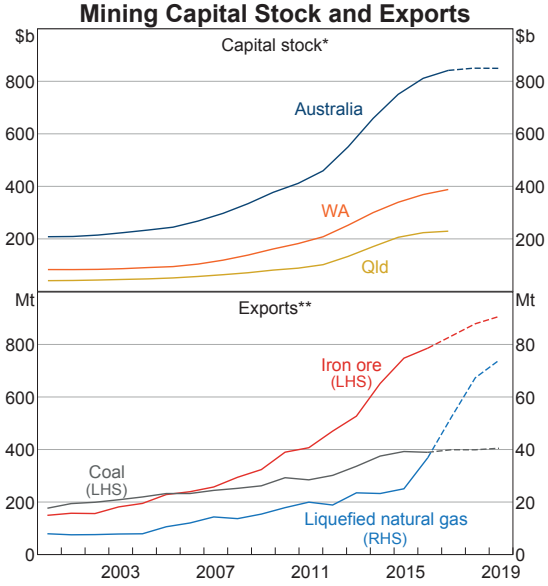
GSP growth in the resource-rich states of Western Australia and Queensland has eased from the rapid rates earlier in the decade. Following the peak in bulk commodity prices in 2011, mining investment has declined considerably since 2012/13 as resource projects have gradually been completed and few new projects have commenced. The increase in the mining capital stock in these states has been substantial, and represents a very large increase in productive capacity (Graph 3). As a result, average GSP growth after the peak in investment activity remained firm in Western Australia and Queensland due to the large increase in mining production and commodity exports brought about by this investment (Graph 4). While production of bulk commodities is not anticipated to increase much over the next couple of years, production and exports of liquefied natural gas (LNG) is expected to rise substantially.

Growth in GSP in Western Australia was 2 per cent in 2015/16, its slowest pace in 15 years, while state final demand (which does not

2 See Table A1 for summary statistics of state size.

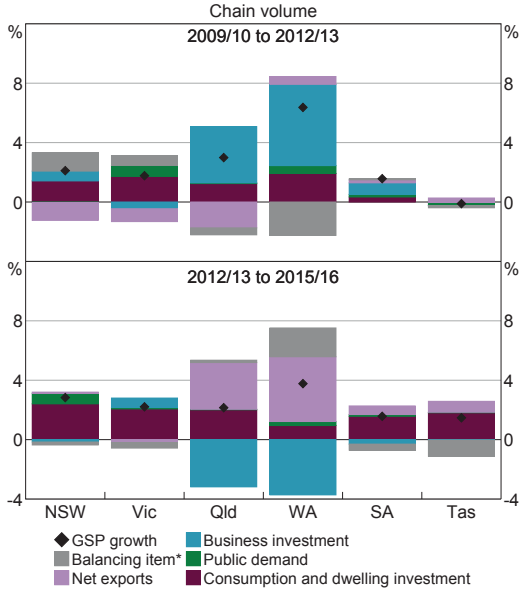
3 State final demand measures consumption and investment spending by the household, business and government sectors. It is different from GSP as it excludes international and interstate trade as well as the change in inventories. State final demand is published as part of the quarterly national accounts whereas GSP is published annually.

Graph 3
Mining Capital Stock and Exports



* Chain volumes, reference year is 2014/15; includes RBA projection
** Department of Industry, Innovation and Science projections
Sources: ABS; Department of Industry, Innovation and Science; RBA

Graph 4
Contributions to Average GSP Growth



* Includes interstate trade, inventories, ownership transfer costs and statistical discrepancies
Sources: ABS; RBA

capture exports) declined by around 8 per cent over 2016. Recent economic activity in Queensland has been more mixed; although the decline in mining investment has weighed heavily on some parts of regional Queensland, the mining sector accounts for a much smaller share of the state economy than it does in Western Australia.[4] Moreover, conditions in some parts of the state have been very positive and have benefited from a pick-up in dwelling investment and tourism.

Investment Cycles

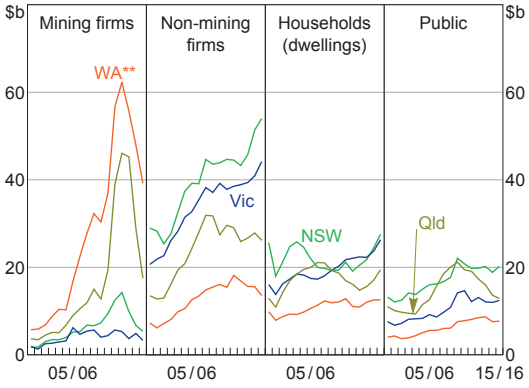
Business investment is a key driver of economic demand and productivity growth, and a source of variation in activity between the states. Although investment accounts only for a moderate share of economic activity on average, shorter-run cycles in business investment can be pronounced (Graph 5). The mining investment cycle accounts for much of the variation in economic activity across states and territories since the mid 2000s, but cycles in other types of investment, such as dwelling investment by households, have been another source of variation more recently.

Growth in national non-mining business investment has been weak over the past decade, but this masks important differences by state. Non-mining business investment has increased in New South Wales and Victoria in recent years alongside the improvement in business conditions and demand in those states. In contrast, non-mining investment in Western Australia and Queensland has decreased, as the decline in mining investment also weighed on non-mining activity (see 'Box A: Non-mining Business Investment by State').

In aggregate, dwelling investment has grown strongly since 2013, which has helped to offset the downturn in mining investment. The low level of interest rates is supporting activity in all markets, but growth in dwelling investment by state has varied, in part due to differences

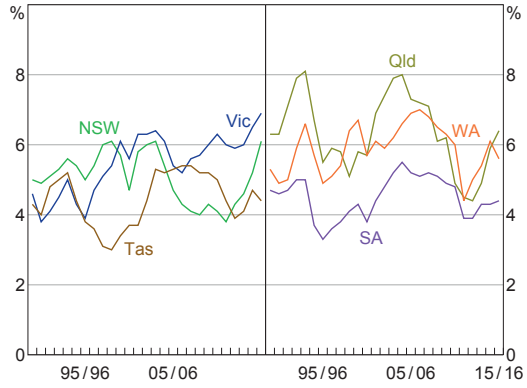
4 See Table A2 for industry shares of state production.

Graph 5
Investment by Sector
Chain volume*



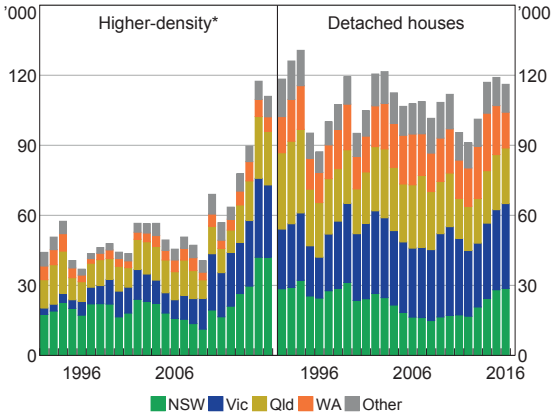
* Reference year is 2014/15
** From 2011/12, includes second-hand asset transfers of buildings and structures
Sources: ABS; RBA

Graph 6
Dwelling Investment
Per cent of state final demand



Sources: ABS; RBA

Graph 7
Dwelling Approvals
Number



* Flats, units, apartments, semi-detached dwellings, terrace houses and townhouses
Sources: ABS; RBA

in underlying housing market conditions and population growth. In Perth, a strong pick-up in residential construction helped to offset the initial decline in mining investment, but housing market conditions have since weakened considerably, and dwelling investment has declined over the past year or so. Housing price growth in recent years has been much stronger in Sydney and Melbourne than in the other capitals, in turn providing strong support for the development of new housing in these cities (Graph 6).

Residential building approvals, which are a leading indicator of dwelling investment, appear to have peaked (Graph 7). However, a significant volume of construction work is yet to be completed, particularly in New South Wales and Victoria, which will continue to support dwelling investment activity in the south-eastern states for the next two years.

Public investment has been broadly flat across most states for several years. However, state government budget estimates suggest that public capital expenditure will make a more meaningful contribution to growth over coming years, particularly in New South Wales and Victoria where there is a substantial pipeline of infrastructure activity. A large proportion of capital expenditure in these states has been directed to high-profile road and rail transport projects. Beyond the direct contribution to economic growth in these states, feedback from firms in the Bank's business liaison program suggests this pipeline of activity has provided opportunities for a range of firms previously focussed on providing services to the mining sector, and has also bolstered business confidence.

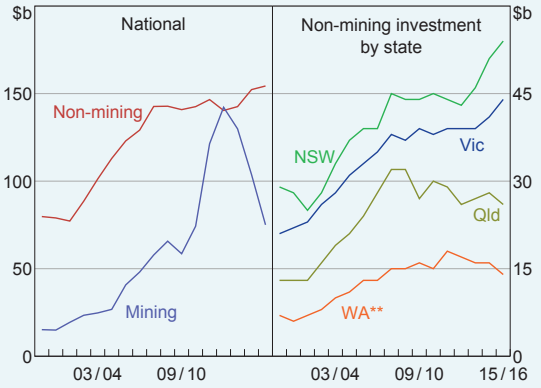
Box A

Non-mining Business Investment by State

Growth in aggregate non-mining business investment has been very weak over the past decade, but this masks significant regional variation (Graph A1).[1] Subdued business investment outside the mining sector was one of the ways in which the Australian economy accommodated the unprecedented increase in mining investment. As mining investment has declined, however, non-mining business investment has remained subdued; many other advanced economies have also experienced sustained weakness in business investment. A range of cyclical and structural explanations have been put forward for subdued non-mining business investment in Australia.[2] Themes emerging from the Bank's liaison with firms include uncertainty about future demand growth, heightened aversion to risk and insufficient demand to warrant expansion (Lane and Rosewall 2014). State-based variation goes some way towards explaining the weak growth in aggregate non-mining business investment.

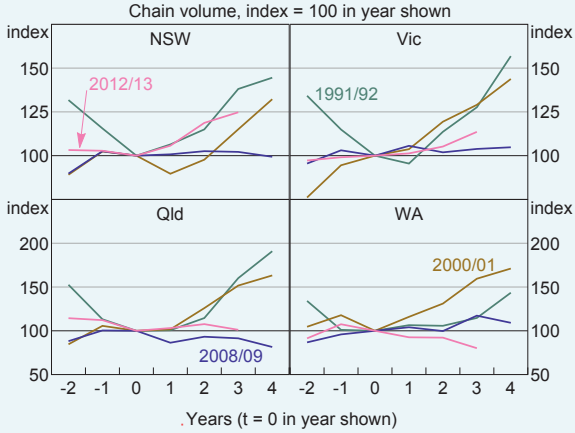
Non-mining business investment in New South Wales and Victoria has increased over the past three years, alongside a broader improvement in state demand. New South Wales has recorded the strongest growth over this period, with non-mining business investment growing by an average of 8 per cent annually, which is a similar pace of growth to earlier investment cycles (Graph A2). In Victoria, investment has grown at a slower rate of 4 per cent per year over the same period, which is somewhat weaker than in previous cycles. In contrast, non-mining business investment in Queensland and Western Australia

Graph A1
Business Investment
Chain volume*



* Reference year is 2014/15
** From 2011/12, includes second-hand transfers of buildings and structures
Sources: ABS; RBA

Graph A2
Non-mining Business Investment Cycles
Chain volume, index = 100 in year shown



Sources: ABS; RBA

1 Also see Kent (2016).

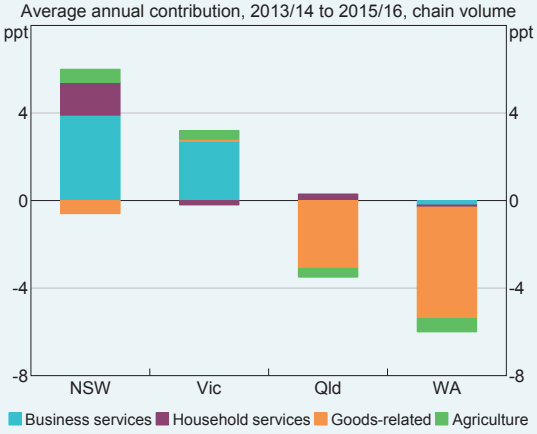
2 See Elias and Evans (2014) and Kent (2014).

peaked during the mining boom, and has since declined.

Much of the recent investment growth in New South Wales and Victoria has been driven by business services, including by rental, hiring & real estate, professional & technical services, and financial & insurance services firms (Graph A3; note that state-based data by industry include public investment). These firms make up a large part of the New South Wales and Victorian economies. While business services firms are often thought of as labour intensive, in practice they can be relatively capital intensive. For example, the construction of office buildings has been a key driver of the recent growth in investment in New South Wales. Conditions in office markets have strengthened considerably in Sydney over the past year, which should support further development activity. Capital expenditure by the household services sector has also contributed to investment growth in New South Wales. While private firms have increased investment in response to strong demand (for example, for accommodation), part of the growth is due to public investment in education and health.

In contrast, investment in goods-related industries (including manufacturing, utilities, construction and wholesale & retail trade) has been little changed in New South Wales and Victoria since 2013. Nevertheless, there are some sub-industries where investment conditions have improved. The underlying improvement in consumption growth, as well as an increasingly competitive retail environment, has driven a strong increase in investment by retailers and wholesalers, especially in Victoria. Investment by manufacturers has stabilised, following several years of decline, consistent with the recent improvement in conditions in the sector.

Graph A3
Industry Contribution to Investment Growth*
Average annual contribution, 2013/14 to 2015/16, chain volume



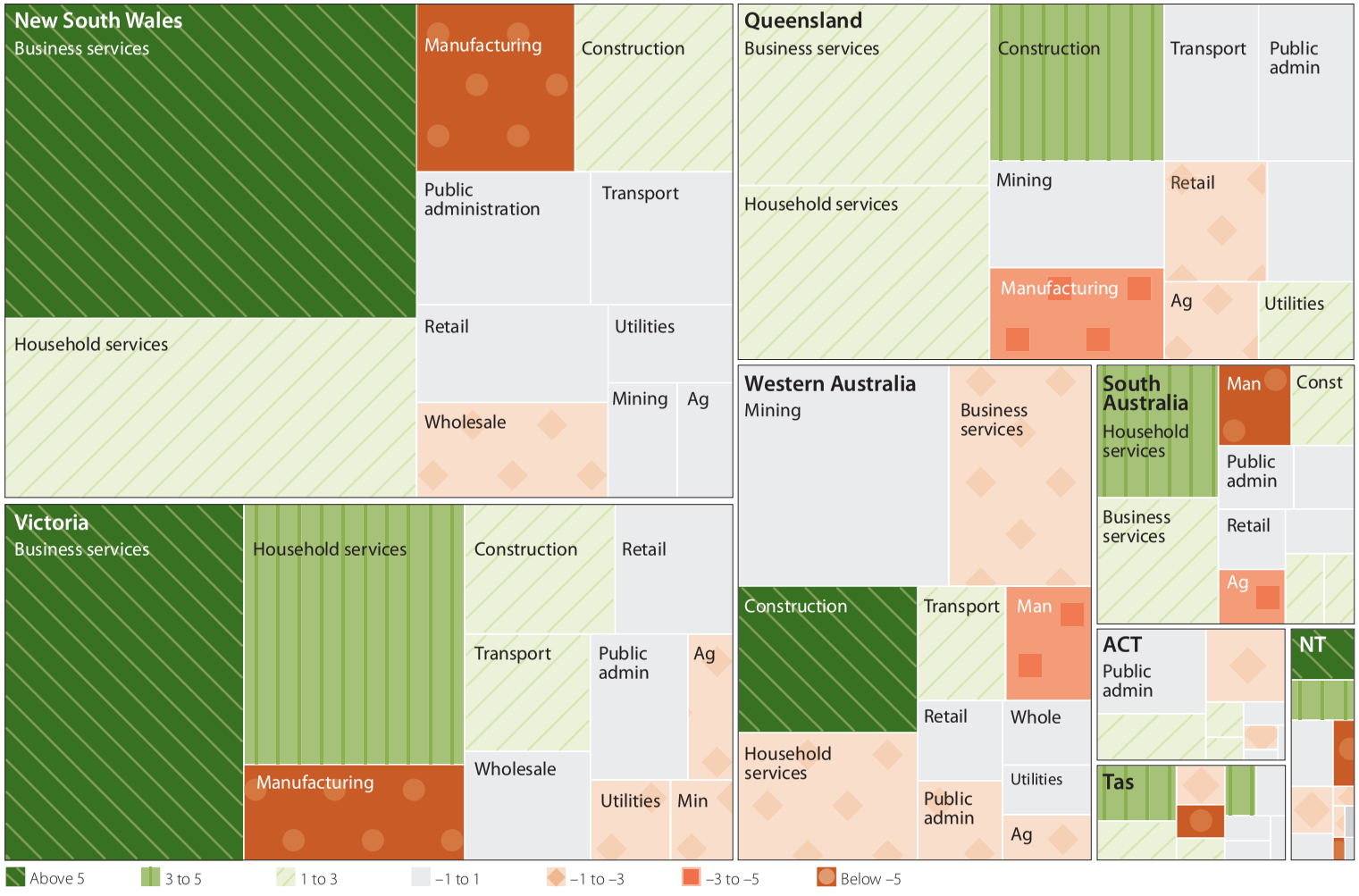
* Includes public and private investment; excludes mining and public administration & safety industries

Sources: ABS; RBA

The decline in non-mining business investment in Queensland and Western Australia over recent years has been associated with the large falls in mining investment. During the earlier upswing in mining investment, many non-mining firms in these states provided goods and services to the mining industry; for example, manufacturers, construction contractors, transport and equipment hire firms. Commodity prices were at historical highs, and this was reflected in contractor rates paid by mining firms and the wages of employees. These non-mining firms responded to the increase in demand and profitability by expanding capacity. Furthermore, population and wage growth drove a broader increase in household consumption, benefiting a broad range of firms not directly involved with mining activity. As commodity prices declined, mining firms shifted from expansion to cost-cutting. As part of this process, contractor rates and wages have also declined, reducing demand for goods and services and weighing on the investment plans of a wide range of non-mining firms.

Figure 1: The Australian Economy by State and Industry*

Colours indicate percentage point change in share of state economy from 2000/01 to 2015/16



* Area of rectangle indicates gross value added (GVA). Excludes ownership of dwellings

Sources: ABS, RBA

Industry Developments

The mining investment boom affected the industry structure of some states, but by less than longer-run structural changes such as the growth in the services sectors. Business and household services are by far the largest industries in most states and territories (except Western Australia where mining predominates) and these industries continue to grow as a share of total activity (Figure 1; also see Table A2).

New South Wales and Victoria have disproportionate shares of business services activity, reflecting the status of Sydney and Melbourne as large business and financial centres. Strength in dwelling investment has supported a wide range of professional services in these states, such as architecture and legal services. There has also been strong demand for information technology services, as firms have sought to harness advances in technology to improve efficiency and minimise costs. Much of the activity in this sector is targeted at the domestic economy, but business services exports have also grown steadily over the past several years, partly in response to the depreciation of the Australian dollar. Liaison with firms suggests that the recent growth in business services exports also partly reflects a concerted effort by mining services firms, particularly in the resource-rich states, to source more work from overseas markets as local conditions have deteriorated.[5]

The depreciation of the Australian dollar since 2013 has helped to improve the competitiveness of other highly trade-exposed industries, including manufacturing. Although the share of manufacturing in all state economies has declined considerably over decades, conditions in the sector have improved recently across a few states, particularly in food & beverage and pharmaceutical production (Langcake 2016).

The depreciation of the Australian dollar has also benefited domestic tourism.[6] All states have recorded an increase in international tourism numbers and spending, though growth in visitors to Tasmania has been particularly strong. The lower dollar also means greater numbers of Australian residents opt to travel locally, rather than overseas. Again, Tasmania has benefited disproportionately.

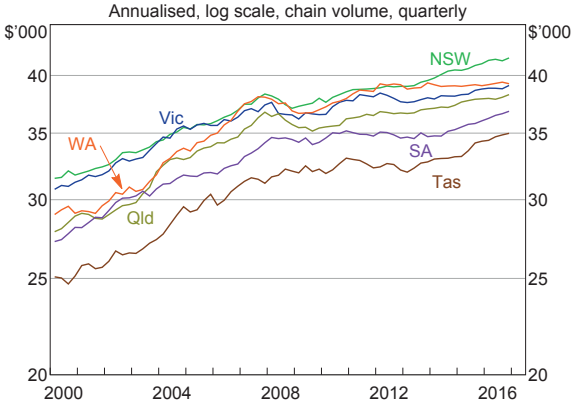
Households

Differences in long-term trends in household consumption spending across states tend to be relatively small (Graph 8). Households tend to smooth consumption over time, which can mitigate differences in consumption growth between the states, as can government policies designed to reduce differences in income growth. Nevertheless, consumption growth in Western Australia has been weak in recent years, both in aggregate and in per capita terms. Aggregate consumption growth in the other states has been relatively even since 2013, through some differences emerge once population growth is accounted for (Graph 9). For example, population growth has made a large contribution to aggregate consumption growth in Victoria, whereas stronger per capita income growth has been a larger driver of growth in New South Wales. Growth in per capita consumption in Tasmania has been supported by the strong growth in tourism activity. Growth in consumption in South Australia has also been relatively firm in per capita terms.

5 More broadly, the domestic services sector also constitutes a higher share of Australia's value-added exports than implied by gross exports because of its indirect exposure to trade, as services are extensively used as inputs to produce goods exports (Kelly and La Cava 2014).

6 'Tourism' is not defined as a distinct industry in the ABS national accounts, as industries are classified according to the products produced rather than customer status. Tourism contributes to activity in a range of industries, including household services, transport and retail.

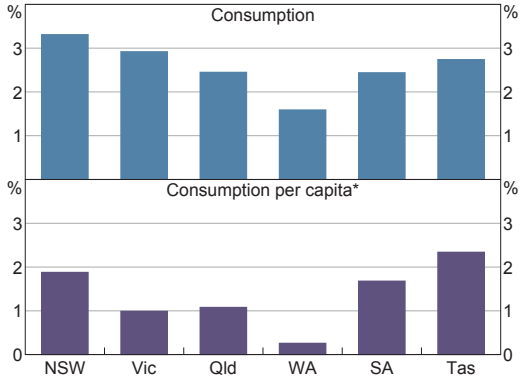
Graph 8
Household Consumption per Capita*
Annualised, log scale, chain volume, quarterly



* Population for September and December 2016 calculated using average growth over the four previous quarters

Sources: ABS; RBA

Graph 9
Household Consumption Growth
Annualised, 2013 to 2016, chain volume

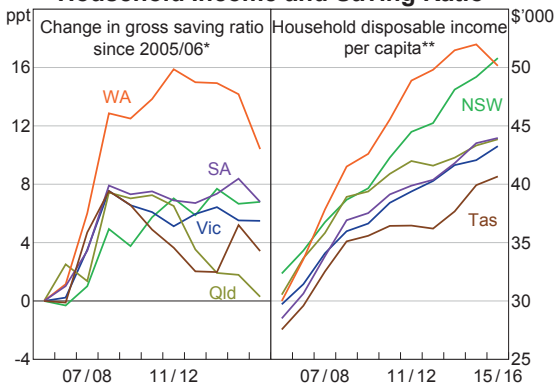


* Population growth over the second half of 2016 estimated using average growth over the four previous quarters

Sources: ABS; RBA

At the national level, consumption has been growing faster than household income and the saving ratio has declined gradually for several years. Much of the decline has been driven by a decline in the saving ratios in Western Australia and Queensland (Graph 10). Western Australian households benefited from a rapid increase in household disposable income and wealth during the mining boom, and the gross saving ratio peaked at around one-quarter of incomes at the height of the boom. Households

Graph 10
Household Income and Saving Ratio



* Gross saving includes depreciation

** Nominal income

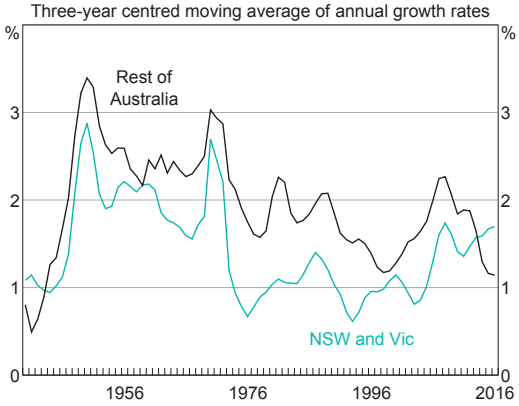
Sources: ABS; RBA

have subsequently used this buffer to support consumption as income growth has waned.

Population and Labour Market Developments

Shifts in population growth and a degree of labour market flexibility have assisted the transition in economic activity associated with the mining investment cycle. Growth in the Australian population has slowed in recent years owing to a much slower rate of net overseas migration to the resource-rich states. There has also been a net outflow of interstate migrants from Western Australia in recent years. These flows partly reflected the departure of mining and construction workers, who had moved to the resource-rich states during the boom in investment, as projects were completed. Also, far fewer people have moved to these states in recent years, including those moving from overseas. In contrast, population growth in New South Wales and Victoria has strengthened to consistently exceed that in the rest of the country for the first time in decades (Graph 11). Population growth in these states has been driven by net overseas migration, and in Victoria also by interstate migration.

Graph 11
Population Growth*
Three-year centred moving average of annual growth rates

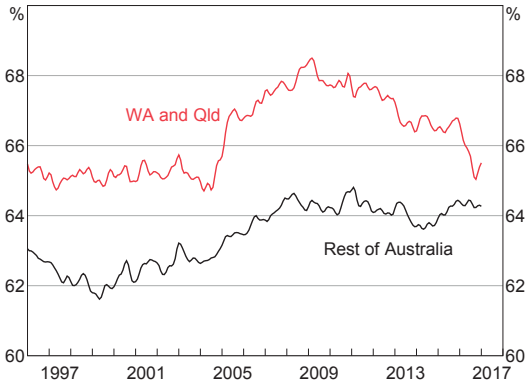


* Observation for 2016 estimated using annualised growth in the first half of the year

Sources: ABS; RBA

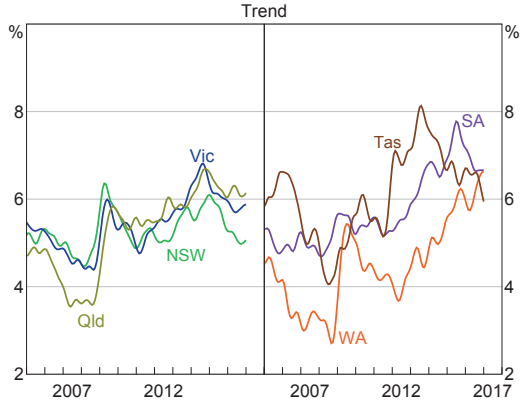
In the resource-rich states, the labour market adjustment to the decline in mining investment has occurred across several dimensions. Population growth has slowed, participation rates have fallen, and part-time work has become more common (Graph 12). As a result, unemployment rates in these states have increased by less than would otherwise have been the case (Graph 13). Employment growth has been relatively strong in New South Wales and Victoria, driving a steady improvement in the unemployment rate in both states. The unemployment rate in New South Wales has fallen to 5 per cent in recent months, to be around its lowest levels in close to a decade.

Graph 12
Participation Rate
Trend



Sources: ABS; RBA

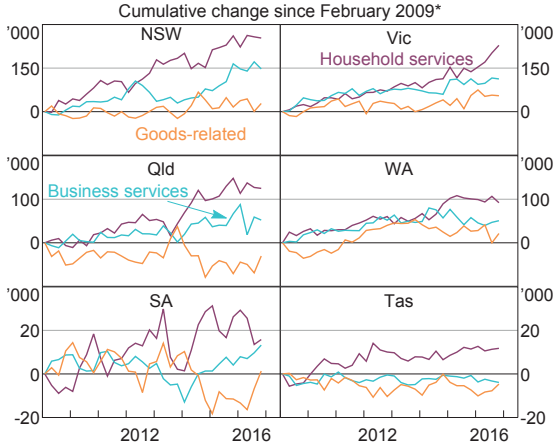
Graph 13
Unemployment Rates by State
Trend



Source: ABS

The pattern of employment growth has been fairly similar across the states over recent years. Growth in household services employment, particularly in health and education employment, has underpinned employment growth across the country (Graph 14). Business services employment has contributed to growth in most states, while the level of employment in the goods-related sector has typically remained steady or declined.

Graph 14
Employment Growth
Cumulative change since February 2009*

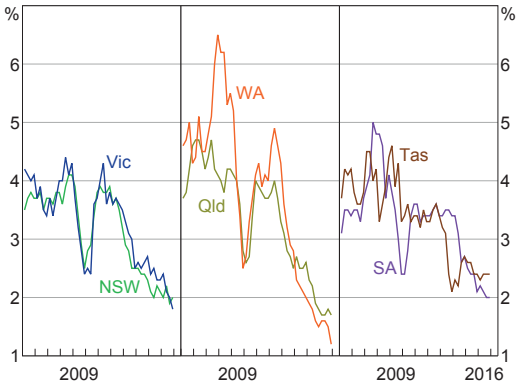


* Seasonally adjusted by RBA; does not take into account the shift in the seasonal pattern due to supplementary surveys

Sources: ABS; RBA

Although labour market conditions have varied across states, wage growth has been weak everywhere. In the non-mining states, private sector wage growth has declined to be around 2 per cent (Graph 15). Average wage growth in Western Australia and Queensland has been weaker recently, in part due to pronounced weakness in mining and mining-related wages, though this follows a period of rapid wage growth at the height of the mining investment boom.

Graph 15
Private Wage Price Index Growth
Year-ended



Source: ABS

Conclusion

New South Wales and Victoria have emerged as the drivers of economic growth in recent years, as part of a broader, gradual strengthening in non-mining activity supported by the depreciation of the Australian dollar since 2013 and low interest rates. Domestic conditions in Western Australia and Queensland have weakened considerably alongside the decline in mining investment, though overall rates of economic growth have remained positive, in part due to growth in commodity exports. The mining investment cycle has been a key source of variation in economic growth across the country, but its impact has been mitigated by a degree of flexibility in the economy. Labour markets have adjusted along several dimensions to help contain the increase in unemployment, aided by shifts in population growth. Adjustments in household saving have helped contain differences in consumption growth. The relatively diverse services sectors have been key contributors to economic and employment growth in most states.

Appendix A: Indicators of State Size and Industry Composition

Table A1: Relative Size of States
Share of Australia, 2015/16, per cent

	NSW	Vic	Qld	WA	SA	Tas
GSP share	32	22	19	15	6	2
Population share[(a)]	32	25	20	11	7	2
Employment share[(a)]	32	26	20	11	7	2
Exports share[(b)]	21	12	20	38	5	1

(a) As at June 2016
(b) Gross exports of goods and services
Sources: ABS; RBA

Table A2: Industry Share of State Production[a]
2015/16, per cent

	NSW	Vic	Qld	WA	SA	Tas	Aus
Agriculture, forestry and fishing	2	2	3	2	4	9	2
Mining	2	2	7	23	3	1	6
Manufacturing	6	7	6	5	7	7	6
Electricity, gas, water and waste services	2	2	3	2	3	4	2
Construction	6	6	10	13	7	7	8
Wholesale trade	4	5	5	3	4	3	4
Retail trade	4	5	5	3	5	6	4
Transport, postal and warehousing	4	5	6	5	5	7	5
Public administration and safety	5	4	6	3	6	6	5
Business services	**30**	**27**	**18**	**16**	**19**	**15**	**24**
Of which:							
Financial and insurance services	13	11	6	4	7	6	9
Professional, scientific and technical services	7	8	5	5	5	3	6
Household services	**17**	**18**	**17**	**12**	**20**	**21**	**17**
Of which:							
Health care and social assistance	6	7	7	5	9	9	7
Education and training	5	6	5	3	5	7	5
Other[b]	17	17	15	12	15	14	16

(a) Gross industry value added as a share of GSP
(b) Ownership of dwellings, taxes less subsidies on products and statistical discrepancy
Sources: ABS; RBA

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Insights into Low Wage Growth in Australia

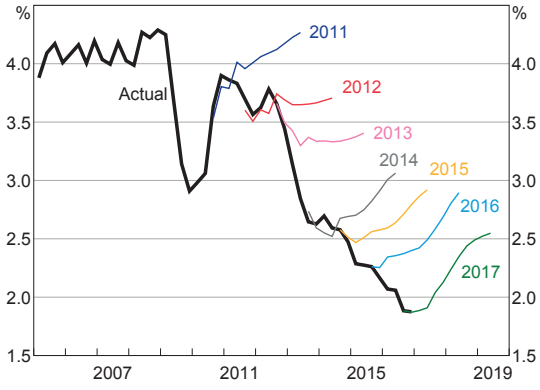
James Bishop and Natasha Cassidy*

Recent low wage growth in Australia appears to be only partly explained by spare capacity in the labour market, the decline in inflation outcomes and the decline in the terms of trade from its 2011 peak. In this article, we present some tentative evidence that the relationship between wage growth and labour market conditions may have changed, and that this may help to explain recent low wage growth. Using job-level micro wage data, we also find that, since 2012, wage increases have been less frequent and wage growth outcomes have become much more similar across jobs.

Introduction

Over recent years, Bank forecasts for wage growth have been persistently too strong (Graph 1). The forecast errors have been largely the result of there being more slack in the labour market than anticipated and the decline in the terms of trade being sharper than expected.[1] However, even after taking these factors into consideration, wage growth has been surprisingly low. This raises the possibility that the relationship between wage growth and its determinants has changed, or that there are other structural or cyclical factors weighing on wage growth. Understanding the drivers of recent wage outcomes is important for assessing labour market conditions and inflationary pressures in the economy. As wages are the largest component of business costs, the decline in wage growth has also contributed to lower inflation outcomes over recent years than expected.

Graph 1
Wage Price Index Forecasts*
Year-ended



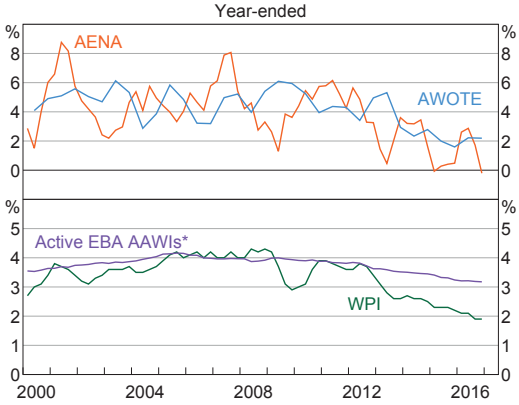
* February SMP forecasts
Sources: ABS; RBA

The analysis in this article will mainly focus on wage growth as measured by the wage price index (WPI). However, the Bank assesses a range of available measures of labour costs to provide insights into labour market conditions and inflationary pressures in the economy. Each measure captures a slightly different concept of labour costs, although importantly they all point to a slowing of earnings growth in recent years (Graph 2). The main measures that the Bank

* James Bishop completed this work in Economic Research Department and Natasha Cassidy is from Economic Analysis Department. The authors would like to thank David Rodgers for his assistance, as well as the Prices Branch at the Australian Bureau of Statistics.

1 The Reserve Bank periodically reviews their economic forecasts. The outcomes of the most recent forecast review are outlined in Kent C (2016).

Graph 2
Labour Costs Growth
Year-ended



* Average annualised wage increases
Sources: ABS; Department of Employment; RBA

follows are the WPI and average earnings from the national accounts (AENA).

The WPI, which began in 1997, is designed to measure changes in wage rates for a given quantity and quality of labour. The index is constructed by the Australian Bureau of Statistics (ABS) by comparing the wage for a given job to the previous quarter; adjustments are made to exclude any changes in wages resulting from changes in the nature of the job or the quality of the work performed.[2] It is constructed for a fixed basket of jobs, so by design it should be unaffected by changes to the composition of the labour force.

AENA is a better indicator of inflationary pressures in the economy than the WPI. This is because it is wider in scope as it includes non-wage costs, such as superannuation and redundancy payments, and the impact of any changes to the composition of the workforce. This may include changes to the type of jobs workers hold or slower-moving demographic changes to the labour force. In practice, the volatility in the AENA series can sometimes make it difficult to separate out noise from signal. Other measures of labour costs include the semiannual average weekly ordinary-time earnings (AWOTE) and wage increases in enterprise bargaining agreements (EBAs).

The Bank has widely discussed the likely determinants of the recent slowing in wage growth. Jacobs and Rush (2015) argue that spare capacity in the labour market, a decline in inflation expectations, lower profitability following the decline in the terms of trade, and the need for the real exchange rate to adjust to improve international competitiveness have all contributed to lower wage growth. Firstly, there has been more slack in the labour market since 2008 and employees may be more willing to accept lower wage growth given concerns about future employment. The decline in inflation outcomes and expectations in recent years may have also contained wage growth. Some employees are effectively bargaining over 'real' wages, with some wages either indexed or heavily influenced by CPI outcomes.

The sharp rise and subsequent fall in the terms of trade has also had a significant effect on wage growth over the past decade. During the run-up in the terms of trade, many firms' output prices rose sharply, meaning they could afford to pay higher wages while profits also increased. Mining and mining-exposed firms needed to pay higher wages to attract labour to increase output. Since the peak in the terms of trade in 2011, firms' output prices have not grown as quickly and wage growth has subsequently slowed. Finally, the strong growth in wages during the large run-up in the terms of trade outpaced that in many comparable economies, resulting in a decline in the international competitiveness of Australian labour. However, since the terms of trade have been declining, low growth of wages has played the reverse role of improving

2 Although the WPI abstracts from pay increases due to improvements in labour quality, it will be influenced by productivity improvements arising from capital investment or technological innovation.

international competitiveness, in conjunction with the depreciation of the exchange rate.

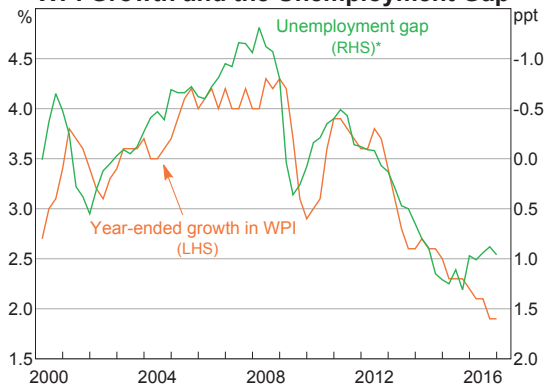
A wage model which includes labour market spare capacity, inflation expectations, a measure of firms' output prices and a lag of wage growth, cannot fully explain the decline in wage growth over recent years.[3] There are many possible explanations for this. For example, it may be that there is more slack in the labour market than the unemployment rate would suggest, or that the relationship between labour market slack and wage growth has changed.

Spare Capacity in the Labour Market

In this section, we delve further into the role of spare capacity in the labour market. The typical measure used in the Bank's Phillip Curve models of wage inflation is the unemployment rate gap – that is, the difference between the unemployment rate and the rate of unemployment that is consistent with the economy producing near its potential. The latter unemployment rate, which is not observed directly and has to be estimated, is associated with a stable rate of inflation and is referred to as the non-accelerating inflation rate of unemployment (NAIRU). The estimate of the NAIRU has fallen over recent years as a result of weakness in unit labour costs (which is AENA adjusted for productivity) and inflation.

The Bank's estimate of the unemployment gap suggests that spare capacity in the labour market has declined a little more recently as the unemployment rate has declined by more than the estimate of the NAIRU; however, wage growth has continued to moderate (Graph 3). This is consistent with the experience

Graph 3
WPI Growth and the Unemployment Gap



* The unemployment gap is inverted
Sources: ABS; RBA

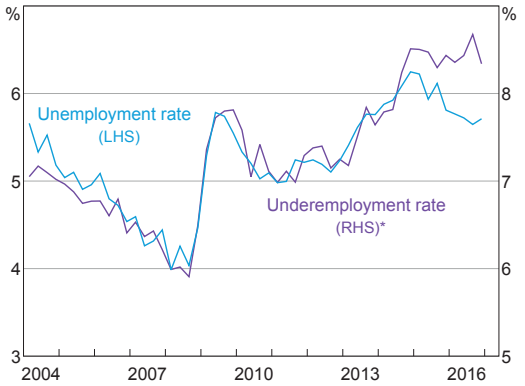
of other advanced economies in recent years that also have experienced modest wage growth despite labour market conditions tightening. This lends itself to a question of whether there is more slack in the labour market than the unemployment gap would suggest or whether the relationship between wage growth and the labour market has changed.

Another measure of spare capacity in the labour market is the level of underutilisation in the economy – which, in addition to the level of unemployment, also captures the level of *underemployment* in the economy. The underemployment rate measures the number of employed people who would like and are available to work additional hours, expressed as a share of the labour force. Between 2004 and 2014 the underemployment rate tended to move fairly closely with the unemployment rate. However, over recent years it has remained elevated while the unemployment rate has declined (Graph 4). Underemployment measured in terms of extra hours of work desired has diverged by less than this heads-based measure (RBA 2017).

Recent Bank analysis provides some information on the characteristics of the pool of underemployed workers. The bulk of

3 The Bank has recently modified the specification of the wages Phillips Curve model that was outlined in Jacobs and Rush (2015). See Appendix A for details of the model.

Graph 4
Labour Underutilisation
Per cent of labour force



* Full-time workers on reduced hours for economic reasons and part-time workers who would like, and are available, to work more hours

Source: ABS

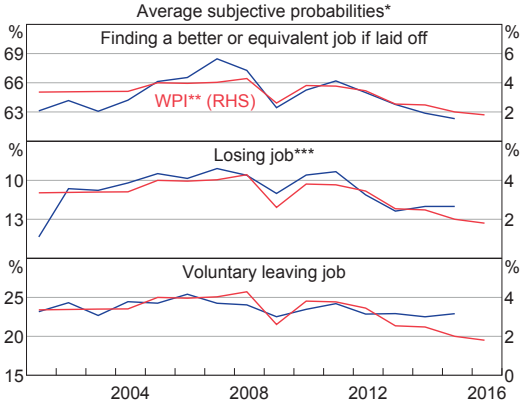
underemployed workers are part-time workers who would like to work additional hours (around 8 per cent of the labour force). The second category of underemployed workers are those who usually work full time, but are working part time for economic reasons (less than 1 per cent of the labour force). There are a number of reasons for the elevated level of the underemployment rate: the changing composition of employment growth towards industries with higher rates of part-time employment and underemployment, along with firms responding to economic conditions by adjusting workers' hours.

It is not clear how much labour underutilisation might weigh on wage growth. The presence of underemployed workers could dampen wage growth given they offer additional labour supply or may be more concerned about their job security and have less bargaining power to achieve higher wages.[4] Unsurprisingly, given the tight historical relationship between unemployment and underemployment, we have found little empirical evidence to suggest that the level of underemployment in Australia has affected wage growth separately to unemployment. More recently, the divergent trends in underemployment and unemployment could account somewhat for wage growth slowing by more than what is suggested by the unemployment gap. As a result, trends in the underemployment rate and other measures of underutilisation will continue to be monitored.

It may also be the case that the relationship between wage growth and spare capacity in the labour market may be changing due to structural changes in the labour market. It has been posited in the international literature that low wage growth may reflect a decline in workers' bargaining power. For example, new arrangements, such as a restructuring of work processes due to technological progress, an increase in contract work, and increased competitive pressure from growing internationalisation of services trade, may be weighing on wage growth. These factors, alongside spare capacity in the labour market, may be making workers feel less secure about their jobs and, in turn, they may be less inclined to push for larger wage increases. Such changes to bargaining power are difficult to observe and, as a result, the evidence of this occurring in Australia is limited. Measures of job security, as measured by households' perceived probability of losing their job in 12 months' time or their overall satisfaction with job security, are at low levels (Graph 5). However, it appears these indicators have tracked labour market conditions fairly closely, suggesting that these job security measures are not measuring anything separate to traditional labour market indicators such as unemployment.

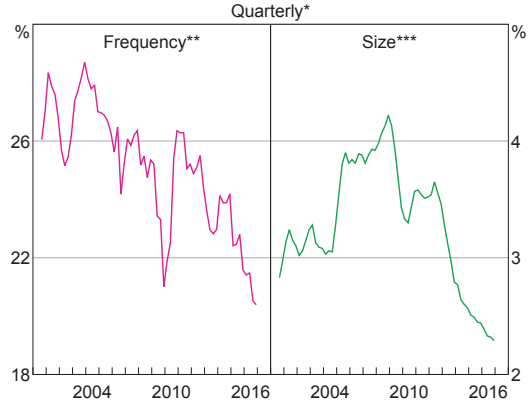
4 It may also be the case that low wage growth may lead to higher underemployment in that workers may desire more hours than otherwise in order to boost income growth.

Graph 5
Job Security and Wage Growth
Average subjective probabilities*



* Within the next 12 months
** Year-ended private sector wage price index growth
*** Indicator has been inverted
Sources: ABS; HILDA Release 15.0; RBA

Graph 6
Frequency and Size of Wage Changes
Quarterly*



* Smoothed using a four-quarter trailing average
** Share of jobs with a wage change
*** Average percentage wage change, conditional on a wage change
Sources: ABS; RBA

Trends in Wage Growth at the Micro Level

Job-level WPI data can provide further evidence on the determinants of wage growth. This analysis is the result of a recent collaboration between the Reserve Bank and the ABS using data on wage growth for around 18 000 jobs (Bishop 2016). Using these job-level data, it is possible to decompose aggregate wage growth into the frequency and average size of wage changes. Since 2012, both the average frequency and the average size of wage changes have declined (Graph 6). Overall, the declining size of wage increases has contributed more than two-thirds of the overall fall in wage growth since 2012, and the reduction in the frequency of wage adjustments has contributed the remainder. This pattern is similar across public and private sector wages.

The frequency of wage adjustments is currently at a low level; around one fifth of all wages are adjusted each quarter compared to around one quarter of all wages in 2012. This fall in the average frequency could reflect more wage freezes or longer delays in renegotiating wage contracts, as wages are often frozen during the negotiation period. It is also likely to reflect an inability of many firms to cut wages. The fall in the average frequency of wage adjustment was also quite pronounced during the global financial crisis; in part, this reflected the Australian Fair Pay Commission's decision to freeze the Federal Minimum Wage and award wages in 2009. The steady decline in the frequency of wage changes since the early 2000s may reflect a longer-run shift towards contracts that make less frequent wage adjustments.

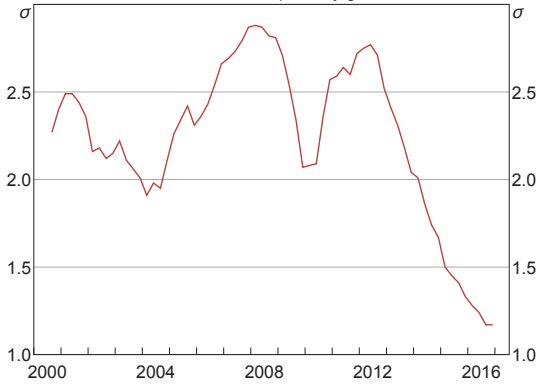
The average size of wage changes (conditional on there being a wage change) has also fallen since 2012. This is largely due to a reduction in 'large' wage rises (more than 4 per cent); in fact, this has had a very significant effect on overall wage growth. The share of jobs that experienced a wage change of over 4 per cent has fallen from over one-third in the late 2000s to less than 10 per cent of jobs in 2016 (Graph 7). In addition, the average size of these large wage changes has declined to a little less than 6 per cent.

The declining share of large wage rises since 2012 has been apparent across all industries, though the shift has been largest in mining and industries

Graph 7
Wage Changes of Different Sizes
Share of jobs that experience a wage change*

* Smoothed using a four-quarter trailing average
Sources: ABS; RBA

Graph 9
Dispersion in Wage Growth Across Jobs
Standard deviation of quarterly growth rate*

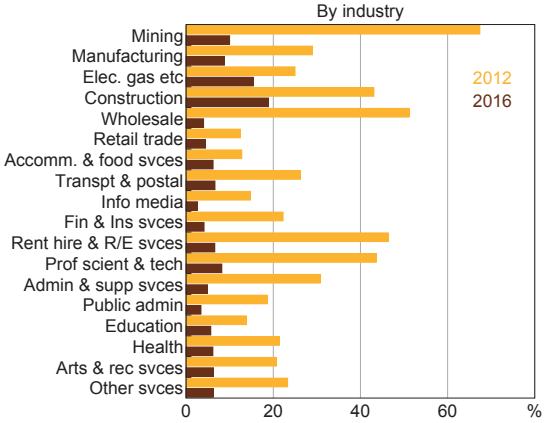


* Smoothed using a four-quarter trailing average
Sources: ABS; RBA

exposed to mining, such as construction and professional services (Graph 8). At the peak of the mining investment boom in 2012, well over half of mining jobs received a wage increase of more than 4 per cent. These large wage increases were required for labour to shift to the mining (and mining-related) sector, and accordingly, there was a high dispersion of wage growth across jobs during that period (Graph 9).

The current low level of wage growth dispersion might also suggest that the labour market adjustment following the end of the mining boom has run its course. However, relative wages in the mining industry and mining-exposed states are still significantly higher than they were pre-boom, suggesting there may be more adjustment to come (Graph 10). It is likely that the adjustment to lower relative wages in mining will be slower than during the run-up to the peak in the terms of trade. This is because most firms tend to be unwilling or unable to cut nominal wages (known as 'downward nominal wage rigidity'). Indeed, real wages have been fairly unchanged over recent years (Graph 11).

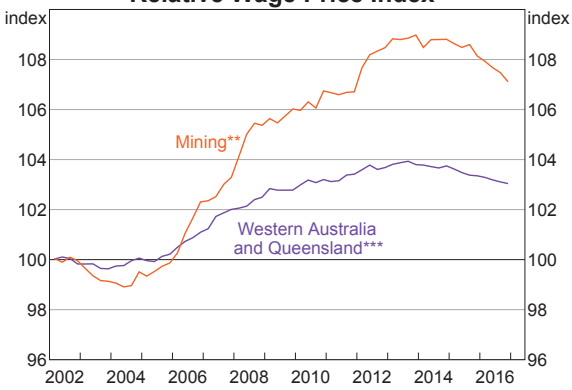
Graph 8
Share of Wage Rises Larger than 4 Per cent
By industry



Sources: ABS; RBA

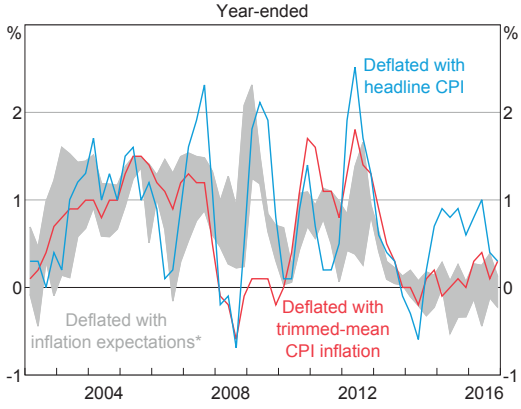
The share of wage rises between 2–3 per cent has increased to now account for almost half of all wage changes (Graph 7). This may indicate some degree of anchoring to CPI outcomes and/or the Bank's inflation target. Decisions by the Fair Work Commission, which sets awards and minimum wage outcomes, are heavily influenced by the CPI. A little over 20 per cent of employees have their pay determined directly by awards, and it is estimated pay outcomes for a further 10–15 per cent of employees (covered by either enterprise agreements or individual contracts) are indirectly influenced by awards. Information from the Department of

Graph 10
Relative Wage Price Index*



* Aggregated by distribution of employers' expenditure on wages; seasonally adjusted; 2002 average = 100
** Wage price index in mining industry relative to non-mining industries
*** Wage price index in Western Australia and Queensland relative to rest of Australia
Sources: ABS; RBA

Graph 11
Real Wage Price Index Growth
Year-ended



* Inflation expectations obtained from bond yields, union surveys and market economist surveys
Sources: ABS; RBA; Workplace Research Centre; Yieldbroker

Employment's EBA database suggests around 7 per cent of employees covered by EBAs have wage outcomes linked to the CPI, while two-fifths of a selection of firms in the Bank's liaison program indicated the CPI was a primary determinant of wage-setting. Furthermore, survey evidence from unions also suggests that inflation outcomes and expectations are an important consideration. This evidence suggests the indexing or anchoring of wage outcomes to CPI may be an important dynamic in explaining current wage outcomes.

Wage growth across all pay-setting methods has declined. Wage growth in industries that have a higher prevalence of individual agreements has declined most significantly over recent years, following strong growth in the previous few years. This may reflect the fact these industries have been influenced by the large terms of trade movements, but may also indicate that wages set by individual contract can respond most quickly to changes in economic conditions. Wage growth in industries with a higher share of enterprise bargaining agreements have the lowest wage volatility, as the typical length of an agreement is around two and a half years. While changes in wage growth and labour market outcomes by pay-setting may reflect differences in wage flexibility or bargaining power, these can be difficult to distinguish from a wide range of other determinants of wages, including variation in industry performance, the balance of demand and supply for different skills, and productivity.

Conclusion

The job-level micro WPI data provides further insights into the slowing of wage growth in Australia over recent years. Following the decline in the terms of trade, there has been a reduction in the average size of wage increases. This has been particularly pronounced in mining and mining-related wage industries. The increasing share of wage outcomes around 2–3 per cent also provides further support for the hypothesis that inflation outcomes and inflation expectations influence wage-setting. The Bank's expectation is that wage growth will gradually pick up over the next few years, as the adjustment following the end of the mining boom runs its course. The extent of the recovery will, in large part, depend on

how wage growth will respond to improving labour market conditions, including the level of underutilisation. While it is difficult to identify if structural changes are partly driving recent wage outcomes, these factors will continue to be monitored.

Appendix A: Wages Model

The Bank has recently made some modifications to the wages Phillips Curve model that was presented in Jacobs and Rush (2015). The baseline model is below:

$$\begin{aligned}\%\Delta WPI_t = \alpha &+ \beta_1 UnemGap_{t-1} + \beta_2 InfExp_{t-1} \\ &+ \beta_3 GDPdef_{t-1} + \beta_4 \Delta UR_{t-1} \\ &+ \beta_5 \%\Delta WPI_{t-1} + e_t \end{aligned} \quad \text{(A1)}$$

Where:

- $\%\Delta WPI$ is the quarterly percentage change in seasonally adjusted private sector WPI
- *UnemGap* is the 'unemployment gap' (difference between the unemployment rate and the estimated NAIRU)
- *InfExp* is 'trend' inflation expectations
- *GDPdef* is the two year-ended percentage change in the non-farm GDP deflator
- ΔUR is the quarterly change in the unemployment rate

Inflation expectations are captured using a 'trend' measure, which combines a mix of long-term survey and financial market measures of inflation expectations; long-term inflation expectations measures had a slightly better fit than shorter-term inflation expectations. The GDP deflator is included to capture changes to growth in firms' output prices. This is motivated by the fact that labour demand is a function of labour productivity and the producer real wage (that is, the cost of wages with respect to firms' output prices). The use of the GDP deflator rather than the gross national expenditure (GNE) deflator as a proxy for output prices incorporates a potential role for changes to commodity export prices to influence wage outcomes. The change in the unemployment rate is included to capture the wage growth pressure from quick changes to the rate of unemployment, for example, during the global financial crisis. The lag of the private sector WPI is included to capture persistent factors affecting wage growth.

The coefficients in the model have the expected sign and the fit of the model is an improvement on the Jacobs and Rush model. This model suggests that the current low levels of wage growth can be mostly explained by weak output prices and spare capacity in the labour market. However, there is still some unexplained weakness in wage growth. There is evidence of structural breaks in the model which provides some evidence that the relationship between wage growth and the labour market has changed. We also allow for the possibility that recent negative shocks may be persistent by estimating a model that has time-varying coefficients. Although the baseline model remains the Bank's main wage model, the suite of wage models will continue to be monitored.

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Housing Market Turnover

Hannah Leal, Stephanie Parsons, Graham White and Andrew Zurawski*

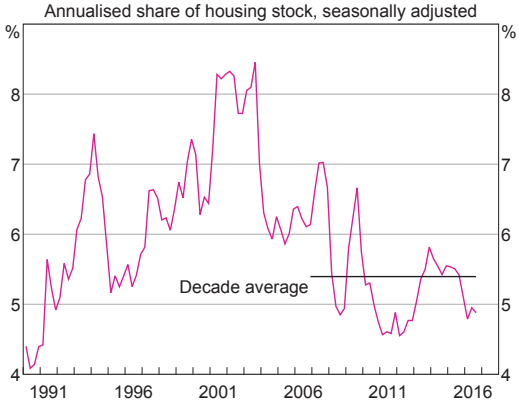
The rate of housing market turnover, an important indicator of housing market conditions, has trended lower since the early 2000s. This is partly because households are moving less often and fewer own their own homes. More recently, the increase in apartment building is likely to have resulted in measured turnover being understated. A lower housing turnover rate could reduce housing-related economic activity and might lead to lower household leverage than otherwise.

Introduction

Housing market turnover is defined as transactions in the housing market involving the transfer of ownership. After rising for a number of years, the rate of housing turnover (that is, the number of transactions relative to the stock of housing) has trended lower since the early 2000s (Graph 1). The most recent decline in the turnover rate has been unusual, particularly given the strength in other indicators of national housing market activity, such as housing prices.

The rate of housing turnover helps inform assessments of conditions in the housing market and can also influence broader economic conditions. To the extent that housing transactions are financed by debt, the value of housing turnover will be closely related to the value of housing loan approvals and subsequently housing credit growth. Changes in the housing turnover rate can directly affect income and employment in related industries, such as real estate services and other professional services, and have spillover effects on household spending through various indirect channels. Tax paid on the transfer of property ownership is also a key source of state government tax revenue.

Graph 1
Housing Turnover Rate
Annualised share of housing stock, seasonally adjusted



Sources: ABS; CoreLogic; RBA

In this article, we provide an overview of some factors that might influence measured housing turnover in Australia. Household-level survey data, in addition to aggregate economic indicators, are used to examine possible reasons for the decline in the housing turnover rate over the past decade or so. This is followed by a discussion of measurement challenges arising

* Hannah Leal, Stephanie Parsons and Andrew Zurawski are from Economic Group. Graham White is from Domestic Markets Department.

from the recent increase in off-the-plan sales of new apartments. We also examine some broader implications of housing market turnover for economic activity and household balance sheets.

How Is Housing Turnover Measured?

In Australia, the most complete set of housing sales data is collected by the state and territory Valuers-General or Land Titles Offices. These agencies receive detailed sales information at the time a housing transaction is settled, which usually includes the date at which the purchase was agreed and contracts were signed. Other parties, such as private research companies, then aggregate these unit-record data to construct regional measures of turnover based on the contract date of the sale. As a result, the length of time between the contract date and settlement date of housing transactions can influence the completeness of recent data. This lag is especially long for off-the-plan apartment sales, which typically occur before construction has begun and are not settled until a few years later when construction is complete.

To overcome some of these limitations, private research companies often supplement official state government data with industry sources. For example, CoreLogic collects information from real estate agents, listings websites and other sources.[1] To address the issue of lengthy publication lags further, CoreLogic estimates housing turnover by adjusting for the historical pattern of revisions to turnover data and, more recently, has applied modelling which incorporates residential listings.

The Australian Bureau of Statistics (ABS) also reports housing turnover ('transfers') using CoreLogic's unit-record database. The ABS does not adjust for missing observations and as a consequence its measure of housing turnover is typically lower than CoreLogic's, although upward revisions to the ABS data tend to bring the series closer together over time.

Drivers of Housing Turnover

Households decide to move for many reasons, stemming from both personal circumstances and macroeconomic conditions. Data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey show that the main reasons why owner-occupiers move home have not changed much over the past decade. In 2015, the most common single reason cited for moving by home owners was to have a place of their own (about 30 per cent), followed by having a larger or better place (about 22 per cent). A number of reasons relating to family and friends, such as moving closer, were also cited by a large proportion of home owners.

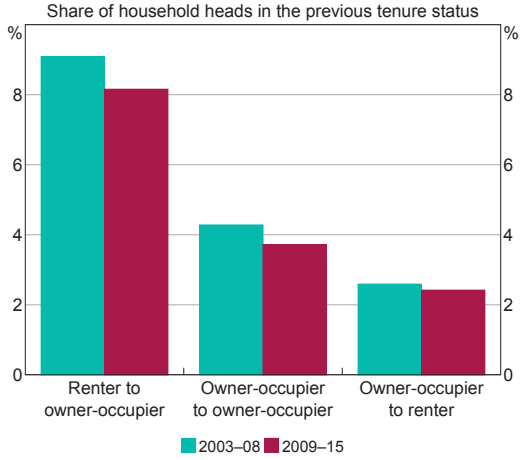
Not surprisingly, the reasons for moving differ by age. Older owner-occupiers (aged 55 years and above) more commonly cite downsizing and location, whereas those aged 35 to 54 years are more often buying larger or better properties. Younger home owners (aged 18 to 34 years) appear to be the least concerned with the location of the home and more frequently prioritise having their own place and family and friends in their moving decision. Moving for work is not a common reason for buying a home, regardless of age, which might reflect a view by some households that work is a temporary reason for moving and therefore not sufficient to commit to home ownership.

While the reasons for moving have not changed much over time, the HILDA Survey shows that households are moving less often than they were in the early 2000s (Graph 2).[2] The largest

1 These data are matched with the state government data and are overridden when the official record of the transaction is available.

2 This is consistent with ABS Census data which show a decline in the share of residents moving over the last two decades.

Graph 2
Moved in the Previous Year*
Share of household heads in the previous tenure status



* Excludes households that did not appear in consecutive surveys
Sources: HILDA Release 15.0; RBA

declines in moving frequencies that involve the transfer of ownership have been for renters transitioning to owner-occupiers and then owner-occupiers moving between dwellings.[3] Even when controlling for various demographic and income characteristics which may affect the decision to move, the probability of owner-occupiers having moved in the previous year appears to have declined since the early 2000s, particularly if owner-occupiers were renters in the previous year.

The factors that affect the propensity of households to move, and therefore housing turnover, are closely related to the drivers of home ownership, which are explored in detail in RBA (2015). For example, the consequences of disinflation and financial deregulation included a significant increase in many households' borrowing capacity during the late 1990s and early 2000s. This likely contributed to relatively high rates of housing turnover in that period. On the other hand, financial and other costs can discourage households from moving frequently, particularly when the purchase of a home is involved.[4] Demographics are another important factor affecting home ownership and housing turnover. Regression analysis suggests that being in a relationship increases the probability of transitioning from being a renter to an owner-occupier and the probability of transitioning between dwellings as an owner-occupier. The magnitude of the effect is much larger for the former transition, suggesting that people are inclined to wait until partnering before purchasing a home. Higher incomes and higher levels of education are also particularly important factors that increase the probability of transitioning from renter to owner-occupier.

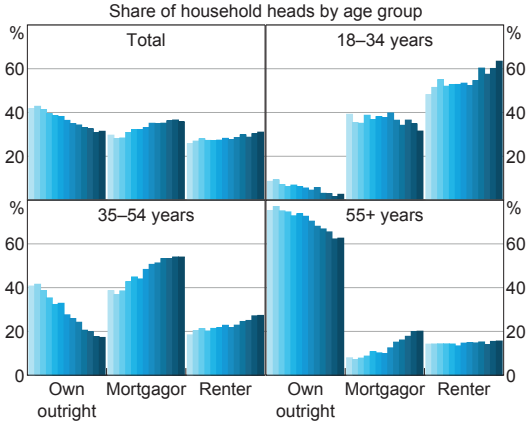
Another demographic factor potentially affecting housing turnover is the age composition of home owners. Data from the ABS Survey of Income and Housing show a small increase in the aggregate share of renter households, driven largely by households with a household head aged under 55 years (Graph 3). All else being equal, a larger proportion of renter households would be expected to reduce housing turnover, to the extent that turnover measures home sales as opposed to household moves.[5] Given that renters tend to be disproportionately younger households, this suggests that older owner-occupier households represent a larger share of housing turnover than in the past. If these older households have a tendency to move less frequently (for example, because of more stable employment, established social networks and a preference to age in their own homes), this

3 The frequency with which renters move between dwellings has also declined, but these moves do not directly affect housing turnover as they do not involve the transfer of ownership.

4 However, the Australian data have not shown strong evidence that transaction costs impede household mobility (Flatau *et al* 2002).

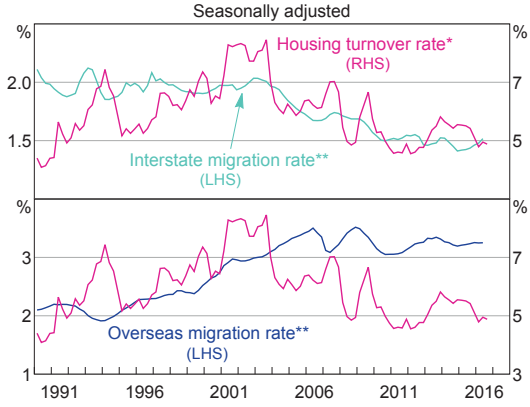
5 This would not be the case if the frequency at which investors bought and sold housing was greater than owner-occupiers. Unfortunately, the available turnover data are not disaggregated by owner-occupier and investor purchases. Data from the ABS Census and National Regional Profiles (for 2011 and 2013, respectively) provide some evidence that local government areas with higher rates of home ownership tend to report higher rates of housing turnover. This relationship holds even when controlling for other variables which may affect home ownership rates, such as income and age.

Graph 3
Composition of Housing Tenure Over Time*
Share of household heads by age group



* From 1994/95 to 2013/14, Surveys of Income and Housing; renter includes government housing
Sources: ABS; RBA

Graph 4
Housing Turnover and Migration Rates
Seasonally adjusted



* Annualised share of housing stock
** Gross annual rolling sum; share of population
Sources: ABS; CoreLogic; RBA

could imply a potentially lower equilibrium rate of housing turnover (Olsberg and Winters 2005).[6]

Another driver of housing turnover is migration, to the extent that households moving between states or countries are purchasing or selling homes. The decline in the turnover rate since the early 2000s appears to have been associated with a significant decline in the rate of gross interstate migration (Graph 4). As previously discussed, the decision to move reflects an interaction between various benefits and costs. For example, moving interstate may bring households closer to family and friends or better employment opportunities, but can involve high costs. Structural factors such as improvements in technology and the changing nature of work are likely to have reduced the benefits of interstate migration while increasing insecurity around employment and income, which would be expected to weigh on the housing turnover rate (Bachmann and Cooper 2014; Kaplan and Schulhofer-Wohl 2015; RBA 2015). In the United States, lower housing turnover rates have also been associated with a long-run decline in interstate migration, which in turn has been linked to declining labour mobility (Molloy, Smith and Wozniak 2014).

By contrast, the relationship between rates of housing turnover and gross overseas migration (the sum of overseas immigration and emigration) appears to have been less strong. The increasing housing turnover rate during the 1990s and early 2000s was associated with a rise in the rate of gross overseas migration, although the decline in the turnover rate since then has occurred alongside a relatively high gross overseas migration rate. While higher rates of gross overseas migration would be expected to have a positive effect on the housing turnover rate, this relationship could operate with a lag given that a large proportion of new immigrants tend to rent their first home in Australia before later transitioning to home ownership (Khoo *et al* 2012). Students also comprise a large share of new migrants to Australia and are likely to be less able and inclined to purchase housing than the average household (RBA 2015).[7]

6 Additionally, older people are much less likely to finance a new housing purchase with a loan, and if they do, the loan size is typically much smaller. Such a compositional change implies a smaller level of credit per housing transaction than otherwise.

7 However, liaison suggests that one recent motivation of foreign buyers of Australian property has been to provide housing for children while they study in Australia (Shoory 2016).

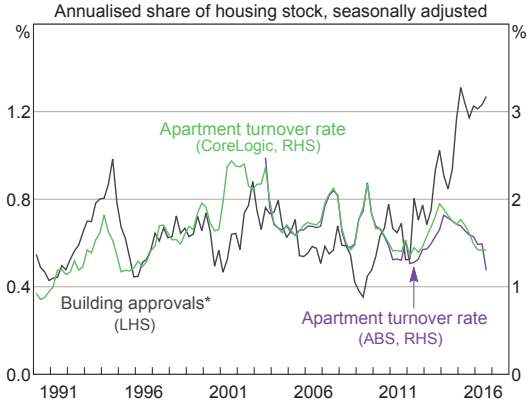
Housing Turnover and the Recent Increase in Apartment Building

The decline in the national housing turnover rate in recent years has occurred despite strength in a number of housing market indicators such as national housing price growth, which has historically been positively correlated with the turnover rate. While the previous section outlined some potential reasons for the longer-run decline in the housing turnover rate, part of the recent weakness could be due to measurement issues arising from the increased share of apartments in new housing construction.

Private residential building approvals for higher-density housing have increased sharply since 2009 and now account for around half of all approvals (Graph 5).[8] Meanwhile the apartment turnover rate, which has historically moved in line with building approvals, has declined. Evidence from business liaison suggests that the majority of new apartments are purchased off-the-plan, well before construction has commenced, and that off-the-plan sales have settlement lags of around two or three years (Shoory 2016). However, data providers have limited information about these sales until settlement, implying that contract-dated measures of housing turnover are likely to be understating actual turnover in the most recent years. Elevated levels of new apartment construction would be expected to increase the degree of this understatement.

One way to approximate the extent of the understatement of apartment turnover is to estimate the share of turnover that relates to new apartments versus existing apartments. This information can then be used to adjust the most recent data. The ABS and private research companies publish data on house and

Graph 5
Apartment Turnover Rate and Building Approvals
Annualised share of housing stock, seasonally adjusted



* Includes semi-detached houses
Sources: ABS; CoreLogic; RBA

apartment turnover separately but are not able to disaggregate turnover by new and existing housing. We use the number of higher-density building approvals as a proxy for new apartment turnover and estimate the turnover of existing apartments as a residual. In doing so, we assume that the approval and contract dates are equivalent and that all approved construction is completed. This seems to be a reasonable proxy for new apartment turnover given that a large proportion of new apartments are sold before being built and housing turnover is measured at the contract date of the sale.

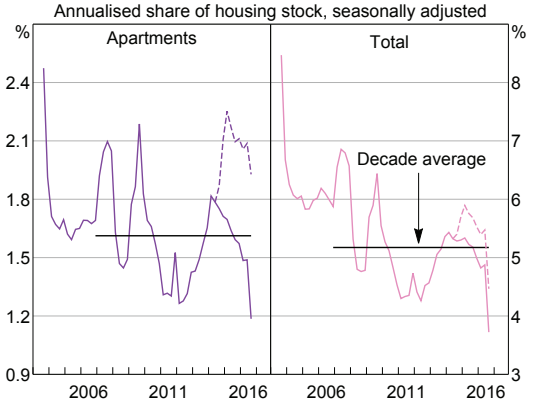
The recent sharp increase in higher-density building approvals seems to imply that turnover of existing apartments has fallen significantly since 2014 to around zero (when estimated as the ABS measure of total apartment turnover minus higher-density building approvals). This seems unlikely, suggesting that total apartment turnover is understated. We can estimate the effect of the understatement by adjusting existing apartments' share of turnover to more reasonable levels. For example, keeping the share constant from the June quarter 2014 (at around 18 per cent) and scaling up the volume of total

8 Higher-density building approvals include apartments as well as semi-detached houses, but apartments have been the main driver of the increase in approvals in recent years (Shoory 2016).

turnover implies that the actual apartment turnover rate may be around ½–¾ percentage point higher than reported over this period (Graph 6).[9] Under these assumptions, apartment turnover appears to have increased sharply through the second half of 2014 and early 2015, before declining to around 2 per cent of the housing stock. The aggregate housing turnover rate would have also increased through late 2014 and early 2015 under these assumptions, before declining to be below its decade average rate.[10]

Although CoreLogic publishes modelled estimates of housing turnover, the pattern of revisions to these data over recent years suggests that the estimates have not been fully adjusted for the increased share of off-the-plan sales. For example, upward revisions to apartment turnover have been substantial for several years after the data were first released. By contrast, revisions to house turnover tend to be limited after a few months. Scaling up reported apartment sales from mid 2014 onwards by CoreLogic's average two-year revision rate produces similar estimates to the above exercise.

Graph 6
Housing Turnover Rates*
Annualised share of housing stock, seasonally adjusted



* Dashed lines are estimates holding the share of turnover of existing apartments constant from June quarter 2014

Sources: ABS; RBA

9 While the volume of turnover attributed to existing houses, new houses and new apartments does not change in this scenario, their share of total turnover is reduced proportionate to the increase in the share of existing apartments.

10 We achieved comparable results using turnover data from CoreLogic.

Implications for Economic Activity

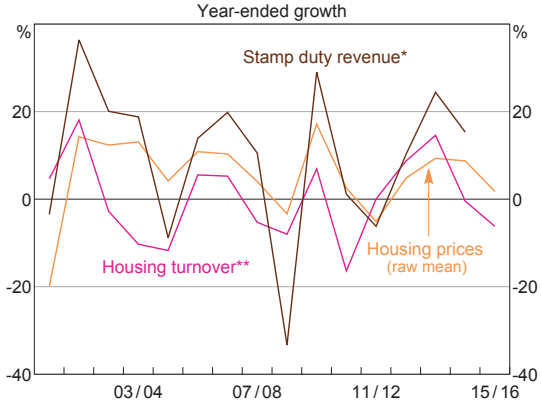
Developments in the rate of housing market turnover can affect broader economic activity through several channels. A number of occupations are involved in housing transactions; these include real estate agents, lawyers and finance professionals. A decline in the rate of housing turnover would be expected to generate less employment and income growth for these professions at the margin.

Housing turnover also affects property tax revenue, which accounted for about 40 per cent of total state tax revenue in 2014/15.[11] More than half of property tax revenue is typically derived from tax paid on the transfer of property ownership (stamp duty). All else being equal, a decline in the number of housing transactions would be expected to reduce stamp duty revenue. However, given that stamp duty is calculated as a proportion of the sale price of the property, strong growth in national housing prices can more than offset a decline in turnover, as occurred in 2014/15 (Graph 7). The interaction between housing turnover and price growth, as well as state differences in the rate of property taxation, concessions and surcharges, can therefore affect government spending and budget outcomes.

Housing turnover can have a number of indirect effects on household spending. For example, housing turnover is positively correlated with household retail spending, particularly on durable goods such as furniture, home appliances and electrical or electronic devices (Graph 8). Renovation activity is another channel through which housing turnover can indirectly

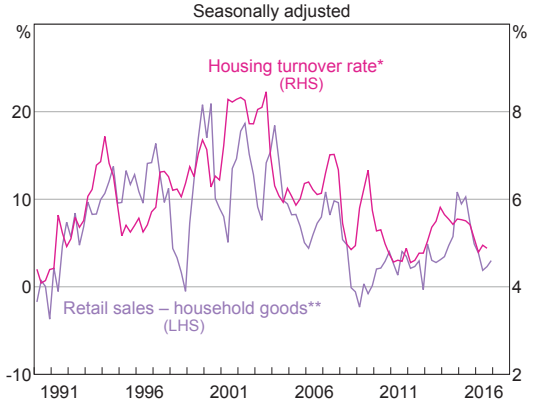
11 This excludes revenue from the transfer of goods and services tax to the states.

Graph 7
Housing Turnover, Prices and Stamp Duty
Year-ended growth



* Annual sum across states; includes residential and non-residential properties
** Annual rolling sum of number of housing sales
Sources: ABS; CoreLogic; RBA

Graph 8
Housing Turnover Rate and Retail Sales
Seasonally adjusted



* Annualised share of housing stock
** Chain volume measure; year-ended growth
Sources: ABS; CoreLogic; RBA

affect household spending, as new owners might choose to modify homes to suit their needs or existing owners might renovate to add value to their home before listing. Renovation activity would also be expected to have flow-on effects for activity in the construction industry.

Another indirect channel through which housing market turnover can affect economic activity is housing prices. A common feature of housing markets in advanced economies is a positive correlation between housing price growth and turnover. One strand of literature posits that changes in housing turnover can lead changes in housing prices if buyers and sellers have incomplete information about market conditions (Wheaton 1990).[12] Changes in housing prices can subsequently affect household consumption via the household wealth channel (Muellbauer and Murphy 1990). Housing price growth can also affect dwelling investment by altering the expected return on investment, with flow-on effects for incomes and employment in related industries.

Changes in the composition of housing turnover, in particular the increase in the share of off-the-plan apartment sales, can affect the relationship between turnover, housing loan approvals and credit. For a typical sale of an existing property financed by a mortgage, the time between the contract date and settlement date is relatively short (around six to eight weeks). As a housing loan approval usually occurs about five to six weeks before settlement, this implies a short lag between housing turnover (recorded at the contract date) and loan approval. Credit is then drawn down at settlement of the transaction. As discussed above, off-the-plan apartments are commonly purchased before construction meaning that the lag between the contract date and settlement date can be around two or three years. As such, the loan approval and drawdown of credit does not occur until well after the initial contract is agreed (see 'Box A: Housing Market Turnover and Housing Finance' for more details).

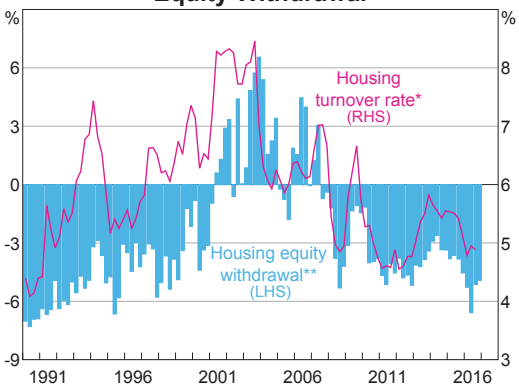
Furthermore, housing turnover has a more general effect on household balance sheets.

12 The literature also puts forward explanations for reverse causality between housing prices and turnover, highlighting loss aversion of sellers and binding financing constraints (Stein 1995; Genesove and Mayer 2001).

Higher rates of housing turnover have been associated with periods of housing equity withdrawal, which indicates an excess of mortgage borrowing over new investment in housing, and was seen in Australia for much of the early to mid 2000s (Graph 9) (RBA 2003). This relationship occurs because a housing transaction typically involves the buyer taking on more debt to finance the purchase than the seller has outstanding against the property (Schwartz *et al* 2006; Greenspan and Kennedy 2008; Reinold 2011).[13] As a result, the current low level of the housing turnover rate might be expected to result in lower household leverage than otherwise.[14]

Relatedly, lower rates of housing turnover will tend to increase the average age of housing loans and the level of mortgage buffers. Households with newer or larger mortgages have had less time to build up buffers, consistent with data from the HILDA Survey which show that borrowers with small or no buffers tend to be younger or have more recently taken out their loan (RBA 2012). Those households with large mortgage buffers tend to be older, suggesting they have had time to accumulate these.

Graph 9
Housing Turnover Rate and Equity Withdrawal



* Annualised share of housing stock
** Share of household disposable income; excludes unincorporated enterprises; before the deduction of interest payments
Sources: ABS; Australian Treasury; CoreLogic; RBA

Conclusion

The housing turnover rate has trended lower since the early 2000s. One contributing factor we highlight in this article is a lower propensity for households to move home. Among the potential reasons for this could be lower rates of home ownership, particularly for younger households, and migration trends.

More recently, the sharp increase in off-the-plan sales of new apartments, which are difficult to measure in a timely manner, suggests that reported housing turnover is likely to be understated. Given the significant settlement lags associated with these sales, the relationship between housing turnover and credit growth also appears to have weakened. Nevertheless, the longer-run decline in the rate of housing turnover suggests that housing-related activity could make a smaller direct contribution to aggregate economic activity in the future, and may also lead to lower household leverage and higher mortgage buffers.

13 Examples where this is especially the case would be when the transaction involves last-time sellers such as retirees or people moving overseas.

14 While lower housing equity withdrawal can reduce funds available for consumption, research suggests that this effect has been small in Australia (Schwartz *et al* 2006).

Box A

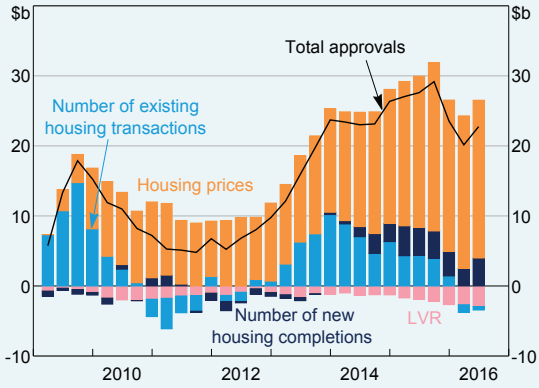
Housing Market Turnover and Housing Finance

There is a close relationship between housing market turnover and the total amount borrowed to purchase residential property. The amount borrowed as a proportion of the value of the property is known as the loan-to-valuation ratio (LVR). The total value of funds borrowed from financial intermediaries, or housing loan approvals, is equal to the amount borrowed on all housing transactions, including both existing housing and new housing completions. This differs from the measures of turnover described earlier, since the finance to purchase an off-the-plan property is only given final approval when construction nears completion, rather than when construction is approved. This means that the finance for off-the-plan housing occurs two or three years after the sale.

Housing loan approvals are related to changes in housing prices, the LVR, turnover of the existing housing stock and housing completions. For example, if housing prices rise, households have to borrow more to afford a given property, assuming an unchanged LVR. Higher LVRs increase total loan approvals because a greater proportion of each housing transaction is financed with debt. An increase in turnover of the existing housing stock or completions of new housing means that there is typically an increase in the number of households taking out new debt, since the majority of housing transactions require debt financing.

Decomposing the change in total housing loan approvals into contributions from these elements allows a more detailed analysis of the drivers of housing finance (although it should be noted that this analysis reflects co-movement, rather than a causality of the relationship in a specific direction).[1] This shows that, for Australia, turnover of existing housing has been an important driver of trends in loan approvals since 2009 (Graph A1). Over the past two years, its contribution to new housing finance has been declining. Over the same period, housing prices have been making a large contribution to growth in housing finance. The decline in turnover of existing housing goes some way to explaining why housing credit growth has been relatively muted, despite rapidly rising housing prices.

Graph A1
Cumulative Change in Loan Approvals
Since March 2009



Sources: ABS; CoreLogic; RBA

1 Loans for refinancing and the construction of new housing with no transfer of ownership will not be associated with housing sales and are therefore excluded from this analysis.

The contribution to loan approvals from the completion of new housing has been relatively small over the sample period, although it has been making a more noticeable contribution recently. The increase in off-the-plan apartment sales can be expected to contribute to more finance for new housing as these buildings are completed in coming years.

Lastly, it should be noted that the sale of new housing will generally contribute more to the outstanding stock of housing credit than the sale of existing housing. This is because the seller of an existing home will typically be another household rather than a property developer, which is likely to be the case when a new home is sold. As such, the funds raised from the sale of the existing home may be used to pay off existing housing debt.

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Inflation Expectations in Advanced Economies

Rachel Adeney, Ivailo Arsov and Richard Evans*

Anchored inflation expectations are important for price stability because expectations affect current actions. Although all inflation expectations measures provide some information about future inflation, professional forecasters have been the most accurate in predicting future inflation, while market-implied and consumer measures have tended to be less so. Recent declines in inflation expectations have been concentrated in the measures that have historically been less accurate predictors. The more accurate measures have been more stable and have remained close to central banks' inflation targets.

Introduction

After declining during the global financial crisis (GFC), inflation rates in advanced economies have remained low and below most central banks' targets for an extended period, although headline inflation has picked up in some economies more recently. The low inflation experience has been mainly caused by the slow economic recovery, which has only very gradually absorbed the spare capacity in labour and product markets. Such a protracted period of low inflation could, in principle, lead economic agents to expect that inflation in the future would remain low and below central banks' inflation targets. Understanding whether low inflation expectations have become entrenched is important for monetary policy decision-making because expectations affect current economic decisions.

A number of measures of inflation expectations are available but some are better indicators of future inflation than others. Understanding which of these measures are the most informative about future inflation is crucial for monitoring developments in inflation expectations. This article assesses how well three widely available types of inflation expectations measures predict inflation at various horizons. These measures are implied from the prices of some financial instruments, or obtained from surveys of professional forecasters and consumers. The analysis covers the period from the mid 1990s in a number of advanced economies: Australia, Canada, the euro area, Japan, New Zealand, Sweden, the United Kingdom and the United States.

Inflation Expectations Measures

Inflation expectations are used by central banks as one of the inputs for assessing the inflation outlook and the associated risks. Inflation expectations affect how workers and firms set prices and wages; determine the level of real interest rates; and, especially over longer horizons, provide an indication of the central banks' inflation targeting credibility (Moore 2016). Over recent years, various inflation expectations measures have displayed different trends. This

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makes it important to know which measures are best at anticipating future inflation.

There are three main types of inflation expectations measures: market-implied, which are derived from observed prices of certain financial instruments with payoffs linked closely to future inflation outcomes; surveys of professional forecasters' expectations; and surveys of consumers' expectations.[1,2] These measures capture different people's expectations and are constructed differently. They also differ in terms of availability across time and economies, and how far into the future they measure expected inflation.

Market-implied measures of inflation expectations

The simplest and most often used market-implied measures of inflation expectations are based on spot and forward rates from inflation swaps, or differences between spot and forward rates on inflation-linked and nominal government bonds. These simple measures do not adjust for the effects of risk premia on asset prices. Such an adjustment is necessary to extract the underlying 'true' expectations component, although the adjustment is both complex and model-dependent so the raw spot and forward rates are mostly used in practice.[3] The key benefits of the simple market-implied inflation expectations measures are that they are timely (they are available at least on a daily basis), they cover expectations going out as far as 30 years into the future, and they reflect the decisions of informed and well-resourced financial market participants.

1 For a detailed discussion of these measures in the Australian context, see Moore (2016).

2 A summary of the inflation expectations measures used in this article is provided in Appendix A. This analysis does not consider the expectations of businesses, except in the case of Canada and New Zealand at the 2-year-ahead horizon where they are used as proxies for consumer expectations.

3 For more information on the risk premia embodied in both inflation swaps and inflation-linked bonds, see European Central Bank (2014) and Moore (2016). Finlay and Wende (2011) decompose inflation expectations and risk premia for Australia.

However, unadjusted for risk premia, these measures can give a distorted view of inflation expectations, especially if these risk premia vary over time.[4] Low and varying liquidity of the financial instruments also distorts these measures.[5]

Market-implied inflation expectations based on inflation swaps are used in this article.[6] Forward rates from inflation swaps abstract from near-term inflation developments. However, the inflation swap market has a relatively short history; it has been in existence since 2004 in most of the larger advanced economies and since 2007 in Australia, Japan and Sweden.

Professional forecasters

Surveys of professional economic forecasters poll private sector economists about the inflation rate they expect across a range of horizons (typically from 1 year to 10 years in the future). Of the three measures, the surveys of professional forecasters are the most likely to accurately reflect the true expectations of the economic agents whose expectations they attempt to capture. Professional economists are also likely to incorporate broader economic conditions into their inflation forecasts more accurately than market participants and consumers. That said, the professional forecasters may face incentives to provide forecasts that are close to consensus or

4 There is evidence that inflation risk premia vary over time, making it difficult to attribute movements in the market-based measures as changes in underlying expectations or inflation risk premia (Moore 2016). Imakubo and Nakajima (2015) find evidence that inflation risk premia declined in both Japan and the United States in 2014.

5 For example, Moore (2016) finds that activity in the Australian inflation swap market is low and prices may reflect the views of just a small number of market makers.

6 The market for inflation-linked government bonds has existed for longer than the market for inflation swaps. However, constructing consistent market-implied measures of inflation expectations requires inflation-linked bonds with a range of maturities at each point in time; the range of maturities is limited and varies through time in most economies. This limits the ability to assess the forecasting performance of market-implied measures from inflation-linked bonds that abstracts from the effects of near-term inflation developments. For further discussion of bond- and swap-implied inflation expectations, see Finlay and Olivan (2012).

to 'stand out', which may result in forecasts that differ from their true expectations.[7] In addition, professional forecasts are updated less frequently than the market-based measures.

Consumer surveys

Consumer, or household, expectations of future inflation are captured by surveys of consumers' views on economic conditions. The specifics of the surveys vary significantly across economies.[8] Some economies have no regular surveys of consumer inflation expectations, and those that do tend to cover only short-term expectations; only the United States and the United Kingdom have surveys that measure longer-term consumer inflation expectations.

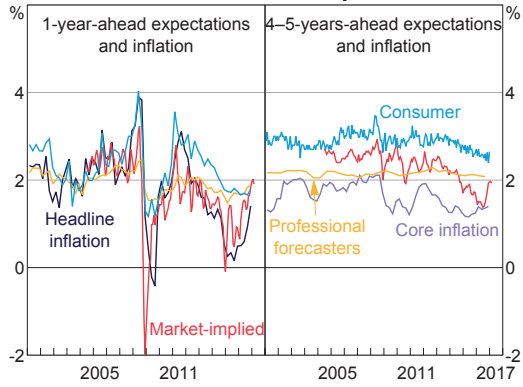
There are a number of factors that might affect the accuracy of consumer survey measures of inflation expectations. For example, consumers may use different information sets based on their personal experience, or place excess weight on some items, while some respondents may be more prone to biases than others (Ballantyne *et al* 2016). Furthermore, there are fewer incentives for consumers to devote effort to putting together informed forecasts, whereas the inflation expectations measures from professional forecasters and market participants are arguably motivated by reputational and financial incentives.

Recent Developments

Inflation in advanced economies has been low and below central banks' targets for much of the post-GFC period, although it has begun to pick up recently. Headline inflation in advanced economies has been volatile in recent years. It declined sharply in late 2014 and early 2015 alongside the steep fall in oil prices, but has increased from mid 2016 as oil prices started to recover (Graph 1). Core inflation, which abstracts from the volatility of energy prices, has declined to relatively low rates since mid 2013. Most measures of inflation expectations in advanced economies have also declined to below their pre-GFC levels. Much of the decline has occurred since 2014; the market-implied inflation expectations measures fell by the most, although they have recovered some of their declines since 2016.

The shorter-term inflation expectations measures have been more volatile, and more correlated with headline inflation.[9] This is unsurprising given that, at the 1-year horizon, economic agents' expectations can reasonably attempt

Graph 1
Advanced Economies – Inflation and Inflation Expectations*



* Year-ended; excludes Japan; PPP-weighted; sample varies over each series depending on data availability, see Appendix A for details

Sources: ABS; Bloomberg; Consensus Economics; ECB; European Commission; IMF; Konjunkturinstitutet; RBA; RBNZ; Thomson Reuters; Westpac and Melbourne Institute

7 For example, Croushore (1997, p3) argues that where forecasts are attributed to individual forecasters, 'participants might shade their forecasts more toward the consensus (to avoid unfavourable publicity when wrong), while others might make unusually bold forecasts, hoping to stand out from the crowd.'

8 For example, while most surveys directly ask participants what they expect the rate of inflation to be over a specific horizon, the European Commission's survey asks euro area consumers whether they expect inflation to be higher, lower or unchanged relative to a prior period and report the results as a diffusion index. The Japanese survey reports the distribution of survey responses about expected inflation.

9 'Long-term' refers to expectations about inflation at least 4–5 years into the future; 'short-term' refers to expectations of 1–2 years ahead. Typically, long-term measures are more stable than short-term measures because developments in headline inflation are harder to predict further into the future. As a result, long-term measures can reasonably be considered as reflecting forecasters' beliefs about whether a given central bank will achieve its inflation target.

to incorporate movements in the more volatile components of inflation (including food and energy prices). Of the three measures, short-term market-implied inflation expectations declined the most in late 2014 and early 2015, although they have increased noticeably in late 2016; these developments have closely followed movements in oil prices. Professional forecasters' short-term expectations have been more stable, while the decline in short-term consumer expectations has been quite broad based across economies.

In general, long-term inflation expectations measures in the advanced economies have been more stable than the short-term measures. This reflects the credibility that economic agents assign to central banks in reaching their inflation targets once short-term shocks dissipate. However, some measures of longer-term inflation expectations have declined noticeably since late 2014. This could mean that expectations are no longer anchored at central banks' targets. How much this matters depends on how informative these measures are about future inflation. Long-term market-implied expectations declined the most; they drifted lower after the GFC, before declining sharply in late 2014 and early 2015.[10] However, in all economies, these measures have increased noticeably since late 2016. This could reflect improvements in the macroeconomic outlook, stabilisation in the oil price, or changes in inflation risk premia.[11]

Long-term consumer expectations are only available for the United States and the United Kingdom, where they have also steadily declined over the past three years. In contrast, long-term professional forecasters' survey measures have been relatively more stable over the post-crisis period.

How Well Do Measures of Inflation Expectations Forecast Future Inflation?

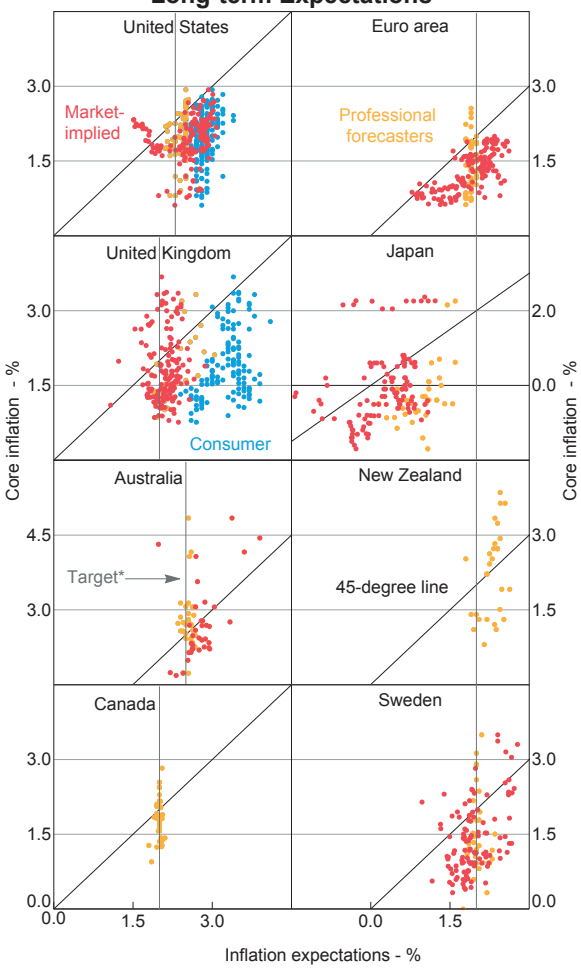
The divergence between inflation expectations measures over recent years, especially between the market-implied and professional forecasters' measures at longer horizons, raises a question about which expectations measures are better able to predict future inflation. If the measures that have been more stable, such as the surveys of professional forecasters, are better at predicting future inflation, this would suggest that inflation expectations have remained anchored and central banks are expected to continue to act in ways that ensure their inflation objectives are achieved. Conversely, if the market-implied measures – which have experienced larger declines over recent years – are better predictors of future inflation, this would suggest that underlying inflation is expected to be lower than many central banks' inflation targets. This would make the task of returning inflation to target more difficult, especially in an environment where policy rates are already low and unconventional monetary policy tools have been deployed extensively.

Comparing each inflation expectations measure to subsequently realised inflation shows both the predictive performance and anchoring of each measure. Graph 2 shows that long-term inflation expectations have tended to over-predict inflation (i.e. the dots lie below the 45-degree line), more so than shorter-term expectations.

10 This was true in particular for the euro area, Sweden and the United States. In contrast, market-implied expectations in Japan picked up sharply in early 2013, following the Bank of Japan announcing its quantitative and qualitative monetary easing program and introducing its 2 per cent inflation target. Japanese market-implied inflation expectations then fell sharply over the second half of 2015 and early 2016 (a year later than the other advanced economies), as inflation remained persistently low and the yen appreciated.

11 To some extent movements in market-implied inflation expectations, even at longer horizons, have coincided with movements in the oil price. The correlation between the longer-term market-implied inflation expectations and oil prices is puzzling as oil price changes should not affect inflation at longer horizons. For more information, see Darvas and Hüttl (2016).

Graph 2
Realised Inflation and Long-term Expectations



* Represents each central bank's inflation target or goal, or the midpoint of the target band where applicable

Sources: ABS; Bloomberg; Consensus Economics; ECB; European Commission; IMF; Konjunkturinstitutet; RBA; RBNZ; Thomson Reuters; Westpac and Melbourne Institute

Inflation expectations are more anchored the closer they cluster around the central bank's inflation target (represented by the grey vertical lines in Graph 2). The longer-term professional forecasters' inflation expectations cluster closely to the inflation targets. In contrast, the market-implied and consumer inflation expectations measures are more dispersed. Longer-term consumer inflation expectations in the United States appear to be fairly closely clustered but at a level higher than the Federal Reserve's inflation goal.[12]

More formally, the relative forecasting performance of an inflation expectations measure can be evaluated based on:

- bias; the average difference between the inflation expectations measure and realised inflation over the relevant horizon; and
- root mean squared error (RMSE); the average distance (measured by the squared difference) between the inflation expectations measure and realised inflation over the relevant horizon.[13]

Measures with lower bias and a lower RMSE are better at predicting future inflation. It is necessary to use a common sample period for a consistent assessment of the relative performance of different inflation expectations measures. The market-implied measures have the shortest history because inflation swaps data are only available from 2004, which limits the period of assessment to 2005–16. This period is dominated by the low inflation experience since the GFC, which may affect the applicability of the results to the extent that the persistence of this low inflation environment was unexpected. To address this concern, the analysis is also extended to the pre-GFC period for professional forecasters' and consumers' expectations for economies where the data are available.

To provide further context, the bias and RMSE of the three types of inflation expectations measures

12 The Federal Reserve's inflation goal is for 2 per cent inflation as measured by the price index of personal consumption expenditure (PCE). However, US inflation expectations measures either reference CPI inflation explicitly (professional forecasters and market-implied), or do not reference a specific inflation index (consumer). Therefore, the US inflation expectations measures are compared to 2.3 per cent – the Federal Reserve's inflation goal plus the average difference between core CPI and core PCE inflation since 2000 (Federal Reserve Bank of Cleveland 2014).

13 See Mincer and Zarnowitz (1969) for further details on evaluating forecasts. Formally, for a forecast $\hat{\theta}$ of a variable θ the bias is $\mathbb{E}\left[\hat{\theta}-\theta\right]$ and the RMSE is $\sqrt{\mathbb{E}\left[\left(\hat{\theta}-\theta\right)^2\right]}$.

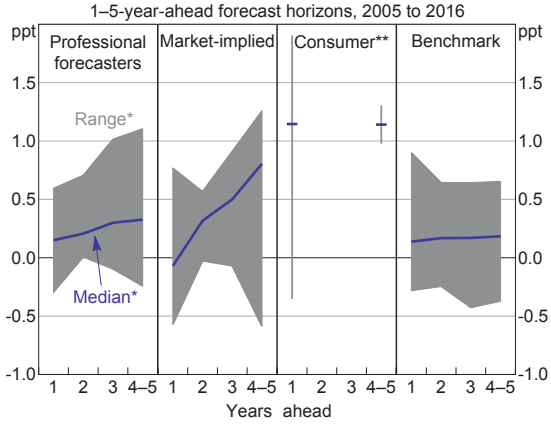
can be compared against the forecasting performance of a simple statistical model (the 'benchmark' model). One such benchmark is a model where quarterly inflation only depends on the central bank's inflation target and last period's inflation. This captures the persistence of inflation, and assumes inflation returns to the central bank's target at a speed which is consistent with the historical experience.[14]

Expectations of headline inflation at the 1-year horizon are most appropriately compared with actual headline inflation over the subsequent year. At longer horizons, inflation expectations are compared with core inflation because it is unlikely that economic agents can, or indeed attempt to, accurately anticipate shocks to the prices of volatile items, such as energy, when forming their longer-term inflation expectations.[15]

Bias

Inflation expectations measures since 2005 have been upwardly biased (Graph 3).[16] That is, in most economies and at most horizons (up to 5 years ahead) inflation expectations measures have been, on average, higher than realised inflation over the

Graph 3
Inflation Expectations – Estimated Bias
1–5-year-ahead forecast horizons, 2005 to 2016



* Median and range of bias at each horizon across the economies in the sample; positive (negative) values indicate that a given inflation expectations measure is on average higher (lower) than the realised inflation at that horizon

** Long-term consumer expectations are only available for the United Kingdom and United States

Source: RBA

period referenced by the inflation expectation measures. While there is some variation across the advanced economies, in general, inflation expectations have been less biased and more accurate at forecasting inflation in the near-term.

Professional forecasters have tended to have the least biased expectations, particularly at longer horizons. Their bias beyond the 1-year horizon is statistically significant in most cases.[17] However, in Australia, New Zealand and the United Kingdom, professional forecasters' inflation expectations measures appear to be unbiased at all horizons.

Market-implied measures are positively biased beyond the 1-year horizon, and this bias increases with the length of the forecast horizon. This is largely as expected, because risk premia should drive a positive wedge between the true, but unobserved, inflation expectations of swap market participants and the forward rate, and

14 More formally, the statistical benchmark follows an autoregressive process of order one, estimated recursively from 1990 with the long-run mean constrained to equal the relevant inflation target. The Bank of Japan and the US Federal Reserve established explicit inflation goals or targets only recently; 2011 in the United States and 2013 in Japan. Even before establishing its explicit inflation goal in 2011, it was widely assumed that the Federal Reserve's goal was to achieve inflation of around 2 per cent (for an example of this see the Federal Open Market Committee's Summary of Economic Projections long-term inflation forecasts, which were generally between 1.7 and 2 per cent from 2007 to the introduction of the formal inflation goal in 2011). As such, this inflation goal is used as the inflation target even before 2011. For Japan, where inflation has been persistently low and often negative, and the inflation target was only recently implemented, the statistical benchmark assumes that inflation in future periods remains at its current level.

15 Faust and Wright (2013) suggest that, even if forecasters are trying to predict headline inflation, they may be better off forecasting core inflation and then using this as if it were a prediction of overall inflation.

16 Detailed estimates of the bias and the RMSE for each economy in the sample at the 1-year and the 4–5-year horizons are available in Appendix A.

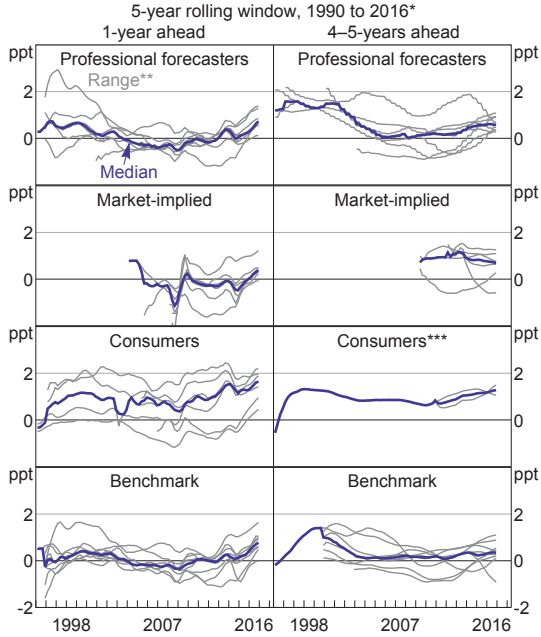
17 The bias is formally assessed with regressions of the forecast errors of an inflation expectations measure (inflation expectations measure less inflation at the relevant horizon) on a constant using autocorrelation-robust standard errors $\left(\pi_t^{e,h} - \pi_{t+h} = C + \varepsilon_t\right)$ and testing the statistical significance at the 5 per cent level of the estimated bias $\left(\hat{C}\right)$.

this difference should increase with the horizon.[18] Market-based inflation expectations measures appear to be unbiased at all horizons in Japan and the United Kingdom. However, the relatively short sample of the Japanese market-implied measures, combined with the effects of the 2014 consumption tax increase, suggest that this conclusion may not hold over longer and more representative periods of time; the effects of the consumption tax increase would not have been incorporated into inflation forecasts made before it was announced in 2012.

Consumer inflation expectations measures are also upwardly biased, reflecting respondents' personal experience and financial literacy (Ballantyne *et al* 2016).[19] It is unclear whether the bias in consumer expectations increases with the length of the forecast horizon; the bias increases with the forecast horizon in the United Kingdom, but is broadly similar in the United States across horizons.

The bias in most inflation expectations measures has increased at all horizons in recent years (Graph 4). The increase has been the largest for consumers, who have consistently expected inflation to be higher than it has been since around 2009. Professional forecasters' inflation expectations have been the least biased at longer-term horizons since the early 2000s. Prior to this, their bias had declined, possibly reflecting an adjustment to the wide-spread adoption of inflation targeting regimes by central banks in the 1990s. The bias of longer-term market-implied inflation expectations measures has been high and relatively stable over time. The lower bias of the professional forecasters relative to the other available expectations over the extended period of time is consistent with the results from the shorter common sample period.

Graph 4
Rolling Average Forecast Error
5-year rolling window, 1990 to 2016*



* Axis date represents the end of each rolling 5-year window; 1-year-ahead expectations evaluated against headline inflation; 4–5-years-ahead expectations evaluated against 2-year annualised core inflation
** Represents each individual economy
*** Long-term consumer expectations are only available for the United Kingdom and United States
Source: RBA

Root mean squared errors

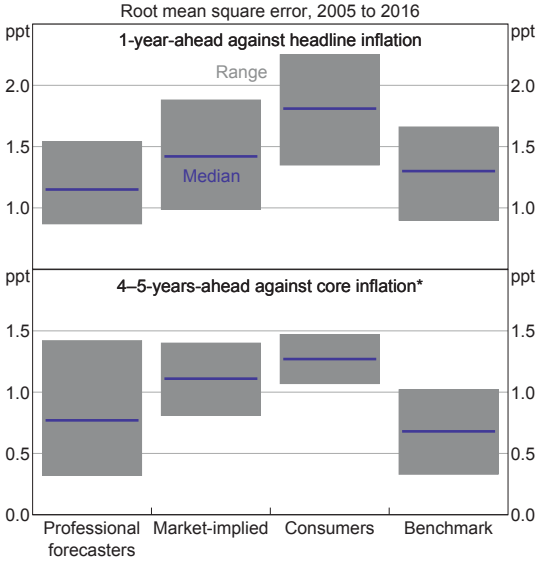
The second aspect of forecasting performance is the accuracy of the forecast. A forecast that is more biased may still be preferred if its variance is sufficiently small.[20] That said, the ranking of the three expectations measures based on their RMSE since 2005 is the same as the ranking based on their bias. Professional forecasters' inflation expectations have been more accurate at anticipating future inflation than those of markets or consumers at all horizons (Graph 5).

18 Haubrich, Pennacchi and Ritchken (2012) find that inflation risk premia are positive and increasing in maturity in the United States. Hördahl and Tristani (2010) find the same result in both the euro area and United States.

19 Two exceptions are the United Kingdom, where consumer inflation expectations at the 1-year horizon are unbiased, and in New Zealand, where business expectations at the 2-year horizon are unbiased.

20 The RMSE is a function of the bias and the variance of the forecast: $RMSE(\hat{\theta}) = \sqrt{\text{var}(\hat{\theta}) + (Bias(\hat{\theta}, \theta))^2}$. Between two forecasts, the more biased one can have a lower RMSE if and only if it has a sufficiently smaller variance.

Graph 5
Inflation Forecasting Accuracy
Root mean square error, 2005 to 2016



* Forecasts evaluated against 2-year annualised core inflation
Source: RBA

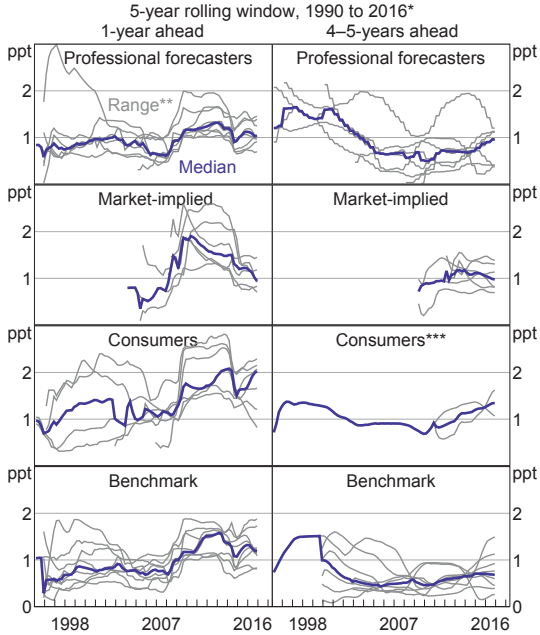
The market-implied measures have, in turn, been more accurate than the consumer inflation expectations measures. As was the case with the bias, the inflation expectations measures' RMSE increases with the length of the forecast horizon.[21]

The difference between the RMSEs of the professional forecasters and the market-implied measures is not statistically significant at shorter horizons.[22] This, together with their similar bias at the 1-year horizon, points to the two types of measures having similar information content about future inflation at shorter horizons. The professional forecasters' and market-implied inflation expectations tend to be at least as accurate as the simple statistical benchmark in forecasting near-term inflation.[23]

At longer horizons however, professional forecasters are statistically more accurate than longer-term market-implied expectations in most economies. Of the three measures, only the professional forecasters' inflation expectations are as accurate as the simple statistical benchmark (both market-implied and consumer measures are statistically less accurate).

Professional forecasters have generally produced the most accurate forecasts of inflation since the late 1990s, consistent with the results from the post-2005 common sample period (Graph 6). Since

Graph 6
Rolling Root Mean Square Error
5-year rolling window, 1990 to 2016*



* Axis date represents the end of each rolling 5-year window; 1-year-ahead expectations evaluated against headline inflation; 4–5-years-ahead expectations evaluated against 2-year annualised core inflation
** Represents each individual economy
*** Long-term consumer expectations are only available for the United Kingdom and United States
Source: RBA

21 A visual inspection of Graph 5 suggests that the RMSE of each expectations measure is larger at the 1-year horizon. This reflects the fact that 1-year ahead inflation expectations are evaluated against headline inflation, while longer-term horizons are evaluated against core inflation which is less volatile. The pattern of increasing RMSE with the forecast horizon is apparent when evaluating expectations against core inflation at 2-, 3- and 4–5-year horizons.

22 The statistical significance of the differences in RMSEs between two inflation expectations measures is assessed with the Diebold-Mariano test using a quadratic loss function. For further details on this procedure, see Diebold (2013).

23 Grothe and Meyler (2015) find similar results, i.e. that market-implied and professional forecasts are statistically at least as accurate as a simple auto regressive process and a random walk in the United States and the euro area at 1- and 2- year-ahead horizons.

the GFC, the accuracy of short-term professional and consumer inflation expectations has declined, especially at longer horizons. The accuracy of the short-term market-implied measures has varied significantly since the mid 2000s.

Conclusion

The forecasting ability of inflation expectations measures in advanced economies has been mixed. Consumer inflation expectations measures are the least accurate at predicting future inflation. Market-implied measures have been able to anticipate inflation accurately over the subsequent year, but they have tended to over-predict inflation at longer horizons. Market-implied measures tend to have relatively large bias and forecast errors at longer horizons, although this bias has decreased a little over the past couple of years. In general, professional forecasters' inflation expectations have been the least biased and the most accurate at predicting future inflation. Given their better forecasting performance, the inflation expectations of professional forecasters should receive the most weight in assessing changes in inflation expectations. Still, other measures should continue to be monitored because they provide more timely information on potential developments (e.g. market-implied measures) or represent the expectations of particular groups of economic agents that are relevant in setting prices and wages (e.g. consumers).

Over recent years, longer-term professional forecasters' inflation expectations measures have been relatively stable while the market-implied and consumer measures have declined since 2014. The stability of the professional forecasters' longer-term inflation expectations at around central banks' inflation targets may alleviate concerns about inflation expectations in advanced economies becoming less well anchored. Supporting this interpretation, market-implied measures have also retraced some of their earlier declines since mid 2016. The high volatility in recent years and the relatively poor forecasting performance of market-implied expectations suggest that these measures should be interpreted with caution.

Appendix A

Table A1: Inflation Expectations Measures in Advanced Economies

	Type	Measure	Horizon	Start	Frequency
United States	Financial market	Swaps-implied	1–10 years	2004	Intraday
	Professional survey	Federal Reserve Bank of Philadelphia Survey of Professional Forecasters	1, 10 years	1981 (1 year), 1991 (10 years)	Quarterly
	Professional survey	Consensus Economics	3–5 years	1989	Semiannual
	Consumer survey	University of Michigan Survey of Consumers	1, 5–10 years	1978	Monthly
Euro area	Financial market	Swaps-implied	1–10 years ahead	2004	Intraday
	Professional survey	European Central Bank Survey of Professional Forecasters	1, 2, 5 years	1999	Quarterly

Table A1: Inflation Expectations Measures in Advanced Economies (continued)

	Type	Measure	Horizon	Start	Frequency
	Professional survey	Consensus Economics	3, 10 years	2003	Semiannual
	Consumer survey	European Commission Consumer Survey[a]	1 year	1985	Monthly
Japan	Financial market	Swaps-implied	1–10 years	2007	Intraday
	Professional survey	Consensus Economics	1–10 years	1994 (1, 2 years), 1989 (3–10 years)	Quarterly and semiannual
	Consumer survey	Cabinet Office Consumer Confidence Survey[b]	1 year	2004	Monthly
United Kingdom[c]	Financial market	Swaps-implied	1–10 years	2004	Intraday
	Professional survey	Consensus Economics	1–10 years	2004	Quarterly and semiannual
	Consumer survey	YouGov Citigroup	1, 5–10 years	2005	Monthly
Australia	Financial market	Swaps-implied	1–10 years	2008	Intraday
	Professional survey	Consensus Economics	1–10 years	1994 (1, 2 years), 1991 (3–10 years)	Quarterly and semiannual
	Consumer survey	Westpac and Melbourne Institute Survey of Inflationary Expectations	1 year	1995	Monthly
New Zealand	Professional survey	Consensus Economics	1–10 years	1995	Quarterly and semiannual
	Consumer survey	RBNZ Household and Business CPI Expectations	1 year (households), 2 years (businesses)	1990	Quarterly
Canada[d]	Professional survey	Consensus Economics	1–10 years	1994 (1, 2 years), 1989 (3–10 years)	Quarterly and semiannual
	Consumer survey	Bank of Canada Business Outlook Survey	2 years	2001	Quarterly
Sweden	Financial market	Swaps-implied	1–10 years	2007	Intraday

Table A1: Inflation Expectations Measures in Advanced Economies (continued)

	Type	Measure	Horizon	Start	Frequency
	Professional survey	Consensus Economics	1–10 years	1995	Quarterly and semiannual
	Consumer survey	Konjunkturinstitutet Household Survey	1 year	2001	Quarterly

(a) The European Commission Consumer Survey asks consumers whether they expect inflation to be higher, lower or unchanged relative to a prior period, and reports the results as a diffusion index; for completeness only, the euro area consumer inflation expectations diffusion index is mapped to an inflation expectation by scaling the index to have the same mean and standard deviation as the euro area headline inflation between 1996 and 2016
(b) The Japanese Cabinet Office Consumer Confidence Survey inflation expectations are reported as the proportion of respondents who believe inflation over the subsequent year will be in a particular range; the measure of Japanese consumer inflation expectations is constructed as the weighted average of the midpoints of these ranges, with weights given by the proportion of responses in each range, and conservative assumptions for the two extreme ranges
(c) UK inflation swaps reference the retail price index (RPI) rather than the consumer price index; UK market-implied expectations are adjusted by subtracting 0.95 percentage points from the forward and spot rate to reflect the average difference between the RPI and CPI priced into market-implied inflation expectations, based on Bank of England (2014) liaison with market participants
(d) In Canada, consumer inflation expectations are not available before 2015 and are proxied by business expectations
Source: RBA

Table A2: Bias and RMSE of Inflation Expectations Measures in Advanced Economies

2005–16

	1-year-ahead		4–5-years-ahead	
	RMSE[(a)]	Bias[(b)]	RMSE[(a)]	Bias[(b)]
Australia				
Professional forecasters	1.00	0.15	0.68**	–0.24*
Market-implied	1.09*	0.17	0.81***	0.64***
Consumers	2.25***	1.90***		
Benchmark	0.93	–0.06	0.64	–0.29***
Canada				
Professional forecasters	0.87	0.16	0.32	0.22***
Market-implied				
Consumers				
Benchmark	0.90	0.28*	0.33	0.24***
Euro area				
Professional forecasters	1.07	0.05	0.69***	0.58***
Market-implied	0.99***	–0.01	1.07***	1.04***
Consumers	1.35***	–0.34		
Benchmark	1.09	0.35*	0.71	0.63***
Japan				
Professional forecasters	0.96***	0.15	1.43	1.10***
Market-implied	1.32***	–0.13	1.40	–0.59*
Consumers	2.06***	1.90***		
Benchmark	1.65	0.01	1.01	–0.37**

Table A2: Bias and RMSE of Inflation Expectations Measures in Advanced Economies (continued)
2005–16

	1-year-ahead		4–5-years-ahead	
	RMSE[a]	Bias[b]	RMSE[a]	Bias[b]
New Zealand				
Professional forecasters	1.23	0.35*	0.94*	–0.01
Market-implied				
Consumers	1.81**	1.30***		
Benchmark	1.36	–0.10	0.82	–0.26*
Sweden				
Professional forecasters	1.40***	0.59***	0.86	0.65***
Market-implied	1.61*	0.77***	1.31**	1.26***
Consumers	1.58	0.87***		
Benchmark	1.54	0.90***	0.84	0.65***
United Kingdom				
Professional forecasters	1.36	–0.29	0.89**	0.12
Market-implied	1.53**	–0.57**	1.15***	–0.03
Consumers	1.37	0.15	1.46***	1.30***
Benchmark	1.24	–0.28	0.61	0.13
United States				
Professional forecasters	1.53	0.07	0.56	0.43***
Market-implied	1.88**	–0.33	1.06***	0.98***
Consumers	2.14***	1.15***	1.07***	0.98***
Benchmark	1.52	0.26	0.52	0.38***

(a) *, ** and *** indicate statistical significance at the 10, 5 and 1 per cent levels, respectively, between the difference in forecasting performance between the RMSE of the measure of inflation expectations and the benchmark using a two-sided Diebold-Mariano test with quadratic loss; rejecting the null hypothesis suggests that accuracy of the measure of inflation expectations and the benchmark are not equal

(b) The reported bias is the coefficient estimate, $\hat{C}$, from the regression $\pi_t^{e,h} - \pi_{t+h} = C + \varepsilon_t$ estimated with autocorrelation-robust standard errors; *, ** and *** indicate statistical significance at the 10, 5 and 1 per cent levels, respectively

Source: RBA

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Developments in Banks' Funding Costs and Lending Rates

Belinda Cheung*

This article updates previous Reserve Bank research on the ways in which developments in the composition and pricing of banks' debt funding have affected their overall cost of funds and influenced lending rates. Major banks' outstanding funding costs and lending rates declined in 2016, following two reductions in the cash rate. However, lending rates and funding costs did not decline by as much as the cash rate. This was largely due to an increase in the cost of deposit funding, which reflected competition between financial institutions for deposits.

Introduction

The rates that banks set on their loans to households and businesses are determined in part by the cost of banks' funding. Banks also take into account risk premia, such as that for credit risk associated with loans, and the liquidity risk involved in funding long-term assets with short-term liabilities. Banks' growth strategies, competition and the desired return to equity holders also affect their lending rates.

An important influence on the cost of banks' funding is the level of the cash rate, which acts as an anchor for the broader interest rate structure of the domestic financial system. However, the cash rate is not the only determinant of lending rates. Changes in the level of compensation demanded by investors to hold bank debt, competitive pressures and non-price factors (such as funding composition) can influence banks' funding costs significantly. There is usually some lag before the full effect of changes in these factors flows through to funding costs and lending rates. This reflects the time it takes for banks' liabilities to be repriced, particularly those with longer terms to maturity.

* The author is from Domestic Markets Department.

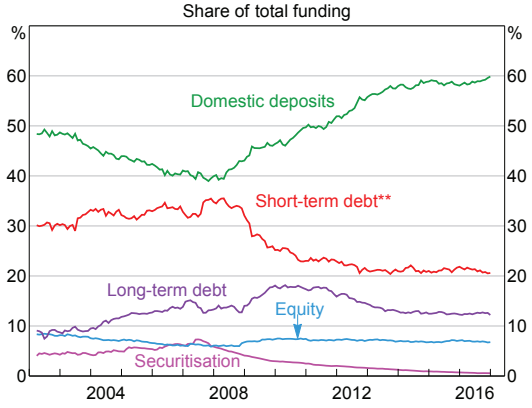
The Reserve Bank Board takes developments in funding costs and lending rates into account when determining the appropriate setting of the cash rate (Lowe 2012). The Board aims to ensure that the interest rates faced by households and businesses are consistent with the desired stance of monetary policy. The following analysis updates previous Reserve Bank research and focuses on developments in banks' funding costs and lending rates over 2016 (Wilkins, Gardner and Chapman 2016).

Over the past year, funding costs have declined in absolute terms, but have risen relative to the cash rate. Deposit pricing has been a major driver of recent changes in funding costs, reflecting increased competition for certain deposits. Banks have also been active in issuing long-term wholesale debt, with net issuance well above levels in previous years, although this has had a relatively small effect on banks' funding costs as the cost of new issuance has declined over 2016.

Composition of Funding

Banks operating in Australia have diverse funding bases, including deposits, short-term and long-term wholesale debt as well as equity (Graph 1).

Graph 1
Funding Composition of Banks in Australia*
Share of total funding



* Adjusted for movements in foreign exchange rates; tenor of debt is estimated on a residual maturity basis

** Includes deposits and intragroup funding from non-residents

Sources: APRA; RBA; Standard & Poor's

Deposits from households and businesses comprise about 60 per cent of Australian banks' funding liabilities. Banks have increased the share of deposit funding since the financial crisis as deposits are considered to be a more stable form of funding than short-term debt, thereby reducing the liquidity risks that banks face. Much of the increase in deposit funding over the past year has been sourced from households, either directly or through superannuation funds.

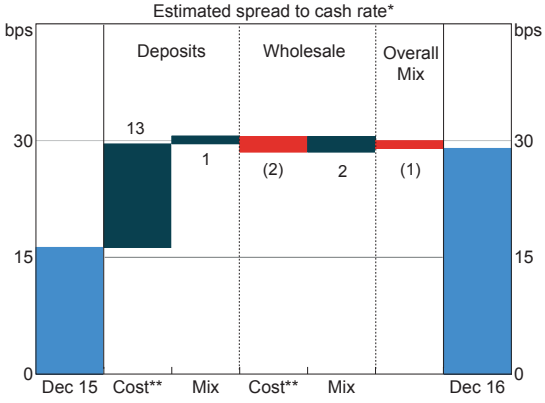
The share of equity funding has remained relatively stable during 2016. Similarly, the share of funding sourced from long-term wholesale debt has remained steady over the past year. Long-term wholesale debt, such as bank bonds, is also considered a relatively stable source of funding; bank bonds typically have a maturity of around three to five years at issuance and this longer term to maturity reduces the frequency with which banks need to refinance their debt.

In contrast, the share of funding sourced from short-term wholesale debt has declined to around 20 per cent of banks' funding. Short-term wholesale debt, such as bank bills, repurchase agreements or unsecured interbank loans, typically has a residual maturity of less than six months and is therefore considered to be a less stable source of funding.

Cost of Debt Funding

In aggregate, debt funding costs (hereafter 'funding costs') for the major banks are estimated to have fallen by around 35 basis points over 2016, partly reflecting a reduction in the cash rate of 25 basis points in May and again in August. The spread between the major banks' funding costs and the cash rate is estimated to have risen by around 13 basis points over the past year (from around 15 basis points to just under 30 basis points, as shown in the blue columns of Graph 2). The widening in this spread largely reflects a rise in the cost of some deposits relative to the cash rate. Compositional changes within the mix of different deposits and wholesale funding sources also added a little to banks' funding costs, while wholesale funding costs declined by more than the cash rate during the year. The increase in the spread between banks' funding costs and the cash rate occurred in mid 2016; funding costs have been little changed since then.

Graph 2
Major Banks' Debt Funding Costs
Estimated spread to cash rate*



* RBA estimates; numbers represent contributions to the overall change in the spread and may not add to the total due to rounding; bracketed numbers represent negative contributions

** Includes the cost or benefit of interest rate hedges

Sources: APRA; Bloomberg; RBA; UBS AG, Australia Branch

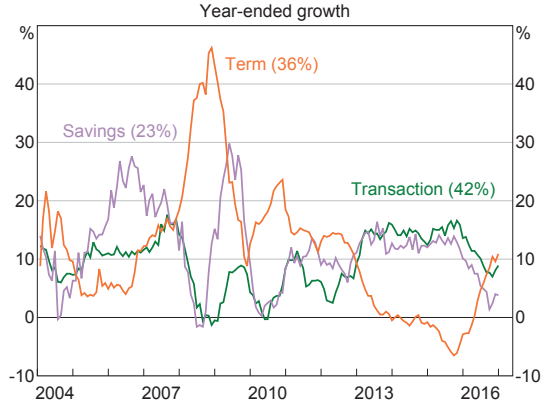
Deposits

Over 2016, the advertised interest rates on at-call savings accounts, such as online and bonus savings accounts, were lowered by less than the total reduction in the cash rate. At the same time, interest rates on term deposits were relatively steady. This followed a period of several years during which average term deposit rates were lower than interest rates on 'bonus saver' deposits (Graph 3).

Consistent with the movements in the relative rates on different deposits, there has been a corresponding change in the composition of deposits, with term deposits growing more strongly than transaction and savings deposits over the past year (Graph 4). The change in the mix of deposit funding increased banks' total funding costs slightly as term deposit interest rates have been higher than other deposit products.

The increased competition for longer-dated deposits, particularly deposits from households and small businesses, reflects the fact that these products are classified as more stable sources of funding under the proposed Net Stable Funding Ratio (NSFR), which comes into effect in 2018 (APRA 2016). The NSFR requires banks to maintain a stable funding profile in relation to the composition of their assets and off-balance sheet activities. Accordingly, banks have begun to prepare their balance sheets for the implementation of the NSFR by offering higher interest rates on term deposits with longer maturities (Graph 5). However, to date the increased cost of these products has had only a very small effect on total funding costs as term deposits with maturities beyond one year only account for around 2 per cent of total funding. Moreover, household and small business

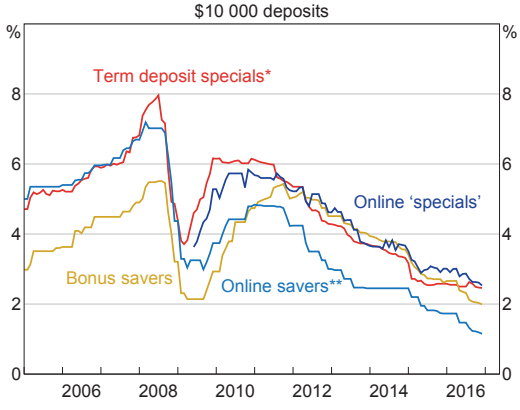
Graph 4
Deposits by Product Type*
Year-ended growth



* Break-adjusted; not seasonally adjusted; excludes foreign currency, intragroup deposits and certificates of deposit; values in brackets represent share of AUD deposits

Sources: APRA; RBA

Graph 3
Major Banks' Deposit Rates
$10 000 deposits

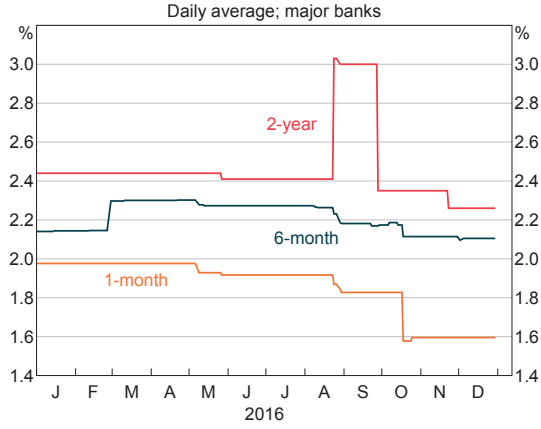


* Average of 1–12, 24-, 36-, and 60-month terms

** Excludes temporary bonus rates

Sources: Canstar; RBA

Graph 5
Advertised Term Deposit Rates
Daily average; major banks



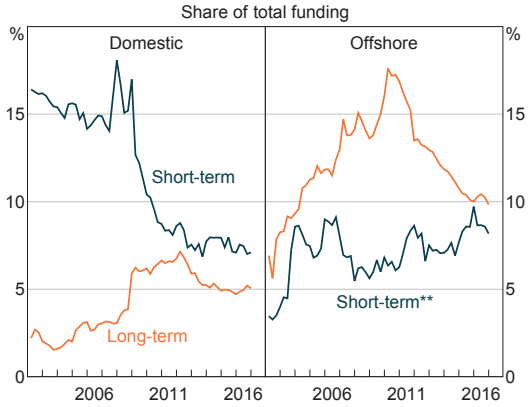
Sources: Canstar; RBA

customers make up a very small proportion of term deposits with maturities of more than one year.

Wholesale Funding

Changes in the cost and composition of wholesale funding had little effect on the major banks' cost of funding relative to the cash rate over the past year. While there was a slight shift in domestic wholesale funding from short-term debt to long-term debt, and an overall lengthening in the term of banks' issuance, this had only a small effect on funding costs (Graph 6).[1]

Graph 6
Major Banks' Wholesale Funding*

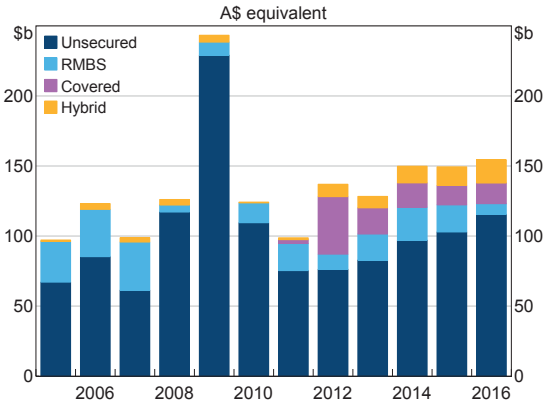


* Adjusted for movements in foreign exchange rates
** Includes deposits and intragroup funding from non-residents
Sources: APRA; RBA

The volume of issuance by banks of senior unsecured bonds, covered bonds and hybrid instruments increased in 2016 compared with the previous year, although banks issued fewer residential mortgage-backed securities (RMBS) (Graph 7). Primary market spreads for RMBS have narrowed in recent months, but remain above the levels seen in late 2015.

1 Short-term offshore wholesale funding is defined as non-resident deposits and non-resident debt securities issued overseas with a residual maturity of less than 12 months (and includes Australian dollar-denominated and foreign currency-denominated securities), as reported to APRA. Residual maturity is useful for assessing banks' funding task for the period ahead, but overstates the issuance of new short-term debt and understates long-term issuance.

Graph 7
Australian Banks' Wholesale Issuance



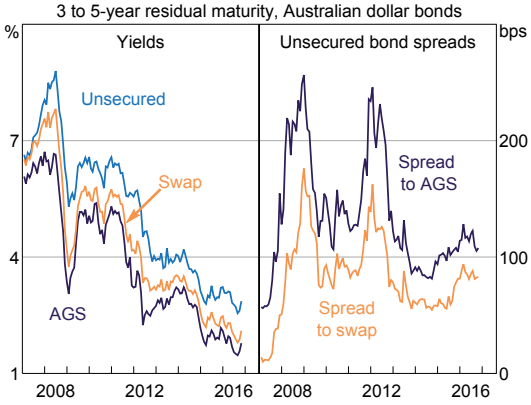
Source: RBA

A decline in wholesale funding rates over 2016 and the refinancing of maturing bonds at lower interest rates have contributed to a reduction in the major banks' outstanding wholesale funding costs. Yields on major banks' senior unsecured debt largely moved in line with sovereign and swap rates in 2016 and, on average, yields were lower than in the previous year (Graph 8).

Conditions for issuance in wholesale funding markets have been favourable for much of 2016; however, wholesale debt funding rates have increased since September, which has raised the cost of issuing new wholesale debt. The cost of new wholesale debt issuance is now fairly close to the cost of outstanding issuance (Graph 9).

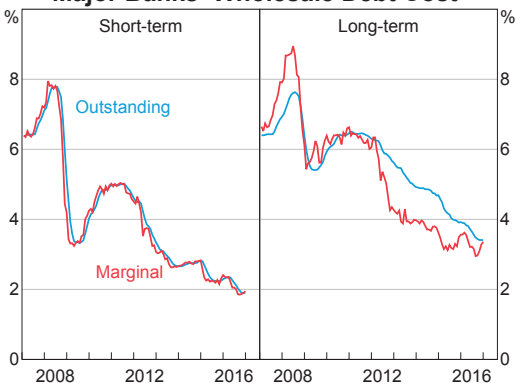
Over recent years, issuance of hybrid securities – securities with both debt and equity properties – has steadily increased owing to the implementation of Basel III capital reforms in Australia. Hybrids have the ability to absorb losses in a situation of stress or default (that is, if certain triggers are breached) and rank higher in a bank's capital structure than common equity, but below senior debt and deposits. While the cost of hybrid funding outstanding has fallen over the year, it remains costly relative to other wholesale funding sources and accounts for a relatively small share of total funding.

Graph 8
Major Banks' Bond Pricing
3 to 5-year residual maturity, Australian dollar bonds



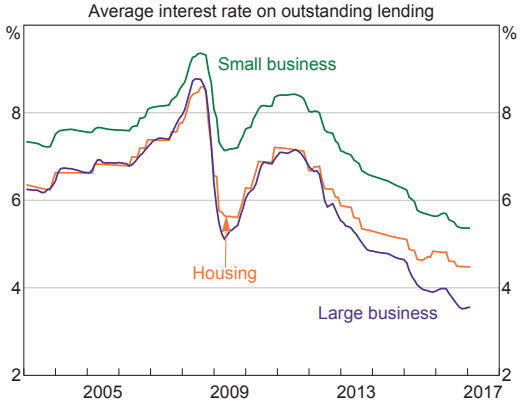
Sources: Bloomberg; UBS AG, Australia Branch

Graph 9
Major Banks' Wholesale Debt Cost*



* RBA estimates; rates do not include interest rate hedges
Sources: Bloomberg; RBA

Graph 10
Major Banks' Lending Rates*
Average interest rate on outstanding lending



* RBA estimate
Sources: APRA; Bloomberg; Financial Reports; RBA; UBS AG, Australia Branch

Lending Rates

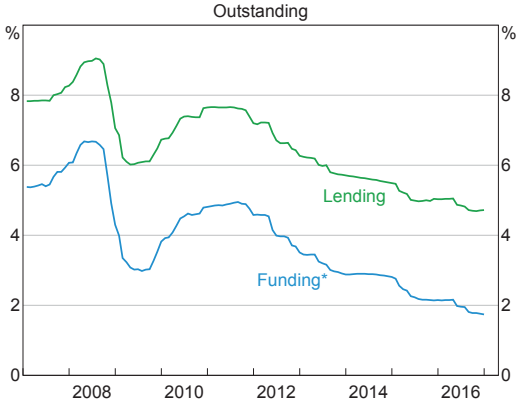
Interest rates for housing loans generally declined during 2016, but by less than the cash rate, with the average outstanding interest rate on mortgages falling by around 35 basis points (Graph 10). The difference between pricing of owner-occupier and investor housing loans declined a little over the year. Interest rates for business loans also declined by less than the cash rate; lending rates for large businesses fell by around 40 basis points over the year, while small business lending rates declined by around 30 basis points.

Towards the end of 2016, banks adjusted their advertised housing lending rates for particular types of loans. These included investor loans, interest-only loans and fixed-rate loans. During the first half of 2016, major banks increased interest rate discounts offered on their standard variable rates; although interest rate discounts were reduced towards the end of 2016 they remained higher than they were a year earlier. Some lenders have indicated that they have implemented these changes in response to higher funding costs and to meet regulatory requirements, including the Australian Prudential Regulation Authority's (APRA) guidance for a maximum growth rate on investor housing credit of 10 per cent. The interest rates on outstanding small and large business borrowing are estimated to have been little changed over the past few months.

Banks' Implied Spread

The major banks' implied spread, which is the difference between average lending rates and average debt funding costs, is estimated to have remained largely unchanged over 2016, as debt funding costs declined by around the same amount as lending rates (Graph 11).

Graph 11
Major Banks' Lending and Funding Rates
Outstanding



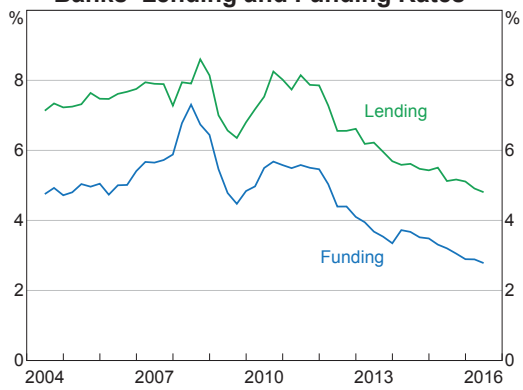
* Assumes interest rate swaps and replicating portfolio hedges
Sources: APRA; Bloomberg; Financial Reports; RBA; UBS AG, Australia Branch

The implied spread on major banks' housing lending has been relatively stable during 2016, owing to lending rates moving broadly in line with funding costs. Housing lending accounts for around two-thirds of all lending; changes in housing lending rates can have a significant impact on the overall implied spread. Over the past two years, outstanding housing lending rates have fallen by less than debt funding costs. This smaller decline in housing lending rates was partly in order to offset some of the increase in overall funding costs attributable to increases in equity funding, particularly in 2015; equity tends to be a more expensive source of funding than debt.

The implied spread on major banks' business lending has been stable over the past year. This is because business lending rates have moved broadly in line with funding costs. Over recent years, there has been strong competition between banks for large business lending, particularly from foreign banks, with the average interest rate on business loans written by foreign banks significantly lower than the business lending rate charged by Australian banks.

Average debt funding costs and lending rates for other Australian banks are estimated to have declined by about the same amount over 2016, and by a similar amount to that of the major banks (Graph 12). Other Australian banks have a greater relative share of housing lending and a smaller share of large business lending. They also tend to source a greater share of their funding from deposits. Differences in the asset and liability mix across other Australian banks, and relative to the major banks, can result in differences in lending and funding rates, although this was not a significant factor in 2016.

Graph 12
Other Australian Banks' Lending and Funding Rates*



* Weighted average lending and funding costs; licensed ADI basis
Sources: APRA; RBA

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Returns on Equity, Cost of Equity and the Implications for Banks

David Norman*

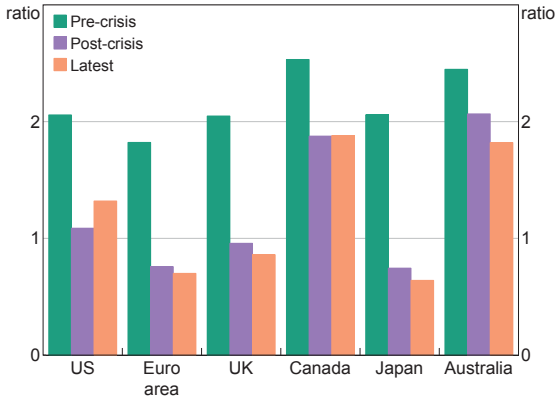
Returns on equity for the major Australian banks have declined of late, following equity raisings in 2015. At the same time, estimates of the cost of raising new equity appear to have fallen very little, despite large declines in risk-free rates. These two developments help to explain why Australian bank stocks are now trading at a declining, but still sizeable, premium to their book value.

Introduction

Share price-to-book (PB) ratios – a firm's market capitalisation divided by the accounting value of its equity – have fallen for banks across the world over the past decade (Graph 1). In most countries, the fall in banks' PB ratios occurred in 2007 and 2008 as problems in the banking sector started to emerge: PB ratios quickly declined from around 2 to 1 or less and have not changed much since then. PB ratios for Australian banks fell more modestly than in most other countries during the financial crisis and had recovered much of that decline by 2013, but have since declined materially.

PB ratios are commonly taken as a signal of banks' health so these declines have generated much commentary. Furthermore, Sarin and Summers (2016) argue that the fall in global banks' PB ratios suggests that the extensive regulatory reforms to the banking sector over the past decade have failed to convince investors that banks have become more resilient. They note that when leverage is measured using the market value of equity, banks in the major advanced economies are more leveraged than before because of large falls in their market capitalisation.

Graph 1
Banks' Share Price-to-book Ratios*



* Pre-crisis is average ratio during 2004–06; post-crisis is average during 2013–15; latest is as at end February 2017

Source: Bloomberg

This article lays out a framework for how to interpret developments in PB ratios. In particular, it shows that changes in PB ratios are driven by shifts in either returns on equity (ROE) or the cost of equity (COE), or both. This framework is then applied to Australian banks, along with estimates of how their ROE and COE have evolved, to explain recent changes in their PB ratios. At a more fundamental level, the article discusses how both ROE and PB ratios can be influenced by the accounting treatment of goodwill, which supports using caution when drawing

* The author is from Financial Stability Department.

conclusions from differences in PB ratios across banks and over time.

Return on Equity, Cost of Equity and Price-to-book Ratios

ROE is a measure of how efficiently shareholder capital is being used to generate profit and is the most widely used metric to assess banks' profitability. Banks commonly set ROE targets both at the institution and product level – and these targets are often a central element of executive remuneration. Investors also use ROE to assess the performance of banks and regulators and academics commonly use it to calculate the cost to banks of raising capital requirements. ROE is determined by both the underlying profitability of a bank's assets and the extent to which these are leveraged. As a result, there is evidence that banks have historically increased leverage to meet ROE targets and that declining ROE has been a trigger for increased risk-taking (Haldane 2011; Adrian and Shin 2014; Adrian, Friedman and Muir 2015).

ROE (π_e) is calculated by dividing earnings (E) by the book value of a firm's equity (B) at time t:

$$\pi_e = E_t / B_t \tag{1}$$

Earnings are typically measured by net profits after tax. The book value of equity is taken from accounting statements and reflects the difference between assets and liabilities as measured under accounting standards. These standards require most assets to be measured at their acquisition cost (net of any subsequent depreciation for physical assets), although loans are valued at the amount outstanding (net of provisions) and some other financial assets – mostly securities and derivatives – are required to be measured at market value (the price they would fetch if sold). Importantly, intangible assets (including goodwill) are only recognised in book value to the extent that they can be separately identified from other assets and their acquisition cost can be accurately determined (a point discussed later).

COE is a related but distinct measure that captures the return required to entice investors to purchase and hold bank shares. It is a function of two market-determined prices: the risk-free rate of return (typically measured by the long-term sovereign bond yield); and a risk premium to compensate investors for holding a risky asset. Accordingly, COE will rise in response to an increase in investors' outlook for growth and inflation as well as any increase in uncertainty around this outlook (Rankin and Shah Idil 2014). The Modigliani-Miller (1958) theorem states that COE should also be proportional to the extent of leverage applied by a firm, although it is commonly accepted that several factors cause COE to depart from the strict predictions of the Modigliani-Miller theorem.

COE is unobservable because it measures investors' risk tolerance and expectations. Nonetheless, it can be proxied using the dividend discount model (Gordon and Shapiro 1956):

$$r_e = D_{t+1} / P_t + g \tag{2}$$

where r_e represents COE, D represents dividends, P the share price and g is the expected future growth rate of dividends. To facilitate a comparison with ROE, this can be converted to a function of earnings by replacing dividends with the product of earnings and the dividend payout ratio (δ):[1]

$$r_e = \delta E_{t+1} / P_t + g \tag{3}$$

1 It is possible to write the model in terms of free cash flow if it is believed that investors care about earnings, regardless of whether they are reinvested or paid out. The intuitions of that approach are the same as those that follow.

If investors expect a bank's dividend will not grow ($g = 0$) then its COE is equal to its forward earnings yield (E_{t+1}/P_t; noting that non-growing companies in the model pay out all their earnings as dividends so that $\delta = 1$).[2]

ROE has often been used as a proxy for COE, given that COE is not observable. The above relationships highlight two reasons why doing so can be misleading. The first is that ROE is calculated from the *book* value of equity while COE is calculated from the *market* value of equity. As discussed later, there are reasons why the book and market values of equity can differ substantially. Indeed, when $g = 0$ the ratio of ROE to COE is the bank's PB ratio:

$$\pi_e / r_e = P/B \tag{4}$$

and, as seen earlier, this ratio can deviate substantially from 1.

The second (less important) reason why the two metrics may differ is that ROE is calculated only from current profits, while COE is also conditional on expectations for future growth (that is, g). For a bank that is growing ($g \neq 0$ and $\delta < 1$), the intuition yielded by the equations above is unchanged but the formulae are more complex. In that instance, COE is still a function of the earnings yield (but adjusted for the difference between the return on equity measured at book and market value), while the ratio of ROE to COE is the PB ratio (but scaled by a weighted average of the PB ratio and 1, where the weight is the dividend payout ratio):

$$\begin{aligned} r_e &\approx E/P + \gamma \quad \text{where } \gamma = (1-\delta)\left(E/B - E/P\right) \\ \pi_e / r_e &\approx P/B \times \varepsilon^{-1} \quad \text{where } \varepsilon = \delta + (1-\delta)P/B \end{aligned} \tag{5}$$

2 The dividend discount model naturally has limitations, the main one being that it only works for dividend-paying companies that are not growing too rapidly. It also assumes that leverage stays constant; if this is not true then g can be 0 and yet δ less than 1, which would mean that the earnings yield overstates COE.

The detail behind these calculations is shown in Appendix A.

Historical Trends in Returns on Equity and the Cost of Equity

Australian banks have consistently generated ROE that are much higher than banks in most other countries. For the major banks, ROE averaged around 17½ per cent for the 15 years prior to the global financial crisis and moderated only slightly (to 15 per cent) over the past five years (Graph 2). However, ROE have fallen more notably over the past year as the major banks raised additional equity to meet tighter capital standards set by the Australian Prudential Regulation Authority (APRA). As this additional equity requirement is permanent, it is unlikely that ROE will return to the levels that major banks and their investors had become accustomed to without the banks taking additional risk or achieving substantial productivity gains.[3]

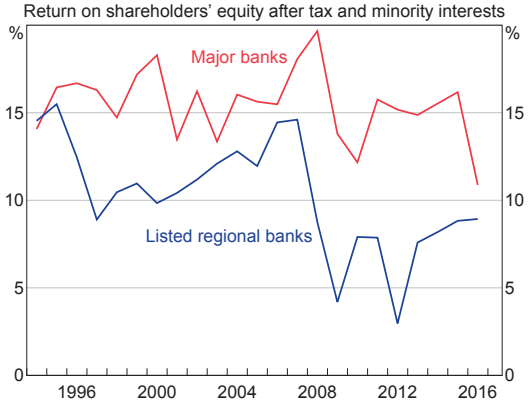
Estimates for Australian banks' COE, derived using the formula shown in Equation (1), are shown in Graph 3.[4] For the four largest banks, COE was consistently around 12 per cent between the late 1990s and the onset of the global financial crisis, and is currently only a little below that level. COE for the two listed regional banks has historically been lower than for the majors but this gap has narrowed as their COE has drifted up.[5] In both cases, the decline in risk-free yields since

3 The requirement to hold more capital against riskier assets mitigates the possibility of greater risk-taking, but cannot remove it because risk weights aren't perfectly calibrated and there is no automatic capital increase in response to deteriorating risk culture or monitoring.

4 One complication is how to value franking credits attached to the dividends paid by Australian banks. We attach full value to these franking credits when estimating COE. This assumption adds almost 2 percentage points to the estimated COE but is fairly consistent over the sample.

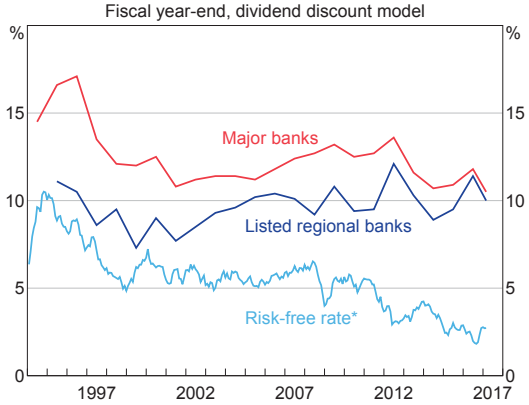
5 It is difficult to know why the regional banks have a lower COE and yet a lower (stand-alone) credit rating. One possibility is that the marginal investor in regional banks has different preferences to the marginal investor in major banks, but this is difficult to prove.

Graph 2
Bank Profitability*
Return on shareholders' equity after tax and minority interests



* Fiscal years from 2003 onwards; prior data are as reported in banks' financial statements.
Sources: APRA; Banks' annual reports; RBA

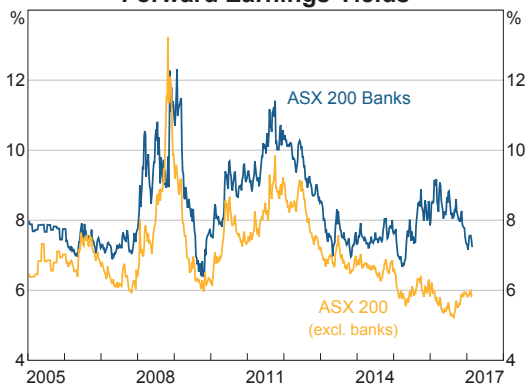
Graph 3
Banks' Cost of Equity
Fiscal year-end, dividend discount model



* Yield on 10-year Australian government securities
Sources: Banks' annual reports; Bloomberg; RBA

2011 has had little impact on measured COE, in contrast to the earlier period of falling risk-free rates (the mid 1990s). Accordingly, the implied equity risk premia for these stocks have risen by almost 300 basis points since the financial crisis. COE measured using a common alternative method – the capital asset pricing model (CAPM) – also produces a lesser fall than the risk-free rate, largely because the sensitivity of banks' share prices to market-wide movements has risen.

Graph 4
Forward Earnings Yields



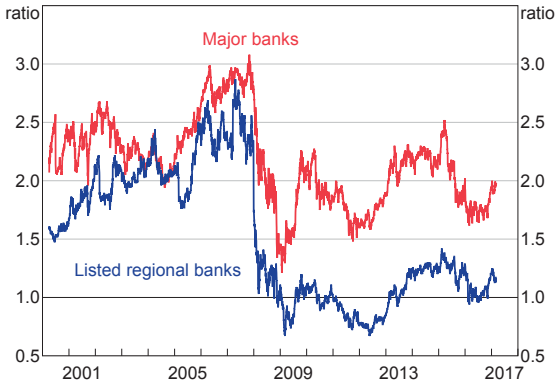
Sources: RBA; Thomson Reuters

The apparent rise in risk premia since the financial crisis looks to have been much larger for banks than for other Australian companies. This is implied by the marked divergence between the earnings yield on bank equities and that on other equities over recent years (Graph 4), only part of which is likely to reflect a greater slowing in the outlook for banks' profit growth. It is not clear why risk premia on bank equities have risen relative to that on other stocks. Some part of the rise is likely to reflect an increase in concerns about the fragility of European banks during 2016 that spilled over to Australia. However, domestic factors were likely to have also been important since the earnings yield differential between banks and other stocks widened more notably in Australia. The divergence happened as banks raised additional equity and may in part reflect investors' uncertainty about how much more capital will be required over time.

Implications for Price-to-book Ratios

When considered alongside these trends in ROE and COE, the equations presented earlier provide a framework to understand why PB ratios for the major Australian banks have persistently been well above 1 (and much higher than for regional banks; Graph 5) and why they have declined over time.

Graph 5
Bank Share Price-to-book Ratios



Sources: Bloomberg; RBA

The first question – why the major banks' PB ratios have persistently been well above 1 – can be superficially explained by noting that their ROE have consistently and significantly exceeded their COE. The major banks have also generated much higher ROE than the regional banks since 2008, more than compensating for a slightly higher COE and resulting in more elevated PB ratios.

A deeper question, however, is why major banks' ROE have persistently been well above their COE. Davis (2012) argues that the fundamental reason is that management at the major banks feel 'handicapped' to price their products to meet prevailing high returns on equity and that smaller banks, whose ROE are closer to their COE, cannot effectively undercut these high prices. But a simpler explanation may be the impact of accounting standards relating to goodwill.

Goodwill is defined as an asset representing the future economic benefits that are expected to flow from the combination of other assets, but which cannot be individually and separately identified from the value of other assets (Australian Accounting Standards Board 2010, p 33). Australian accounting standards require goodwill to be recorded when there is a business acquisition in which the amount paid for that business exceeds the value of its identifiable net assets,[6] but prevent companies from recognising goodwill that is generated *internally* (that is, without an acquisition).[7] Accordingly, banks that have created ongoing value through the natural course of utilising their assets to develop their business organically will see their share price appreciate without any corresponding rise in their book value (that is, their PB ratio will rise). Internally generated goodwill such as this can take many forms, including brand value, synergies or advantages in funding or distribution.

The effect of this accounting treatment of goodwill on Australian banks' ROE and PB ratios can be most clearly observed from the merger of Bendigo Bank and Adelaide Bank in 2008. Before merging, these banks generated a weighted average pre-tax ROE of 20 per cent and had a combined PB ratio of 2.2. The transaction required the combined entity to book $1.5 billion of goodwill in its accounts, equivalent to almost half its combined shareholders' equity. Consistent with the theory above, this resulted in the combined entity's ROE immediately halving and its PB ratio falling to 1.3. This transaction also explains the step lower in the regional banks' PB ratios shown in Graph 5.[8] Similar effects would be observed if each of the major banks were to be sold, with the acquirer accounting for the associated goodwill. In aggregate, this would require the banks to book $210 billion of goodwill – almost as much as their current

6 While such goodwill is recorded in book value, it is deducted from measures of capital used for regulatory purposes.

7 Internally generated goodwill is not recognised because it isn't separable from other assets, does not arise from contractual or other legal rights and cannot be reliably measured at cost. For similar reasons, recorded goodwill – that is, arising from a business transaction – cannot be revalued upwards but must be amortised and can be subject to writedowns when it is deemed to have been impaired.

8 The effects of other mergers in the Australian banking industry have been smaller. Westpac's merger with St. George increased the combined entity's goodwill by only 15 per cent of total equity. CBA booked no goodwill when it acquired Bankwest because its assets were acquired at a discount to book value.

shareholders' equity – and would lower their ROE to the same level as their earnings yield (7½ per cent) and their PB ratios to 1.

Differences in the extent to which goodwill is recorded in book value at various banks have implications for how valid it is to compare ROE and PB ratios across banks or countries. The major Australian banks have a much smaller proportion of their book value attributable to goodwill than the regional banks – just over 10 per cent on average, compared with one-quarter for the listed regional banks – despite having brand names and other advantages that are more valuable. This gap in recorded goodwill explains a reasonable portion of the difference in ROE and PB ratios between these two sets of banks: excluding goodwill, both listed regional banks generated ROE that were similar to ANZ in the past financial year and have PB ratios that are equivalent to both ANZ and NAB (though still well below CBA and Westpac).

The second question – why banks' PB ratios declined during the financial crisis and again over the past two years – can also be explained by trends in their ROE and COE. The falls in PB ratios during the crisis occurred because of both a substantial decline in banks' ROE as credit losses increased and funding pressures built, and a rise in their COE as concerns about the health of the banking industry intensified. More recently, the movement in PB ratios has been more evident for the major banks than the regional ones. This is because major banks' ROE have fallen by almost 3 percentage points as a result of the large amount of new equity that was raised in response to regulatory changes, significantly reducing their leverage. (Return on assets has also fallen marginally.) In contrast, COE has been broadly stable over the same time, resulting in a narrower gap between ROE and COE and hence a 50 basis point decline in PB ratios (though some of this has been unwound very recently). These trends differ from those at banks globally: for banks in other countries, both ROE and COE appear to have been broadly unchanged over the past two years, resulting in their PB ratios holding steady (see Graph 1). This different trend in ROE (and, in turn, in PB ratios) arises because Australian banks increased their capital levels more rapidly than other banks over the past two years (APRA 2016) and global banks have generated a modest recovery in their return on assets of late (although from low levels). PB ratios for many global banks nevertheless remain low, reflecting concerns over the future value of their assets and profitability.

The narrowing gap between Australian banks' ROE and COE is at odds with the predictions of the Modigliani-Miller theorem whereby a reduction in leverage should have the same effect on both measures. Haldane (2011) notes that a narrowing like this creates an environment in which banks have an incentive to take additional risk – whether by writing loans to more marginal borrowers or by weakening the quality of their risk culture, monitoring or governance. To date, banks have instead sought to lift their ROE by raising the price of credit relative to the cash rate or by scaling back their exposure to lower return businesses, such as international banking and wealth management (RBA 2016). Some banks have also lowered their stated ROE targets. However, it will be important to continue monitoring how banks respond to pressure from investors for higher returns.

Appendix A

The dividend discount model states that the fair value of a share (P) is determined by the expected value of its future stream of dividends (D), discounted to present value using the cost of equity (r_e):

$$P_t = \sum_{t=0}^{\infty} \frac{E_t D_t}{(1+r_e)^t} \tag{A1}$$

where E_t is the expectations operator. A typical way to simplify this equation (following Gordon and Shapiro 1956) is to assume that the firm grows at a steady state (represented by g) forever, so that the model can be simplified to:

$$P_t = \frac{D_{t+1}}{r_e - g} \tag{A2}$$

This can be rearranged to provide an expression for the cost of equity:

$$r_e = {}^{D_{t+1}}\!/_{P_t} + g \tag{A3}$$

This can also be expressed in earnings form by replacing D with the product of earnings (E) and the dividend payout ratio (δ). It is also possible to eliminate the unobservable steady-state growth rate variable by noting that growth comes only from reinvesting retained earnings:

$$\begin{aligned} r_e &= {}^{\delta E_{t+1}}\!/_{P_t} + g \\ &= {}^{\delta E_{t+1}}\!/_{P_t} + (1-\delta)\,{}^{E_t}\!/_{B_t} \\ &\approx {}^{E}\!/_{P} + (1-\delta)\left({}^{E}\!/_{B} - {}^{E}\!/_{P}\right) \end{aligned} \tag{A4}$$

(where the second line uses the equation $g = (1-\delta)E/B$ – the earnings retention rate times the return on equity).

For companies that are not expected to grow ($g = 0$), COE can be simplified to being the earnings yield (E/P) and the ratio of ROE (E/B) to COE is then the PB ratio:

$$\begin{aligned} r_e &= {}^{E}\!/_{P} \qquad \text{when } g = 0; \\ \therefore {}^{\pi_e}\!/_{r_e} &= {}^{P}\!/_{B} \end{aligned} \tag{A5}$$

This same relationship broadly holds when we allow for an expectation that dividends will grow ($g \neq 0$), but the ratio of ROE to COE is now scaled by a weighted average of the PB ratio and 1 (with the weight being the dividend payout ratio):

$$\begin{aligned} r_e &= {}^{\delta E_{t+1}}\!/_{P_t} + g \\ \text{since } \pi_e &= {}^{E}\!/_{B}, \\ {}^{\pi_e}\!/_{r_e} &\approx {}^{E}\!/_{B} \times {}^{P}\!/_{(\delta E + Pg)} \\ &\approx {}^{P}\!/_{B} \times {}^{E}\!/_{E\left(\delta + (1-\delta)\,{}^{P}\!/_{B}\right)} \\ &\approx {}^{P}\!/_{B} \times \varepsilon^{-1} \quad \text{where } \varepsilon = \delta + (1-\delta)\,{}^{P}\!/_{B} \end{aligned} \tag{A6}$$

For most banks (those that pay out at least half their earnings and grow at a moderate rate), this equation converges on the ratio of ROE to COE being the PB ratio. However, for banks that don't pay a dividend this equation implies that ROE always equals COE – the intuition being that there is no difference between the book value of equity and its market value when a firm is growing its capital rapidly.

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How Australians Pay: New Survey Evidence

Mary-Alice Doyle, Chay Fisher, Ed Tellez and Anirudh Yadav*

The Reserve Bank's 2016 Consumer Payments Survey showed that Australian consumers are increasingly using their debit or credit cards instead of paying in cash or writing cheques. While more and more small payments are being made with contactless 'tap and go' cards, cash is still often used for lower-value transactions and accounts for a significant share of payments for some segments of the community.

Introduction

In November 2016, the Bank undertook its fourth triennial survey of consumer payments.[1] As in previous surveys, participants recorded details about every transaction they made for a week – including value, payment method, channel (e.g. online or in person) and type of merchant – and provided additional information on their payment preferences and attitudes in a post-survey questionnaire. Over 1 500 people participated in the 2016 survey, recording around 17 000 consumer payments (see 'Box A: Details of the Survey').

The survey showed that Australian consumers are continuing to switch to electronic payment methods in preference to paper-based methods – cash and cheques – for their transactions. Credit and debit cards combined were the most frequently used means of payment in the 2016 survey, overtaking cash (Table 1). Cards are increasingly being used for lower-value transactions, reflecting the adoption of contactless 'tap and go' functionality at the point of sale. Although the share of payments made in cash continued to fall, cash was still used for over one-third of consumer payments.

This article discusses key findings of the 2016 Consumer Payments Survey, focusing on: consumers' use and holdings of cash; trends in payment card use; and the use of personal cheques.[2]

Cash Use and Holdings

The trend decline in the share of consumer payments made in cash continued in 2016 – survey participants made 37 per cent of their payments in cash, compared with 47 per cent in 2013 and 69 per cent in 2007 (Graph 1, left panel).[3] The decline in the use of cash relative to other payment methods since the 2013 survey mainly reflects consumers switching to contactless cards for lower-value payments (Graph 2).[4] Nonetheless, cash was still frequently used for smaller transactions and was the most common payment method for transactions of $10 or less (accounting for over

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1 The research firm Ipsos conducted the 2016 survey on behalf of the Bank. The Bank has undertaken a consumer payments survey every three years since 2007. See Emery, West and Massey (2008); Bagnall, Chong and Smith (2011); and Ossolinski, Lam and Emery (2014).

2 A detailed report will be published later in the year.

3 See Meredith, Kenney and Hatzvi (2014) and Davies *et al* (2016) for detailed discussions of cash use.

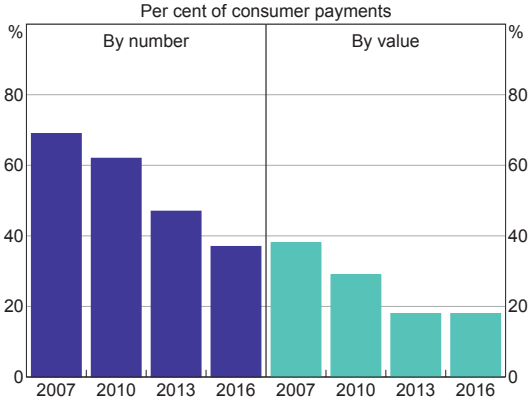
4 Between 2010 and 2013, contactless cards also appeared to displace cash and, to a lesser extent, PIN-authenticated card transactions at the point of sale.

Table 1: Consumer Payment Methods[(a)]
Per cent of number of payments

	2007	2010	2013	2016
Cash	69	62	47	37
Debit, credit/charge cards	26	31	43	52
BPAY	2	3	3	2
Internet/phone banking	na	2	2	1
PayPal	na	1	3	3
Cheque	1	1	0.4	0.2
Other[(b)]	1	1	2	4

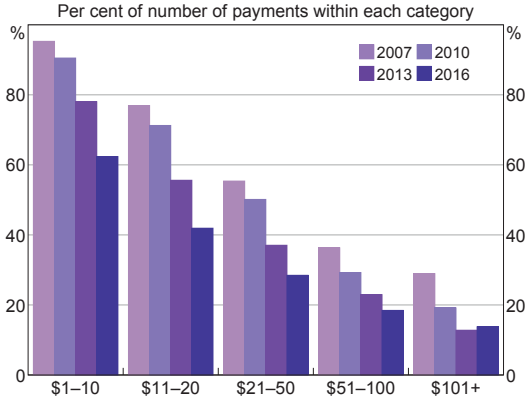
(a) Excluding payments over $9 999
(b) 'Other' methods would include prepaid, gift and welfare cards, bank cheques, money orders, Cabcharge, and other online payment methods apart from PayPal (e.g. POLi)
Sources: Colmar Brunton; Ipsos; RBA; Roy Morgan Research

Graph 1
Cash Payments
Per cent of consumer payments



Sources: Colmar Brunton; Ipsos; RBA; Roy Morgan Research

Graph 2
Cash Payments by Size
Per cent of number of payments within each category



Sources: Colmar Brunton; Ipsos; RBA; Roy Morgan Research

60 per cent of these payments). The median size of a cash payment was $12, which was the same as in the 2013 survey. When measured by the value of payments (rather than the number), the share of cash transactions was steady, at around 18 per cent, reflecting a small number of large cash payments (Graph 1, right panel).

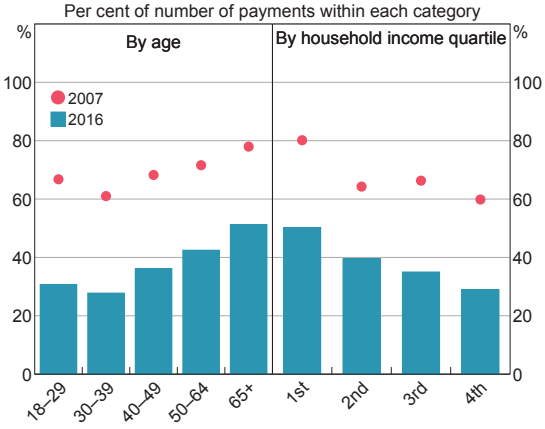
Although electronic payment methods have become more popular, some members of the community make a substantial share of their payments in cash, including older Australians and lower-income households (Graph 3).[5] While these demographic groups have not, on average, adopted electronic payments as quickly as the general population, they are nonetheless using cash for a smaller share of transactions than in the past. Older Australians, for example, are using electronic payment methods more frequently, as indicated by the ongoing decline in the share of payments made in cash by people aged 65 and over – from 78 per cent in the 2007 survey to 51 per cent in 2016.[6]

People continue to use cash at the point of sale for a variety of reasons. When asked about the

5 Around 12 per cent of all 2016 survey participants reported that they used cash for all of their in-person transactions, a similar share to the 2013 survey.

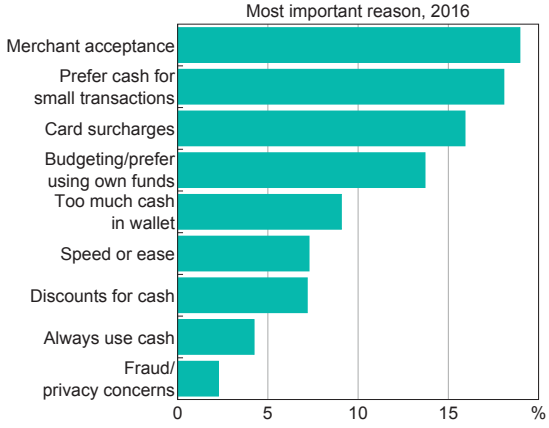
6 These figures will capture both the effect of a change in the composition of age cohorts and a shift away from cash by older Australians.

Graph 3
Cash Payments
Per cent of number of payments within each category



Sources: Ipsos; RBA; Roy Morgan Research

Graph 4
Why Use Cash?
Most important reason, 2016



Sources: Ipsos; RBA

most important reason for using cash for their transactions, survey participants in 2016 cited factors mainly relating to:

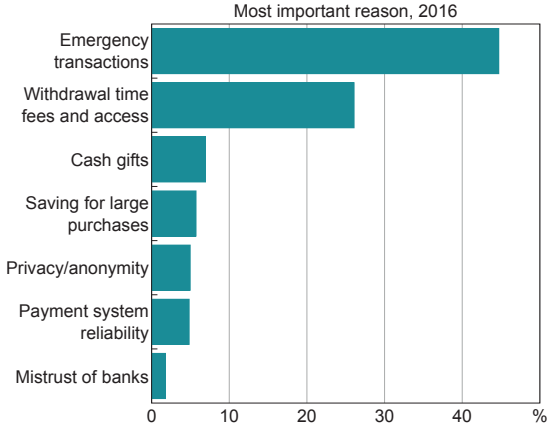
- Merchant acceptance, fees and pricing. The most common reason for using cash, cited by 19 per cent of respondents, was that merchants did not accept alternative payment methods or had minimum spend requirements. A further 16 per cent of participants cited a desire to avoid card surcharges, while 7 per cent cited discounts for cash use (Graph 4).
- Consumer preferences and habits. Respondents indicated a preference for using cash in small transactions (18 per cent of respondents) and a preference for using their own funds and to use cash as a budgeting tool (14 per cent). A smaller share indicated that fraud and privacy concerns were their most important reasons for using cash. For those participants who used cash most intensively, consumer preferences were more important than factors relating to merchant acceptance.

Consistent with the decline in transactional use of cash, the median value of cash held in consumers' wallets fell to $40, from $55 in 2013.[7] The main reason for holding cash, other than for day-to-day transactions, was for precautionary purposes (i.e. to fund emergency transactions). But there was a wide dispersion across participants in the amount of cash that they carried – for example, around one-fifth of respondents were not holding any cash in their wallets at the beginning of the survey week (compared with 8 per cent in 2013).

The survey also asked people about the cash they usually hold in places other than their wallets. In 2016, around 70 per cent of survey participants reported holding some cash outside of their wallet, compared with about 75 per cent in 2013. While the majority of participants held $100 or less, around 3 per cent reported that they held over $1 000. As with cash held in wallets, the most common reason for holding cash elsewhere was for emergency transaction needs (Graph 5). A smaller but still significant share of respondents (26 per cent) cited issues relating to the accessibility of cash – ATM fees and access, and withdrawal time – as their most important reasons for holding cash outside their wallet.

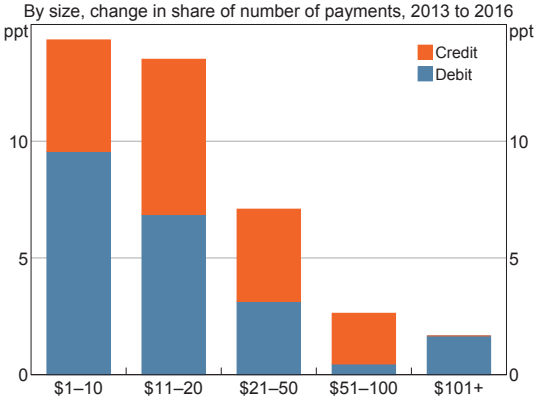
7 The average value of cash holdings was little changed from 2013, reflecting the fact that a small number of participants in the 2016 survey reported that they carried a large amount of cash in their wallets.

Graph 5
Why Hold Cash Outside of Wallet?
Most important reason, 2016



Sources: Ipsos; RBA

Graph 6
Change in Point-of-sale Card Payments
By size, change in share of number of payments, 2013 to 2016



Sources: Colmar Brunton; Ipsos; RBA

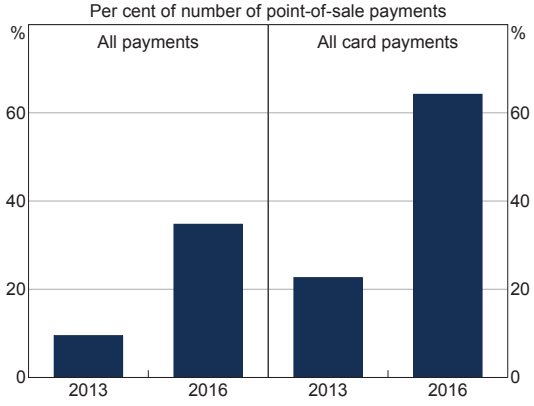
Payment Cards

As the decline in transactional use of cash has continued, there has been a rise in the share of card payments. Between 2013 and 2016, the share of payments (by number) made using credit and debit cards increased by 9 percentage points to 52 per cent.[8] The recent increase in the frequency of card use relative to other payment methods was almost entirely because cards were used more often for in-person payments; card use for online payments barely increased as a share of total payments in the 2016 survey (and the share of total payments made online was stable, Table 2).

Between 2013 and 2016, growth in the relative use of cards was strongest for lower-value transactions, with consumers increasingly using debit (and to a lesser extent credit) cards for payments of $20 or less (Graph 6). Cards are now the most commonly used payment method for all but the lowest-value transactions (i.e. those of $10 or less). As a result, the median value of card payments at the point of sale continued to decline, from $40 in 2007 to $28 in 2016. The use of cards for lower-value payments has been facilitated by the rapid adoption of contactless functionality by consumers and merchants in recent years. Around one-third of all point-of-sale transactions were conducted using contactless cards in 2016, which is 3½ times the share reported by participants in the 2013 survey (Graph 7).

The 2016 survey provided some preliminary insights into the use of mobile devices to make card payments at the point of sale (mobile payments). These payments are made by tapping or waving a smartphone or other mobile device

Graph 7
Contactless Card Payments*
Per cent of number of point-of-sale payments



* Does not include mobile card payments
Sources: Colmar Brunton; Ipsos; RBA

8 In this article, references to 'payment cards' or 'cards' generally refers to debit, credit and charge cards. In the 2016 survey, gift/prepaid cards were separately identified for the first time. However, for comparability with previous surveys, gift/prepaid cards have been included in the 'other' payment method category. These cards accounted for around 2 per cent of consumer payments in 2016.

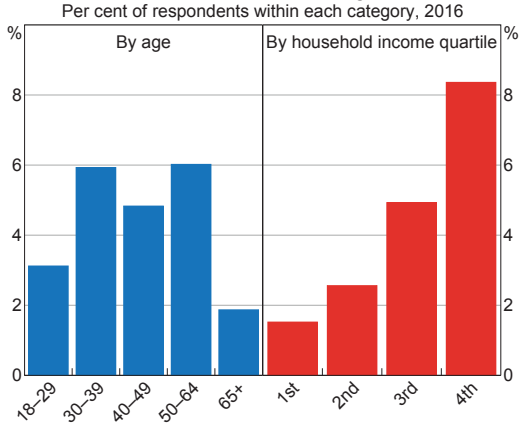
Table 2: Payments by Channel
Per cent of number of payments

	2013	2016
In-person payments	86	86
of which: card payments	*37*	*45*
Online payments	13	13
of which: card payments	*5*	*6*
Telephone/mail payments	1	1

Sources: Colmar Brunton; Ipsos; RBA

in front of a card terminal rather than using a physical (plastic) card.[9] The ability to make mobile payments – whether provided via third-party mobile wallets or banks' proprietary banking applications – is a relatively new feature of the payments landscape (and is not yet available across all payment schemes and card issuers). Consistent with this, mobile payments accounted for only around 1 per cent of the number of point-of-sale transactions over the week of the survey (around 2 per cent of in-person card payments). The users of mobile payments were spread across a range of age groups and tended to have above-average incomes (Graph 8). Many

Graph 8
Users of Mobile Card Payments*
Per cent of respondents within each category, 2016



* Made a mobile card payment during the week of the survey
Sources: Ipsos; RBA

9 The physical card details are typically stored (provisioned) in a digital 'wallet' application on the mobile device, which is equipped with contactless functionality similar to contactless physical cards.

respondents who did not use mobile payments indicated that they were, at this stage, satisfied with their current payment methods.

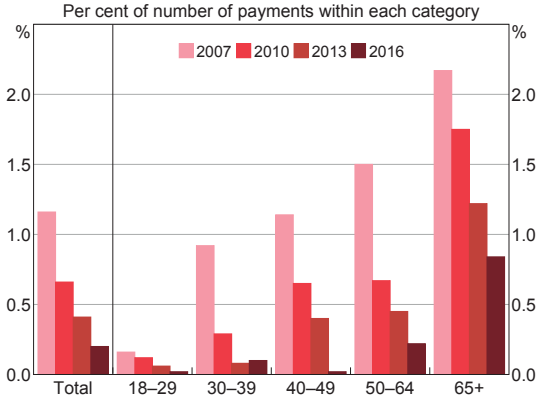
Personal Cheques

The use of personal cheques continued to decline, with cheques accounting for only 0.2 per cent of payments made by participants in the 2016 survey, compared with 0.4 per cent in 2013 and 1.2 per cent in 2007. However, 12 per cent of respondents said they had made at least one personal cheque payment in the year prior to the survey (down from around 20 per cent in 2013). The latest survey results provide further evidence of the long-term decline in the use of cheques.[10] Cheque use remains concentrated among older Australians; around 70 per cent of the small number of cheque payments recorded in the 2016 survey were made by participants aged 65 and over. Nonetheless, fewer cheques are being written by consumers of all ages (Graph 9).

As in previous surveys, personal cheques were mainly used for larger expenditures such as household services, bills or holidays. Accordingly, cheque payments have a higher median value ($135) than cash or card payments. For the most part, those households that continue to use cheques report that they do so because some merchants prefer to be paid by cheque, there is no alternative for that particular type of payment

10 See Richards (2016) for a discussion of the cheque system.

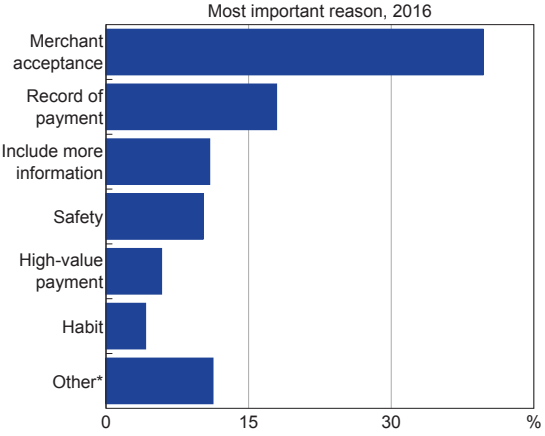
Graph 9
Cheque Payments by Age
Per cent of number of payments within each category



Sources: Colmar Brunton; Ipsos; RBA; Roy Morgan Research

or because cheques provide a useful record of the payment (Graph 10). Those respondents also value the safety of cheque payments and that cheques allow them to include more information with the payment (by attaching documents).

Graph 10
Why Use Cheques?
Most important reason, 2016



* Includes low cost, avoiding surcharges, useful for sending by post and other

Sources: Ipsos; RBA

Conclusion

The Australian payments system is evolving. The Bank's 2016 Consumer Payments Survey showed that consumers are continuing to shift away from paper-based payment methods towards electronic means of payment, particularly cards. It would not be surprising if these trends continue, as electronic payment methods are increasingly adopted and new payment methods emerge. For instance, the New Payments Platform (NPP) – which is due to be launched late this year – may provide additional convenient electronic alternatives to cheques, and also to cash in some circumstances (e.g. person-to-person payments).[11] An assessment of the ability of the NPP to meet the demands of cheque users is likely to inform industry discussions about the future of the cheque system.[12] Although a smaller share of consumer payments are being made in cash than in the past, the 2016 survey indicated that cash remains an important part of the economy and payments system. Cash is still used for a significant share of consumer payments, is heavily relied on by some members of the community and is widely held as a store of value.

11 The NPP will allow individuals and businesses to make account-to-account funds transfers in real time, at any time of the day or night, seven days a week. It will also allow for end users to attach data or documents to payments. For more details see Bolt, Emery and Harrigan (2014).

12 For more details see Australian Payments Council (2015).

Box A
Details of the Survey

The fieldwork for the 2016 Consumer Payments Survey was conducted by the research firm Ipsos on behalf of the Bank in November 2016. The survey consisted of three parts: a pre-diary questionnaire about the demographic characteristics of respondents; a seven-day payments diary; and a post-survey questionnaire about respondents' payment preferences and attitudes. To encourage participation and engagement with the survey, respondents received a gift card on completion of the three components.

The survey was delivered online for most respondents but to ensure the sample was broadly representative of the Australian population, participants without internet access were recruited by telephone to complete a paper-based survey. The overall response rate was good, and broadly in line with the 2013 survey, resulting in a final sample of just over 1 500 respondents.

In addition to household internet access, recruitment targets for age, sex, household income, credit card ownership and location (i.e. capital city or regional area) were set so that the sample would be reasonably representative of the Australian population.[1] To account for different response rates across the various demographic categories, the Bank weighted the responses so that the final sample aligned with Australian Bureau of Statistics population benchmarks.

1 Recruitment targets for most demographic variables were based on data from the Australian Bureau of Statistics.

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Recent Trends in Banknote Counterfeiting

Alexandra Brown, Shaun Collard and Morgan Spearritt*

Counterfeiting banknotes is a crime under Australian law. Although counterfeiting in Australia remains modest by international standards, the rate of counterfeiting has been rising in recent years as counterfeiters have increasingly taken advantage of developments in printing and copying. To ensure that counterfeiting remains low and banknotes remain a secure payment method, the Reserve Bank of Australia is issuing a new series of banknotes with upgraded security features.[1] This article discusses trends highlighted by the Reserve Bank's ongoing monitoring and analysis of banknote counterfeiting activity in Australia.

Introduction

Currency, defined here as banknotes and coins, plays an important role in the economy as a medium of exchange and a store of value. For Australia's currency to function efficiently, it is important that the public has confidence in it and is therefore willing to accept banknotes and coins in transactions. Counterfeiting currency is a crime under the *Crimes (Currency) Act 1981*, and carries penalties of up to 14 years' jail. People who fall victim to this crime have essentially been robbed. They cannot be reimbursed for their loss as, among other things, doing so would serve as an incentive to counterfeiters to continue their illegal activities. As a result, a high prevalence of counterfeiting can threaten public confidence in currency given that someone who accepts a counterfeit in place of a genuine banknote is left out of pocket and may be reluctant to accept banknotes in the future.

Under the *Reserve Bank Act 1959*, the Reserve Bank issues Australia's banknotes and has a mandate to contribute to the stability of the Australian currency. To ensure the security of these banknotes, the Reserve Bank works actively to monitor and manage the threat of banknote counterfeiting in Australia. The Reserve Bank works in partnership with key stakeholders to ensure that cash-handling professionals have information on how to detect counterfeits, that machines can authenticate banknotes, and that counterfeiters are apprehended and prosecuted (Evans, Gallagher and Martz 2015). The periodic issuance of new banknote series with upgraded security features, as is currently under way in Australia, is key to ensuring the security of, and thus confidence in, banknotes. Research into potential new security features is ongoing so that the Reserve Bank is well placed to develop and issue new banknote series as required and before counterfeiting levels become problematic. Monitoring of counterfeit activities informs the Bank's decisions about the timing of such issuance.

* Shaun Collard and Morgan Spearritt are from Note Issue Department; Alexandra Brown is from Economic Analysis Department. This work was completed in Note Issue Department. This article draws on the expertise and work of staff in the Counterfeit Examination Laboratory.

1 For information about the Reserve Bank's Next Generation Banknote Program see <http://banknotes.rba.gov.au/australias-banknotes/next-generation-banknotes-program/>.

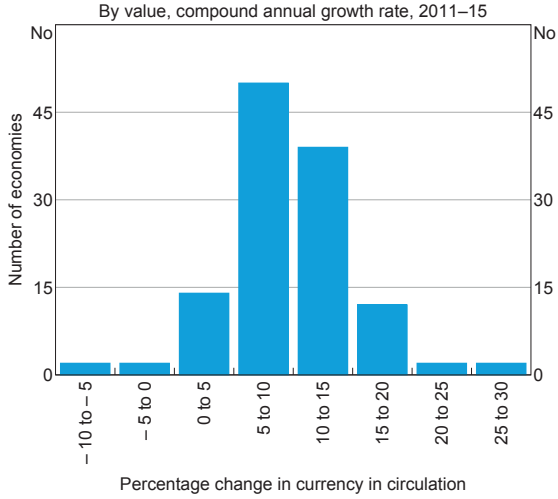
In the 1990s and early 2000s, the monitoring of counterfeit currency was largely conducted by Australian law enforcement agencies. While the Reserve Bank was able to directly monitor counterfeit banknotes detected during cash processing at Reserve Bank sites, these counterfeits were submitted to the Australian Federal Police. Counterfeits detected in other locations were handed directly to police. In 2009, the Reserve Bank established a centralised counterfeit examination laboratory. All counterfeits seized and detected in Australia now pass through this laboratory for detailed analysis. This provides the Reserve Bank with a more comprehensive understanding of the nature of counterfeiting across the country, enabling detailed assessments of the features and manufacturing methods used by counterfeiters. This article discusses some of the key results of this work.

Use of banknotes

There are currently around 1.5 billion Australian banknotes in circulation, worth almost $73 billion. The value of banknotes in circulation grew by around 6 per cent last year, in line with its long-term trend growth rate. This is also broadly in line with growth in the demand for cash seen internationally. In 123 economies for which data are readily available, the median growth of currency in circulation was around 9 per cent per annum for the four years to 2015, and around 6 per cent among advanced economies (Graph 1).

The results of the Reserve Bank's latest Consumer Payments Survey also indicate that currency remains an important payment method in Australia, with cash used in 37 per cent of transactions in 2016 (Doyle *et al* 2017). While electronic payment methods are now used in slightly more than half of the number of transactions, cash demand remains strong and

Graph 1
International Currency Growth Rates
By value, compound annual growth rate, 2011–15



Sources: Bank of England; CEIC Data; European Central Bank; IMF; Norges Bank; RBA; Swiss National Bank

it is likely that cash will remain an important part of the Australian payments system for the foreseeable future (Davies *et al* 2016).

Given the continued important role that cash plays in the economy, the Reserve Bank carefully monitors and analyses counterfeiting activity in Australia (and elsewhere) so it can take the necessary steps to ensure banknotes remain a safe and secure payment method.

Counterfeiting in Australia

Central banks must work closely with law enforcement authorities to monitor counterfeiting activity in order to determine how and when best to respond. This is complicated by the fact that it can take some time for counterfeits detected in circulation to reach central banks and law enforcement agencies, which can lead to delays in being able to accurately assess current counterfeiting levels.

Counterfeiting can be highly episodic in nature as counterfeiters ramp up their activities and law enforcement agencies respond. The increasing

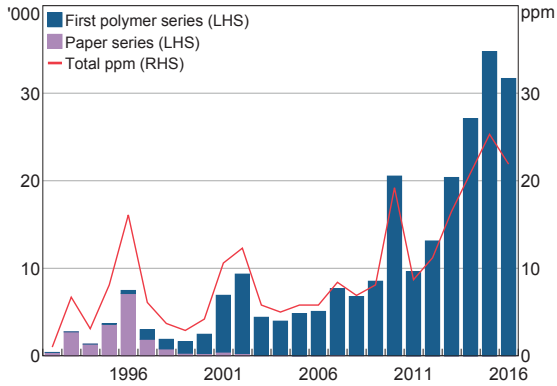
availability of high-quality, low-cost graphic reproduction technology has allowed criminals to be able to produce larger volumes of more sophisticated counterfeits (Fox, Liu and Martz 2016). However, to be able to then distribute these in large volumes typically requires some sort of organised distribution network.

Counterfeiting trends

The impetus for the introduction of polymer banknotes in Australia can be traced back to a counterfeiting incident in December 1966 when a number of high-quality counterfeits of the country's newly issued paper banknote series – regarded at the time as state of the art – began to circulate (Reserve Bank of Australia 2016). In response, the Reserve Bank established a 'think tank' with scientists from the Commonwealth Scientific and Industrial Research Organisation and tasked them with identifying innovative approaches to creating substantially more secure banknotes. A plastic-based substrate was proposed as a platform for a new generation of radically different security features, and the first Australian polymer banknote, a commemorative banknote, was issued in 1988.

The subsequent introduction of a full polymer series – a world first that was issued between 1992 and 1996 – proved to be timely. The early 1990s had seen the counterfeiting rate in Australia trending upwards, reaching 16 parts per million (ppm) in 1996, the year the final banknote in the new series was issued (Graph 2).[2,3] Counterfeiting rates subsequently fell noticeably following the introduction of the first polymer series, before gradually starting to drift higher in the mid to late 2000s. The spikes in counterfeit

Graph 2
Counterfeits Detected*



* Estimates shown for 2016
Source: RBA

detections in 2001–02, 2010, and 2014–15 reflect a small number of counterfeiting incidents where criminal groups produced and passed a large volume of counterfeits into circulation over a short time period. The Reserve Bank worked with the Australian Federal Police and other law enforcement agencies to shut down these production sources.

In May 2006, when most counterfeits were produced on paper, local authorities, working in conjunction with Interpol and the Australian Federal Police, intercepted a criminal operation in Colombia attempting to counterfeit the Australian $100 banknote and seized a number of printing materials, including partially printed counterfeits on plastic film (Kim and Turton 2014).[4] In response to gradually rising counterfeiting rates at the time, along with the evidence of polymer banknotes being counterfeited overseas, in 2007 the Bank established a program to issue a new series of banknotes that would incorporate cutting-edge anti-counterfeiting technologies to ensure banknotes remain secure against counterfeiting (Fox *et al* 2016; Kim and Turton 2014). The first denomination, the new $5 banknote, was issued

2 The Reserve Bank did not receive all counterfeits detected in circulation until 2009, so the counterfeiting data are less precise prior to this date.

3 Counterfeiting rates are generally measured as ppm – the number of counterfeits detected per million genuine banknotes in circulation.

4 These counterfeits are not included in Graph 2, as this graph shows only counterfeits detected in circulation, not counterfeits seized by police before they enter circulation.

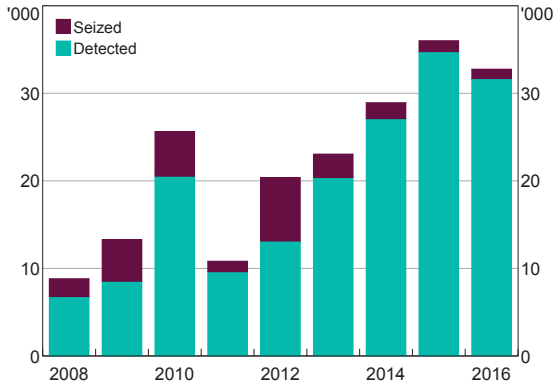
into circulation on 1 September 2016. The Bank plans to issue roughly one denomination per year, with the $10 to be issued in September 2017. Issuance of the $50 banknote is planned for 2018.

The counterfeiting rate has continued to rise in recent years, albeit from relatively low levels, increasing by an average of 20 per cent per year over the past five years. In 2016, an estimated 31 682 counterfeit Australian banknotes, with a nominal face value of almost $1.8 million, were detected in circulation. This equates to a counterfeiting rate of 22 counterfeits per million banknotes in circulation.

It might be expected that the $100 would be the most counterfeited denomination because, on face value, it provides the greatest return to a counterfeiter. However, $100 banknotes are more likely to attract scrutiny given that they are not generally dispensed from automatic teller machines and do not circulate particularly widely. Rather, the $50 banknote is by far the most counterfeited denomination both in absolute terms and as a share of the volume of banknotes in circulation as it is more readily accepted and still offers a high return for the counterfeiter (Table 1).

Australian law enforcement agencies, and particularly the Australian Federal Police, are key partners in the management of the threat of counterfeit banknotes in Australia. Some counterfeits are seized by law enforcement agencies before they enter circulation, such as the counterfeits intercepted by Interpol and the Australian Federal Police in 2006. While seized counterfeits are not included in the statistics that are published – as counterfeits do not defraud people until they are passed into general circulation – they nevertheless represent a valuable contribution that law enforcement agencies make to protect the Australian public from counterfeiting. While in most years counterfeits detected in circulation far outweigh counterfeits seized, counterfeit seizures have accounted for around 35 per cent of identified counterfeits in some recent years (Graph 3).

Graph 3
Counterfeits Seized and Detected*



* Estimate shown for counterfeits detected in 2016
Source: RBA

Manufacturing trends

In the 1990s, when Australia's first polymer banknote series was issued, technologies such as the internet, colour printing and digital imaging software were in their infancy (Adobe Systems Incorporated 2007). Today, these

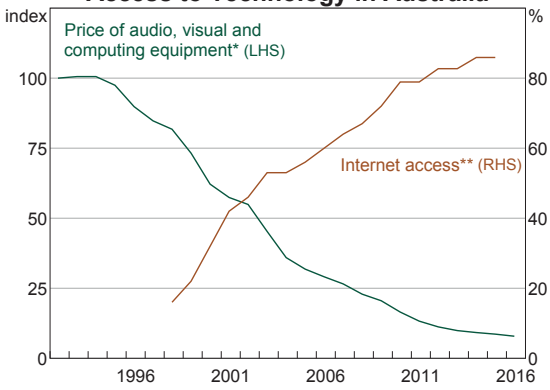
Table 1: Estimated Counterfeits Detected in Circulation in 2016[(a)]
12 months ending December

	$5	$10	$20	$50	$100	Total
Number	31	66	466	26 486	4 632	31 682
Nominal value ($)	155	660	9 320	1 324 300	463 200	1 797 635
Parts per million	<1	1	3	40	14	22

(a) Estimates are used to compensate for lags in counterfeit submissions to the Reserve Bank
Source: RBA

kinds of technologies are readily available and affordable. Data from the Australian Bureau of Statistics highlights the dramatic fall in the cost of audio, visual and computing equipment since the first polymer series was introduced, and how widespread access to the internet (and, by extension, computers and other internet-enabled devices) has become (Graph 4).

Graph 4
Access to Technology in Australia

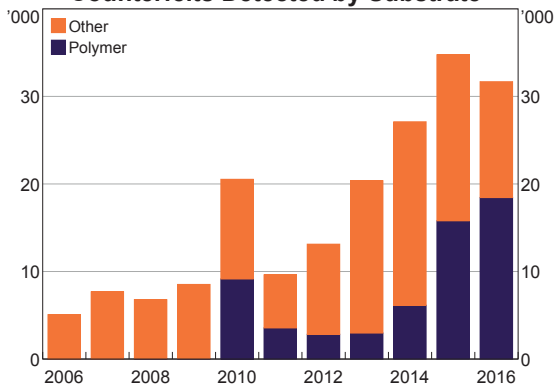


* Includes computers and printers; 1992 = 100
** Per cent of all households with home internet access
Source: ABS

As a pioneer of polymer banknotes, Australia was able to take full advantage of the technical difficulty and expense of producing polymer counterfeits in the 1990s and 2000s. While the first recorded counterfeits on polymer were detected in 1997, they were printed using traditional, labour-intensive techniques. It was not until 2010 that polymer counterfeits began to appear to any noticeable extent when technological advancement enabled counterfeiters to more readily print larger volumes of counterfeits on plastic (Graph 5).

The increase in the volume of counterfeits on polymer has been associated with an increase in the quality, and thus deceptiveness, of counterfeits detected in Australia. While reasonable quality counterfeits that show evidence of more complex manufacturing techniques have been detected

Graph 5
Counterfeits Detected by Substrate*



* Estimates shown for 2016
Source: RBA

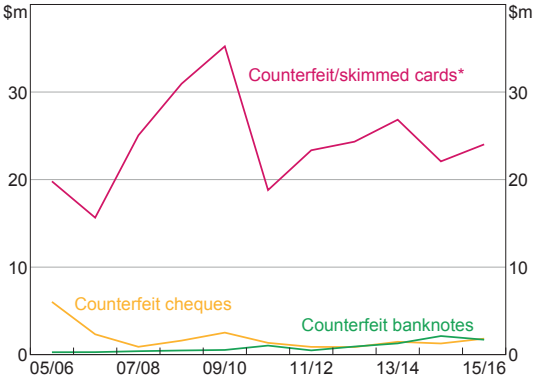
in increasing volumes, many are still poor-quality paper counterfeits that are produced with minimal effort. Over half of the counterfeits detected in 2016 were printed on polymer, while the rest were mainly the much poorer quality paper counterfeits.

Comparison with fraud of other payment instruments

The direct cost of counterfeiting is low relative to fraud levels of other payment instruments in Australia (Graph 6). In the 2015/16 financial year, the nominal face value of counterfeits detected in circulation was around $1.7 million. This represents the direct cost borne by merchants or individuals who accepted the counterfeit banknotes for payment. By comparison, in the same period, around $24 million of fraudulent transactions were made using counterfeit or skimmed Australian-issued credit, debit and charge cards in Australia (APCA 2016). The annual value of counterfeit or skimmed card fraud has been consistently higher than the annual nominal face value of counterfeits detected since data on card fraud were first made available in 2006.

By contrast, the total cost of fraud committed using counterfeit cheques was similar to the value of counterfeit cash detected in

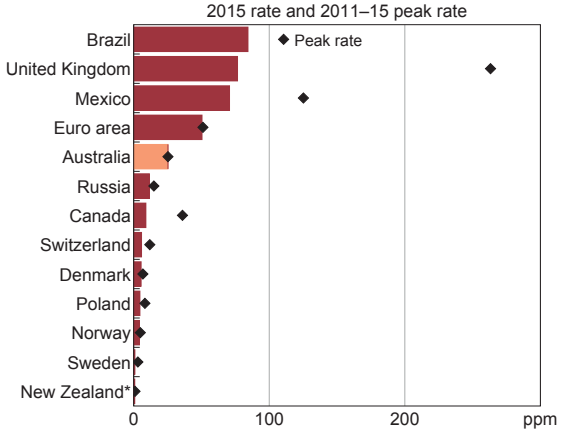
Graph 6
Counterfeit Payments by Instrument
Annual value of transactions



* Value of fraudulent transactions in Australia made using counterfeit or skimmed Australian-issued cards

Sources: APCA; RBA

Graph 7
Counterfeiting Rate
2015 rate and 2011–15 peak rate



* Financial year data (2011/12–2015/16)

Sources: Central banks; Law enforcement agencies; RBA

circulation in 2015/16, at $1.8 million. The value of fraud committed using counterfeit cheques has declined since 2006. However, it is worth noting that cheques are used far less frequently than cash. It is estimated that in 2016, cheques accounted for as few as 0.2 per cent of transactions by volume, compared with 37 per cent for cash.

International Comparison

Overall, Australia's counterfeiting rate is relatively low compared with many other countries. In particular, Australia has avoided the high levels of counterfeiting that some other countries have experienced. Australia's counterfeiting rate peaked at 25 ppm in 2015 (Graph 7). By contrast, Brazil, Canada, Mexico and the United Kingdom have all reported counterfeiting rates in excess of 100 ppm in the last 15 years. Notably, Canada's counterfeiting rate reached a peak of 470 ppm in 2004 while the United Kingdom reached a peak of over 300 ppm in 2008. As a result, Canada issued a new series of banknotes between 2001 and 2006 and 'aggressively withdrew' the previous series, while the United Kingdom has issued the first denomination in a new series, with further denominations to be issued in coming years (Fung and Shao 2011). Both countries also made the move to polymer as part of their push to further enhance the security of their banknotes.

While counterfeiting rates in Australia have been rising, they have been falling in most other countries. Only four countries in the available sample have counterfeiting rates that rose in 2015: Australia, New Zealand, Norway and Sweden.[5] It is worth noting that the countries that have seen the biggest fall in counterfeiting rates (Brazil, the United Kingdom, Mexico and Canada) are the same countries that have reported counterfeiting rates over 100 ppm in the past 15 years. These large reductions are likely to reflect, at least in part, the result of activities undertaken by central banks and law enforcement agencies in response to these high rates.

It is relevant to note, however, that international comparisons of counterfeiting rates are not straightforward. Monitoring practices vary from country to country and so consistent data are difficult to obtain. It may also take considerable time for accurate figures to be published, as

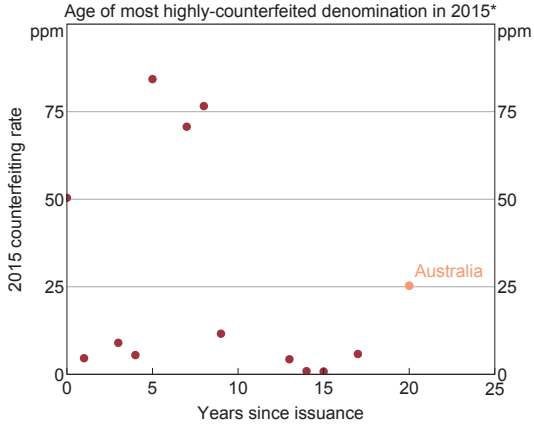
5 Sample based on countries that publicly release counterfeiting data.

counterfeits will often be handled by many organisations before reaching the entity that collates and publishes the data. In addition, like other crime statistics, counterfeiting data may suffer some degree of under-reporting, as not all victims will report the crime to the relevant authorities, and some countries put more resources into counterfeit detection and recording than others (Levitt 1988).

Country-specific factors also play an important role in influencing counterfeiting rates. General socio-economic and institutional factors that affect economic crime rates more broadly, such as economic and political instability, the effectiveness of law enforcement agencies, entrenched organised criminal activity, or high poverty levels, may all affect counterfeiting rates (Buonanno 2003). Some countries use international currencies such as the US dollar or the euro alongside their local currency, and counterfeiters may prefer to target these international currencies (USDT, BGFRS and USSS 2006).

There is also likely to be a relationship between the age of a banknote series and counterfeiting rates of that series. There are two aspects to this: over time, technological advances make it easier to counterfeit the security features on the banknotes in circulation; and counterfeiters also learn how to better counterfeit these security features and refine their manufacturing techniques. Nevertheless, when the rate of counterfeiting of a country is considered relative to the age of its banknote series, Australia's counterfeiting rate is more closely aligned with countries experiencing low levels of counterfeiting (Graph 8).

Graph 8
Counterfeiting and Series Age
Age of most highly-counterfeited denomination in 2015*



* Excludes commemorative banknotes; 2015/16 counterfeit data used for New Zealand
Sources: Central banks; Law enforcement agencies; RBA

Conclusion

Cash remains a popular payment instrument in Australia and it is important to ensure that it remains secure and easy to use. The Reserve Bank carefully monitors counterfeiting activity in Australia and in other countries and constantly researches new security features. While improvements in copying technology have seen both the rate and quality of counterfeiting in Australia increase in recent years, it nevertheless remains low relative to the experience of many other countries.

It is necessary to upgrade Australian banknotes periodically to ensure they remain secure into the future. The monitoring and analysis of counterfeiting trends both in Australia and overseas allows the Reserve Bank to keep several steps ahead of counterfeiters by making improvements pre-emptively, before counterfeiting becomes a significant problem.

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The Rise of Chinese Money Market Funds

Kate McLoughlin and Jessica Meredith*

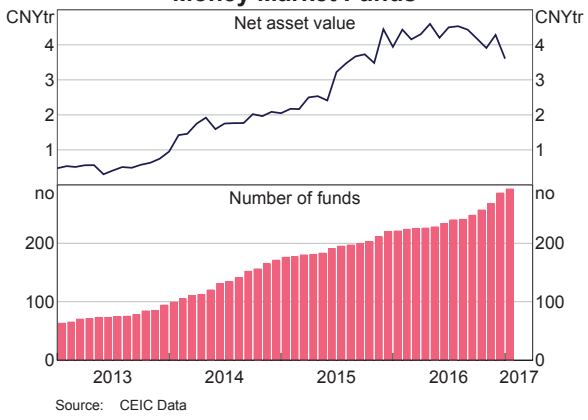
Money market funds (MMFs) pool funds in an investment vehicle to invest in short-term, highly rated securities. The MMF sector in China has grown rapidly over the past few years and is now the world's second largest by assets, though it is small compared with China's domestic bank deposits. This growth has been driven by investors attracted by high yields relative to bank deposits and technological developments that allow Chinese MMFs to offer a convenient cash management service. Chinese MMFs differ from similar products in many other countries: they tend to be more leveraged, and they offer more liquidity and maturity transformation. Nonetheless, recent regulatory reforms to address vulnerabilities have taken a similar direction to reforms globally.

Introduction

MMFs have become increasingly important to China's financial markets over the past few years. Since January 2013, their combined net asset value (NAV) – the value of a fund's assets minus its debt liabilities – has grown by nearly eight times to around CNY3.6 trillion and the number of MMFs has more than quadrupled to around 295 (Graph 1). By comparison, banking system deposits have only grown by around 1.6 times over the same period. Nonetheless, the value of MMFs' net assets has been broadly stable since late 2015, possibly because investors were shifting into wealth management products (WMPs) in response to the low returns paid on MMFs relative to WMPs.[1]

Products marketed as MMFs pool funds in an investment vehicle, with investors in MMFs receiving units (or shares) in this vehicle. MMFs invest largely in short-term, highly rated securities and are generally considered to be low-risk and low-return products with high liquidity. In this regard, MMFs serve as important intermediaries between short-term borrowers (such as governments and corporations that issue highly rated securities) and lenders (retail and institutional investors) who are seeking low-risk and liquid short-term investments.

Graph 1
Money Market Funds



Source: CEIC Data

* The authors are from Economic Group and International Department, respectively.

1 WMPs are investment products sold by banks and non-bank financial institutions that usually offer fixed rates of return. WMPs generally have higher-risk asset allocations than MMFs and lower liquidity.

The emergence of MMFs in China has occurred in the context of the rapid evolution of the broader market for investment products. Other products that have grown rapidly include WMPs, non-MMF mutual funds and products offered by insurance companies and securities firms (Perry and Weltewitz 2015).

This article provides some background on Chinese MMFs before discussing who invests in these funds and potential reasons for their rapid growth. It then outlines MMFs' asset allocations and their importance to Chinese short-term funding markets, before assessing potential vulnerabilities.

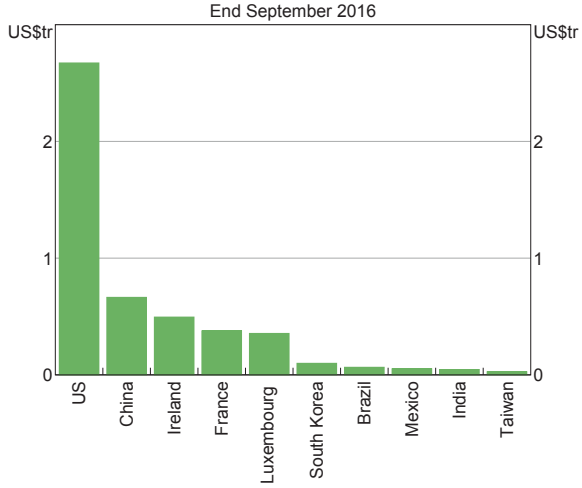
The Emergence of Chinese MMFs

Globally, the largest MMF sector by assets is located in the United States, with around US$2.7 trillion in net assets (Graph 2). Chinese MMFs had around CNY3.6 trillion (US$520 billion) in net assets in January 2017, which makes China the second largest market for such funds globally. Total assets held by Chinese MMFs are much larger (US$1.3 trillion) than net assets due to the use of leverage, a practice which is less common or prohibited for these products in many other economies. The rapid growth of MMFs (prior to 2016) has accounted for the majority of growth in the entire Chinese mutual fund sector over the past four years (Graph 3).[2] As a result, MMFs comprise a large share of China's mutual fund sector, in contrast to mutual fund sectors in many other large markets where equity and bond funds typically dominate.

Management of the MMF industry in China is fairly concentrated; the 10 largest asset managers in China account for a little over half of the sector's assets under management (AuM). This concentration is broadly comparable to that in the European Union but substantially lower than in the United States, where the top 10 asset managers hold around 75 per cent of total MMF AuM.

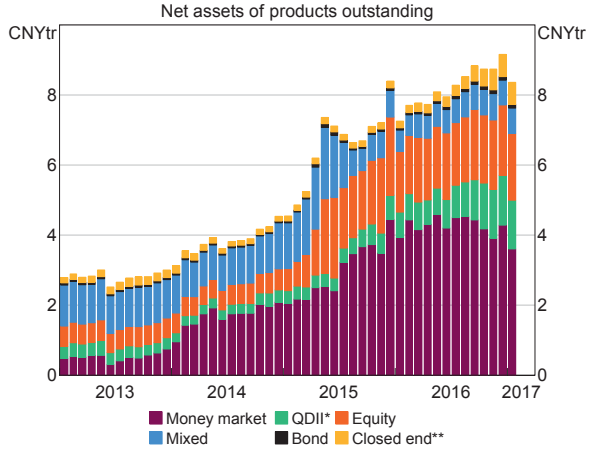
Chinese MMFs compete with WMPs, which also attract short-term funding from retail and institutional investors. WMPs are investments sold

Graph 2
Global MMFs' Net Assets
End September 2016



Sources: Investment Company Institute; RBA

Graph 3
Fund Management Products
Net assets of products outstanding



* The Qualified Domestic Institutional Investor (QDII) program enables authorised onshore asset managers to offer foreign equities and fixed income products to mainland investors denominated in foreign currency, although substantial restrictions apply.

** All other products are open end. Closed-end funds raise a fixed amount of capital through an initial public offering, while open-end products do not have a limit as to how many shares are on offer.

Source: CEIC Data

2 The mutual fund sector includes bond and equity funds, in addition to MMFs.

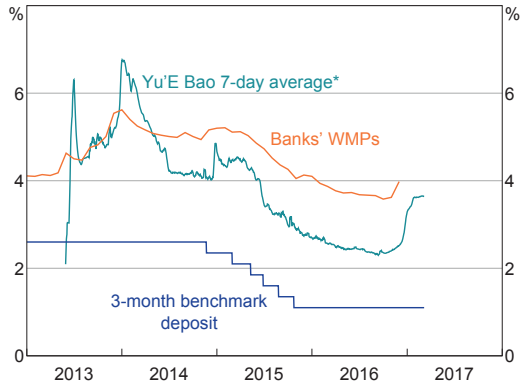
by banks and non-bank financial institutions and usually offer fixed rates of return. WMPs typically offer higher returns than MMFs, which reflects WMPs' riskier asset allocation and lower liquidity – funds raised are invested for a fixed term in a range of securities and loans. Nevertheless, like MMFs, WMPs are often perceived to be alternatives to term deposits in China despite carrying more risk. Partly as a result of higher WMP returns, the Chinese MMF sector is much smaller than the WMP sector; MMFs' net assets are around CNY3.6 trillion while banks' WMPs are around CNY29 trillion.

Who Invests in China's MMFs?

Chinese MMFs are an attractive investment option for both retail and institutional investors because many funds provide on-demand redemptions, which make them close substitutes for bank deposits. However, like in the United States, investments in Chinese MMFs are not covered by a deposit insurance scheme, while bank deposits are insured up to predefined limit. Nonetheless, they remain the most comparable investment option for retail investors and are regarded by many investors to be low risk, in part because some of China's MMFs are sponsored or distributed by large corporations and investors expect that these corporations will honour payments if a fund cannot meet redemptions. Indeed, a substantial share of the market is distributed online by financial affiliates of large Chinese technology conglomerates such as Alibaba and Tencent.

Retail investors (rather than institutional investors) dominated inflows into MMFs from 2013 to mid 2015. Through this period, MMFs were able to offer substantially higher returns than those available on retail bank deposits because bank deposit rates were constrained by regulation (Graph 4). In particular, the People's

Graph 4
Interest Rates



* Yu'E Bao is China's largest MMF
Source: CEIC Data

Bank of China (PBC) set deposit rate ceilings at this time (such as the three-month benchmark deposit rate in Graph 4), which were considered to be below market rates.[3] This was similar to the experience of the United States in the 1970s when MMFs were able to avoid a regulation that prohibited the payment of interest on demand deposits at deposit-taking institutions (IMF 2010).

Large MMFs in China had been able to offer higher returns than retail bank deposits because MMFs reinvested their investors' funding into 'negotiable deposits' at banks (that is, bank deposits with negotiable maturities and rates). Yields on these negotiable deposits were higher than retail bank deposit rates partly because of the stronger bargaining power of some MMFs compared to individual depositors, and because banks also reinvested these MMFs' funds in higher-risk products. However, over much of 2016, the returns offered by MMFs (such as the Yu'E Bao rate in Graph 4) declined, which may have led investors to shift their investments into alternative financial products, such as WMPs or equities. The rates offered by MMFs have increased more recently, which is likely to have

3 The ceilings on deposit rates were removed in October 2015, although deposit rates in China are still thought to be largely tied to the PBC's benchmark rates.

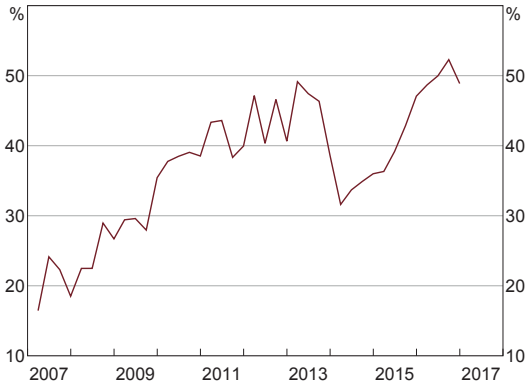
reflected the broad rise in money market rates at the end of 2016, but they still remain below WMP rates.

Strong retail demand for MMFs was also facilitated by the rapid modernisation of the payments system via internet finance platforms, which make MMFs easier to access. These platforms allow MMFs to offer an efficient cash management tool that enables consumers to buy and sell goods online, which has likely contributed to the strong growth of China's largest fund, Yu'E Bao (see: 'Box A: Yu'E Bao'), and similar products offered by other large, and often non-financial, Chinese corporations and their affiliate entities.

Over the past two years, the investor base of Chinese MMFs has become more similar to that of MMFs in developed markets. Institutional demand for MMF products surged to around half of the overall sector in the six months following the sharp fall in Chinese equity prices in mid 2015.[4] Prior to this, institutional investors held around 30 per cent of all units issued by MMFs.[5] By comparison, in 2012 institutional investors held 65 per cent in the United States, 90 per cent in France, and almost the entire market in Ireland and Luxembourg (IOSCO 2012).

One structural difference between Chinese and developed market MMFs, however, is how extensively leverage is used. Chinese MMFs have been able to increase the scale of their investments (and returns) by using debt funding; investors' funds only comprise around half of MMFs' funding (Graph 5).[6] This is in contrast to MMFs in developed markets, where leverage is either prohibited (such as in the United States) or strictly limited (such as in the European Union, where leverage is limited to 10 per cent of assets). Chinese MMFs use repurchase agreements (repos) to obtain leverage and achieve a higher yield. Market sources suggest that most repo activity by Chinese MMFs occurs in the interbank market – that is, Chinese MMFs borrow from financial institutions such as banks whereas MMFs in other countries would typically act as lenders in repo markets.

Graph 5
MMFs' Debt-to-asset Ratio*



* Estimated based on the difference between total and net assets; measure of debt (excluding MMF deposits) may include other liabilities such as undistributed gains

Sources: RBA; WIND Information

MMFs, however, comprise only a small share of the repo market. MMFs and other types of funds in China (referred to locally as 'funds institutions') borrow only CNY4.2 trillion and lend CNY2.7 trillion of the CNY31 trillion interbank repo market (Graph 6). National commercial banks dominate this market, although WMPs (many of which are off-balance sheet vehicles of banks) have also become important sources of funding.

4 For further detail on the movements in Chinese equity markets, see RBA (2015a, 2015b).

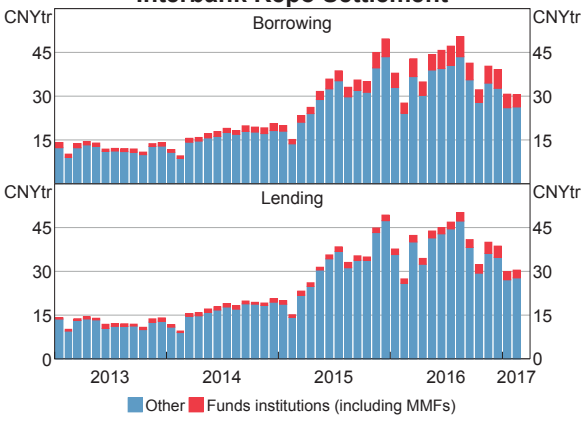
5 This level of retail participation is similar to the Chinese stock market.

6 MMFs' leverage is estimated as the difference between total assets and net assets (net assets are equivalent to the 'equity' in MMFs).

Box A
Yu'E Bao

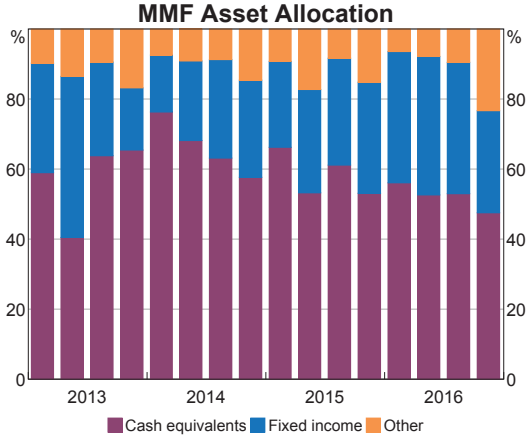
- Yu'E Bao is the largest MMF in China and one of the largest in the world with around CNY800 billion (US$120 billion) in total assets at end September 2016.
- The fund is offered through Alipay, an affiliate of e-commerce firm Alibaba, and is managed by Tian Hong Asset Management through its Tian Hong Zeng Li Bao fund.
- It was established in mid 2013, and has more than 250 million retail investors; more investors than China's equity markets. Investors include individuals and corporations (e.g. sellers on Alibaba's online commerce platform Tao Bao), most of which are reportedly looking for investments of less than three months.
- Investors buy units in Yu'E Bao by transferring funds (with a minimum of only CNY1) from a linked deposit account to their Alipay account through the Alipay app; investors can draw on multiple bank cards (or receive payments from other individuals' Alipay accounts) to purchase units in Yu'E Bao. But, banks limit the amount their customers can transfer to Yu'E Bao per day per card and can vary this amount.
- Yu'E Bao operates 24 hours a day and allows online shopping purchases from MMF dividends, offering clients an efficient cash management facility.
- Little information on the underlying investments is available to investors; the fund's broad asset allocation is available on the website and is updated on a quarterly basis.
- Investors can withdraw funds from Yu'E Bao at any time and there are no limits on the amount that can be withdrawn; however, since October 2016 Yu'E Bao has imposed transfer fees on users transferring more than CNY20 000 to a third party. There are also potential delays for larger withdrawals: for example, there is a two-hour delay for withdrawals of up to CNY50 000 and up to a 48-hour delay for larger withdrawals (timeframes also vary depending on the bank to which money is being transferred). Investors can make up to three withdrawals per day.

Graph 6
Interbank Repo Settlement



Source: CEIC Data

Graph 7
MMF Asset Allocation



Source: WIND Information

Chinese MMFs' Assets and Their Role in Funding Markets

Chinese MMFs invest in three broad asset classes: cash equivalents; fixed income securities; and other investments (Graph 7).[7]

- Cash equivalents are predominantly negotiable deposits at banks. Since investors are likely to have switched to MMFs from bank deposits, the growth of MMFs is likely to have increased the cost of banks' deposit funding. It has, however, allowed banks to increase lending to some extent because unlike retail deposits, negotiable deposits are exempt from China's high reserve requirement ratios.
- MMFs' fixed income investments include Chinese government paper, policy bank paper, some short-term commercial paper and, more recently, certificates of deposit with banks.[8,9]
- The 'other' category includes loans, reverse repos (which is when MMFs lend money, including to other mutual funds) and investments in WMPs, but the exact composition of this category is unclear.

Cash equivalents and fixed income securities account for around 75 per cent of aggregate MMF AuM, but asset allocations can vary widely between funds. In terms of the quality of the securities in which they invest, Chinese MMFs are restricted to investing in commercial paper rated AA+ or higher by a local credit rating agency. This is notionally higher than in the United States where investments can be rated A, but Chinese ratings are not directly comparable to those assigned by international ratings agencies. Chinese regulations also permit investments in corporate paper with longer maturities than in the United States.

Available data do not reveal how much corporations, banks and governments depend on funding from Chinese MMFs. In the United States, MMFs are significant providers of funding; prime MMFs hold around 8 per cent of the commercial paper market and 2 per cent of US Treasury bills. For China, limited data suggest that non-bank financial corporations

7 More granular data on MMF investments in China are not readily available. The breakdowns within these categories in this article are sourced from IOSCO (2015) and various market reports.

8 China has three 'policy' banks that are responsible for government-funded spending and targeted lending.

9 Authorities announced new guidelines for certificates of deposit in mid 2015, which partially liberalised these products.

(which include MMFs) hold around 30 per cent of commercial paper and around 25 per cent of policy bank bonds, which makes them significant funders of these sectors.[10] However, there is no breakdown of the financial entities providing these funds. Corporations in China are also generally more reliant on bank funding than corporations in the United States.

MMFs also provide funding to other financial institutions by lending via reverse repo in the smaller exchange-traded markets in Shanghai and Shenzhen rather than in the much larger over-the-counter interbank market. This is largely because counterparty risk is lower when stock exchanges centrally clear all repos. While data on turnover in the exchange-traded markets are not readily available, market sources indicate that a key recipient of these funds are non-MMF mutual funds, which borrow to purchase more assets and to fund redemptions from their investors. Nonetheless, the stock exchanges have typically only accounted for 5–10 per cent of total repo market activity.

Assessment of Vulnerabilities

One concern about MMFs is that they can amplify stressed conditions in financial markets. A large share of investors withdrawing funding from MMFs can harm the functioning of money markets and lead to pressure on banks' funding; this happened to US and European MMFs during the global financial crisis (IOSCO 2012). Chinese MMFs are subject to less restrictive regulations compared to their counterparts in developed economies, and may in principle be more vulnerable to these sorts of risks. Features of MMFs that can contribute to the propagation of financial stress include:

- maturity and liquidity mismatches. A maturity mismatch refers to the difference between the term of MMFs' assets and liabilities, and a liquidity mismatch refers to the difference between the length of time it takes investors to redeem funds from MMFs and the (longer) length of time it can take MMFs to sell assets to fund these redemptions. These mismatches can lead to fire sales and exacerbate price falls in other financial markets if MMFs are required to meet large redemptions;
- the use of leverage, which can exacerbate maturity and liquidity mismatches as MMFs that cannot roll over their debt funding may need to quickly unwind positions (including funding to banks). Leverage also exacerbates any MMF losses; and
- constant NAV. If an MMF's liabilities (including those to unit holders) exceed the market value of its assets, the MMF may 'break the buck' – that is, reduce the value of its units to below par – in the event of significant redemption requests from unit holders. The prospect of such an event may induce a run on the MMF sector more broadly, as occurred in the United States in 2008.

As a result of the global financial crisis, international organisations and national regulators have developed reforms that aim to improve the risk management frameworks of MMFs, with a focus on mitigating their susceptibility to heavy redemptions (IOSCO 2015). The China Securities Regulatory Commission has introduced rules that came into effect from February 2016, which bring China's regulatory framework closer to these international standards. However, even under these new rules, MMFs in China still exhibit some important structural differences to their counterparts in large developed financial markets (Table 1). For example, Chinese MMFs are able to obtain leverage of up to 20 per cent (revised down from 40 per cent, although

10 Bonds account for a significant share of policy banks' funding.

Table 1: Key Regulatory Differences

	China	United States
Maximum weighted-average maturity	120 days (previously 180 days)	60 days
Liquidity	Minimum 5% in cash, Chinese government bonds, PBC bills and policy bank bonds, 10% of the above assets must mature within 5 days, and no more than 30% of non-tradeable portfolio with more than 10-day maturity (previously no liquidity requirements were specified)[(a)]	Minimum 10% of portfolio overnight maturity and 25% within 7 days
Redemption	Same day retail; day after institutional	Same day
Diversification	Maximum of 10% of commercial paper from single issuer	Maximum of 5% of commercial paper from single issuer
Leverage	Maximum 20% (previous maximum 40%)	Prohibited

(a) Non-tradeable assets include: bank term deposits (though, contractually many funds have negotiated for before end-term redemption for no financial consequence – deposits of this type are therefore exempt from this rule) and reverse repo with more than a 10-day maturity

Sources: China Securities Regulatory Commission; Fitch Ratings; Goldman Sachs; Securities and Exchange Commission

available data imply that departures from this limit have occurred), compared with 10 per cent in the European Union and zero in the United States. Chinese MMFs can also undertake more maturity transformation; Chinese MMFs are allowed to hold assets with a maximum weighted average maturity of 120 days, twice that allowed in the United States. These differences could result in greater risk-taking by Chinese MMFs, but the level of risk is difficult to compare across countries as MMFs are affected by numerous factors, including broader differences in the financial systems in which they operate. For instance, recent US MMF reforms require prime funds to trade on the basis of a variable NAV, which allows an MMF's unit price to more closely reflect movements in the market value of its assets over time. This limits the focus on the point at which the fund 'breaks the buck'. The reforms also allow prime MMFs to temporarily freeze redemptions if necessary.

While Chinese MMFs appear more leveraged and have larger maturity mismatches than their US counterparts, their assets are small relative to the size of the banking system. Chinese MMFs also have provisions that help mitigate some of these risks. Redemption freezes can be imposed if they face redemptions of 10 per cent or more for two consecutive days and some funds have also negotiated contracts with banks that allow them to break term deposits without penalty (albeit possibly at the cost of tighter liquidity for banks). MMFs also sometimes benefit from periods of broader financial market stress as investors shift from higher-risk products (such as equities) into MMFs.

Conclusion

The Chinese MMF sector has grown significantly over the past few years to become one of the largest MMF sectors in the world. That growth partly reflects the attraction of higher returns on MMFs than on bank deposits and easier access through technological innovation. To the extent that MMFs experience further rapid growth, they are likely to play an increasingly important role in China's financial markets.

While MMFs are not as risky as other investment products such as WMPs, Chinese MMFs exhibit structural differences to MMFs in many other jurisdictions, such as their use of leverage and generally longer average maturities of their assets. The recent implementation of regulations by the Chinese authorities has reduced these differences, although the regulatory framework still permits a greater degree of risk-taking by Chinese MMFs. The vulnerabilities apparent in the Chinese market increase the chances of substantial redemptions from Chinese MMFs, which could adversely affect other parts of the financial system if the role of MMFs grows in the future.

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