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Firms' Investment Decisions and Interest Rates

Kevin Lane and Tom Rosewall*

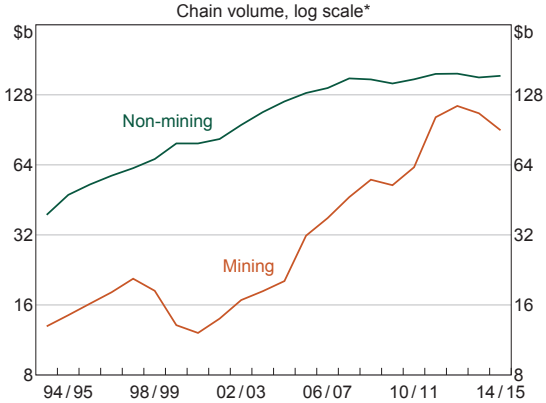
Firms typically evaluate investment opportunities by calculating expected rates of return and the payback period (the time taken to recoup the capital outlay). Liaison and survey evidence indicate that Australian firms tend to require expected returns on capital expenditure to exceed high 'hurdle rates' of return that are often well above the cost of capital and do not change very often. In addition, many firms require the investment outlay to be recouped within a few years, requiring even greater implied rates of return. As a consequence, the capital expenditure decisions of many Australian firms are not directly sensitive to changes in interest rates. Furthermore, although both the hurdle rate of return and the payback period offer an objective decision rule on which to base expenditure decisions, the overall decision process is often highly subjective, so that 'animal spirits' can play a significant role.

Introduction

In real terms, non-mining business investment in Australia has been little changed for several years (Graph 1). In nominal terms, it is at a low level as a share of GDP compared with its history. Relatively low levels of investment outside of the resources sector was one of the ways in which the Australian economy accommodated the unprecedented boom in commodity prices and the associated strong increase in mining investment over much of the past decade. Mining investment peaked in mid 2012 and although there has been modest growth of economic activity in the non-mining sector in recent years, non-mining business investment has remained subdued. Many other advanced economies have also experienced sustained weakness in business investment since the late 2000s.

Several reasons have been put forward to explain the ongoing weakness in business investment both here and abroad, including weak demand, heightened uncertainty and low business confidence.[1] These themes also feature in discussions about firms' investment intentions with contacts in the Bank's business liaison program.[2] Moreover, many contacts

Graph 1
Private Business Investment
Chain volume, log scale*



* Reference year is 2012/13; RBA estimates for 2014/15 as at May 2015 *Statement on Monetary Policy*

Sources: ABS; RBA

* The authors are from Economic Analysis Department.

1 See Kent (2014) for a discussion of the possible constraints on non-mining business investment in Australia and IMF (2015) for a discussion of subdued private investment activity across advanced economies more generally.

2 The Reserve Bank business liaison team conducts around 70–80 discussions with contacts on a monthly basis. Discussions with individual firms occur around every 6 to 12 months, with Bank staff usually meeting the chief executive officer, chief financial officer and/or operations manager. Liaison meetings are held with firms of all sizes, although 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).

have reported that low interest rates do not *directly* encourage investment. In contrast, economic theory suggests that the rate of interest affects the cost of capital and should influence investment decisions directly, based on standard methods used to evaluate investment opportunities.

Detailed discussions with business liaison contacts reveal why lower interest rates might not have any direct effect on investment, even at the margin. Contacts indicate that required rates of return on capital expenditure, also referred to as 'hurdle rates', are often several percentage points above the cost of capital. More importantly, contacts note that the hurdle rate is often held constant through time, rather than being adjusted in line with the cost of capital. Regardless of whether changes in interest rates have a *direct* effect on investment decisions, interest rates will still have a powerful *indirect* influence on firms' investment decisions through other channels, including their effect on aggregate demand.

The Investment Decision

The appraisal process for capital expenditure usually varies according to the objective of the investment opportunity. Some capital expenditure may be approved without the use of quantitative criteria, particularly if it relates to maintenance, reducing pollution, improving safety or security, or complying with regulations. But, in general, discretionary capital expenditure is subject to quantitative evaluation, with the level of scrutiny determined by the size of the investment, its perceived riskiness and managers' attitudes towards risk. Typical evaluation methods used include discounted cash flow (DCF) analysis and the payback period. Both methods need an assessment of future cash flows that will be generated by the investment. This requires a range of inputs (e.g. projected sales, operating costs, taxes, etc), many of which are uncertain. Businesses typically use the most likely cash flows in each period, though the expected value of cash flow, calculated as a probability weighted average, is also used.

Discounted cash flow analysis

DCF analysis is a standard method recommended by finance theory to evaluate investment opportunities. The method proposes that the investment decision should be made with reference to the estimated net present value (*NPV*) of the opportunity, which is the sum of all cash flows (CF_t) resulting from the investment, discounted using the firm's chosen discount rate (i):

$$NPV = \sum_{t=0}^{N} \frac{CF_t}{(1+i)^t} \tag{1}$$

In the simplest case, the firm should invest if the *NPV* is positive for the chosen discount rate; put differently, the project should be approved if the internal rate of return of the project is above this specific discount rate.[3] Because it provides a natural threshold to accept or reject investment decisions, the discount rate used in DCF analysis is often called the 'hurdle rate'.

Theory suggests that the hurdle rate for a typical investment should be set with some reference to the firm's weighted average cost of capital (WACC), which includes the cost of both debt and equity. For example, the level of the hurdle rate may be greater than the WACC if the potential investment has greater non-diversifiable risk than the overall operations of the firm. The extent of such a gap will also depend on the extent to which managers and shareholders are averse to risk. Changes in interest rates influence the cost of debt and, under reasonable assumptions, the cost of equity, and so should influence the hurdle rate.

Payback period

Firms may also evaluate investment decisions using the payback period, which is simply the number

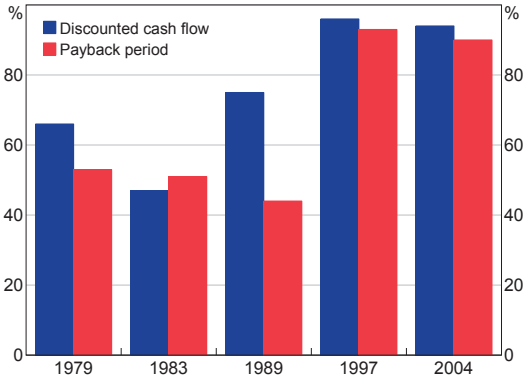
3 In practice, firms often have the option to defer investments to learn more about the economic environment. The ability to wait can be valuable because it may allow firms to avoid loss-making investments. In this case, the simple NPV decision rule does not apply: the firm should invest only when doing so provides returns in excess of the sum of the outlay plus forgoing the option value of waiting. This line of reasoning calls for the use of real options analysis; see Dixit and Pindyck (1994).

of years it would take for the capital outlay to be returned by the cash flows generated by the project. Although the payback period is intuitive and easy to communicate, it does not take into account the time value of money and ignores cash flows beyond the chosen cut-off date.

Evidence from Australian Firms

A typical firm in the Bank's liaison program evaluates discretionary capital expenditure by using DCF analysis, and also by considering the payback period as a supporting consideration. This is in line with the evidence from other advanced economies such as the United States and the United Kingdom (see below) and is also in line with earlier survey evidence for Australia. For instance, a survey of Australian firms conducted by academics in 2004 also found that the vast majority of firms used both methods, which, according to other surveys, had become more popular over the preceding decades (Graph 2).

Graph 2
Capital Budgeting at Australian Firms
Proportion of firms surveyed using each method

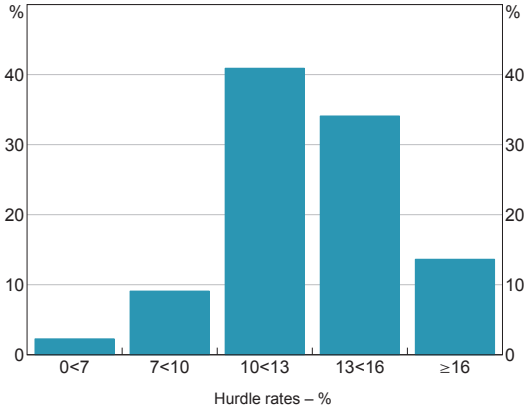


Sources: Freeman and Hobbes (1991); Kester *et al* (1999); Lilleyman (1984); McMahon (1981); Truong, Partington and Peat (2008)

Discounted cash flow analysis

Liaison contacts indicate that the hurdle rates used to evaluate business investment opportunities are often several percentage points above the WACC. Hurdle rates of around 15 per cent are quite common, though the range of rates reported is relatively wide, from a little less than 10 per cent up to 30 per cent. These observations are broadly in line with recent evidence from the Deloitte CFO Survey, which found that nearly 90 per cent of the Australian corporations that responded used hurdle rates exceeding 10 per cent, and around half of the corporations used a hurdle rate exceeding 13 per cent (Deloitte 2014; Graph 3). Liaison contacts reason that the hurdle rate is often set above the cost of capital to account for uncertainty about the cash flow projections. Contacts also note that there is likely to be an optimism bias in these cash flow projections. As a result, setting a hurdle rate above the cost of capital is likely to improve the chances that investments add value to the firm on a risk-adjusted basis.[4]

Graph 3
Hurdle Rates
For investment decisions, share of firms*

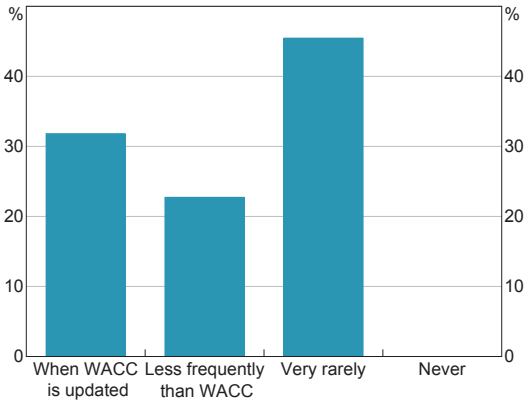


* Excluding firms that do not use a hurdle rate
Sources: Deloitte CFO Survey; RBA

Many liaison contacts also report that hurdle rates are not changed very often and in some instances have not been altered for at least several years. These observations are also reflected in the recent survey by Deloitte; two-thirds of corporations indicated their hurdle rate was updated less frequently than their formal review of the WACC, and nearly half reported the level of their hurdle rate was changed 'very rarely' (Graph 4). For these firms, changes in

4 Adjusting for risk by using a higher discount rate rather than by probability weighting the cash flows introduces a bias against longer-term projects, since the present value of a longer-dated cash flow is more sensitive to changes in the discount rate.

Graph 4
Frequency of Hurdle Rate Changes
Share of firms*



* Excluding firms that do not use a hurdle rate
Sources: Deloitte CFO Survey; RBA

interest rates do not flow through to hurdle rates; rather, the margin between the WACC and the hurdle rate changes. One-third of firms said they update their hurdle rate when they review their WACC, which is possibly on a quarterly or annual basis; other contacts in the liaison program have also noted the WACC used in investment decisions is similarly reviewed infrequently.

Liaison contacts have provided several reasons why the hurdle rate may not be sensitive to the cost of capital. A common observation is that the true cost of equity, and therefore the overall cost of capital, cannot be observed.[5] Managers have also noted that changes in the observed cost of debt owing to changes in interest rates are likely to be temporary, and so they are reluctant to react to developments that may soon be unwound. A few business contacts have argued that keeping the hurdle rate constant acts as an automatic time-varying risk adjustment: interest rates tend to be low when uncertainty is high, so the gap between the hurdle rate and the cost of capital should be higher (and vice versa). There are two additional reasons why the net present value is not particularly sensitive to unit changes in the hurdle rate. First, a unit change in the hurdle rate will have less effect on the net present value when that rate is set well above the cost of capital. Second, firms often ignore cash flows that are some distance in the future (say, beyond five years), and the present values of these later cash flows are more interest sensitive.

For some firms, moving the hurdle rate by a percentage point or more would be immaterial to the decision process, since accepted investments tend to have much higher returns. Many contacts report that projects with a rate of return above the hurdle rate were often rejected anyway. This may be because the payback period was too long or because of other considerations (see below). These reasons suggest that managers might value the option to defer an investment until its expected net present value is greater. In the absence of more sophisticated analysis, using a hurdle rate in excess of the WACC may be a reasonable approach to account for this option value of waiting (McDonald 2000).

Discussions with managers have shown that there are several reasons why small changes in the cost of capital may not warrant changes in a firm's hurdle rate. Some managers indicate that changes to the hurdle rate may send the wrong message to staff proposing projects about the overall risk tolerance of the firm. Others indicate that changes in the hurdle rate require board approval, which introduces stickiness. However, in many instances it appears that firms are using hurdle rates that have not changed in a long time, set at a time when nominal long-term interest rates were far higher than they are today. Whether explicit or not, such behaviour is consistent with a reduced appetite for risk or the possibility that risks have increased.

Payback period

The payback period is used extensively by firms in Australia. In liaison, the most common payback period reported by contacts is three years, though

5 In general, managers of listed firms appear to use the capital asset pricing model (CAPM) as their primary measure of the cost of equity. Similar results have been found for US and European firms (Graham and Harvey 2001; Brounen, de Jong and Koedijk 2004). As several liaison contacts have noted, the cost of equity implied by CAPM will be sensitive to the estimation sample period and method. In addition, other measures of the cost of equity could provide different results.

not all contacts that use the method use a fixed value. Some firms have reported a period of less than three years for at least some types of capital expenditure, including target periods of 12 months, implying very high required rates of return for a given capital outlay. In some cases, firms have reduced their maximum payback period in recent years. Contacts often report using the payback period in conjunction with DCF analysis and smaller firms sometimes rely on the payback method exclusively.

Liaison contacts cite various reasons for using the payback period, despite its theoretical shortcomings, in addition to DCF analysis:

- Firms place a premium on recouping cash. In liaison, this reason has been used by both financially constrained and unconstrained firms. For example, strongly performing firms have explained that they use the payback period to help ensure that they retain their high credit rating.[6]
- There is greater uncertainty around cash flows that are further into the future.[7]
- The cash flow forecasts used by project proponents in DCF analysis are often considered to be optimistic by their managers. In effect, the payback period adds another buffer to the hurdle rate to increase the likelihood that investment projects generate a return in excess of the cost of capital.
- There are more projects with expected returns exceeding the notional hurdle rate than the firm wishes to pursue. Firms view the payback period as an efficient method to screen projects, especially when the ultimate decision-maker in the firm has less information than those proposing the project.

Other considerations

It is clear from discussions with managers that the overall investment decision process is often highly subjective, introducing a role for 'animal spirits' or 'gut feeling' to have an important effect on capital expenditure decisions. This is not surprising, given that future cash flows generated for the quantitative criteria discussed are often difficult to forecast and hence rely on subjective input from project proponents. However, many contacts have reported that projects satisfying quantitative criteria have been rejected anyway because of other constraints, including strategic considerations, heightened risk aversion, a restricted capital budget imposed by higher levels of management or the global parent company, limited resources to deploy projects or shareholder perceptions.

Evidence from Other Advanced Economies

The available evidence suggests that firms in other advanced economies undertake investment decisions using similar criteria employed by Australian firms. Surveys have found that firms in the United States and Europe tend to evaluate proposed investments using discounted cash flow techniques, which have become more popular over the past few decades, and the payback period.[8]

Studies of firms overseas have found that they also use hurdle rates that are above their cost of capital. Jagannathan, Meier and Tarhan (2011) surveyed firms in the United States in 2003 and found that a typical firm used a hurdle rate several percentage points above its WACC. Brunzell, Liljeblom and Vaihekoski (2013) found a similar result for Nordic firms. Similarly, firms in other countries also appear to use hurdle rates that are not sensitive to the cost

6 In a large-scale survey of US chief financial officers, Graham and Harvey (2001) found the firm's credit ratings to be a chief concern. Graham and Harvey also found no evidence that use of the payback period was related to a firm's financial position or performance.

7 Although, under DCF analysis, greater uncertainty around cash flows that are further into the future is accounted for, at least in part, by the greater effect of discounting on these cash flows.

8 See Graham and Harvey (2001) for a discussion of North American firms and Brounen *et al* (2004) for a study of European firms.

of capital.[9] Sharpe and Suarez (2013) drew on several surveys to conclude that the average hurdle rate of US firms has not changed since the mid 1980s, even though there has been a marked decline in long-term nominal interest rates over the past three decades.

Several surveys have confirmed that the payback period remains popular among firms in other advanced economies. As in Australia, a payback period of around three years is common for firms in the United States and the United Kingdom (Lefley 1996).

Implications for Business Investment

Analysis of the investment decision process helps to explain the subdued growth of non-mining business investment. First, there is some evidence of a tightening in investment criteria since the global financial crisis. For example, some firms have reduced their maximum payback period, suggesting implied discount rates for investment decisions may have increased even as long-term interest rates declined. Second, identifying investment opportunities with returns exceeding the typical hurdle rate of around 15 per cent may be difficult for many firms given their expectations for the growth of their sales.

It is clear from discussions with liaison contacts that the overall decision process is highly subjective, which in turn allows 'animal spirits' to play a role. As noted, firms frequently reject investment decisions that satisfy self-imposed quantitative criteria on other grounds, such as concerns about the economic outlook, the availability of capital within the company, or shareholders' preferences. Some managers have noted that they have taken a more cautious approach to capital expenditure since the financial crisis, either because there is more uncertainty about the future or they are more averse to taking risks. As a consequence, firms with a range of opportunities may only be willing to pursue the most profitable projects in the current economic environment.

Although changes in interest rates may not have a *direct* effect on investment decisions for many firms, interest rates will still have a powerful *indirect* influence on firms' investment decisions. For example, a reduction in interest rates may improve firms' cash flows through reductions in interest payments, freeing up cash for other purposes. More broadly, interest rates affect economic activity via a number of channels, including the saving and spending behaviour of households, the supply of credit, asset prices and the exchange rate, all of which affect the level of aggregate demand.

Conclusion

Contacts in the Bank's business liaison program have reported a range of reasons for the subdued level of non-mining investment, though they typically state that low interest rates do not by themselves encourage investment. Detailed discussions with managers and survey evidence indicate that the lack of direct interest rate sensitivity partly arises because Australian firms typically use effective discount rates that are high and sticky to evaluate capital expenditure opportunities. This reflects the use of hurdle rates that are considerably higher than the weighted average cost of capital and are adjusted infrequently, or a requirement that any outlay must be expected to be recouped within a few years. ✠

9 The phenomenon of firms using very high hurdle rates was noted even earlier by Shackle (1946), following a series of interviews with business managers conducted by the Oxford Economists' Research Group: see Besomi (1998).

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Why Is Wage Growth So Low?

David Jacobs and Alexandra Rush*

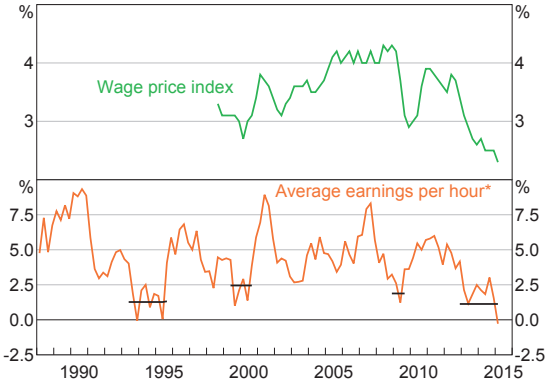
Wage growth has declined markedly in Australia over the past few years. At the same time, stronger growth in labour productivity has worked to contain growth in labour costs. These developments reflect several factors, including spare capacity in the labour market, a decline in inflation expectations, a lower terms of trade and the need for the real exchange rate to adjust to improve international competitiveness. The size of the decline in wage growth has been larger than simple historical relationships would suggest, which might be explained by various characteristics of the current episode.

The Decline in Wage Growth

The rate of wage growth has important implications for the macroeconomy. Wages are the largest source of household income and the largest component of business costs, and so have significant implications for consumer price inflation. Wage growth has declined markedly in recent years to the lowest pace since at least the late 1990s, according to the wage price index (WPI) (Graph 1). Wage measures with a longer history suggest that this has been the longest period of low wage growth since the early 1990s recession.[1] Across these measures, the rate of annual wage growth has declined to around the pace of inflation, about 2–3 per cent.

The slowing in wage growth has occurred alongside faster growth in labour productivity. This has also helped to moderate growth in labour costs for firms, beyond the impact of lower wage growth. Accordingly, growth in the labour cost of producing a unit of output (unit labour costs, or ULCs) has also declined markedly since 2012 (Graph 2). Indeed, the level of ULCs has been little changed for more than

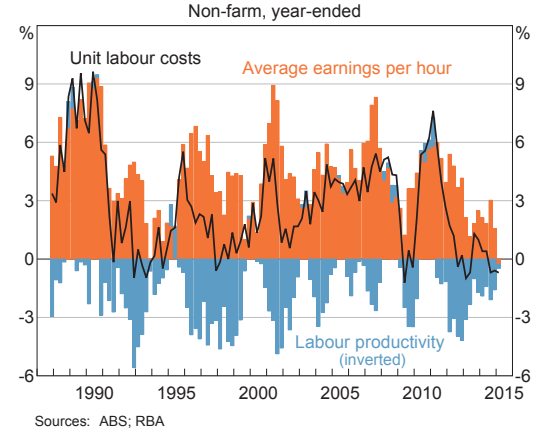
Graph 1
Wage Growth
Year-ended



* The black lines represent the average over the period

Sources: ABS; RBA

Graph 2
Contributions to Unit Labour Cost Growth
Non-farm, year-ended



Sources: ABS; RBA

* The authors are from Economic Analysis Department and thank Trent Wiltshire for valuable input to this article.

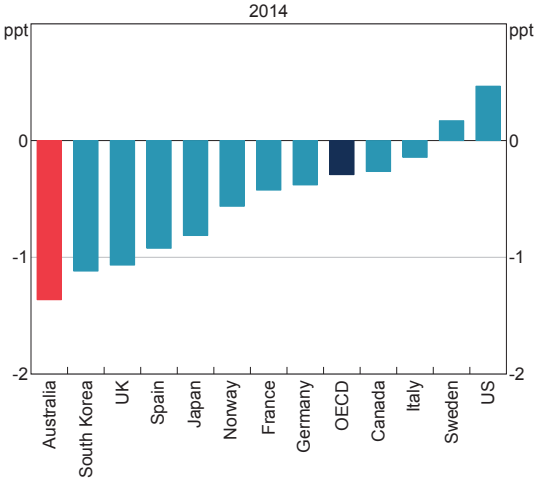
1 The WPI tends to be the smoothest measure of wage growth because it measures the change in wages for a fixed and representative basket of jobs (which is updated periodically). Other measures, including measures of average earnings from the national accounts (AENA), tend to be more volatile as they are affected by compositional change and quality improvements. The various measures of wages are useful in different circumstances. For further discussion, see RBA (2006).

three years – the longest such period since the early 1990s.

The recent low wage growth has not been unique to Australia. Internationally, wage growth has been lower than forecast for several developed economies in recent years, including some where labour markets have tightened considerably. Various factors have been proposed to explain this weakness, including secular trends that have been in place for some time and have also resulted in a general decline in the labour share of income (see, for example, Yellen (2014)).[2] However, the decline in wage growth in Australia stands out, with the extent of the forecast surprise for Australia particularly large in the context of OECD countries in recent years (Graph 3).

Several factors appear to explain much of the decline in Australian wage growth, and these are discussed in the remainder of this article. There has been an increase in spare capacity in the labour market, and expectations of future consumer price inflation have declined to be a bit below average. Inflation in output prices in recent years has been particularly subdued, in large part owing to the lower terms of trade. More generally, the decline in the terms of trade and fall in mining investment in recent years mean that the economy requires a lower 'real' exchange rate, which has been in part delivered by low wage growth. A statistical model indicates that these factors do not fully explain the extent of decline in wage growth, suggesting that other factors, such as an increase in the flexibility of wages to market conditions, may also have contributed.

Graph 3
Wage Growth Surprise*
2014



* 2014 growth in compensation per employee (i.e. AENA per head), relative to 2013 OECD forecast

Sources: OECD; RBA

Wage Growth and Unemployment

It has been widely observed that, in the short run, lower wage growth is associated with higher rates of unemployment (Phillips 1958; Fuhrer *et al* 2009). Firms experiencing subdued demand for their goods and services will seek to contain costs, including labour costs. Wages tend not to adjust quickly to lower growth in labour demand, so firms initially seek to contain their labour costs by laying workers off, reducing hours or reducing hiring.[3] As slack in the labour market rises, employees become more anxious about their job security and become willing to accept lower wage growth as there are fewer opportunities for alternative employment and more competition for any given job vacancy. As labour market conditions fluctuate over the business cycle, the economy moves along this so-called Phillips curve (Graph 4).[4]

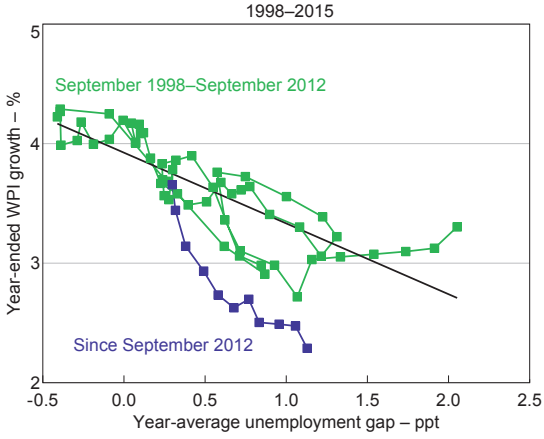
The decline in wage growth since late 2012 appears to have been unusually large relative to the increase in the unemployment rate. Based on the estimated

2 For example, an increase in the global supply of low-skilled labour over the past decade may have eroded the bargaining power of competing labour in developed economies. In addition, certain job types may have been more prone to automation (Borland 2011), and there has been a general decline in union density in many developed economies.

3 There are various theoretical explanations for the slow adjustment in wages, including the use of contracts, imperfect information, the effect of wages on productivity (the 'efficiency wage' theory) and the absence of unemployed workers from wage bargaining ('insider-outsider' theory).

4 The unemployment gap is the difference between the unemployment rate and a statistical estimate of the non-accelerating inflation rate of unemployment (NAIRU). For a discussion, see Ballantyne, De Voss and Jacobs (2014). While one possible explanation for slow wage growth is a decline in the NAIRU, other evidence does not suggest that a marked reduction in the NAIRU has occurred.

Wage Phillips Curve*
1998–2015

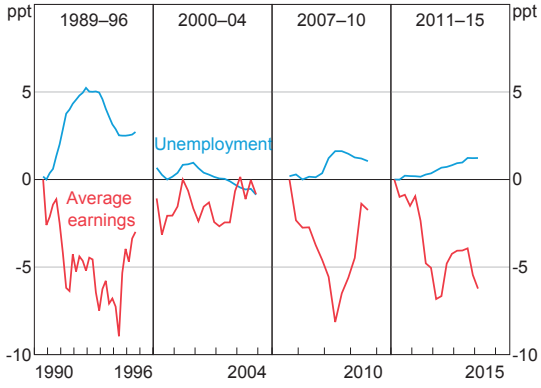


* The line of best fit for the 1998 to 2012 data is shown in black

Sources: ABS; RBA

relationship that held from 1998–2012, WPI growth has declined by more than twice as much as would have been expected. A longer-term analysis, based on the measure of average earnings from the national accounts (AENA), also suggests that the wage adjustment has been large given the change in unemployment (Graph 5). What stands out about the current episode is that wages have fallen as sharply as they did in some earlier episodes that had larger and sharper increases in the unemployment rate.

Graph 5
Unemployment and Wages in Downturns
Difference to trough/peak*



* Difference to trough of unemployment rate; peak of year-ended growth of average earnings per head

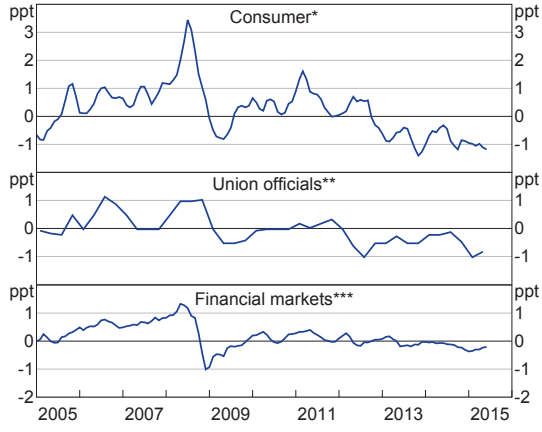
Sources: ABS; RBA

Inflation Expectations

The above results suggest that wage growth may be lower for a given rate of unemployment than in the past (i.e. the Phillips curve may have shifted inwards). Inflation expectations are one important factor that can shift the position of the Phillips curve. Employees are ultimately concerned with the purchasing power of their wage in terms of the goods and services it affords, rather than its monetary value (i.e. they are concerned about their real as opposed to nominal wage). Accordingly, lower wage growth might be partly explained by temporarily lower inflation expectations for consumer prices.

Surveys of households and unions indicate that expected consumer price inflation for the year ahead has been below average, while long-term financial market measures are also a little below average (Graph 6). Some liaison contacts also report that inflation benchmarks applied in wage negotiations are a little lower than in the past few years. Altogether, expectations of inflation of consumer prices, while generally well anchored, appear to have a cyclical component that might feed back into wage outcomes.

Graph 6
Consumer Price Inflation Expectations
Deviations from average since July 1996



* Three-month moving average of the trimmed mean of inflation expectations over the next year

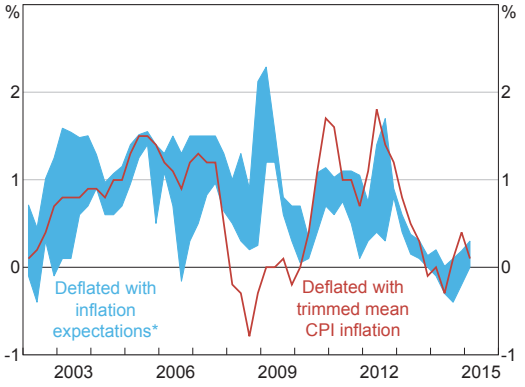
** Median of union officials' expectations of inflation over the next year

*** Break-even 10-year inflation rate on indexed bonds; interpolation used to match exact maturity

Sources: Australian Council of Trade Unions; Employment Research Australia; Melbourne Institute of Applied Economic and Social Research; RBA; Workplace Research Centre; Yieldbroker

However, even accounting for temporarily lower inflation expectations, real wage growth from the perspective of consumers has declined markedly, to around zero (Graph 7). This suggests that inflation expectations account for only a small part of the overall decline. Moreover, inflation expectations tend to decline during most periods of rising unemployment, so it is unlikely to explain why the decline in wage growth has been unusually large in the recent episode.

Graph 7
Real Wage Price Index Growth*
Year-ended



* Inflation expectations obtained from bond yields, union surveys and market economist surveys (from 2005)

Sources: ABS; Australian Council of Trade Unions; Employment Research Australia; RBA; Workplace Research Centre; Yieldbroker

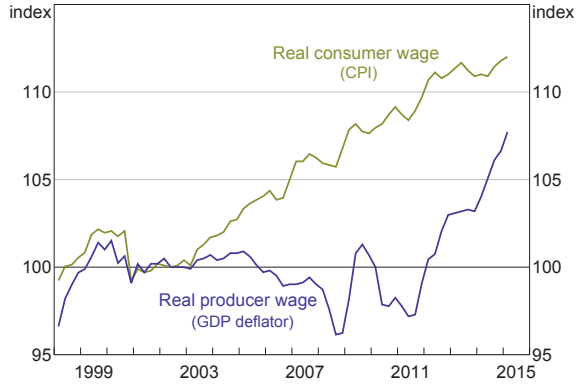
Output Prices and the Terms of Trade

Firms are also concerned with prices when considering the wages that they offer. Higher prices for a firm's output mean that it can afford to pay higher wages, and vice versa. Normally, output prices in the economy would be closely related to the prices that consumers pay for goods and services, so firms and households would have similar inflation expectations. But when there are changes in the terms of trade, the prices that firms receive and the prices that consumers pay can deviate substantially.

The rise in the terms of trade during the mining boom saw many firms' output prices increase by more than consumer prices. This was particularly true of mining prices, but also of prices in other industries that service mining extraction and investment (such as business services and construction). For these firms, higher output prices meant that nominal wages could rise while also increasing profits. Facing higher prices and a relatively tight labour market, higher wages would also have served to attract scarce labour and increase output.

The result was that increases in wages benefited employees by more than they cost employers over much of the past decade. That is, real wages from the perspective of employers fell relative to real wages from the perspective of households (Graph 8). From 2002 to 2012, the real producer wage declined overall, while the real consumer wage increased by around 10 per cent. In recent years, this situation has reversed; since 2012, real consumer wages have seen little growth (as noted above) whereas real producer wages have increased sharply.

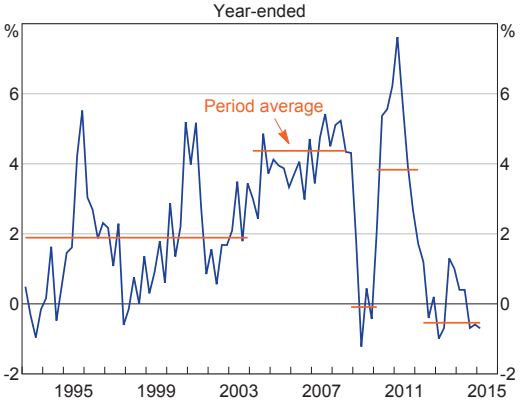
Graph 8
Real Wages
Deflated with inflation, June 2002 = 100



Sources: ABS; RBA

Strong growth in output prices up to 2012 meant that firms could afford higher unit labour costs. Over the period of the rising terms of trade and increased mining investment, ULC growth averaged close to 4 per cent a year, with the exception of a brief period following the financial crisis in 2008 (Graph 9). This pace was well above that recorded over the first decade of inflation targeting, when ULC growth averaged around 2 per cent.

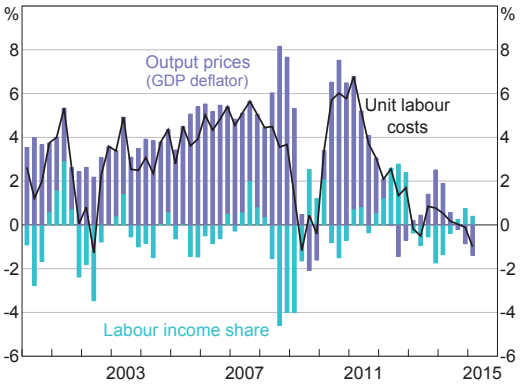
Graph 9
Unit Labour Cost Growth
Year-ended



Sources: ABS; RBA

Growth in unit labour costs can be broken down into growth in output prices and changes in the share of income being paid to labour (Graph 10). The strong growth in ULCs over much of the 2000s was fully explained by the faster pace of growth in output prices, while the labour share of income actually fell slightly.[5] Similarly, the recent period of slower growth in ULCs can be fully explained by the slower pace of growth in output prices, while the labour share of income has increased a little.

Graph 10
Unit Labour Cost Growth Decomposition*
Year-ended

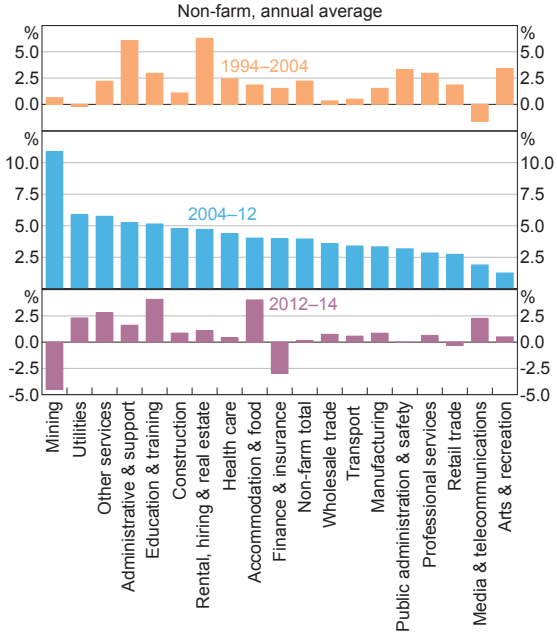


* Composition does not sum precisely due to cross-product
Sources: ABS; RBA

5 That is, strong growth in unit labour costs was accompanied by even stronger growth in firms' margins. For a discussion of the labour income share over the resources boom, see Parham (2013).

While the rise and subsequent decline in ULC growth has been particularly pronounced in those industries more exposed to the resources boom, it has been relatively broad based. ULC growth between 2000 and 2012 was above the growth rates experienced in the 1990s for around three-quarters of industries, with many industries recording ULC growth in excess of 3 per cent. ULC growth in this period was fastest for mining and several industries that provide intermediate inputs to resource extraction and investment, including construction and business services (such as administrative and rental services) (Graph 11). Since 2012, a decline in ULC growth has been recorded across almost all industries, but again has been most pronounced in the mining industry.

Graph 11
Unit Labour Cost Growth
Non-farm, annual average



Sources: ABS; RBA

The Real Exchange Rate

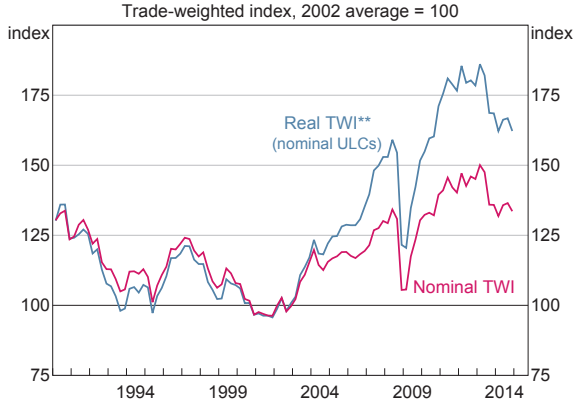
The cycles in wage growth over the past decade have had consequences for the cost competitiveness of Australian producers, which has been an important part of the economy's adjustment over this period. This can be examined in the context of the 'real' exchange rate. The real exchange rate expresses

prices or costs relative to those of our trading partners in common currency terms, and provides one indication of an economy's competitiveness. Other things equal, an economy's competitiveness improves when the real exchange rate depreciates, either by way of a depreciation of the nominal exchange rate or a decline in that economy's relative prices or costs (and vice versa). One measure of the real exchange rate is based on relative ULCs.[6]

Over the decade to 2012, the ULC measure of the real exchange rate appreciated markedly (Graph 12). This reflected an appreciation of the nominal exchange rate of about 50 per cent and an increase in Australia's ULCs relative to our trading partners of almost 30 per cent. As has been widely discussed, the appreciation helped to ensure that the economy did not overheat in response to the large run-up in export prices and mining investment, by dampening non-mining activity (Plumb, Kent and Bishop 2013; Kent 2014).

More recently, the decline in ULC growth has assisted in improving the international cost competitiveness of Australian producers. The ULC measure of the real exchange rate has depreciated by around 12 per cent since 2012, due to both a lower nominal exchange rate and, to some extent, a decline in Australia's ULCs relative to our trading partners.[7] In turn, this has helped the economy to adjust to the headwinds posed by the lower terms of trade and falls in mining investment.[8] Nevertheless, the ULC measure of the real exchange rate remains about 20 per cent higher than when the terms of trade were at a similar level in 2006.

Graph 12
Real Effective Exchange Rate*
Trade-weighted index, 2002 average = 100



* Excludes China and several other trading partners as unit labour cost data are unavailable
** Nominal trade-weighted index adjusted for ratio of nominal unit labour costs
Sources: OECD; RBA

The pattern of rising and then falling relative ULCs has been broadly evident across trading partners. It has been most pronounced against highly industrialised economies such as Germany, Japan and Korea, and more modest against other commodity exporters such as New Zealand and Canada.

Estimating the Contributions: A Phillips Curve Model of Wages

A simple econometric model of private sector wage growth in Australia can be used to estimate the relative contribution of many of the factors outlined above. In particular, the model attempts to explain wage growth using the unemployment rate (both in level terms as a gap to the non-accelerating inflation rate of unemployment (NAIRU) and in changes), expectations of consumer price inflation, and inflation outcomes for firms (capturing movements in the terms of trade, and as a proxy for firm inflation expectations).[9] Of course, such a model captures only co-movements between different variables, which may not indicate causation. The model is estimated over 1997–2015 (the period for which WPI data are

6 This measure of the real exchange rate gives a sense of international competitiveness from the perspective of labour costs, but it is not comprehensive. For example, it does not capture the effect of margins and non-labour costs on international competitiveness, and it is subject to various data limitations. A more commonly cited measure of the real exchange rate is based on consumer prices.

7 To some extent, nominal ULCs in Australia would be expected to trend higher relative to many developed economy trading partners over long periods, owing to Australia's slightly higher inflation target.

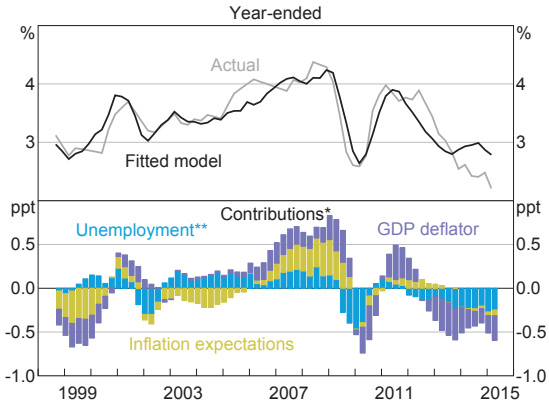
8 These developments in the real exchange rate stand in contrast to the decade to 2003, during which movements were driven largely by changes in the nominal exchange rate.

9 For more information on the NAIRU and how it is estimated, see Ballantyne *et al* (2014).

available). Full details of the model specification and results are set out in Appendix A.

Much of the recent decline in wage growth can be attributed to these explanatory variables (Graph 13). Historical relationships suggest that rising unemployment, lower inflation expectations and the decline in the terms of trade can together explain about two-thirds of the total decline in wage growth over the past few years. Wage growth has declined by somewhat more than historical relationships with these variables would suggest.[10]

Graph 13
Private Sector WPI Growth



* Contributions to fitted line relative to average since 1998

** This includes the effect of the change in the unemployment rate and NAIRU gap terms in the model

Sources: ABS; RBA

The econometric model simply summarises average historical relationships between wage growth and other variables. However, each episode has its own unique characteristics that may vary from that average experience. It is also possible for relationships to change over time. In particular, there is some statistical evidence that wages have become more sensitive to the unemployment rate in this episode (see Appendix A). Several factors may have, in theory, contributed to the extent of the decline and apparent sensitivity of wages more recently:

- The model does not account for the *level* of wages. Through the mid 2000s, wage growth tended to be higher than the model could explain (i.e. there were positive residuals both in and out of sample). The weakness in recent years might reflect a need for firms to adjust to a particular level of wages, in which case there may have been an element of 'payback' for this earlier period of strength.
- There may have been some shift in the bargaining power of labour. While this is difficult to observe directly, inflation expectations for unions have shifted by more than some other measures and union wage expectations are also at historic lows. Liaison reports indicate that secular influences from technology and competition from offshore labour may partly explain the weakness in wage growth in some sectors in recent years; however, the influence of such developments is subject to considerable debate.
- Low wage outcomes for public sector agreements in recent years may also have indirectly affected wage bargaining in the private sector, particularly as many firms benchmark their wages to industry-wide wages. This effect appears have been strongest in the health and education sectors.
- The rise in the unemployment rate may have understated the extent to which spare capacity has developed in the labour market. For example, greater labour market flexibility may be allowing firms to adjust hours rather than heads by more than usual. Alternatively, there may have been a larger-than-usual decline in labour force participation, potentially owing to the length of the episode.
- Wages may have become more flexible over time. It has been widely recognised that the system of wage bargaining in Australia has become more flexible over the course of the past few decades (Borland 2011), and there are reasons to think that flexibility may have been greater than usual in the current episode. To some degree, individual employment contracts are more prevalent in the industries most exposed to the declines in resource prices and investment,

10 A similar result is found when estimating the model over the period to 2012, and then examining the out-of-sample error from 2012 to 2014.

such as mining and business services. Another factor is the relatively long span of the episode, at more than three years. As a result, a higher portion of employment contracts have been renegotiated during this period of subdued demand conditions. The typical length of an Enterprise Bargaining Agreement (EBA) is around three years, so virtually all outstanding EBAs have been renegotiated since mid 2011 and some agreements have been negotiated twice (Table 1). By comparison, over 2008–09 a lower proportion of agreements were renegotiated, covering fewer employees.

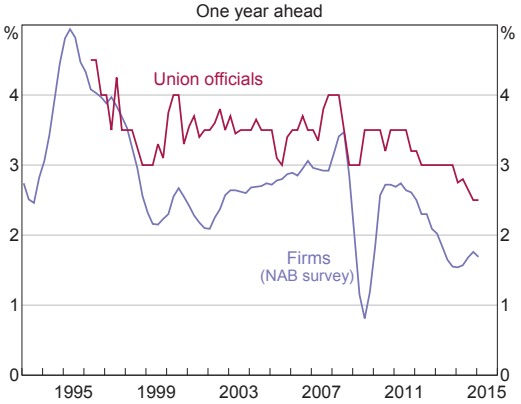
Assessment and Outlook

A range of related factors appear to explain much of the decline in wage growth in Australia in recent years. Below-average growth in economic activity has translated into subdued growth in labour demand, which has resulted in an increase in spare capacity in the labour market. At the same time, expectations for consumer price inflation have moderated to be below average. The decline in the terms of trade and falls in mining investment appear to have played a particularly important role, weighing on economic activity and placing pressure on firms to contain costs. This has partly unwound the relatively strong inflation in Australian unit labour costs over the period of the mining boom, which was part of the economy's adjustment to the domestic income boost from the higher terms of trade. Altogether, the result has been an adjustment in Australia's relative labour costs, improving cost competitiveness against other advanced economies. In effect, this has assisted in bringing about some adjustment of the real exchange rate. Statistical estimates suggest that these factors explain much, but not all, of the episode, meaning there may also have been some other forces at play including an improvement in the flexibility of wages.

While a large wage adjustment has taken place, wage growth is widely expected to remain low (Graph 14). Evidence from the Bank's liaison with businesses, alongside surveys of firms and union officials, suggest that the general pace of wage growth is not expected to pick up over the year ahead.

One further factor that may continue to weigh on wage growth is a 'pent-up' adjustment. Reports through the Bank's business liaison in recent years have indicated that many firms and employees have been reluctant to bargain for wage growth below expected inflation of 2–3 per cent. Accordingly,

Graph 14
Expected Wage Growth
One year ahead



Sources: Australian Council of Trade Unions; Employment Research Australia; NAB; RBA; Workplace Research Centre

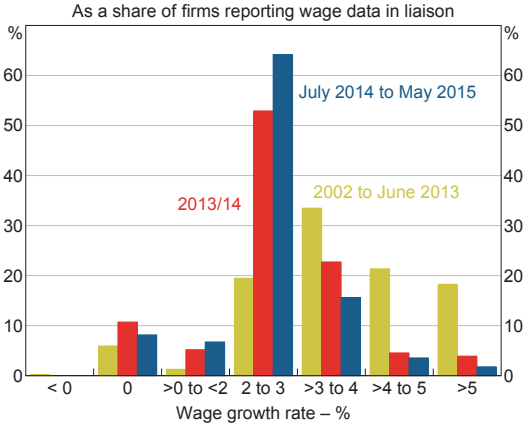
Table 1: Enterprise Bargaining Agreements
Per cent of total

	Mar 2008–Sep 2009	Jun 2011–Dec 2014
Agreements replaced[(a)]	80	105
Employees covered under replaced agreements[(b)]	75	133

(a) Calculated as the number of non-greenfield agreements negotiated divided by the average number of agreements active during the period
(b) Calculated as the number of employees covered under non-greenfield agreements negotiated divided by the average number of employees covered by EBAs during the period
Sources: Department of Employment; RBA

wage outcomes of 2–3 per cent have been relatively common over the past couple of years among liaison contacts (Graph 15). Outcomes lower than this, which would imply a fall in real consumer wages, are generally seen to have a negative effect on worker morale and productivity, as well as on the retention of quality staff. So while the decline in wage growth has been large, it might have been larger still if not for this element of rigidity in real wage growth. Accordingly, a degree of 'pent-up' downward pressure on wage growth might remain for a time, even if labour market conditions more generally were to improve.

Graph 15
Distribution of Wage Growth Outcomes
As a share of firms reporting wage data in liaison



Source: RBA

In all, the decline in wage growth has been an important aspect of the adjustment of the economy to subdued growth in demand in recent years. Had wage growth not declined over this period, employment growth may have been more subdued than actually observed, and unemployment higher, which may have weighed yet further on aggregate demand.

Appendix A: Wage Phillips Curve Model

The Phillips curve model of WPI growth is specified as follows:

$$\%\Delta WPI_t^{Private} = \alpha + \beta_1 NAIRUgap_{t-1} + \beta_2 NAIRUgap_{t-2} + \beta_3 \Delta UR_{t-1} + \beta_4 BondInfX_{t-1} + \beta_5 BondInfX_{t-2} + \beta_6 BondInfX_{t-3} + \beta_7 \%\Delta GDPdef_{t-1} + e_t \quad \text{(A1)}$$

Where:

- $WPI^{Private}$ is the private sector WPI
- *NAIRUgap* is the difference between the quarter-average unemployment rate and the NAIRU, and enters the model with up to a two quarter lag
- ΔUR is the change in the quarter-average unemployment rate and captures the 'speed limit' effect – that a rapid decrease in unemployment could cause an increase in inflation and wages (and vice versa)
- *BondInfX* is a measure of consumer price index (CPI) inflation expectations implied by 10-year indexed bonds and enters the model with up to a three quarter lag
- $\%\Delta GDPdef$ is the year-ended growth rate of the non-farm GDP deflator.

The estimation results indicate that, all else constant, a rise in the unemployment rate of 1 percentage point has been typically associated with a decline in WPI growth of around a third of a percentage point in the near term, on average, but somewhat less thereafter (Table A1). While the *NAIRUgap* and ΔUR variables do not appear to be significant in the models, these variables are jointly significant. The *BondInfX* variables are not jointly significant.

The Quandt-Andrews unknown break-point test suggests that breaks in the two NAIRU gap coefficients are significant at the 1 per cent level for the third quarter of 2012. When a dummy variable for observations after the third quarter of 2012 (inclusive) and interaction terms with the other explanatory variables are included in the model, there is a significant negative coefficient for

the NAIRU gap interaction term. The timing of the break-point, in the third quarter of 2012, coincides with the decline in the quarterly growth of the private sector WPI and thus seems plausible.

Table A1: Wage Phillips Curve Models

Variable	Coefficient[a]
Constant	0.44 ***
$NAIRUgap_{(t-1)}$ [b]	0.07
$NAIRUgap_{(t-2)}$ [b]	–0.11
$\Delta UR_{(t-1)}$	–0.39
$BondInfX_{(t-1)}$	0.10
$BondInfX_{(t-2)}$	–0.08
$BondInfX_{(t-3)}$	0.10
$\%\Delta GDPdef_{(t-1)}$	0.03 ***
R^2	0.57
Adjusted R^2	0.52

(a) *** denotes significance at the 1 per cent level
(b) Standard errors do not take into account that the NAIRU results from a previous estimation
Source: RBA

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Developments in Thermal Coal Markets

Trent Saunders*

Thermal coal prices increased markedly over the decade to 2011, driven by a substantial increase in global demand. That led to significant investments in thermal coal mine and port capacity, particularly in Australia and Indonesia. The resulting increases in the seaborne supply of thermal coal have underpinned a significant fall in global thermal coal prices. However, an easing of the pace of growth of global demand for thermal coal, reflecting a move towards cleaner energy sources and a slowing in the growth of aggregate electricity demand, has also weighed on prices. The outlook for prices and production over the next few years depends on a number of factors, particularly the response of Chinese demand to policy measures.

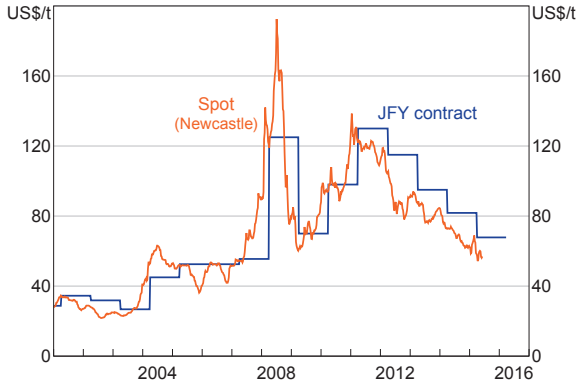
Introduction

There was a sharp increase in global demand for thermal coal over the past 15 years, driven by China's rapid economic development.[1] This underpinned a marked rise in global thermal coal prices over the 2000s, with the benchmark Japanese Fiscal Year (JFY) contract price of thermal coal peaking in 2011 (Graph 1). The increases in prices over that period led to significant expansions in investment and the global supply of thermal coal increased, including from Australia.

As supply has continued to increase and growth in demand for thermal coal has been subdued, prices have declined noticeably; spot prices have fallen by around 50 per cent since 2011. In response to these lower prices, there have been a number of closures of higher-cost mines around the world (including some smaller Australian operations) and delays to planned investment, while coal producers have focused their efforts on reducing costs.

This article provides an overview of the global market for thermal coal. It also discusses the factors that have underpinned the fall in prices over the past few years and their effect on Australian coal producers.

Graph 1
Thermal Coal Prices
Free on board basis



Sources: Department of Industry and Science; IHS

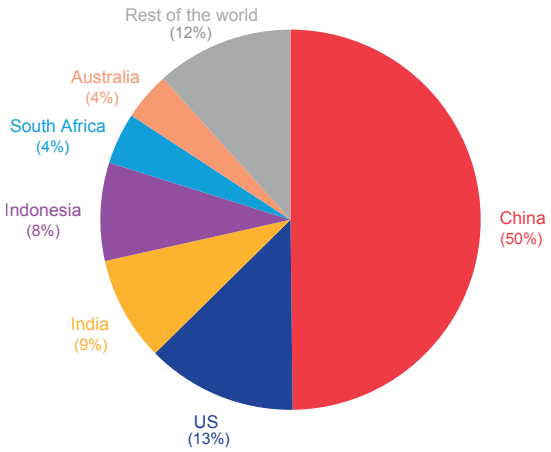
* The author is from Economic Analysis Department. This work has benefited greatly from previous internal analysis on the thermal coal market. The author would particularly like to thank Tim Atkin, Corrinne Dobson, Stephen Elias and Tenzin Ringpapontsang for their contributions to this analysis.

1 Most coal falls into three broad categories – coking coal, thermal coal and brown coal. Coking coal is typically used for steelmaking and attracts a price premium over other coals. Thermal coal (also known as steaming coal) is generally used for power generation. Brown coal is also used for power generation, although its use is less common than thermal coal as it has much lower energy content and produces high levels of carbon emissions.

Thermal Coal Markets

Production of thermal coal is dominated by China, North America and India, which together accounted for over 70 per cent of global production in 2013 (Graph 2). The vast majority of coal produced in these countries is consumed domestically, due to the high cost of transporting coal (relative to production costs).

Graph 2
Thermal Coal Production
2013, share of global production

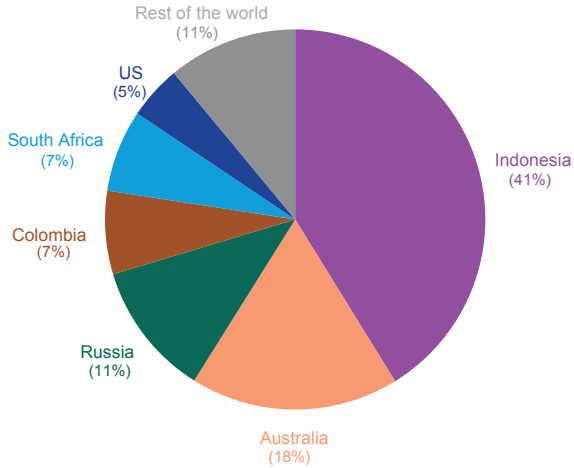


Source: International Energy Agency

Nonetheless, seaborne trade of thermal coal is also important for many economies. China and the euro area are the largest importers of thermal coal, while Indonesia and Australia are the largest exporters (Graph 3). The importance of Australian and Indonesian exports for global thermal coal trade is due to the small size of their domestic energy requirements relative to production, as well as their proximity to key sources of demand.

Due to high transportation costs, global trade in thermal coal has historically been segmented between two regional markets: the Atlantic market and the Pacific market. The Atlantic market involves exports from the Americas to Europe, and the Pacific market largely involves Australian and Indonesian exports to the rest of Asia. These two markets are

Graph 3
Thermal Coal Exports
2013, share of global exports



Source: International Energy Agency

linked by Russia and South Africa, which, due to their geographical location, tend to supply both markets depending on price differentials. However, certain market dynamics – which depend on low freight costs, relative price differentials and fluctuations in supply – can result in trade between the two geographical markets overlapping (RBA 2013).

Differences in quality also affect thermal coal trade, as power generation plants often have technical constraints on the types of coal they can use. For example, Japanese power plants tend to value higher quality coal and price stability. Conversely, Chinese buyers have more tolerance for lower quality coal and can switch between higher- and lower-grade coal depending on the price. As a result, Japan is the largest destination for Australian thermal coal exports (which tend to be of a higher quality than Indonesian exports), while China is the largest destination for Indonesian coal exports.

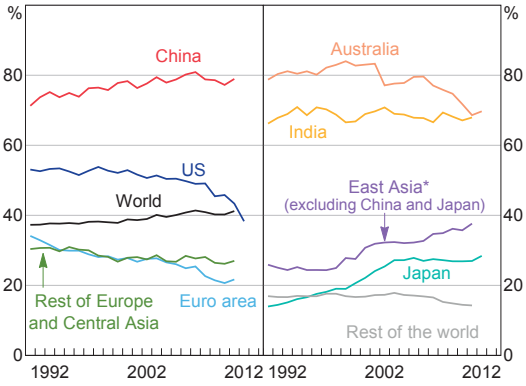
The pricing arrangements for thermal coal vary between different source and destination countries. Annual contracts are the usual pricing arrangement with Japanese importers. The JFY contract price between Australian producers and Japanese power

utilities is also used as a benchmark for other contract prices in the Pacific market, particularly for exports to Korea. For exports to other destinations, including China, transactions tend to occur on spot markets. The Newcastle thermal coal spot price is the benchmark price for most Australian thermal coal sold on shorter-term contracts (RBA 2013).

Trends in global demand

Coal is used to generate around 40 per cent of the world's electricity, and this share has remained relatively stable over the past 15 years (Graph 4). Coal's importance for global electricity generation reflects several factors, including its reliability as a base-load energy source and its relatively low cost.[2] Coal's share of electricity generation is particularly high in China, Australia and India, reflecting the substantial domestic reserves in these countries.

Graph 4
Coal-fired Electricity Generation
Share of region's total electricity generation

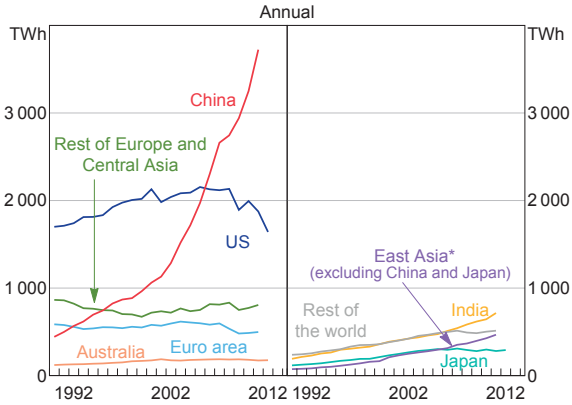


* Includes Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Thailand and Vietnam

Source: World Bank

China's rapid economic development over the 2000s drove a sharp increase in global demand for thermal coal. China surpassed the United States as the largest generator of coal-fired electricity in 2006 and accounted for 41 per cent of global coal-fired electricity generation in 2011 (up from 18 per cent in 2000; Graph 5). Demand for thermal coal in the rest of Asia also increased noticeably over the 1990s and 2000s. In India and east Asia (excluding China and Japan), this increase in demand was largely due to relatively strong economic growth and urbanisation. In Japan, demand for thermal coal increased until the mid 2000s, owing to significant investment in coal-fired power plants to replace the country's high-cost oil generators.

Graph 5
Coal-fired Electricity Generation
Annual



* Includes Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Thailand and Vietnam

Source: World Bank

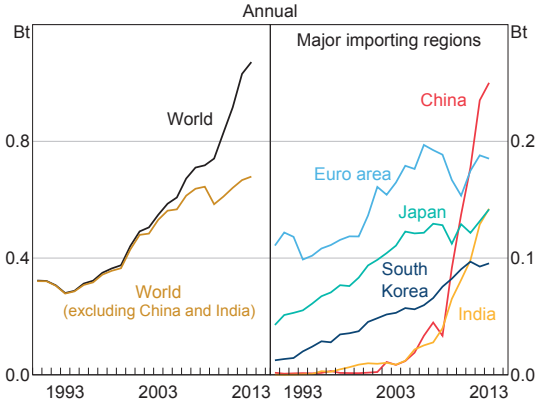
In contrast, coal-fired power generation fell in the United States and euro area over the 2000s, reflecting a move towards cleaner energy sources and an increase in the competitiveness of gas-fired electricity generation. In the United States, there was a particularly marked shift in demand towards gas from late 2011. This shift towards gas-fired power generation coincided with the sharp fall in domestic gas prices and the increase in production of unconventional gas from shale rock.

2 Base-load generators produce electricity at a fairly constant rate and generally only shut down occasionally for maintenance or repairs. These plants have low production costs but require large upfront capital investments. It also takes a long time to change the level of production from these plants, so they are not suited to meeting rapid changes in demand.

Trends in global trade

The sharp rise in Chinese demand for thermal coal saw global trade in coal increase significantly from the mid 2000s (Graph 6). Historically, China has been self-sufficient in thermal coal, owing to the country's substantial domestic reserves and production capacity. However, China became a net importer of thermal coal in 2009 and surpassed the euro area as the world's largest importer in 2011. The sharp increase in Chinese imports of thermal coal reflected both the rapid increase in demand and the lower cost of imports relative to domestic production. The price competitiveness of coal imports is largely a result of geographical factors. A large share of China's coal deposits is located in the north and west of the country, so coal must be transported to the north-east coast and then shipped by sea to southern locations. Coal imports have also been supported by the closure of smaller mines in China due to safety concerns.

Graph 6
Thermal Coal Imports
Annual

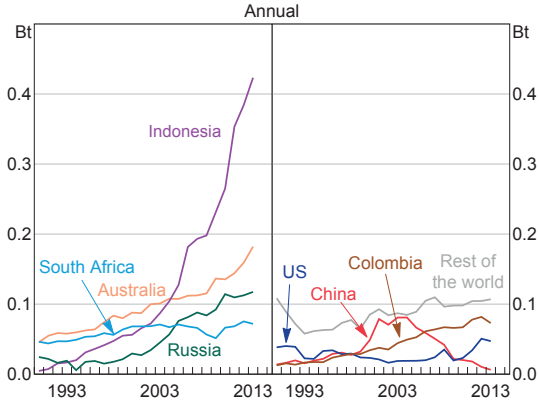


Source: International Energy Agency

There was also a sharp increase in Indian imports of thermal coal from the mid 2000s. Despite its significant coal reserves, a lack of investment in coal mines and infrastructure has seen India become increasingly reliant on imports to meet their domestic energy requirements. Imports accounted for around 22 per cent of India's consumption of thermal coal in 2013, up from just 3 per cent in the early 2000s.

This strength in Chinese and Indian demand underpinned a sharp rise in seaborne thermal coal prices. The supply of thermal coal from the two largest exporters, Australia and Indonesia, increased markedly in response to these higher prices (Graph 7). The rapid expansion in Australian and Indonesian coal exports was facilitated by high investment in resource extraction and infrastructure. Similarly, Russian exports of thermal coal increased noticeably from the early 2000s, although growth was somewhat constrained from the late 2000s due to rail bottlenecks in Russian Far East.

Graph 7
Thermal Coal Exports
Annual



Source: International Energy Agency

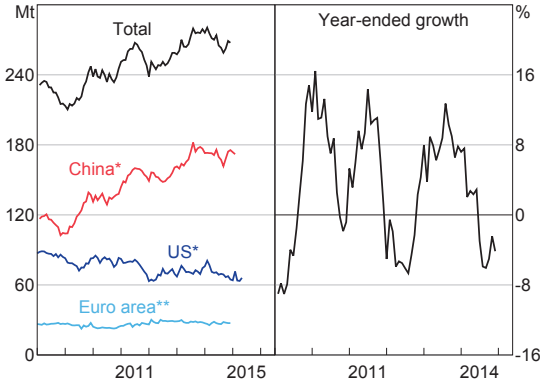
Recent Developments

As mentioned above, the contract and spot prices of thermal coal have declined markedly over recent years, reflecting both subdued growth of global demand and significant increases in supply. In response to lower prices, many companies have focused on reducing production costs, while some companies have closed mines.

Subdued demand

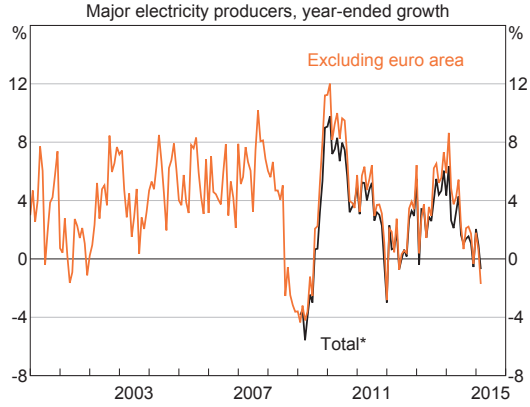
Demand for thermal coal across a number of major electricity producing regions has been relatively weak since 2011 (Graph 8). This weakness partly reflects a slowing of growth of aggregate electricity generation, particularly in China, and is consistent with a moderation in the growth of activity in China's

Graph 8
Power Industry Coal Demand
Seasonally adjusted, monthly



* Power industry coal consumption
** Coal delivered to power stations
Sources: Eurostat; RBA; US Energy Information Administration; WIND Information

Graph 9
Electricity Generation
Major electricity producers, year-ended growth



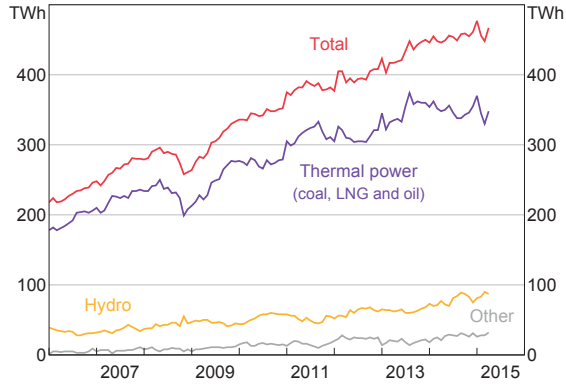
* Includes China, euro area, India, Japan and the United States
Sources: CEIC Data; Eurostat; RBA; Thomson Reuters

energy-intensive manufacturing sectors (Graph 9). There also appears to have been a substitution away from coal and towards cleaner energy sources.

In China, the shift in demand towards cleaner energy sources has been motivated by a number of policy measures to combat air pollution.[3] While coal remains the dominant source of power generation in China, these actions have contributed to an increase in the share of electricity generation provided by non-coal sources (Graph 10).

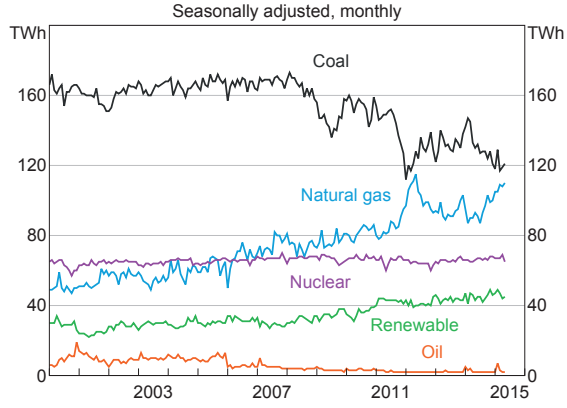
Coal-fired electricity generation in the United States has also been relatively weak in recent years, owing largely to the increased cost competitiveness of gas-fired electricity generation (Graph 11). This shift towards gas-fired electricity generation has been aided by the retirement of many ageing coal-fired generators. In 2012, 10 gigawatts (GW) of coal-fired capacity was retired, representing around 3 per cent of the country's total capacity in 2011 (EIA 2014).

Graph 10
China – Electricity Generation
Seasonally adjusted, monthly



Sources: CEIC Data; RBA

Graph 11
United States – Electricity Generation
Seasonally adjusted, monthly



Sources: RBA; Thomson Reuters

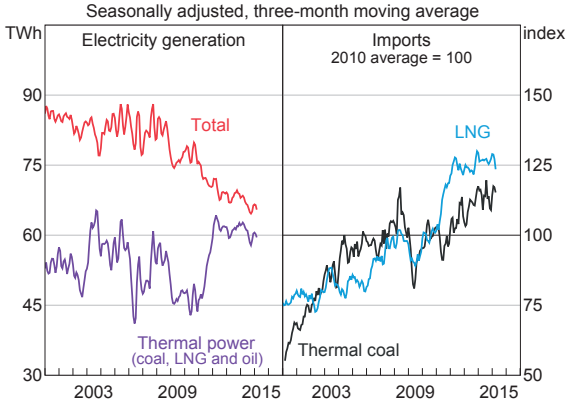
3 As part of the 12th Five Year Plan (2011–2015), the Chinese Government announced plans to reduce energy use per unit of GDP by 16 per cent from its 2010 level by 2015, and reduce coal's share of energy consumption from 68 per cent to 65 per cent. More recently, the State Council's Energy Development Strategy Action Plan (2014–2020) outlined plans to cap annual primary energy consumption and reduce coal's share of energy consumption to 62 per cent (Westpac-Department of Industry and Science 2015). In September 2014, the National Development and Reform Committee (NDRC) also announced bans on the transport, import, production and use of coal that does not meet certain ash and sulphur content requirements from 2015.

The US Energy Information Administration expects a further 13 GW of coal-fired capacity to be retired in 2015 due to the introduction of stricter emissions standards earlier this year (EIA 2015).

In contrast, coal demand from power plants in the euro area increased strongly in 2011 and 2012, despite aggregate demand for electricity remaining relatively flat. This increase in demand for thermal coal was likely to have been a response to the decline in coal prices over this period, as well as high regional gas prices. However, this strength in demand was short-lived and coal deliveries to power plants fell in late 2013 and early 2014 as a result of a decline in aggregate electricity production, increased output from renewable energy sources and the retirement of many coal plants.

Demand for thermal coal from India and east Asia (excluding China and Japan) appears to have continued to rise in recent years. Japanese demand for thermal coal has also remained at a relatively high level, supported by the shutdown of the nation's nuclear reactors in the wake of the March 2011 Tohoku earthquake (Graph 12). However, growth in demand for coal has been somewhat constrained by a lack of spare coal-fired capacity, given that many generators were already operating at close to capacity prior to the earthquake. As a result, much of the decline in nuclear power generation has been met by increased output from gas-fired power generators.

Graph 12
Japan – Energy
Seasonally adjusted, three-month moving average



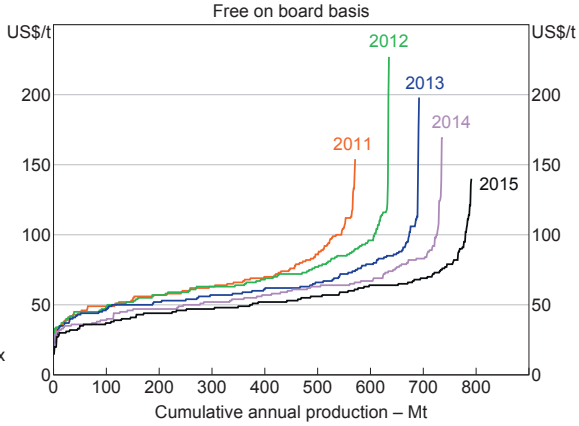
Sources: CEIC Data; IHS; RBA

Increases in seaborne supply

Significant investment in new mines and capacity expansions has resulted in growth of thermal coal supply outpacing demand over the past few years. The completion of these investment projects has also seen producers increasingly focus on productivity improvements. These factors have contributed to significant declines in thermal coal prices since 2011. A sharp fall in oil prices since mid 2014 is also likely to have put downward pressure on thermal coal prices, insofar as it has reduced coal extraction and transport costs and enabled supply to be maintained.

A comparison of cost curves over time illustrates how the dynamics of the global seaborne market have changed (Graph 13).[4] The significant increases in supply from lower-cost producers have resulted in the thermal coal cost curves shifting outward in recent years. The cost curves have also flattened, due to both the expansions to low-cost supply and a fall in production costs at existing mines.

Graph 13
Seaborne Thermal Coal Production Costs*
Free on board basis



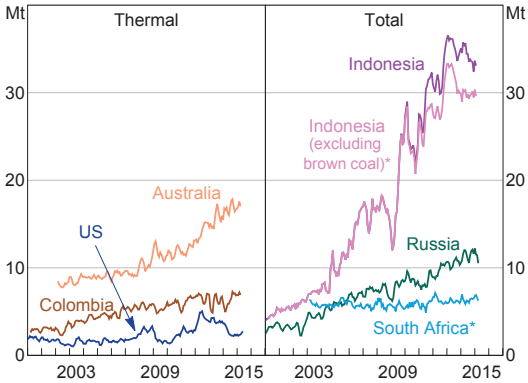
* Costs are quality adjusted
Source: AME Group

The increases in seaborne supply have been driven by Australia and Indonesia. Australian thermal coal exports have continued to increase in recent years, due to the completion of capacity expansions and

4 The cost curves are based on the average variable costs of production of different mines and are constructed by ranking production at each mine according to its costs (RBA 2014).

the ramp-up of production from newly completed mines (Graph 14). Indonesian exports of thermal coal and brown coal have also remained at a high level. However, Indonesian exports have eased slightly since 2012, owing to both weaker Chinese demand and domestic policy changes in Indonesia.[5]

Graph 14
Coal Exports
Seasonally adjusted, three-month moving average



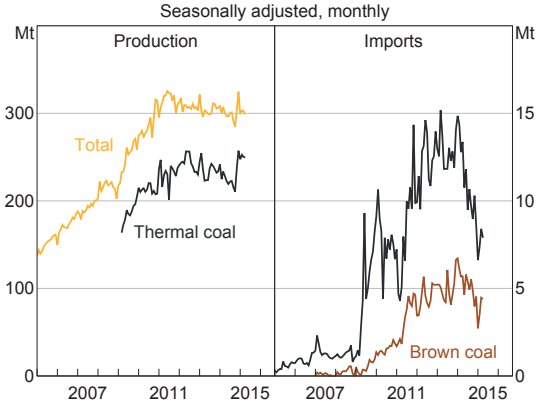
* Thermal coal accounts for the majority of exports
Sources: ABS; IHS; RBA; Thomson Reuters

Responses to lower prices

In response to lower prices over recent years, some companies have opted to close higher-cost mines, while a number of projects in the investment pipeline have also been delayed. A large share of the supply response to lower prices over the past 18 months has been in the United States. While exports from Indonesia and Australia remain at or around historically high levels, a combination of lower production rates and mine closures has seen exports from the United States return to their 2011 levels (Graph 14).

The decline in thermal coal prices over recent years has also coincided with a moderation of Chinese coal production (Graph 15). While part of this weakness reflected subdued demand for coal from Chinese

Graph 15
China – Coal Production and Imports
Seasonally adjusted, monthly



Sources: IHS; RBA; WIND Information

power plants, it is likely that the easing of Chinese coal production also represents the displacement of high-cost domestic production with low-cost imported thermal coal.

Chinese authorities have announced several policies aimed at supporting the domestic coal industry, including a directive for power utilities to reduce their usage of imported thermal coal and introducing tariffs on thermal coal imports.[6] The implementation of these policies, together with weaker Chinese demand for thermal coal, has resulted in a marked decline in Chinese thermal coal imports since early 2014. There has been a significant decline in Chinese imports from Indonesia and some smaller exporters, while imports from Australia have declined more modestly.

Chinese authorities have made several announcements over the past year encouraging coal producers to moderate production, in an attempt to support domestic coal prices.[7] However, the response of domestic production to these

5 In October 2014, the Indonesian Government introduced regulations requiring the implementation of more rigorous checks of coal exporters' paperwork at Indonesian ports, in an attempt to reduce the amount of unlawful production. Indonesia's exports of coal are also likely to have been affected by the Domestic Market Obligation, which requires that a proportion of output of coal is reserved for the domestic market.

6 In mid 2014, the NDRC directed power utilities to reduce coal imports by around 50 million tonnes (Mt) in 2014. In October 2014, authorities also introduced a 6 per cent tariff on thermal coal imports in order to support the domestic coal industry. Under the recently signed China-Australia Free Trade Agreement, the tariff on Australian thermal coal will be phased out over two years.

7 In August 2014, the China National Coal Association (CNCA) urged coal producers to reduce their 2014 production targets by 10 per cent. The CNCA also announced plans in April 2015 to reduce domestic coal production by 5 per cent in 2015.

announcements is likely to have been offset, to some extent, by the various policies aimed at reducing the country's reliance on imported coal.

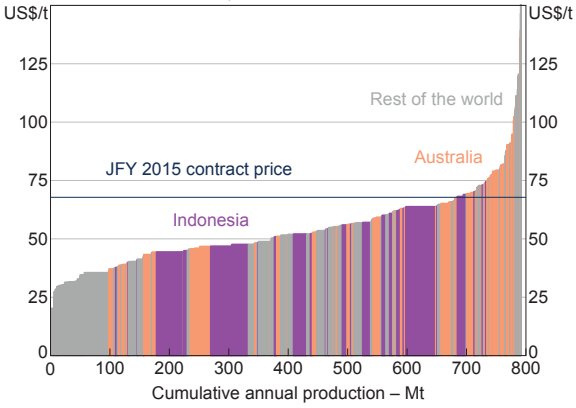
Australian Producers

Thermal coal accounted for around 5 per cent of Australia's total exports in 2014. The significant investment in Australia's coal mining and port capacity has driven a marked increase in Australian thermal coal exports over the past decade. However, investment in the coal sector has fallen sharply since 2012, with a number of projects having been cancelled or delayed over this period in response to lower prices.

At current prices, a significant share of seaborne thermal coal supply is unlikely to recoup its costs of production (Graph 16). Nonetheless, there have been very few closures of Australian mines to date and most producers have continued to focus on cutting costs and improving efficiency. The limited response of Australian supply so far is likely to reflect several factors.

First, Australian coal producers have been among the most effective at reducing production costs. These cost reductions appear to have been facilitated by the composition of costs for Australian producers. Extraction costs comprise the majority of Australian costs and are generally more responsive than land freight costs, which are a more significant cost for other major exporters. Within the extraction cost component, labour, fuel and maintenance expenses are estimated to be the largest components for most Australian producers. These appear to be the cost components that Australian coal producers have been able to reduce the most since 2011.

Graph 16
Seaborne Thermal Coal Production Costs*
2015, free on board basis



* Costs are quality adjusted
Sources: AME Group; Department of Industry and Science

Second, the existence of take-or-pay contracts for rail transport may limit the supply response for some Australian mines, at least for a time. In a take-or-pay contract, the miner purchases a fixed amount of transport capacity and must pay for it, regardless of whether they use the capacity. These contracts are commonly used in the Australian thermal coal industry, as the fragmented supply chain can cause significant coordination issues between miners, port operators and rail companies, as well as the potential for insufficient infrastructure investment.

And finally, the depreciation of the Australian dollar has offset some of the impact of declining prices for Australian producers. This is because prices are primarily denominated in US dollars, while a large share of Australian coal production costs are in Australian dollars. Therefore, a depreciation of the exchange rate increases revenues relative to costs. However, while the depreciation has increased the competitiveness of Australian production relative to the United States and China, the exchange rates of other major coal exporters have also depreciated since 2011.

Outlook

The relatively low cost of coal-fired power generation, and its stability as a source of base-load power generation, is expected to support thermal coal demand over the medium term, particularly in China and India. However, the outlook for Chinese demand will largely depend on broader economic activity in China, particularly in the energy-intensive manufacturing sectors.

The pace of expansion in the global seaborne supply of thermal coal is expected to slow over the next few years, as existing investment projects reach completion and there are few plans to commit to new projects. Indeed, the falls in thermal coal prices over the past few years may elicit a reduction in existing supply from higher-cost producers. In Australia, the extent of any additional mine closures and the level of exports will depend on the ability of Australian producers to continue to reduce costs relative to international competitors. Nevertheless, the rate of cost reductions is likely to slow as the easiest measures are exhausted.

The outlook for prices depends on a number of factors, including the response of Chinese demand to various policy measures aimed at reducing the role of coal in its energy mix and protecting its domestic coal industry. Overall, thermal coal prices are expected to remain at relatively low levels over the next couple of years, owing to the high level of thermal coal supply and a continued shift towards cleaner energy sources in some countries.

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Potential Growth and Rebalancing in China

Cai Fang and Ivan Roberts*

In rapidly growing emerging economies such as China, it can be difficult to distinguish changes in long-term trends in growth from short-term macroeconomic cycles. This article provides a narrative account of recent phases in Chinese economic growth, and explores the role of cyclical and structural factors in shaping China's recent growth performance. It reviews evidence documented by Lu and Cai (2014) suggesting that the slowing of GDP growth in recent years has resulted from a decline in the potential growth rate rather than being a cyclical downturn. The article emphasises the positive impact that reforms which raise labour force participation and productivity could have on the growth of potential output in China. It suggests that 'rebalancing' the economy's demand from investment and exports towards consumption may not be sufficient to prevent a decline in potential growth but that, at a minimum, such rebalancing would probably be conducive to a more stable macroeconomic cycle.

Introduction

In 2014, China experienced its fourth consecutive year of GDP growing at a rate below the 10 per cent average pace of the period of 'reform and opening' that began in 1978. While the slowdown is widely interpreted as structural in nature, and few people believe that it will be possible to return to the era of double-digit growth rates, there is still debate regarding the causes of slowing growth and appropriate policy responses.

Since the process of structural change in emerging economies such as China is likely to be more pronounced than in more developed economies, it can be difficult to distinguish cyclical fluctuations from changes in trend growth. Different conjectures about the causes of slowing growth can have different implications for policy. If the slowdown is interpreted as a slowing of potential growth, driven by supply-side factors, policy solutions targeting the supply side of the economy may be most relevant to policymakers seeking to sustain rising incomes. But if weaker growth of aggregate demand related to the macroeconomic cycle is the main reason for the slowing of growth, a range of stimulus measures may be more appropriate policy options. Incorrectly diagnosing the cause of the slowdown could lead to undesirable outcomes. For example, applying stimulus measures that boost expenditure to address a structural slowing in growth could lead to higher consumer and asset price inflation. By the same token, policy actions that contribute to increased excess capacity in parts of the economy could hasten the emergence of disinflationary pressures.

This article provides an account of recent phases in Chinese economic growth. It focuses on the supply-side factors underpinning slowing growth in China, with reference to estimates of actual and potential GDP growth over recent decades. It suggests that a heavy reliance on demand-side countercyclical stimulus policies could lead to less desirable macroeconomic outcomes. It remains the case, however, that the demand side of the economy is important, so while reforms leading to a rebalancing of demand may not increase potential growth in the same way that supply-side policies would, they can

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still help to stabilise the macroeconomy, smooth cyclical volatility and contribute to sustainable long-term economic growth.

Competing Views on China's Economic Slowdown

Based on data for a large number of countries, Eichengreen, Park and Shin (2011) present evidence suggesting that, in general, economies experiencing rapid growth will eventually face a significant slowdown, defined as a fall of at least 2 percentage points in the seven-year average growth rate. Pritchett and Summers (2014) similarly report a strong empirical association between the pace of growth and the likelihood of a deceleration. China's official GDP growth rate has exceeded 7 per cent in each of the past 24 years. Seen from this perspective, the deceleration of Chinese growth that has occurred is hardly unexpected.

Indeed, the idea that high-growth economies eventually experience a decline in growth is widely understood by economists. The intuition can be explained with reference to a simple production function:

$$Y = f(TFP, K, H, L). \tag{1}$$

In this equation, Y represents GDP, which in turn is a function of total factor productivity, *TFP*, and the factors of production: the physical capital stock available at the end of the previous period, K, the human capital stock, H, and the labour supply, L. Many emerging economies slow down because (a) they get closer to the productivity frontier (i.e. TFP growth slows); (b) growth of the population and/or the labour force slows; (c) the growth in the physical or human capital stock slows; or (d) because the returns to capital and the other factors of production that accumulate over time eventually diminish in the absence of growth in productivity or the other factors.

Cross-country data suggest that since the 1970s it has been relatively unusual for major advanced economies to achieve real GDP growth rates in excess of 3–4 per cent for sustained periods. By comparison, it has not been uncommon for large developing economies to sustain growth rates faster than 5 per cent per annum for a run of years.[1] But academic observers disagree on whether China has yet reached the stage at which a structural slowing of growth should be expected.

On the one hand, Justin Yifu Lin (2011) has argued that the problems facing China are cyclical rather than structural, and stem from a slowing of China's export demand due to a cyclical slowing in the advanced economies in the wake of the global financial crisis. Accordingly, he has advocated a policy of continuing to expand investment to stimulate economic growth.

On the other hand, a number of commentators have endorsed more pessimistic scenarios involving the eventual 'collapse' of China's growth model and an ensuing crisis. Chang (2012) infers from the challenges posed by unfavourable demographics that China will soon replace Michigan in the United States as the world's new 'rust belt'. Similarly, Paul Krugman has argued that the Chinese growth model will soon hit a 'Great Wall' and is sceptical that China will make necessary policy adjustments in time to avert such an outcome (Krugman 2013).

Krugman's argument is based on the idea that growth in developing economies can be driven by investment for very long periods, because the gradual transfer of surplus labour from unproductive employment in rural areas to productive employment in urban areas slows the diminishing returns to capital. In Krugman's view, this transfer of surplus labour has allowed China to sustain more than 30 years of rapid growth, but he warns that the Chinese economy will eventually reach its 'Lewis turning point' (where surplus rural labour has been exhausted as a result of urbanisation).[2] Krugman further contends that if sufficient rebalancing from investment to consumption has not been achieved at that point and the economy continues to rely

1 These patterns can be observed in data from the Penn World Table Version 7.0.

2 The 'Lewis turning point' was first proposed by Lewis (1954) and revised by Ranis and Fei (1961). See Cai (2011) for a discussion of this concept in the Chinese context.

on 'excessive' investment, the result will be sharply diminishing returns to capital. All else equal, this would lead to slower longer-term growth.

Rapid growth of investment has made a significant positive contribution to economic growth in China. The expansion of the capital stock has often embodied technological progress and thereby contributed to TFP growth. It has also raised the capital-to-labour ratio and hence growth in labour productivity and higher returns to labour which, in turn, have supported the growth of household consumption. However, if the Lewis turning point has already been passed, as argued by Cai (2011), and ongoing improvements in labour productivity depend on ever higher capital-to-labour ratios with no improvement in broader total factor productivity, then diminishing returns to capital will tend to have a dampening effect on economic growth. Diminishing returns to capital are likely to be observed in the long run even though the timing of a slowdown in growth depends on the efficiency with which capital is allocated across regions and industries. Inefficient allocation of capital would also tend to reduce the scope for strong growth of incomes, which would otherwise support the government's stated objective of rebalancing growth away from investment and towards consumption.

Distinguishing Trend and Cycle: Phases in China's Economic Growth

One way of differentiating long-term structural trends and short-term macroeconomic cycles is to use the concept of potential output, which can be defined in various ways. For example, it can be defined as the level of output in the absence of nominal rigidities (Woodford 2003), or as the maximum output possible without inflationary pressure (Okun 1970).[3] Four basic situations can be envisaged: actual and potential output growing strongly together; actual growth running at a slower rate than potential growth; actual growth and potential growth running at similarly low rates; or actual growth exceeding the rate of potential growth (Figure 1). During the period of 'reform and opening' that started in the late 1970s, the Chinese economy has experienced several phases of growth, which can be represented in terms of these hypothetical situations.

Figure 1: Actual and Potential Growth

		Potential output growth	
		Strong	*Weak*
Actual output growth	*Strong*	Situation 1	Situation 4
	Weak	Situation 2	Situation 3

Situation 1: Actual and potential output growing strongly together

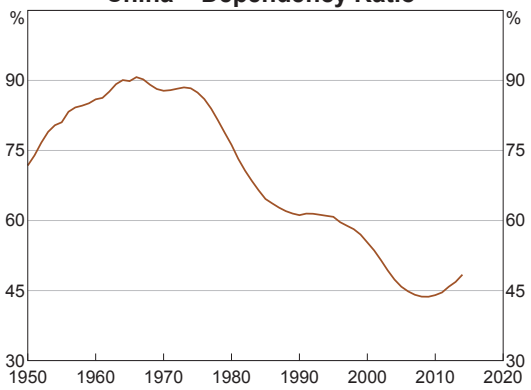
The first situation (actual and potential output growing strongly together) is consistent with labour being relatively abundant and the capital stock still growing rapidly, such that diminishing returns to these factors have not yet set in. In China, this situation prevailed for much of the period prior to 2010, when China was still enjoying a 'demographic dividend' in the form of a falling dependency ratio (the ratio of children and the elderly to the total population) that underpinned relatively strong growth in potential output (Graph 1). Using a production function similar to Equation (1) above, Lu and Cai (2014) estimate that between 1978 and 2009, potential growth averaged around 10 per cent per annum (Graph 2).[4] The combination of strong growth of supply and strong growth of demand allowed China to achieve rapid actual GDP growth during this period.

Over the first 30 years or so of the reform era, the growth of the working-age population and the steady decline of the dependency ratio enabled the rapidly growing working-age population to accumulate savings which, in turn, underpinned the capital accumulation needed for economic development. Meanwhile, abundant labour supply meant that diminishing returns to physical capital could be

3 The latter is closest conceptually to the estimates of potential output growth presented in this article.

4 The estimates shown in Graph 2 are similar to those obtained by others using a variety of techniques (for example, see Anand *et al* (2014), Felipe, Lanzafame and Zhuang (2014) and IMF (2014)).

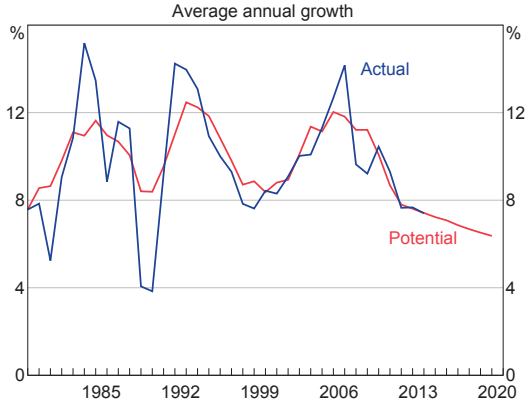
Graph 1
China – Dependency Ratio*



* Non-working-age over working-age population; working-age population is between 15 and 59 years

Sources: National Bureau of Statistics of China; RBA; United Nations

Graph 2
China – Actual and Potential GDP
Average annual growth



Source: Lu and Cai (2014)

avoided, thereby ensuring that investment made a significant contribution to economic growth. Human capital was also accumulated at a rapid pace through education. Finally, the large-scale transfer of surplus rural labour from unproductive occupations in agricultural areas to more productive jobs in urban areas resulted in higher productivity growth than would otherwise have been the case. According to Cai and Zhao (2012), in the 1982–2010 period, the contributions to GDP growth of capital, labour and human capital were, respectively, 73.7 per cent, 7.1 per cent and 4.2 per cent. The decline in the dependency ratio contributed 6.7 per cent through its effect on other factors of production. The implied contribution of the remainder – that is, total factor productivity – was 15 per cent.

At the same time, the growth of household incomes, rapid growth of investment and the strong boost to China's exports stemming from China's entry to the World Trade Organization (WTO) in 2001 meant that estimated growth of potential output coincided with rapid growth of private and public demand, and hence actual output, particularly during the early to mid 2000s. Although actual growth has periodically fluctuated above and below its estimated potential rate, the difference between the two growth rates has rarely remained large for extended periods.[5] Extrapolating current trends, these estimates suggest that potential growth is likely to slow further in coming years.

Situation 2: Actual growth running at a slower rate than potential growth

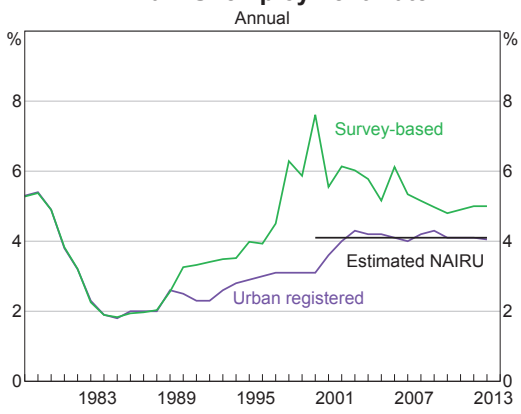
The second situation (combining strong growth of potential output and weak actual output growth) is consistent with a cyclical downturn. For example, a negative temporary shock to demand may weaken actual growth, notwithstanding still strong potential growth for reasons such as those noted earlier (e.g. rapid capital formation or a declining dependency ratio). This situation often gives rise to dislocations in the labour market, resulting in cyclical unemployment.

In the reform era, there are two examples of such episodes in the Chinese labour market. First, in the late 1990s, slowing domestic growth combined with weak external demand due to the 1997–98 Asian financial crisis led to a fall in capacity utilisation and

5 It might be expected that during periods when actual output exceeds its potential level, a rise in inflation would be observed. Despite the steady liberalisation of product markets during the reform era, however, the government has succeeded in maintaining relatively tight control over inflation, notwithstanding a fluctuating gap between estimates of actual and potential GDP. As a result, it is hard to detect a clear long-run relationship between inflation and production function-based estimates of the output gap such as that of Lu and Cai (2014), although the relationship has become somewhat closer in recent years.

resulted in large-scale unemployment. The fact that many redundant workers in urban state-owned enterprises were laid off but not counted by the statistical agency as unemployed during this period meant that the effect was not apparent in official urban registered unemployment statistics. Estimating the actual urban unemployment rate using survey-based employment indicators suggests that in the late 1990s/early 2000s, China's urban unemployment rate rose to hitherto unseen levels (Graph 3). Subsequently, a resumption of global demand for China's exports following WTO entry allowed a situation of rapid growth in supply to be absorbed by resurgent growth of demand.

Graph 3
China – Unemployment Rate



Sources: Du and Lu (2011); National Bureau of Statistics of China

A second episode of weak actual growth coinciding with strong estimated growth of potential output was the period affected by the global financial crisis of 2008–09. The failure of both the registered and surveyed urban unemployment rates to respond noticeably to the downturn in aggregate demand during this period is a puzzle at first glance. However, it can be explained by the fact that migrant labourers, who had transferred from the countryside to the cities, were most affected by the negative demand shock, and consequently returned *en masse* to rural areas. These 'floating' workers are not reflected in the urban registered unemployment figures because they only include those workers with local urban *hukou*, a form of permanent registration that guarantees them access to certain welfare benefits provided by the government (including health care and education services). The lack of a comprehensive social safety net for migrant workers in urban areas meant that those who lost employment had a strong incentive to return (temporarily) to the countryside in the face of weaker labour demand. As their movements were not recorded in urban labour force data, the return of migrant workers to the countryside had little influence on the survey-based urban unemployment rate.

Indeed, estimates by Du and Lu (2011) suggest that China's non-accelerating inflation rate of unemployment (NAIRU) has averaged around 4.0–4.1 per cent in the period since 2000 (see Graph 3). The NAIRU provides an indication of the level of unemployment that would still prevail, for frictional or structural reasons, in the absence of cyclical macroeconomic fluctuations. Although Du and Lu's estimates are based on survey-based unemployment data rather than registered unemployment figures, the estimated NAIRU nonetheless aligns quite closely with the urban registered unemployment rate of recent years. This is consistent with the idea that fluctuations in the rural migrant labour population in cities and towns do not, in general, exert a significant influence on the NAIRU for urban areas.

Situation 3: Actual and potential growth running at similarly low rates

The third situation (simultaneous weakness in actual and potential output growth) corresponds to the period since 2012, in which growth in the productive capacity of the Chinese economy has moderated, the comparative advantage of China's manufacturing sector has begun to wane, and diminishing returns to capital accumulation appear to have become more evident. In particular, since China entered the period of the 12th Five Year Plan (2011–2015), the working-age population has started to decline and the dependency ratio has begun to rise. At the same

time, slowing rural-urban migration has contributed to tighter conditions in urban labour markets, returns to capital have fallen and TFP growth looks to have eased. Consequently, estimates of the growth of potential output have fallen: Lu and Cai (2014) estimate that potential growth fell by around a percentage point between 2011 and 2013, and their baseline estimates suggest that, other things equal, potential growth will continue to moderate (see Graph 2).

In recent years, the Chinese Government has sought to wind back the economic stimulus of 2008–09 and has encouraged slower growth of domestic demand. This has occurred in tandem with weaker growth of potential output, so the slowing of actual output growth has had a fairly limited negative impact on labour market conditions. The survey-based measure of the unemployment rate was reported by the National Bureau of Statistics to be 5.1 per cent in December 2014, only slightly higher than it was in 2009 and exceeding estimates of the NAIRU by around 1 percentage point, which suggests that cyclical unemployment has not increased by a significant margin.

Situation 4: Actual growth exceeding the rate of potential growth

The fourth situation (weak potential output growth together with strong growth of actual output) could occur in the event that the government seeks to stimulate actual output growth through demand-side levers, in the face of a persistent slowdown in the growth of the economy's productive capacity. If the Chinese Government tried to use countercyclical stimulus policies to prevent a slowing of growth, it would face the prospect of this kind of situation occurring. One indicator that can often be used to gauge cyclical mismatches between actual and potential output is inflation. In the current environment of relatively low consumer price inflation, falling producer prices and moderating growth of aggregate demand, a pick-up in inflationary pressures might be expected to follow from a large-scale demand-side stimulus. (Of course, if the stimulus expanded capacity in pockets of the manufacturing sector – and put additional downward pressure on relative prices in those industries – the observable impact on inflation could be obscured, at least initially.)

Structural Reform and Rebalancing

In China, policymakers have traditionally addressed slower growth through countercyclical stimulus policies. If the problem is one of a cyclical slowing, such solutions may be effective, as was the case with stimulus policies employed in response to the slowing experienced during the late 1990s. China's policy response to the global financial crisis of 2008–09, which involved a large-scale fiscal-monetary stimulus, also succeeded in ameliorating the effects of a negative external shock, albeit at the cost of sidelining earlier plans to facilitate rebalancing from investment towards household consumption and allowing investment to be driven by technological progress and innovation. In the present climate of slowing rural-urban migration, together with the reversal of China's 'demographic dividend', much of the slowing growth of recent years increasingly appears to be structural in nature. To the extent that this is true, it is unlikely that a similar fiscal-monetary stimulus would be as successful as a response to such a structural slowing of growth.

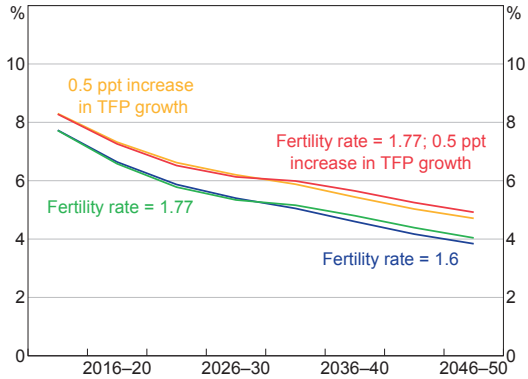
However, there is reason to believe that a slowing of China's potential growth rate could be moderated, or even reversed for a time, by structural reforms. For example, work by Lu and Cai (2014) suggests that reforms of the *hukou* system, population (fertility) policy, education and training institutions, and unproductive state-owned enterprises could be expected to boost labour force participation, human capital accumulation and TFP growth, thereby raising the growth rate of potential output. Such measures would be unlikely to prevent growth from slowing in the very long run, when growth in the labour supply

slows and the growth of both capital accumulation and productivity ease as China gets closer to the global productivity frontier. But it remains the case that reforms could prevent an otherwise more rapid decline in output growth.

Among other scenarios, Lu and Cai (2014) consider a hypothetical situation in which TFP growth receives a boost from reform initiatives, and then construct projections for potential GDP growth under alternative assumptions for China's total fertility rate. Stronger TFP growth slows the overall rate of decline in potential output growth – that is, it tends to make the slope of the decline shallower. Intuitively, the disappearance of the 'demographic dividend' and an end to the era of abundant, cheap rural labour means that, ultimately, productivity improvements due to reform endeavours are likely to be key drivers of China's average growth in coming years. A higher fertility rate tends to raise the projected growth of potential output even further. The positive effects of a higher fertility rate take time to become apparent: an increased birth rate will initially increase the dependency ratio and it takes at least 15 years for newborns to reach working-age adulthood and contribute to labour supply (Graph 4).[6] An implication is that relaxing China's fertility policy (which currently places restrictions on the number of children Chinese adults can have), in combination with other policies, could boost labour supply and hence potential output.

The effect of reforms, such as relaxing the *hukou* system to allow people to relocate more permanently from rural areas to urban areas, or to relocate more conveniently between different urban areas or broader regions, is to boost productivity by increasing allocative efficiency. Allowing factors of production to flow to their most productive location (such as allowing labour to flow from relatively less productive jobs in agriculture to relatively more productive jobs in manufacturing or service industries) raises aggregate productivity. Similarly, reducing the monopoly power of state-owned enterprises, streamlining administrative approval procedures, and allowing a greater role for private and mixed-ownership enterprises in the economy could enhance technological progress and innovation, by enabling more productive and innovative firms to succeed and the least efficient and innovative firms to fail. The reallocation of resources arising from reform can thus boost TFP growth and raise the potential growth rate of the economy.

Graph 4
China – Potential Growth
Scenarios*



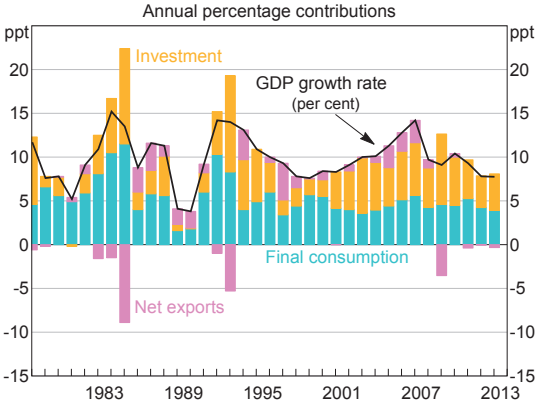
* Annual potential growth of GDP, under alternative fertility and TFP growth scenarios

Source: Lu and Cai (2014)

To the extent that the slowing of growth in China over recent years largely reflects structural factors, efforts to facilitate a 'rebalancing' of domestic demand from investment towards consumption are unlikely, by themselves, to moderate or reverse the long-term downward trajectory in GDP growth. Nevertheless, it is worth noting that in the past, especially since the early 2000s, growth of consumption has been relatively stable, while exports and investment have typically been quite volatile (Graph 5). This suggests that increasing household consumption's share of expenditure may be conducive to improving overall economic stability and reducing the call on policy interventions designed to smooth the macroeconomic cycle.

6 The purple line in Graph 4 shows the baseline in which the total fertility rate is 1.6 births per woman, consistent with official estimates in the range of 1.5–1.6 (National Health and Family Planning Commission of China 2013).

Graph 5
China – GDP Growth
Annual percentage contributions



Source: National Bureau of Statistics of China

It is also worth noting that while reforms aimed at raising household consumption's share of GDP may not directly increase the economy's potential growth rate, initiatives that improve the income distribution and develop the social safety net contribute to broader economic welfare. Increasing the scope for profits by state-owned enterprises to be allocated to households and used for consumption would, for instance, generally be preferable to allowing those funds to be allocated to unproductive investments. Moreover, reforms that support household consumption could be expected to go hand in hand with the other structural reforms discussed above. For example, efforts to improve social security and reduce income inequality could complement *hukou* reforms, by enabling more migrant workers to become settled permanently in cities. Such a combination would not only support greater consumption by newly settled migrant workers, contributing to a rebalancing of demand, but it would also increase labour force participation and boost productivity through a more efficient allocation of resources.

Conclusion

During the Third Plenary Meeting of the 18th Central Committee of the Chinese Communist Party in November 2013, it was signalled that China would embrace a new stage of comprehensive reform and allow the market to play a 'decisive role' in economic development. A simple comparison of growth in actual and estimated potential output over the past three decades, and consideration of the factors supporting potential growth in recent years, suggests that much of China's recent slowing is probably structural rather than cyclical in nature. Accordingly, a substantive reform program along the lines envisaged by the authorities may be necessary for China to sustain relatively high rates of growth over the medium to longer term.

Evidence from the work of Cai and Zhao (2012) suggests that rapid growth of the capital stock and productivity, combined with favourable demographic factors such as a declining dependency ratio and abundant migrant labour, contributed strongly to China's GDP growth over the past few decades. The reversal of these favourable demographics means that China will have to rely increasingly on productivity gains to sustain elevated rates of growth. If this analysis is correct, reforms enhancing productivity and labour participation would have an advantage over efforts targeted at boosting growth through further countercyclical policies to stimulate expenditure. Similarly, reforms to facilitate 'rebalancing' of the economy's demand structure from investment towards household consumption may not be sufficient, on their own, to prevent a decline in potential growth. However, it is likely that such a rebalancing could augment the impact of other, productivity-enhancing structural reforms, and would contribute to a more stable macroeconomic cycle. ☘

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Banking Fees in Australia

Kelsey Wilkins*

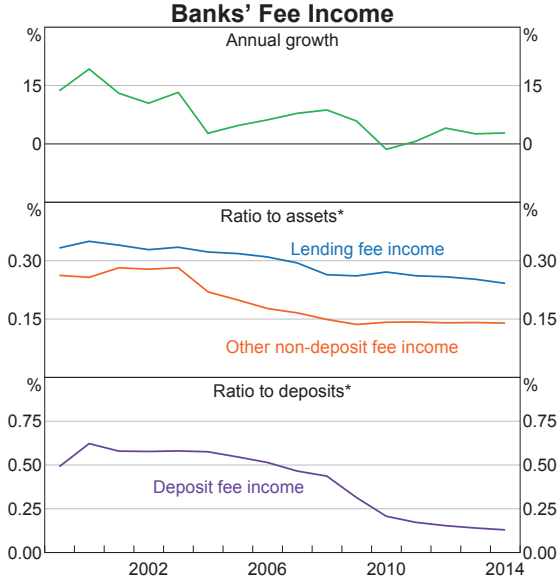
The Reserve Bank has conducted a survey on bank fees each year since 1997. The results of the most recent survey suggest that banks' fee income from both households and businesses rose moderately in 2014, predominantly as a result of balance sheet growth, rather than increases in fees on loans or deposits. Overall, developments in banks' fee income followed similar patterns to 2013.

Overview

The Reserve Bank's annual bank fee survey provides information on the fees earned by banks through their Australian operations.[1] The focus of the survey is on fee income generated through the provision of loans, deposit services and payment services. The 2014 survey included 16 institutions, capturing almost 90 per cent of the Australian banking sector by balance sheet size. Fees earned from operations outside of Australia and other fee income obtained through funds management and insurance operations are excluded from the survey. This article summarises the results from the latest survey, covering banks' financial years ending in 2014.[2]

In 2014, domestic banking fee income grew by 2.8 per cent, to around $12 billion (Table 1). This reflected moderate increases in fees paid by both households and businesses, largely driven by volume growth rather than increases in unit fees. Deposit and loan fees as a ratio to outstanding values of deposits and assets were slightly lower than in the previous year (Graph 1).

Graph 1
Banks' Fee Income



* Adjusted for breaks in series in 2002 due to a change in banks' reporting; financial-year average assets and deposits have been used

Sources: APRA; RBA

* The author is from Domestic Markets Department.

1 The data from the survey are published in the Reserve Bank's Statistical Table C9, 'Domestic Banking Fee Income', and are subject to revision on the advice of the participating banks.

2 Apart from Table 3, all data from the survey are based on individual banks' financial years, which differ between banks.

Table 1: Banks' Fee Income

	Households		Businesses		Total	
	Level	Growth	Level	Growth	Level	Growth
	$ million	Per cent	$ million	Per cent	$ million	Per cent
2011	4 069	–5.6	6 830	4.8	10 899	0.7
2012	4 043	–0.6	7 298	6.9	11 341	4.1
2013	4 110	1.7	7 525	3.1	11 635	2.6
2014	4 171	1.5	7 791	3.5	11 962	2.8

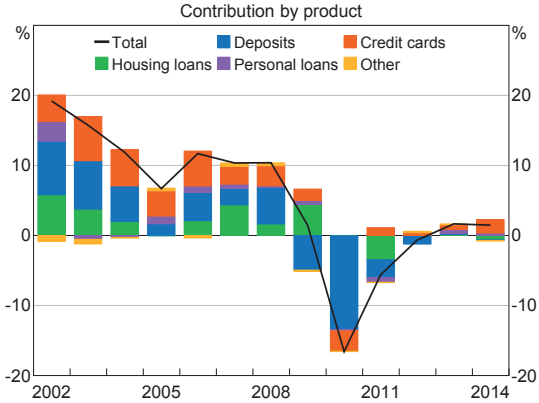
Source: RBA

Households

Banks' fee income from households grew by 1.5 per cent in 2014, the second consecutive year of positive growth after earlier notable declines (Table 2). Higher fee income reflected growth in credit card and personal lending fees, whereas fee income from housing lending and deposit accounts declined (Graph 2).

Fee income from credit cards, which represents the largest component of fee income from households, increased by 5.9 per cent in 2014. Growth in fee income from credit cards was largely volume driven, relating to an increased number of cards on issue, as well as a higher frequency of foreign exchange conversion fees being incurred by customers. Annual fees charged on credit cards were little changed in 2014 (Table 3), while income from credit card exception fees declined for the fifth consecutive year in 2014 (Graph 3). This decline reflected a reduction in the number of instances of customers exceeding their credit limit or making late payments.

Graph 2
Growth in Household Fee Income
Contribution by product



Source: RBA

The increase in fee income from personal lending was due to an increase in the number of loans issued by banks in 2014. Most of the fees earned from personal lending reflected higher instances of late/early payment fees or establishment fees associated with the increase in the volume of lending.

Table 2: Banks' Fee Income from Households

	2012	2013	2014	Annual growth 2014	Average annual growth 2007–13
	$ million	$ million	$ million	Per cent	Per cent
Loans:	2 848	2 904	2 972	2.3	2.0
– Credit cards	1 309	1 337	1 415	5.9	2.1
– Housing	1 221	1 226	1 201	–2.1	2.2
– Personal	317	341	356	4.3	1.4
Deposits	1 096	1 102	1 099	–0.3	–9.1
Other Fees	99	104	100	–3.5	2.9
Total	4 043	4 110	4 171	1.5	–1.9

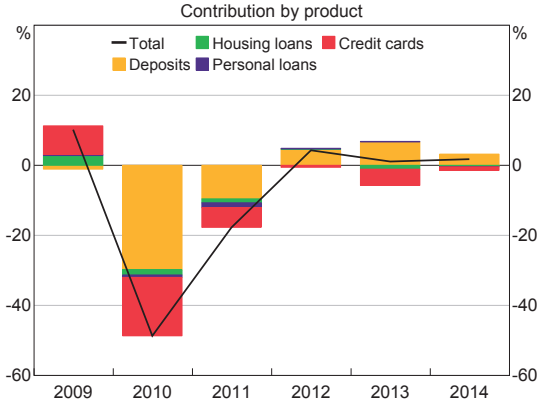
Source: RBA

Table 3: Unit Fees on Credit Cards[a]

	2012	2013	2014	Change 2014 Per cent	Average annual change 2007–13 Per cent
Annual fees ($)[b]					
Low-rate cards	55	55	54	–2.2	2.3
Standard cards	29	29	29	0.0	0.0
Standard rewards-based cards	80	80	80	0.0	0.0
Platinum rewards-based cards	246	236	236	0.0	0.4
Cash advance fees (per cent of value)[c]					
Domestic ATM	1.8	1.9	1.9	3.3	6.6
Overseas ATM	1.8	1.9	1.9	3.3	4.5
Other fees					
Foreign currency conversion fee (per cent of value)	2.9	2.9	3.0	4.3	2.7
Late payment fee ($)	14	14	14	0.0	–13.1
Over-limit fee ($)	10	8	5	–33.3	–20.6

(a) Simple average fees for cards with interest-free periods issued by major banks on core products, except for the annual fee on low-rate cards, which is based on a wider sample of banks; note that changes in the sample affect the average fee; as at June
(b) Includes fees for membership in rewards program where charged separately
(c) Most banks charge the greater of a flat fee or a percentage of the cash advance
Sources: Credit Card Issuers' Websites; RBA

Graph 3
Growth in Household Exception Fees
Contribution by product



Source: RBA

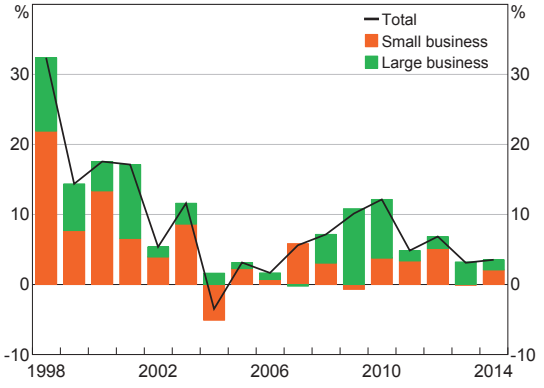
Total deposit fee income decreased slightly in 2014, following a modest increase in 2013. The decrease in fees from household deposits was broad based across most types of fees on deposit accounts. In particular, account-servicing and transaction fee income, as well as some fee income on other non-transaction accounts (e.g. break fees on term deposit accounts) declined notably. This decrease was the result of fewer customers incurring these fees rather than a decrease in the level of fees, as well as customers shifting to lower fee products. However, this was partially offset by an increase in income from more frequent occurrences of exception fees (such as overdrawn fees and dishonour fees) and foreign exchange conversion fees being charged on deposit accounts involving such transactions.

Total fee income from housing loans decreased in 2014, with all components of housing loan fee income decreasing, including exception fees. This was due to a combination of fewer instances of penalty fees being charged, and lower unit fees as a result of strong competition between banks in the home lending market. Similar to 2013, there was a decrease in fee income from housing lending despite strong growth in such lending. Several banks again reported waiving fees on this type of lending for some customers.

Businesses

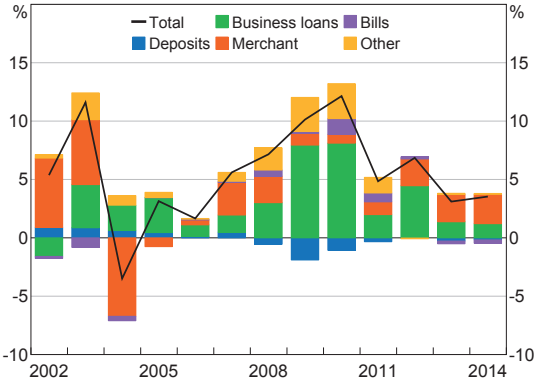
Total fee income from businesses increased by 3.5 per cent in 2014 (Table 4). The increase in fee income was evident for both large and small businesses (Graph 4).

Graph 4
Growth in Business Fee Income
Contribution by business type



Source: RBA

Graph 5
Growth in Business Fee Income
Contribution by product



Source: RBA

By product, the composition of the increase in fee income was very similar to the previous year (Graph 5). Growth was driven by increases in merchant service fee income and, to a lesser extent, fee income from loans. Business fee income from deposit accounts and bank bills declined over 2014.

The increase in merchant service fees was mainly attributable to an increase in utilisation of business credit cards and a slight increase in some merchant unit fees. Merchant fee growth was approximately evenly spread across both small and large businesses.

The increase in loan fee income was mainly from an increase in account-servicing and exception fees from small businesses, which was a result of higher lending volumes (including through the introduction of some new lending products). Fee income from loans to large businesses increased slightly due to a higher volume of prepayment fees (though this was mostly offset by declines in other fee income from large businesses). The increase in exception fee income from business loans was also mainly from small businesses, mostly in the form of honour fees (fees charged in association with banks honouring a payment despite insufficient funds in the holder's account).

Fee income from business deposits continued to decline in 2014, with most of the decrease resulting from lower account-servicing and transaction fees, particularly for small businesses (small businesses account for the majority of business deposit fee income). The decrease was the result of a combination of lower volume growth and customers shifting to lower fee products.

Table 4: Banks' Fee Income from Businesses

	2012 $ million	2013 $ million	2014 $ million	Annual growth 2014 Per cent	Average annual growth 2007–13 Per cent
Deposit accounts	623	603	590	–2.2	–5.3
– of which: exception fees	*46*	*42*	*41*	*–1.1*	*na*
Loans	3 142	3 243	3 334	2.8	11.7
– of which: exception fees	*36*	*38*	*40*	*6.5*	*na*
Merchant service fees	2 067	2 238	2 427	8.4	5.4
Bank bills	248	231	210	–9.2	21.2
Other	1 218	1 225	1 231	0.5	9.4
Total	7 298	7 525	7 791	3.5	7.3
– of which: exception fees	*81*	*80*	*82*	*2.5*	*na*

Source: RBA

Structural Features of Australian Residential Mortgage-backed Securities

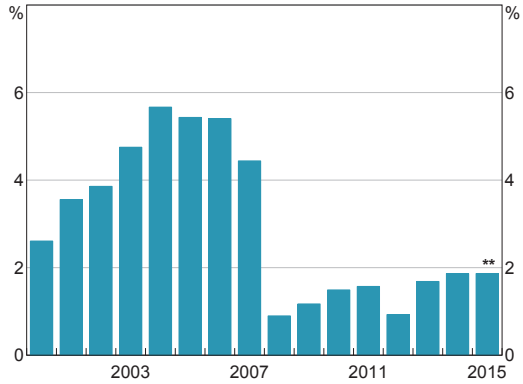
Ivailo Arsov, In Song Kim and Karl Stacey*

This article provides a summary of structural features typically found in Australian residential mortgage-backed securities and their evolution over the past decade. Understanding the structural features of the securities is essential to the effective risk management and valuation of the securities because these features determine how the risks of the securitised mortgages are borne by the different investors in the securities.

Introduction

A residential mortgage-backed security (RMBS) is a collection of interrelated bonds that are secured by a dedicated pool of residential mortgages (the 'mortgage collateral pool'). The payments of principal and interest on these bonds are funded from the payments of principal and interest made on the underlying mortgage collateral by the mortgagors. Historically, RMBS have provided an alternative to bank deposits as a source of funding for residential mortgages. This has been particularly important for smaller authorised deposit-taking institutions (ADIs) and non-ADIs that have limited access to deposit funding or term funding markets. By allowing smaller institutions to raise funding in the capital markets, RMBS promote competition between lenders in the residential mortgage market. After increasing steadily in the early 2000s, issuance of Australian RMBS to third-party investors fell in the wake of the global financial crisis when these securities were adversely affected by a loss of confidence in the asset class globally despite the low level of mortgage defaults in Australia. The market has recovered somewhat over the past couple of years (Graph 1).

Graph 1
Australian RMBS Issuance*
Per cent of GDP



* RMBS sold to third-party investors
** 2015 is year to May; GDP based on RBA's forecast published in the May 2015 *Statement on Monetary Policy*

Sources: ABS; RBA

RMBS have been an eligible form of collateral in repurchase agreements (repos) with the RBA since 2007. During the height of the global financial crisis, RMBS formed a significant part of the RBA's repo collateral and hence played an important role in the RBA's response to the crisis (Debelle 2012). Currently, RMBS form the largest class of securities held under the RBA's repos, although unlike the earlier episode, this has been in response to innovations in the payments system (Fraser and Gatty 2014).

From 1 January 2015, the RBA has provided a Committed Liquidity Facility (CLF) to eligible ADIs as part of Australia's implementation of the Basel III

* In Song Kim and Karl Stacey are from Domestic Markets Department, and Ivailo Arsov is from Economic Analysis Department but completed this work while in Domestic Markets Department. The article has benefited from valuable comments and discussions with David Wakeling and Ellana Brand (both are from Domestic Markets Department).

liquidity standards. In total, the CLF provides ADIs with a contractual commitment to $275 billion of funding under repos with the RBA, subject to certain conditions.[1] Given that RMBS are eligible collateral that could be provided to the RBA were the CLF to be utilised, they represent a substantial contingent exposure for the RBA and, hence, understanding RMBS is particularly important in terms of managing the RBA's balance sheet.

While discussions of RMBS often focus on the mortgage collateral pool, as all payments to investors are made from the cash flows generated from this pool, the structural features of RMBS play an equally important part in determining the risks facing the holders of these securities. The 'structure' of an RMBS refers to the number and size of the interrelated bonds of the RMBS, the rules that determine how payments are made on these bonds and various facilities that support these payments.

This article provides a summary of the structural features typically found in Australian RMBS and how these have evolved over the past decade.[2]

Overview of RMBS Structures

When an RMBS is issued, the economic interest in the mortgages in the collateral pool is transferred from the RMBS 'sponsor' to a newly established bankruptcy-remote legal entity (the 'RMBS trust').[3] The mortgage collateral pool, together with bank accounts used to temporarily store payments made on these mortgages, constitute the majority of the assets of the RMBS trust. (A schematic description of the cash flows in an RMBS is provided in Figure 1 and the structural features shown there are discussed in detail throughout the rest of this article.) The RMBS trust issues a number of bonds ('notes'), each with its own unique characteristics, to raise the funds necessary to purchase the economic interest in the mortgages from the sponsor. The notes, together with payment obligations to the various external parties that provide services to the trust, constitute the liabilities of the RMBS trust. Over time, as repayments are made on the mortgages, the funds received by the trust are used to pay interest due on the notes and to gradually repay (amortise) the notes' outstanding principal. Credit risks and risks regarding the timing of payments originate in the mortgage collateral pool, but are reshaped by the RMBS structure that is used to distribute the payments and losses to the notes. The rules that govern these distributions are documented when the RMBS is issued.

Payments of interest and principal, and allocations of losses, to the RMBS notes are made at regular intervals (typically monthly) on preset 'payment dates'. The payments in a given period are made out of funds received from the mortgage pool during the most recently ended 'collection period', which typically runs over the preceding month. The rules that determine how the payments of interest and principal are made to the notes, and how losses are allocated to the notes, are referred to as the RMBS 'cash flow waterfall' (waterfall). In practice, each RMBS has three separate, but interacting, sub-waterfalls: the 'income waterfall'; the 'principal waterfall'; and the 'chargeoff waterfall'.[4] The trust manager

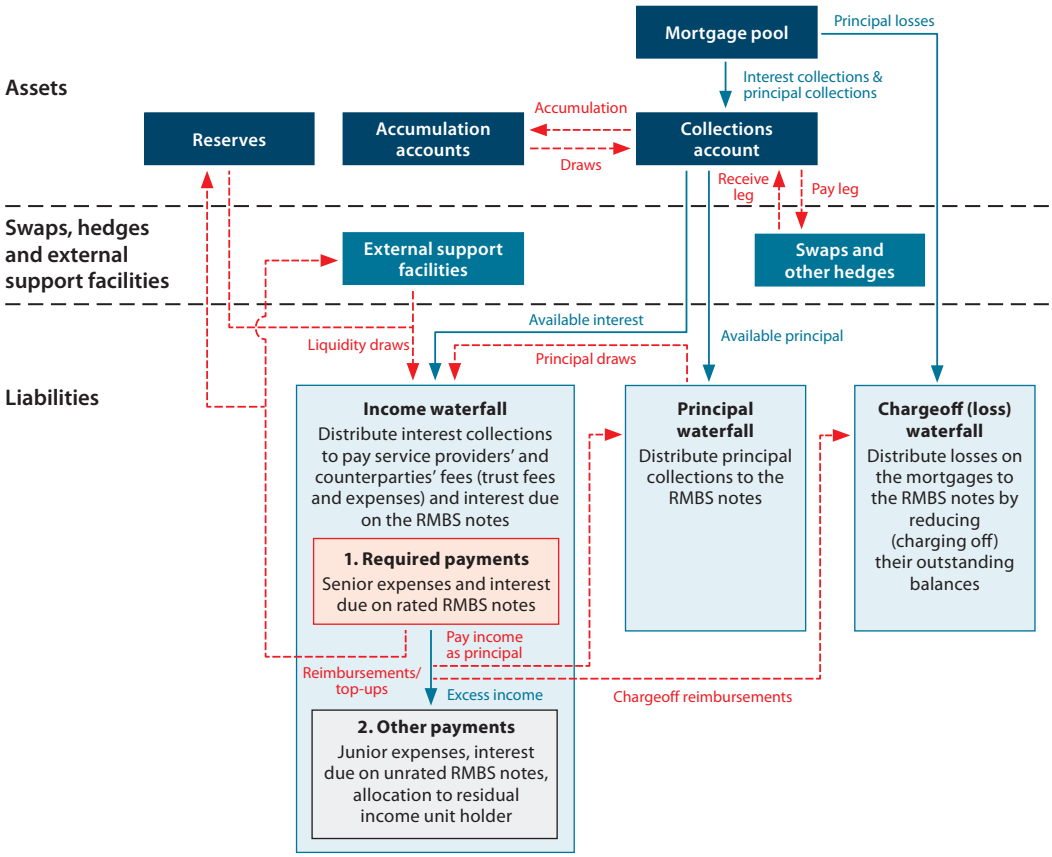
1 For further discussion of the CLF, see Debelle (2011).

2 The focus of this article is on the structural features of marketed RMBS, which are issued to third-party investors. Self-securitised RMBS are retained entirely by the issuing ADI as a form of collateral to be used in repos with the RBA in order to access central bank liquidity (for further information, see Debelle (2012)). The structural features of self-securitised RMBS are effectively the same as the structural features of marketed RMBS, except that most self-securitised RMBS have a revolving mortgage collateral pool. This allows, during a specific period of time, for the accumulated principal repayments from the mortgage pool, instead of being used to make the principal repayments to the RMBS bonds, to be used to purchase additional mortgages that are added to the pool. In these RMBS, the purchase of additional mortgages can also be funded by issuing additional RMBS bonds.

3 In the event that the RMBS trust defaults on payments that are due, the note holders (and other creditors) have recourse to the assets of the trust but not to the sponsor. Similarly, in the event of default by the sponsor, its creditors have no recourse to the mortgage collateral pool of the RMBS. Hence, the RMBS trust is bankruptcy-remote from the sponsor.

4 RMBS also have a 'default waterfall'. This sub-waterfall sets out the rules on how payments are distributed in the event of default by the RMBS trust. This is distinct from how losses from defaults in the mortgage collateral pool are distributed, which is governed by the chargeoff waterfall. As a large number of the RMBS structural features are designed to prevent a trust default, the default waterfall is expected to be used very infrequently to distribute payments. Following an event of default, a meeting of the secured creditors (this would typically include swap and facility providers and note holders) must be called to vote by extraordinary resolution on the next course of action. Generally, secured creditors' voting rights are proportional to the amount owed to them by the trust.

Figure 1: Flow of Funds in a Typical Australian RMBS



Source: RBA

calculates on the 'determination date' the payments to be made to the notes and how any losses are to be allocated to the notes following the rules set out in these waterfalls.[5]

In an RMBS, the collections from the mortgage pool, less any redraws, are deposited in a bank account called the 'collections account'.[6] The need to store the collections in a bank account arises because payments on the RMBS notes are generally made monthly, while payments on the mortgages occur daily throughout the preceding collection period.

Australian RMBS often face an asset-liability mismatch because the payments by borrowers on the mortgages have different characteristics from the payments on the RMBS notes. For example, collections from Australian residential mortgages are in Australian dollars, while some of the notes may be denominated in a foreign currency. Swaps with third parties are used to reduce asset-liability mismatches by modifying some of the funds in the collection account (see 'Transforming Cash Flows' section).

Once the collections are modified, they are split into separate 'available income' and 'available principal' components, which are then paid out separately as

5 The determination date is after the end of the relevant collection period and typically a few days before the corresponding payment date.

6 Australian mortgagors often have an option to make redraws from the principal that they have prepaid. Since principal prepayments are not retained by the trust, but are instead passed through to the notes, there is a need for the RMBS trust to fund redraws. In most cases, principal collections (which are yet to be transferred to the note holders) during a period are sufficient to cover redraws during the same period, leading to a net positive principal collection. However there may be situations where redraws exceed principal collections. To deal with this situation, RMBS often have 'redraw facilities' or 'redraw reserves' in order to fund negative net principal repayments from the mortgage pool; these can also be funded through the issuance of new notes (redraw notes).

interest and principal to the RMBS notes. The rules that specify how the available income is distributed to the notes are defined in the income waterfall, and the rules for the distribution of available principal are defined in the principal waterfall.[7] Any principal losses on the mortgages are allocated to the RMBS notes following the rules in the chargeoff waterfall (see 'Tranching' section).[8]

In the income waterfall, the available income is first used to make the payments of: the trust's expenses; the fees due to the various counterparties of the RMBS trust; and the interest due on the rated RMBS notes (these payments are collectively referred to as the 'required payments').[9] An inability of the RMBS trust to meet some of the required payments results in an event of default. Hence, to minimise this risk and to obtain credit ratings on the RMBS notes, Australian RMBS use a number of structural features to support the full and timely payment of the required payments (see 'Liquidity Support' section). While some of this support is provided by external counterparties for a fee in the form of 'liquidity support' facilities, some of it is also provided internally through reserves and the interaction between the sub-waterfalls.

There are other interactions between the sub-waterfalls that may redirect available income that remains after the required payments have been made (referred to as 'excess income') to the principal and chargeoff waterfalls or to the liquidity support facilities and reserve accounts (see 'Use of Excess Income' section).

The principal waterfalls of Australian RMBS have changed significantly in recent years as discussed in the 'Tranching' and 'Allocation of Principal' sections. The structures of Australian RMBS can be dynamic because the rules that distribute the interest, principal and chargeoffs to the notes may change over time in predefined ways based on the performance of the RMBS (see 'Allocation of Principal' section), and in some limited cases new notes may be issued (see 'Other Features').

Tranching

The key feature of RMBS structures is 'tranching', which transforms the mortgage pool into a range of securities (the RMBS notes), each with a different risk and maturity profile.

While historically Australian residential mortgages have experienced low default and loss rates (Debelle 2010), they nonetheless carry credit risk. Given the expected losses on a residential mortgage portfolio, securities backed by such a portfolio without some form of credit support to reduce the expected losses would not appeal to most fixed-income investors. Moreover, the typical Australian residential mortgage has a legal maturity of around 30 years, which is much longer than the usual investment horizon for fixed-income investors. In addition, the actual repayment behaviour is uncertain, largely reflecting the borrower's option to repay the mortgage, in part or in full, ahead of its legal maturity.

In an RMBS, principal payments and losses generated from its mortgage pool are tranched across credit and time dimensions to determine how these two risks are borne by the various notes in the RMBS. Tranching establishes the relative order in which the RMBS notes receive principal payments and are allocated losses, by designating each note to be either junior or senior to another note in the principal and chargeoff waterfalls. Groups of notes within the same RMBS can also have equal seniority, in which case they are allocated principal and/or chargeoffs in proportion of their outstanding amounts.

Through credit tranching, losses arising from the underlying pool are distributed first to the most 'junior' note outstanding until its principal is fully charged off, then to the next most junior note outstanding until its principal is fully charged off,

7 The depiction of the swaps in Figure 1 outside of the sub-waterfalls is for illustration only. In practice, net payments from the RMBS trust to its swap counterparties are generally made within the sub-waterfalls, while net receipts from the swap counterparties generally occur before the distributions are made in the sub-waterfalls.

8 The charged off amount of a note represents the part of a note's principal that will crystallise into a loss of principal for the investor if the chargeoff is not reimbursed before the final maturity of the RMBS.

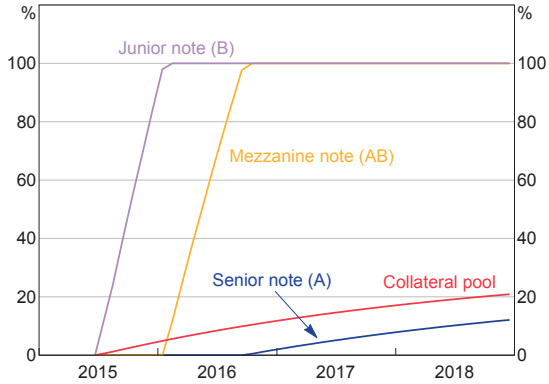
9 Some of the RMBS notes receive a credit rating, these are the rated notes; some notes may not receive a credit rating, these notes are the unrated notes.

and so on until losses are fully allocated to the RMBS notes (Graph 2).[10] In this way, a senior note is protected from taking any losses until all of its junior notes are fully charged off; the junior note is said to provide 'credit enhancement' to the senior note through the junior note's credit subordination. The size of the credit enhancement to an RMBS note is measured by the size of the outstanding balance of its subordinated notes as a percentage of the aggregate outstanding balance of all notes.

As a result of credit tranching, RMBS can be structured to have senior notes with much lower credit risk than the credit risk of the underlying mortgage pool by concentrating the credit risk in the junior notes. The reduction in credit risk achieved by the senior note depends on the size of its subordinated junior notes (and any external forms of credit support).[11] The credit enhancement provided by the junior notes to the most senior notes in Australian RMBS has generally increased since 2008. For banks there has been a fourfold increase, with the size of the credit-subordinated notes as a share of all notes increasing from 2 per cent in 2005 to 8 per cent in 2015, while the increase for RMBS issued by credit unions and building societies (CUBS) and non-ADIs has been around twofold (Graph 3).

Australian RMBS are structured to provide a level of credit enhancement sufficient for the most senior note to obtain a AAA credit rating. Some RMBS notes can be 'mezzanine' in that they are both junior to some notes and senior to others. Mezzanine notes can achieve a AAA rating just like senior notes; however, they ultimately have different credit risk characteristics.[12] Since 2013, the senior notes in ADI-sponsored RMBS have had at issuance around 8 per cent credit enhancement from subordinated notes, compared with around 3 per cent for mezzanine notes (Graph 4). The level of credit enhancement provided for RMBS sponsored by non-ADIs is higher, with 10 per cent and 4 per cent credit enhancement provided for the senior and

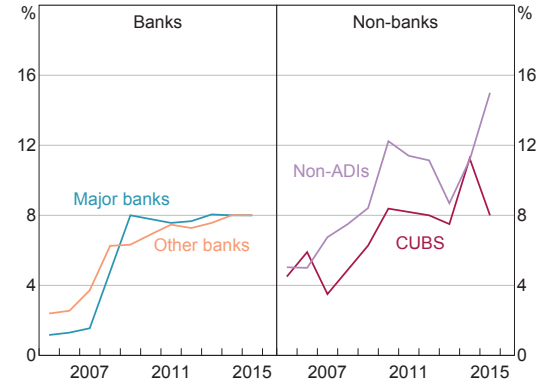
Graph 2
Example of Credit Tranching*
Cumulative chargeoffs as per cent of initial note balances



* Illustrates credit tranching based on the hypothetical RMBS described in footnote 10; assumes mortgages default at a rate of 12 per cent per annum and loss given default of 100 per cent; all losses are absorbed by the junior note until losses reach 5 per cent and it is fully charged off in February 2016, all subsequent losses up to 10 per cent are absorbed by the mezzanine note until it is charged off in October 2016, and losses above 10 per cent are absorbed by the senior note

Source: RBA

Graph 3
Credit Support to Senior Notes*
By sponsor type; principal of subordinated notes as percentage of principal on all notes



* Credit support at issuance; senior notes are defined as credit-unsubordinated notes; simple average of annual RMBS issuance backed by 100 per cent full-doc loans that are rated by Standard & Poor's; sample size for RMBS issued by CUBS and non-ADIs in 2014 and 2015 is small and observations may not be representative of underlying trends

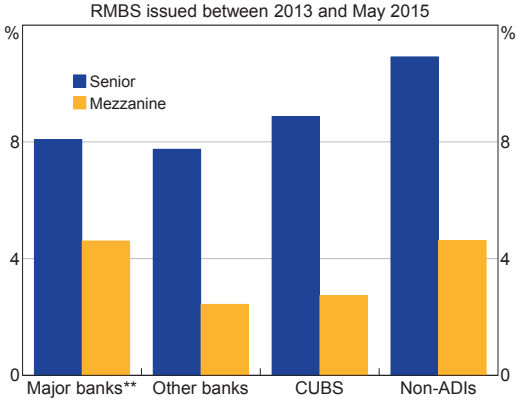
Sources: Macquarie Bank Limited; RBA; Standard & Poor's

10 Some of the key structural features discussed in this article are illustrated with a hypothetical RMBS that represents the salient features of Australian RMBS. The hypothetical RMBS has three notes, A, AB and B, with outstanding amounts at issuance of 90 per cent, 5 per cent and 5 per cent, respectively, of their combined outstanding amount of the notes. At the time of issuance, 22 June 2015, note A is senior to note AB, which is senior to note B at the issuance date.

11 The use of lenders mortgage insurance (LMI) as a form of credit support in Australian RMBS has declined since 2008, and these developments are discussed in Appendix A.

12 For further discussion of mezzanine notes and their relative risks, see Antoniades and Tarashev (2014).

Graph 4
Credit Support in Recent RMBS*
RMBS issued between 2013 and May 2015



* Credit support from subordination, measured as the size of the subordinated notes as a percentage of all outstanding notes; simple average of marketed RMBS backed by conforming mortgages

** Most of the mezzanine notes in major banks' RMBS obtain a AAA rating without reliance on external credit support; due to this, the level of credit support provided from subordination to these notes is higher than that in RMBS issued by other originators; for further discussion, see Appendix A

Source: RBA

mezzanine notes, respectively; this reflects the relatively riskier characteristics of the mortgages typically originated by non-ADIs.

Through time tranching, principal repayments from the underlying mortgage pool are directed first to pay the outstanding principal on some of the notes before they can be allocated to repay the outstanding principal on the rest of the notes. Often the notes receiving principal payments first are the senior notes created by the credit tranching, although since 2008 Australian RMBS have evolved more complex time tranching mechanisms that are discussed in more detail in the 'Allocation of Principal' section. While a typical Australian RMBS pool has an average contractual maturity of around 30 years, reflecting the features of the underlying mortgages, senior RMBS notes, through time tranching, are expected to be fully repaid within 10 years.[13] Time tranching is an important influence on the weighted average life (WAL) of the notes (a concept of duration commonly used for RMBS).[14] Reflecting time tranching, the senior notes in Australian RMBS issued since 2011 have had a WAL of 3 years at issuance, while the junior notes have had a WAL of 5.3 years at issuance (Graph 5). For comparison, the WAL of a pool of Australian mortgages is expected to be around 3.8 years.[15]

Time tranching also affects a note's sensitivity to prepayment risk, which arises from variation in the rate at which mortgages in the collateral pool are prepaid. Under normal market conditions, when the senior notes are not expected to experience credit losses, the market practice is to value the senior RMBS notes based on their expected WAL, which depends on expected prepayments. Any variations from the expected prepayments of mortgage principal, which is measured by the conditional prepayment rate (CPR), leads to variations in the WAL and, hence, the valuation of the RMBS notes.[16] The WAL of senior notes exhibits significantly smaller sensitivity than the WAL of junior notes to variations in the prepayment rate (Graph 6).

For a given CPR, the WAL of the senior notes is lower than the WAL of the collateral pool and, conversely, the WAL of the junior notes is higher than the WAL of the pool. Moreover, at a given CPR, the WAL of a

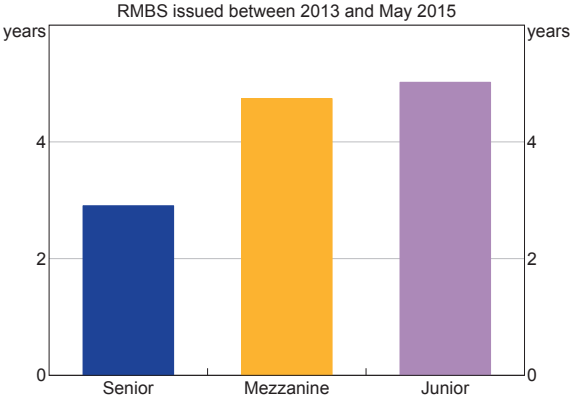
13 Along with time tranching, the clean-up call (discussed in the 'Other Features' section) is another factor that contributes to the shortened expected maturity for senior notes.

14 The WAL of an RMBS note is defined as the weighted average of the expected timing of the repayments of the principal to the note weighted by the size of the principal repayments. It is similar to the measure of duration of a non-amortising principal bond in the sense that it measures the effective maturity of the cash flows of the security. However, the WAL is not a measure of interest rate risk as most RMBS notes pay a floating rate coupon over a benchmark interest rate and have only minimum interest rate risk exposure.

15 The WAL of a pool of Australian 30-year standard variable rate residential mortgages is based on the typical repayment behaviour of borrowers over the past 10 years. For further discussion on mortgage prepayments in the Australian market, see Thurner and Dwyer (2013).

16 Prepayments are repayments of mortgage principal made in excess of the scheduled principal payments on the mortgage. The CPR measures the prepayment rate as an annualised percentage of the outstanding mortgage principal. Australian prepayment rates have been fairly steady historically, averaging around 22 per cent per annum and with a standard deviation of around 2 per cent since 2005 (Standard & Poor's 2015). Unlike in some other jurisdictions, such as the United States where changes in long-term interest rates are the major driver of prepayments, the economic drivers of Australian prepayment rates are less obvious due to the prevalence of variable-rate mortgages.

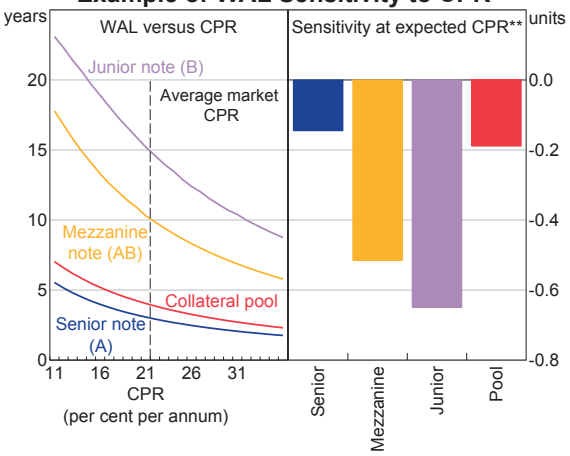
Graph 5
WAL and Note Seniority*
RMBS issued between 2013 and May 2015



* Simple average of RMBS that have senior, mezzanine and junior notes; WAL at issuance as reported by the sponsor; seniority is measured by credit subordination

Source: RBA

Graph 6
Example of WAL Sensitivity to CPR*



* Illustrates WAL and its sensitivity to prepayment risk based on the hypothetical RMBS described in footnote 10; sensitivity of WAL to CPR is measured by the slope of the WAL versus CPR curve; average market-wide CPR rate for 2014 is 21 per cent as reported by Standard & Poor's which is used as an indication of expected CPR

** Units measuring WAL sensitivity are number of years change in WAL per one percentage point change in CPR

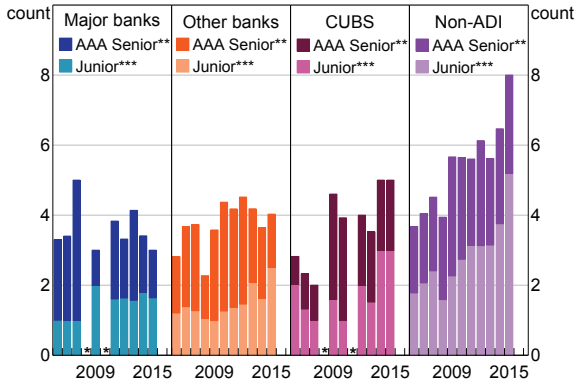
Source: RBA

senior note changes by less than the WAL of a junior note for a given change in the CPR.

Since the junior notes do not receive any principal payments until the senior notes are fully amortised, the relative size of junior notes increases over time. As a result, there is a gradual increase in the loss level as a share of the outstanding mortgage pool that can be absorbed by the junior notes before losses begin to affect the senior notes. Therefore, time tranching, in combination with credit tranching, reduces over time the credit risk of the senior notes.

In summary, tranching enhances one part of the RMBS liability structure at the expense of another, by reducing credit and prepayment risk on the senior notes, while increasing these risks for the junior notes. Since 2005, there has been an increase in the degree of tranching in Australian RMBS. The average number of notes in an RMBS has increased from three in 2005 to four in 2015, with most of the increase occurring after 2008 (Graph 7). The increase has been concentrated in the junior notes (which are typically rated below AAA), with the average number of such notes increasing by 1.5 per RMBS. The increase has been more pronounced in RMBS issued by non-ADIs. The higher number of tranches for RMBS issued by non-ADIs reflects the need for non-ADI sponsors to fund their mortgage lending fully through RMBS issuance. This has led RMBS issued by non-ADIs to be structured with a larger number of tranches with different characteristics that appeal to a broad range of investor risk appetites.

Graph 7
Tranching in Australian RMBS
Number of tranches by sponsor type; face-value weighted averages



* No issuance

** Includes AAA-rated senior and mezzanine notes

*** Includes tranches that are rated below AAA

Source: RBA

Liquidity Support

A key consideration in the structuring of Australian RMBS is to ensure the timely and full payments of the required payments in the income waterfall. When the risk of missing required payments arises from temporary factors, it is a form of liquidity risk rather than credit risk.

There are two main sources of this liquidity risk. The first is that Australian RMBS typically have a longer accrual period on the first interest payment due on the notes relative to the length of the first collection period.[17] The other is that delinquent borrowers make no interest payments, thus reducing the interest paid on the mortgage pool. This is a problem as the interest due on the notes is calculated on the outstanding amount of the notes, which is only reduced after defaulting mortgages are eventually foreclosed.

Australian RMBS use a number of facilities (or reserves) and internal structural features to provide temporary support to manage the risk of having insufficient available income to meet required payments.

The first mitigant is an interaction between the principal and income waterfalls through the 'principal draw', which redirects some of the principal collections away from the principal waterfall towards making the required payments in the income waterfall. Principal draws, which are effectively a borrowing from the principal waterfall, must be reimbursed eventually from the excess income in the income waterfall in subsequent periods. Principal draws are ubiquitous and have been present in all RMBS issued since 2013 (Table 1). The size of the liquidity support provided by the principal draw depends on the prepayment behaviour of the borrowers in the mortgage pool, as it is limited to the principal repayments received during the collection period, and is equivalent to around 2 per cent per month of the size of the pool (based on current prepayment rates).

The second mitigant, which is typically used only when the principal draw is insufficient, is a dedicated 'liquidity facility' or a 'liquidity reserve'. A liquidity facility is a line of credit provided to the RMBS trust for a fee. A liquidity reserve, which serves the same role as a liquidity facility, is an account held by the RMBS trust. A liquidity reserve can either be: funded upfront by the sponsor; funded by the issuance of notes to a value exceeding the value of the mortgage pool; or gradually built up through an accumulation of excess income. After being drawn, liquidity facilities and reserves are eventually repaid or topped up through excess income in future periods.[18] Liquidity facilities have been more prevalent than liquidity reserves in recently issued RMBS since 2013, reflecting the larger share of RMBS issuance by the major banks which tend to use liquidity facilities given their financial strength. The size of the liquidity support provided from liquidity facilities is slightly larger than from reserves.

The final mitigant, and the one that provides the strongest protection against liquidity risk, is the 'threshold rate mechanism'. A threshold rate mechanism is an agreement between the RMBS trust and the 'mortgage servicer' that requires the mortgage servicer to set at each point in time the interest rate charged on the variable-rate mortgages in the mortgage collateral pool to a level that is sufficient to generate enough available income to meet the required payments.[19] This has been a

17 Generally, a collection period runs for approximately the same length of time as the corresponding 'accrual period' (the length of time from the previous to the current payment date), which is used to calculate the size of the interest payment on the notes. However, for the first payment on the RMBS notes after an RMBS is issued, the collection period is shorter than the interest accrual period because, while the two periods start on the issue date, the collection period ends at the end of the first calendar month while the payment date is in the subsequent calendar month.

18 Unlike liquidity facilities, liquidity reserves can provide a small form of credit enhancement to the RMBS notes in addition to the liquidity support because, at least in some RMBS, losses on the mortgage pool can be charged to the liquidity reserve before they are charged against the senior notes.

19 The 'mortgage servicer' is responsible for administering the mortgages, including the collection of principal and interest from mortgage borrowers and the distribution of these funds to the RMBS trust. Often the mortgage servicer and the mortgage originator are the same legal entity or subsidiaries of the same legal entity.

Table 1: Liquidity Support in Australian RMBS
RMBS issued 2013 – May 2015

	Prevalence	Average Size	Range
	Per cent of RMBS	Per cent of collateral pool	Per cent of collateral pool
Principal draw[(a)]	100	2.0	1.5–2.1
Liquidity facility[(b)]	73	1.9	0.8–4.0
Liquidity reserve[(b)]	30	1.3	0.8–2.3
Threshold rate mechanism	100	Unlimited[(c)]	na

(a) Size of the liquidity support provided from the principal draw is estimated from the average market-wide monthly CPR for Australian RMBS between 2013 and 2015 as reported in Standard & Poor's (2015), with the range estimated from the maximum and minimum market-wide average CPR observations during this period
(b) Some RMBS have both a liquidity facility and a liquidity reserve, hence the prevalence of the two items sums to more than 100 per cent
(c) Theoretically, the threshold rate mechanism provides an unlimited support against liquidity risk; however, in practice, there may be a limit to which the variable rate can be raised due to competitive pressures – for instance, Standard & Poor's standard assumption when rating RMBS is to impose a 50 basis point limit on the extent to which the variable rate can be raised above the prevailing market-average standard variable rate (see Standard & Poor's (2010))
Sources: RBA; Standard & Poor's

standard structural feature of Australian RMBS. For example, all RMBS issued since 2013 have a threshold rate mechanism. However, the threshold rate mechanism has two major drawbacks. First, to meet the obligations under the threshold rate mechanism, the mortgage originator may have to ultimately raise its standard variable rate, which affects all mortgages originated by the mortgage originator, not just the mortgages in the collateral pool of the particular RMBS experiencing liquidity stress. Second, an increase in the rate paid by the mortgages in the pool above comparable market rates may lead to good quality borrowers refinancing their mortgages with another lender, leaving the mortgage pool more concentrated in low quality borrowers who have been unable to refinance.

Australian RMBS typically have liquidity support arrangements that can meet required monthly payments equivalent to around 4 per cent of the size of the outstanding notes before there is a need to invoke the threshold rate mechanism. As such, the use of threshold rate mechanisms is very unlikely in an environment of low delinquency rates on securitised mortgages.

Transforming Cash Flows

In order to appeal to fixed-income investors, Australian RMBS notes pay regular coupons based on capital market conventions, either as a fixed margin added to a short-term interest rate benchmark (typically the comparable maturity bank bill swap rate (BBSW)) or as a fixed rate, and may include notes denominated in foreign currencies. However, the interest payments on the mortgage assets do not follow the same capital market conventions and interest and principal payments are made in Australian dollars. These asset-liability mismatches create a risk that the RMBS trust may not be able to meet payments due on its liabilities because of adverse movements in interest rates or exchange rates. These risks are managed through interest rate swaps and foreign exchange swaps, which are tailored to meet the specific requirements of individual RMBS.

Australian RMBS mortgage pools contain both fixed- and variable-rate mortgages, though generally most securitised mortgages pay a variable rate set by the mortgage originator (i.e. the originator's standard variable rate less any discount offered to the borrower). As a result, typically the interest payments received from the mortgage pool are determined

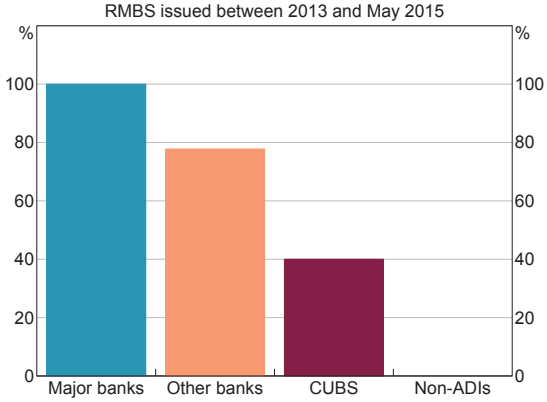
by the standard variable rate, while the interest payments on the liabilities are determined by the BBSW. While the standard variable rate and BBSW move approximately in line with each other, there may be situations where the basis between the two rates (i.e. the difference between the standard variable rate and BBSW) varies significantly. This basis risk needs to be managed effectively in all Australian RMBS.

Some RMBS manage the basis risk through 'basis swaps', where the interest payments on the variable rate mortgages are swapped for a payment of BBSW plus a margin. Basis swaps are typically provided by the RMBS sponsor because they are non-standard swap contracts that are relatively large and difficult to hedge. Moreover, the variable rate on the mortgage pool that determines one leg of the basis swap payments is set by the mortgage originator, which is often the sponsor of the RMBS. This limits the ability of counterparties other than the originator to provide the swap. In recent years, basis swaps have been used in all RMBS issued by the major banks and most of the RMBS issued by other banks, reflecting the fact that these institutions have the financial strength to be credible counterparties (Graph 8). RMBS issued by CUBS are less likely to feature basis swaps, and RMBS issued by non-ADIs have not used basis swaps in their structure.[20]

Besides managing the basis risk, the basis swap allows the RMBS originator to prevent the triggering of the threshold rate mechanism that would require it to increase its standard variable rate above the prevailing market level, reducing its competitiveness. In this way, the basis swap is a structural feature that not only enhances the RMBS, but also benefits the mortgage originator.

Australian RMBS face interest rate risk from the fixed-rate mortgages in the mortgage pool because the BBSW rate may rise relative to the rate received on these mortgages. Conversely, RMBS with fixed-rate notes face the risk that the interest rate on the variable-rate mortgages in the pool may decline relative to the fixed rate on the notes. Fixed-for-floating interest rate swaps are commonly used to manage this interest rate risk. Similarly, cross-currency swaps are used to hedge the foreign exchange rate risk in RMBS with notes denominated in a foreign currency. These swaps are tailored to the RMBS market by having a notional amount amortising in line with the mortgage pool. While the basis risk in an Australian RMBS is relatively low because the standard variable rate and BBSW rates tend to move closely together, the interest rate risk (and the foreign exchange rate risk when present) may be significant. The swaps used to hedge these risks expose the RMBS to counterparty risk, that is the risk that the swap provider defaults. The counterparty risk is managed by requiring the swap counterparty to post collateral to the RMBS trust when the counterparty's credit rating declines below a particular level, and to find a replacement counterparty when its rating falls below a second, lower level.[21]

Graph 8
Prevalence of Basis Swaps*
RMBS issued between 2013 and May 2015



* Face-value weighted average
Source: RBA

20 Some RMBS sponsored by non-ADIs include alternative provisions such as threshold rate subsidies, which permit sponsors to assist the RMBS in meeting its required payments in order to avoid activating the threshold rate mechanism. A third of RMBS sponsored by non-ADIs issued since 2013 have included a threshold rate subsidy.

21 Such measures are not present in basis swap contracts as these are provided by the RMBS sponsors and there are no viable replacement counterparties. The posting of collateral is not required in basis swap contracts as the required amount would be prohibitively large given the relatively large size of these contracts.

Use of Excess Income

For an RMBS to be economically viable, the available income expected to be received from the mortgage pool must be no lower than the interest expected to be paid to the notes and the RMBS expenses. In the income waterfall, available income remaining after the required payments have been made represents excess income, which is used to support some of the key structural features of the RMBS. Uses of excess income include:

- support to the liquidity facilities by reimbursing previous draws on the facilities, including principal draws
- the build-up of internal RMBS reserves that can provide additional credit and liquidity enhancements to the RMBS notes
- the reimbursement of chargeoffs on the notes, thus reducing losses from mortgage defaults
- the acceleration of the repayment of principal on the notes.

Any excess income left after making such distributions is paid to the 'residual income unit holder', which is usually the RMBS sponsor.

Allocation of Principal

Because credit and time tranching concentrate the credit and prepayment risk in the junior notes, RMBS investors require a higher compensation for these risks in the form of receiving a higher margin over BBSW on the junior notes relative to the senior notes. Through time tranching, the lower-yielding senior notes amortise first, leading to an increase in the proportion of the higher-yielding junior notes over time and an increase in the yield payable on the RMBS liabilities. In contrast, the yield that is received from the mortgage pool remains the same over time (abstracting from any changes in interest rate levels). The compression between the yield payable on the liabilities and the yield received from the mortgage pool (known as yield strain) makes meeting the required payments in an RMBS more difficult over time.

In Australian RMBS, there are two typical approaches to the allocation of principal collections to the notes – 'sequential paydown' and 'serial paydown'. Under sequential paydown, principal collections are allocated to the most senior note outstanding. Under serial paydown, principal collections are allocated to all notes in proportion to their outstanding principal balances. Sequential paydown represents a strict application of time tranching. However, because this results in yield strain, sequential paydown is often used to distribute principal in the first few years after the issuance of an RMBS, with the principal allocation switching to serial paydown usually two to four years after the issuance of the RMBS (Graph 9).

Unlike sequential paydown of principal, which builds up credit enhancement over time (see 'Tranching' section), serial paydown limits yield strain but also limits the build-up of credit enhancement and lengthens the WAL of the senior notes (Graph 10).

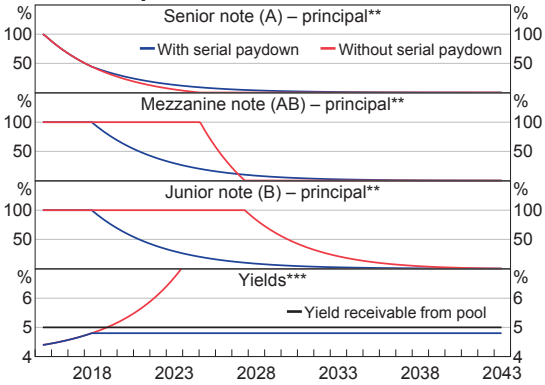
Given this, the switch from sequential to serial paydown only occurs when a number of conditions are satisfied, with these conditions designed to ensure that the use of serial paydown does not materially increase the credit risk of the senior notes.[22] These conditions typically require that:

- a minimum length of time has elapsed since the issuance of the RMBS
- the level of credit enhancement of the senior notes has increased since the RMBS issue date to be above a minimum level

22 The RMBS manager determines when these conditions are satisfied. When they are satisfied the principal allocation is switched from sequential to serial. If, subsequently, one of the conditions is no longer satisfied, the principal allocation is switched back to sequential. These conditions represent a trigger that alters the distribution of principal based on the rules specified in the principal waterfall. They, together with the clean-up call trigger condition (see 'Other Features' section), are the most prevalent example of the use of triggers in Australian RMBS that alter the rules distributing income, principal and chargeoffs following the specifications in the relevant waterfalls. In this sense, the RMBS structures are dynamic as they do not have to follow the same distribution rules as the ones that were in place at the time of issuance of the RMBS. Triggers are deterministic in the sense that they are specified in the waterfalls. Most triggers are non-discretionary; however, the clean-up call option (see 'Other Features' section) is an example of a discretionary trigger, where the trust manager may choose whether to exercise the trigger.

- delinquencies in the mortgage pool are low
- there are no outstanding chargeoffs on the notes
- there are no unreimbursed draws on liquidity facilities, including the principal draw.

Graph 9
Effect of Serial Paydown on Note Principal Amortisation and Yields*



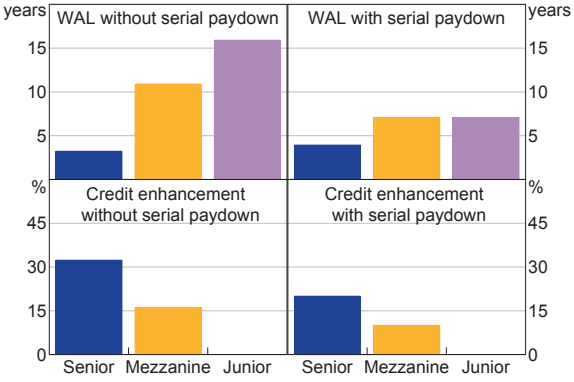
* Example of the effect of serial paydown based on the hypothetical RMBS described in footnote 10; serial paydown is assumed to start two years after issuance, with sequential paydown in the first two years; there are no clean-up calls

** Outstanding amount of note as per cent of its initial amount outstanding

*** Trust expenses and yields payable on the notes as a per cent of the outstanding amount of the notes; assumes 3, 4 and 10 per cent for coupon rates on senior, mezzanine and junior notes, respectively; RMBS trust expenses are assumed to be 1 per cent per annum of the pool; yield on the mortgages is assumed to be 5 per cent; under the scenario without serial paydown, the yield payable is shown only up to 2023; it continues to increase to 11 per cent, at which point the increase is capped by the yield on the junior note and the trust expenses

Source: RBA

Graph 10
Effect of Serial Paydown on WAL and Credit Enhancement*

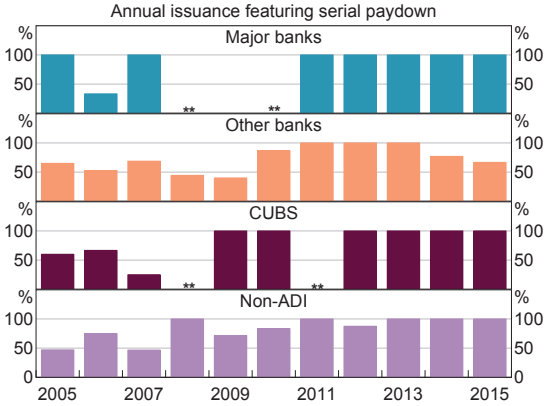


* Illustrates effects based on the hypothetical RMBS described in footnote 10; serial paydown is assumed to occur in two years after issuance; WAL at issuance assuming 20 per cent CPR; expected credit enhancement five years after issuance

Source: RBA

The spread between senior and junior note margins in Australian RMBS has widened significantly since the global financial crisis, increasing the risk of yield strain. This has led to a more widespread use of serial paydown since 2008 (Graph 11). Another factor contributing to the increased use of serial paydown, particularly in RMBS issued by ADIs, was the revision of the Australian Prudential Regulation Authority's (APRA) *Prudential Standard APS 120 Securitisation* (APS 120) in 2010 that clarified the applicability of the 20 per cent limit on an ADI's holdings of the notes in an RMBS sponsored by the ADI (for details, see APRA (2010)). A sponsoring ADI may hold some proportion of the junior notes in an RMBS it sponsors, and the share of these notes will increase over time through the sequential paydown of principal. By structuring the RMBS to include a serial paydown, the share of the junior notes can be capped, thereby assisting the ADI in meeting the 20 per cent holding limit under APS 120 (Moody's 2010).[23]

Graph 11
Serial Paydown in Australian RMBS*
Annual issuance featuring serial paydown



* Simple averages

** No issuance

Source: RBA

23 In 2013 APRA announced its intention to reform APS 120, including possible revisions to the 20 per cent holding limit rule (for more details, see Littrell (2013, 2014)). In anticipation of the revision, some ADI-issued RMBS since the announcement have been structured without serial paydown.

Other Features

Clean-up calls

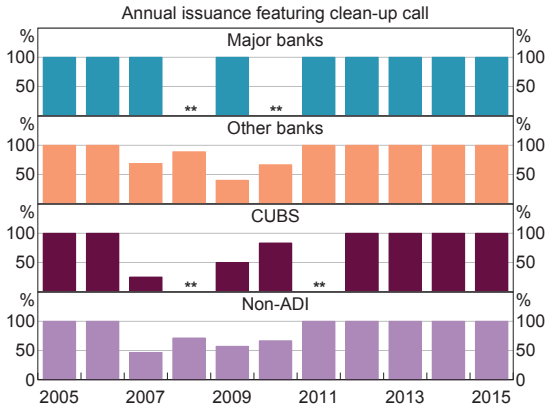
The clean-up call option is the most prominent example of a discretionary trigger. It has become a standard feature of Australian RMBS that allows the RMBS sponsor to buy back all of the outstanding notes when certain conditions are met. Typically, clean-up calls can be exercised when the outstanding mortgage pool balance falls below a certain proportion (often 10 per cent) of its initial value, and in the case of non-ADI RMBS, a clean-up call can be exercised after a certain date.[24]

Clean-up calls provide investors with more certainty around the WAL of the notes. This is particularly important for the junior notes as the expected final maturity of a junior note will increase to the contractual maturity of the mortgages (typically 30 years) if the clean-up call option is not exercised.

Furthermore, as the mortgage pool amortises it may become uneconomical to run the RMBS as the fixed administration costs rise relative to the income generated from the mortgages. The exercise of the clean-up call, after the relevant triggers have been satisfied, is at the option of the sponsor as the sponsor needs to fund the purchase of the mortgage pool (which often occurs through repackaging the mortgage pool into a new RMBS) and is effectively conditional on prevailing market conditions.

Typically, RMBS issued before the global financial crisis included clean-up calls (Graph 12). As funding conditions tightened, especially in the RMBS market, the inclusion of clean-up calls in RMBS issued between 2007 and 2010 declined significantly for RMBS not sponsored by the major banks. As conditions improved, clean-up calls returned as a typical structural feature of Australian RMBS issued by all sponsor types since 2011.

Graph 12
Clean-up Calls in Australian RMBS*



* Simple averages
** No issuance
Source: RBA

Bullet notes

The majority of Australian RMBS notes are fully amortising 'pass-through' securities, where all the principal payments from the mortgage pool during a collection period are distributed to the notes.

In recent years, some RMBS have been structured with one or more bullet notes, where the principal on the bullet note does not amortise but is instead repaid on the note's maturity date. Bullet notes are of interest owing to: investor demand for more certainty in the timing of principal payments; and the lower cost of hedging interest rate or foreign exchange risk when there is certainty around the timing of principal payments. Bullet notes are structured either as 'hard bullets' or 'soft bullets'. Hard bullets must be repaid in full at their maturity, while for a soft bullet, an RMBS trust has the option to convert the security into a pass-through note with the coupon increasing by a predefined margin.[25] Often bullet principal is repaid by the issuance of a 'refinance note'. However, the successful issuance of such notes depends on market conditions. The refinancing risk of a hard bullet is managed through a 'redemption facility', whereby a third party agrees to fund the principal repayment

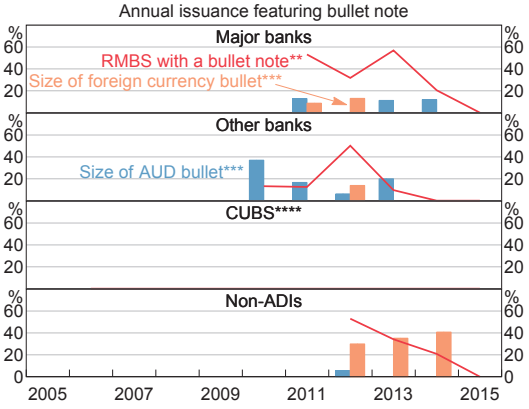
24 APS 120 prohibits date-based clean-up calls in RMBS sponsored by ADIs.

25 Non-repayment of a hard bullet at its maturity constitutes an event of default for the RMBS trust.

on the hard bullet if this cannot be financed in the market. For the RMBS trust, the refinance risk of a soft bullet is limited to the step-up margin; however, investors in soft bullets face the risk of a delay in the return of principal (extension risk).[26]

The repayment of principal on bullet notes may also be partially or fully made from mortgage payments that have been gradually accumulated in a dedicated account over the life of the bullet; however, such accounts have a lower yield than the RMBS notes, which adds to yield strain. As a result of the refinancing risk of bullets, their use has been relatively limited. While bullet notes have become more common in Australian RMBS, and have been included in around 20 per cent of the RMBS issued since 2010, the relative size of the bullet notes has been quite small (Graph 13). Over this period, foreign currency-denominated RMBS notes have been exclusively structured as bullet notes, and such notes have been mainly used in non-ADI RMBS to access a broader investor base.

Graph 13
Bullet Notes in Australian RMBS*
Annual issuance featuring bullet note



* Simple averages
** Share of RMBS with a bullet note
*** Size of bullet notes expressed as a proportion of respective RMBS sizes
**** RMBS issued by CUBS have not included bullet notes
Source: RBA

Conclusion

The structures of Australian RMBS have evolved over time. Australian RMBS have generally become more structured over the past 10 years, especially since the global financial crisis: the tranching of both credit and prepayment risk has increased; the use of principal allocation mechanisms that vary over the life of the RMBS has become more widespread; bullet notes have been added; and various external and internal support facilities have continued to be used. The increased structuring, which has developed to address changing market conditions, does not necessarily create more risk for investors, especially if they are provided with transparent and complete information about RMBS structures. Indeed, there has been a significant increase in the size of the credit enhancement provided to the most senior notes through the subordination of junior notes, with the increase in excess of the requirements of the credit rating agencies. The reliance on external credit support from LMI has also declined.

Understanding RMBS structures is essential to the effective risk management and valuation of RMBS because the RMBS structure determines how the risks generated from the securitised mortgages are borne by each particular RMBS note. Given the importance of RMBS as collateral in the RBA's repurchase agreements, the RBA has a keen interest in understanding RMBS structures. The RBA's reporting requirements for repo-eligible asset-backed securities, which come in effect from 30 June 2015, will provide standardised and detailed information, not only on the mortgages backing RMBS, but also on the RMBS structures, including their cash flow waterfalls.

26 If the repayment of the principal of a soft-bullet note cannot be financed through the issuance of new notes in the market, then the maturity of the note is extended and its coupon margin is increased. This increase to the coupon margin is called a step-up margin.

Appendix A: Australian RMBS and Lenders Mortgage Insurance

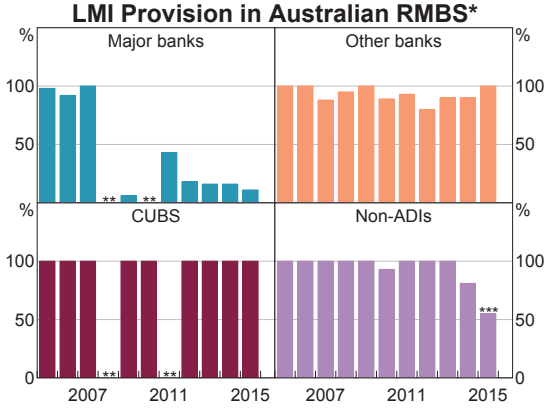
Lenders mortgage insurance (LMI) is a type of insurance policy that covers the losses from a default on a (residential) mortgage that remain after the sale of the collateral property.[27] After credit tranching, LMI on the mortgage pool is the main type of credit enhancement used in Australian RMBS. However, the credit enhancement provided by LMI is different from that of credit tranching, as it relies on the LMI provider's willingness and ability to pay under the terms of the policy, and is limited by the financial strength of the LMI provider. The credit ratings agencies take into account the losses on the mortgages pool that are expected to be covered by LMI when determining the minimum credit enhancement required for a note to achieve a particular rating. In this way, more extensive LMI coverage of the mortgage pool results in a lower required minimum credit enhancement.

Prior to 2007, market confidence in LMI was high and it was standard for Australian RMBS mortgage pools to be 100 per cent covered by LMI (Graph A1). Taking advantage of the extensive LMI coverage, the typical RMBS issued before 2008 had at least one senior note that obtained its AAA rating based on reliance on LMI; that is, the credit enhancement provided to the note by more junior notes was below the level of credit enhancement that the credit ratings agencies would have required if none of the mortgages had LMI (Graph A2).

However, during the global financial crisis, market confidence in many forms of external credit support, including LMI, declined (RBA 2008; Moody's 2011). Since 2008, the credit rating agencies have reduced the benefit they assign to LMI coverage when assessing RMBS ratings and the credit ratings of the major LMI providers have been lowered. As a result, reliance on LMI as a form of credit enhancement has declined. In RMBS issued by the banks, the level of credit enhancement provided by the junior notes

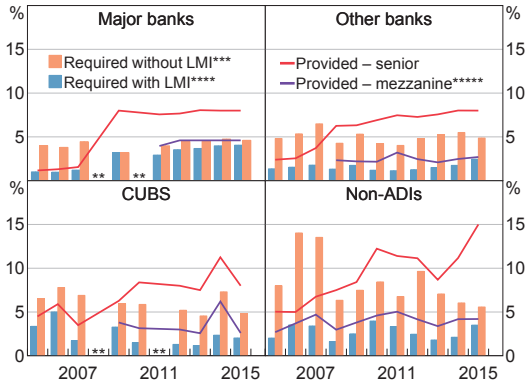
27 For further discussion of LMI, see RBA (2013).

Graph A1
LMI Provision in Australian RMBS*



* Face-value weighted averages; sample is restricted to 100 per cent full-doc conforming RMBS
** No issuance
*** Sample size for RMBS issued by non-ADIs in 2015 is small and observations may not be representative of underlying trends
Sources: Perpetual; RBA

Graph A2
Credit Enhancement for AAA Rated Notes*



* Simple averages; sample is restricted to conforming 100 per cent full-doc RMBS that are rated by Standard & Poor's
** No issuance
*** Credit subordination required to achieve a AAA rating assuming that there is no LMI coverage of the collateral pool
**** Credit subordination required to achieve a AAA rating with the provided LMI coverage of the collateral pool
***** Most junior of the subordinated notes that is rated AAA
Sources: Macquarie Bank Limited; RBA; Standard & Poor's

to the most senior AAA-rated notes has increased fourfold to above the level required for a AAA rating without any LMI coverage. This has delinked the AAA ratings on the most senior notes in bank-issued RMBS from the credit quality of the LMI provider. Similarly, the credit enhancement of the most senior notes in RMBS issued by CUBS and non-ADIs has increased to be above the level required for a AAA rating without

LMI coverage. Consequently, the most senior notes in these RMBS have also had their ratings delinked from LMI. RMBS issued by banks since 2011 have often included a mezzanine AAA-rated note, whose rating has been delinked from LMI for the major banks' RMBS but has been LMI dependent for the smaller banks. RMBS issued by the CUBS have typically featured such LMI-dependent AAA-rated LMI notes since 2009, while non-ADI RMBS have been structured with such mezzanine notes since before the global financial crisis. Therefore, while reliance on LMI has declined in Australian RMBS for the most senior notes since 2008, RMBS issued by smaller banks, CUBS and non-ADIs have continued to be structured with some reliance on LMI.

Reflecting these developments, major banks' RMBS have significantly reduced LMI coverage of their RMBS mortgage pools, with LMI coverage now limited to mortgages with higher loan-to-valuation ratios (i.e. an LVR over 80 per cent).[28] In contrast, LMI coverage of the mortgage pools in RMBS issued by other banks, CUBS and non-ADIs has declined only a little relative to pre-2007 levels. Furthermore, the demand by some Australian ADIs for LMI coverage of their residential mortgages has been diminishing in recent years, partly due to regulatory changes (Moody's 2014). This has been another factor contributing to the decline in the share of securitised mortgages covered by LMI, particularly in RMBS originated by the major banks.

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28 See Moody's (2011) for further discussion on the use of LMI in Australian RMBS.

Wealth Management Products in China

Emily Perry and Florian Weltewitz*

Wealth management products (WMPs) in China are investments that offer fixed rates of return well above regulated interest rates for deposits and are often used to fund investments in sectors where bank credit is restricted. They are typically actively managed by banks, with other firms commonly used as 'channels', but few are recorded on banks' balance sheets. A key concern about such products is the moral hazard created by a history of banks bailing out unguaranteed WMPs.

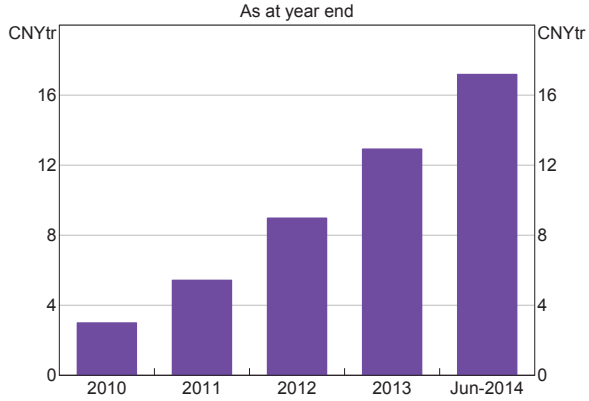
Introduction

Chinese WMPs are investment vehicles marketed to retail and corporate investors and sold by both banks and non-bank financial institutions (NBFIs), sometimes with explicit principal or interest guarantees. They differ from conventional mutual funds in that their returns are fixed and the products have a set maturity (which is usually fairly short). However, WMPs are also distinct from bank deposits in that the funds raised are invested in a range of loans and securities and the returns offered significantly exceed regulated deposit rates.

Issuance of WMPs has grown rapidly in recent years. The estimated stock outstanding exceeded CNY17 trillion as at 30 June 2014 (around 26 per cent of GDP; Graph 1).[1] Our estimate is likely to understate the stock of WMPs outstanding as it only captures WMPs that have either 'active' bank involvement ('bank WMPs')[2] or involve trust companies, which are financial institutions that manage assets and make investments on behalf of clients. The strong growth in WMPs in recent years has been supported by the higher yield they offer investors compared with the regulated ceilings on deposit rates, and a desire among banks to obtain funding beyond that possible at the deposit rates they can offer.

This article discusses the risks associated with WMPs in China and who is exposed to these risks. In order to understand the risks, it is necessary to recognise how the riskiness and investor exposure to underlying assets vary across different types of WMPs.

Graph 1
WMPs Outstanding*
As at year end



* Sum of published data on the stock of outstanding bank WMPs and collective trust products; excludes all other WMPs for which data are unavailable

Sources: CBRC; CEIC Data; China Trustee Association; People's Bank of China; RBA; Securities Association of China

* The authors are from International Department and Economic Group.

1 Generating estimates of the stock of outstanding WMPs, including a breakdown by type of WMPs, involves multiple data sources and some assumptions and calculations. Forming estimates is also complicated by the fact that there is no universally accepted definition of a WMP, and the mechanics involved in the creation of WMPs are often not transparent.

2 Some types of WMPs are not included in this analysis due to data limitations. We do not capture most WMPs where banks are involved merely as 'passive' distributors of the WMPs, or WMPs offered by NBFIs where there is no bank involvement. We use 'passive' distributor to signify financial institutions that are involved in the WMP business but do not have control over investment decisions. Examples of WMPs not captured within our estimates include 'collective asset management plans' set up by securities companies, and some WMPs offered by guarantee companies, fund management entities and insurance firms.

Types of WMPs

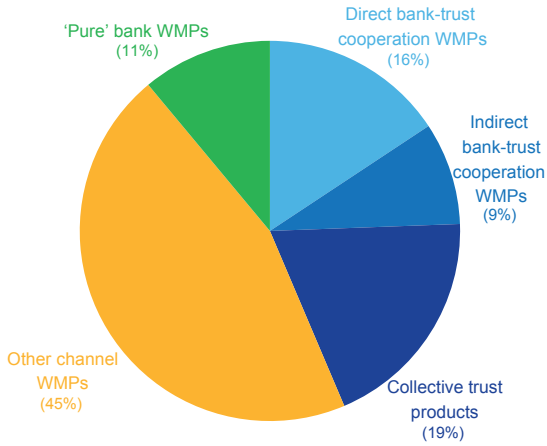
WMPs can be categorised according to the financial institutions that are involved in their issuance. Banks may raise and invest WMP funds themselves or use another financial institution, a so-called 'channel' firm, to make the investments; the latter is usually done in order to keep WMPs off banks' balance sheets and thereby avoid many regulatory requirements. In most cases where it uses a channel firm, the bank still has an active role – that is, the bank retains control over the investment decisions – and the channel firm acts as a passive administrator. Some WMPs are also set up by NBFIs without active bank involvement, though the product may still be sold by banks to investors.

As at mid 2014, 11 per cent of WMPs were estimated to have been developed and managed in-house by banks with no involvement from other financial institutions ('pure' bank WMPs; green area in Graph 2). Such products are most similar to deposits, but still offer yields higher than regulated deposit rate ceilings. This category of WMPs has explicit principal guarantees by the bank and is required to be accounted for on the balance sheet of the issuing bank.

The remaining 89 per cent of WMPs were evenly split between those that use trust companies as channel partners and those that use other financial institutions as channels.

Among WMPs that involve cooperation between banks and trust companies, there are three main types – direct bank-trust cooperation products, indirect bank-trust cooperation products and collective trust products (the three blue shaded areas in Graph 2). Direct bank-trust cooperation products are the most straightforward, and were estimated to account for 16 per cent of the stock of WMPs outstanding. Funds raised by banks through such WMPs are placed in a newly created trust product with the bank as the sole investor, thereby creating a 'single unit trust product' (SUTP). Direct bank-trust cooperation WMPs are recorded on banks' balance sheets and the issuing bank explicitly guarantees the principal invested (and sometimes the interest as well). The bank remains the active decision-maker by directing the trust company to make specific investments (KPMG 2012). Reports suggest that trust companies' fee commission income is relatively low, which is consistent with their passive role in this business (Bedford and Rothman 2013).

Graph 2
WMPs Outstanding
Shares of CNY17.2 trillion outstanding as at 30 June 2014*



* Excludes most WMPs with either no or only 'passive' bank involvement
Sources: CBRC; China Trustee Association; RBA; WIND Information

In recent years, issuance of WMPs has shifted away from *direct* bank-trust cooperation products towards *indirect* bank-trust cooperation products, which accounted for 9 per cent of outstanding WMPs. Such products introduce a passive 'bridge' entity between the bank and the trust company. The bridge entity buys the trust product and then sells the claim on the returns of that product to a bank. The shift towards indirect bank-trust cooperation WMPs appears to be a response to regulations introduced by the China Banking Regulatory Commission (CBRC) requiring banks to bring all business with trust companies onto their balance sheets (CBRC 2010). This greatly reduced the incentive for direct bank-trust cooperation because it effectively required banks to guarantee the principal invested in these WMPs explicitly.

The third type of WMP that involves cooperation between banks and trust companies is known as a collective trust product (CTP; 19 per cent of outstanding WMPs). This category differs from the other two types of bank-trust cooperation products in that the trust company, rather than the bank, actively makes the investment decisions. CTPs are set up and managed by trust companies, and the units in the trust product are sold to wealthy individuals and corporate investors. Investors' funds are pooled and then generally invested in a single asset or asset type. There are relatively strict rules governing investment in CTPs: the minimum investment is CNY1 million; there can be no more than 50 individual investors in each product; and marketing is restricted to the home city of the product and no more than two other cities (Hu 2014). CTPs are not recorded on banks' balance sheets, and the role of banks is limited to being passive distributors by using their sales force and branch networks to attract investors. These WMPs can also be distributed through NBFIs.[3] Banks earn small distribution fees, while the profit margin on CTPs for trust companies is reportedly as high as 150–300 basis points, which is far greater than for direct and indirect bank-trust cooperation WMPs.

The remaining 45 per cent of WMPs were estimated to involve cooperation between banks and other financial institutions (mainly securities firms; orange area in Graph 2).[4] These WMPs are similar to direct bank-trust cooperation products, where the bank remains the principal decision-maker and the so-called 'channel' firm collects a small management fee for its role. However, data on bank WMPs organised through other financial institution channels are more limited. These WMPs are all assumed to be off the balance sheets of banks. Growth of this category of WMPs has been more rapid than that of bank-trust cooperation products, which is in part due to the less stringent regulation faced by non-trust financial institutions. Non-trust channel firms are also believed to charge lower management fees than trust companies, making them a cheaper partner for banks.

While in principle a wide variety of financial institutions could serve as channel firms, securities companies have recently become the most prominent competitor to trust companies. Securities firms offer vehicles known as targeted asset management plans, with CNY4.8 trillion outstanding as at the end of 2013 (Securities Association of China 2014). Insurance companies also act as channel firms for banks, though data on the size of this channel are not readily available.

There is a potentially large and rapidly growing stock of WMPs that are set up and actively managed by various NBFIs that have no bank involvement. However, data and information on this category of WMPs are limited and are not covered in this article.[5]

Links between Trust Company Assets and WMPs

The links between WMPs and trust companies are significant. As at mid 2014, trust companies were estimated to source 60 per cent of their assets under management through the issuance of WMPs (or CNY7.5 trillion;[6] Figure 1). The remaining CNY5 trillion were largely accounted for by financial institutions investing their own funds with trust companies.[7] In some cases, financial institutions use trust companies as intermediaries to make investments they cannot make themselves due to regulatory restrictions, such as banks extending loans to particular sectors (Green *et al* 2013). In these cases, banks retain the investment risk, as they do with guaranteed WMPs (shown in dark blue in Figure 1), though as discussed below it is not clear whether they will also absorb any losses on WMPs that are not legally guaranteed (those coloured orange in Figure 1).

3 Absent any breakdown, we include all CTPs under our coverage of WMPs. However, it has been suggested that banks distribute up to half of the CTPs issued (Bedford and Rothman 2013).

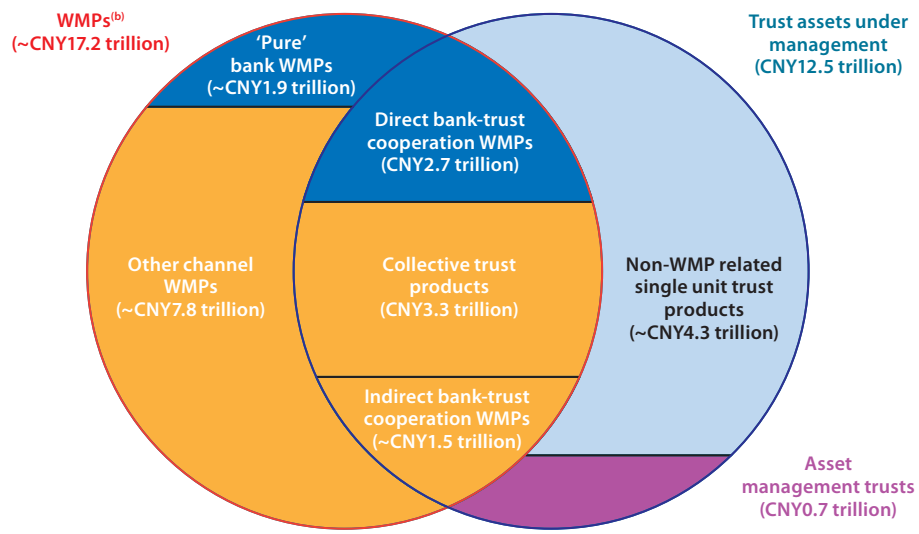
4 Securities firms in China perform both brokerage and asset management functions.

5 Our analysis includes CTPs that are sometimes distributed through NBFIs, as discussed above.

6 Calculated as the sum of direct and indirect bank-trust cooperation WMPs (CNY2.7 trillion and CNY1.5 trillion, respectively) and CTPs (CNY3.3 trillion).

7 However, around CNY700 billion relates to asset management trusts, which focus on the management of revenue streams from assets such as toll roads and rental properties (KPMG 2012).

Figure 1: WMPs and Trust Assets
As at 30 June 2014[a]



(a) Dark blue areas indicate WMPs recorded on banks' balance sheets, while orange areas indicate WMPs kept off banks' balance sheets
(b) Excludes most WMPs with either no or only 'passive' bank involvement
Sources: CBRC; Chinese Trustee Association; RBA; WIND Information

Risks Associated with WMPs

CTPs

CTPs differ from bank WMPs in important ways: their distribution is limited to wealthier investors; they tend to face fewer restrictions on their investment activity; and they typically have terms of between one and two years, though sometimes significantly longer. CTPs invest in a single asset or asset type and so do not have the diversification benefits of many other WMPs; in 2014 these assets were mostly loans or bonds (Graph 3).

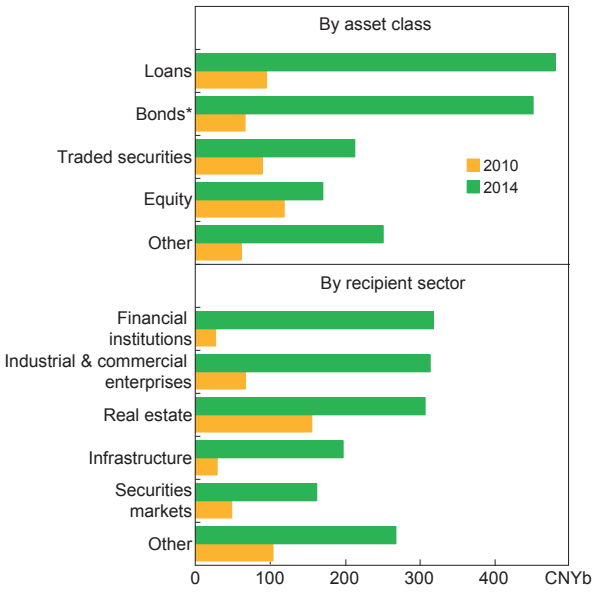
According to data from the Chinese Trustee Association (CTA), around two-thirds of CTP assets are invested in either financial institutions, 'industrial & commercial enterprises' or real estate, with the distribution between these three fairly even.[8] The latter two sectors include industries currently experiencing excess capacity and declining profitability, such as property development, coal extraction and solar panel manufacturing. There are also reasons to believe that these data may understate the underlying exposure of CTPs to property if some of the financing extended to financial and other enterprises is related to real estate financing or loans made to other sectors are collateralised by real estate, as is commonly believed.

Although CTPs result in undiversified credit risk, their disclosure of investment details is better than for other WMPs. Prospectuses outline the project or company being funded, the mechanism used to finance it and any credit enhancement structures, including pledged collateral and third-party guarantees provided. Nonetheless, some CTP investors have previously alleged that sales practices fell short of such disclosure and risks were misrepresented (see 'Box A: The "Credit Equals Gold #1" Collective Trust Product Default').

CTPs also tend to offer investors higher yields than other WMPs to compensate (at least in part) for the undiversified credit risk, with rates of return averaging around 8.5 per cent at the end of 2014 (Graph 4). This was around 350 basis points more

8 The CTA is a CBRC-affiliated industry body providing statistics, commentary and research as well as representing the industry to the public and regulators. We use gross issuance data because data on the stock of CTP investments outstanding do not provide breakdowns by asset class or recipient industry.

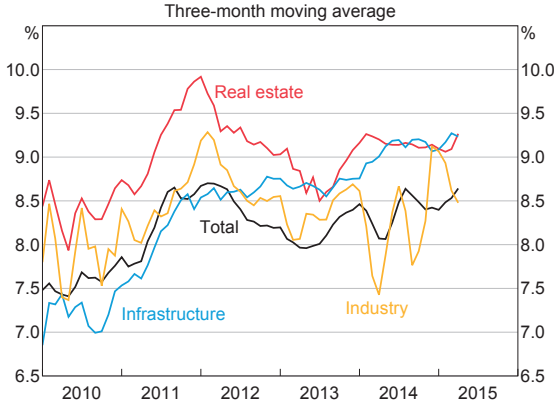
Graph 3
CTP Investments
Gross issuance



* Securities 'held to maturity' and 'available for sale'; we assume these are mostly bonds

Sources: China Trustee Association; RBA

Graph 4
Advertised CTP Returns
Three-month moving average



Sources: RBA; WIND Information

than the average return on other types of WMPs and 600 basis points more than the regulated one-year benchmark deposit rate. Compensation for exposure to real estate and infrastructure projects appears to be a little higher than the average.

Risks in Bank WMPs

The risks posed by WMPs with active bank management differ from those inherent in CTPs owing to differences in their structures. 'Pure' bank WMPs have explicit principal guarantees and typically invest a higher share of assets in relatively low-risk investments, including government bonds, interbank loans and highly rated corporate bonds (Bedford and Rothman 2013). Other on-balance sheet bank WMPs (those with direct bank-trust cooperation) also have explicit principal guarantees and hence any risks are borne by the issuing bank. In contrast, investors in WMPs without an explicit guarantee legally bear the investment risk, though in practice banks may still absorb any losses.

We assume that data on the investments of SUTPs serve as a reasonable proxy for the investments of WMPs that are not legally guaranteed. On this basis, these WMPs invest in similar assets to CTPs (predominantly loans and bonds). The investments of SUTPs tend to be a little less exposed to the property sector than those of CTPs (around 7 per cent of SUTP assets are directly invested in real estate) and a little more exposed to 'industrial & commercial enterprises' and infrastructure. An important distinction is that unlike CTPs, the investments of these WMPs are diversified across asset types.

Instead, a key risk of unguaranteed bank WMPs is the maturity mismatch between most WMPs sold to investors and the assets they ultimately fund. Many WMPs are, at least partly, invested in illiquid assets with maturities in excess of one year, while the products themselves tend to have much shorter maturities; around 60 per cent of WMPs issued have a maturity of less than three months (Graph 5). A maturity mismatch between longer-term assets and shorter-term liabilities is typical for banks' balance sheets, and they are accustomed to managing this. However, in the case of WMPs, the maturity mismatch exists for each individual and legally separate product, as the entire funding source for a particular WMP matures in one day. This results in considerable rollover risk and could force banks to use their own

Box A
The 'Credit Equals Gold #1' Collective Trust Product Default

There have been no verified reports of bank WMPs failing to repay investors. However, in several high-profile instances CTPs have failed and these provide useful case studies of the approach of Chinese institutions and authorities to defaults. The most prominent such event concerned a CTP called 'Credit Equals Gold #1'.

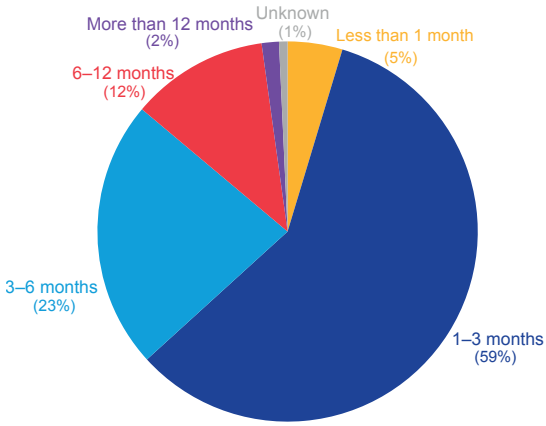
In January 2014, media reports confirmed that this product, set up by the China Credit Trust Company and marketed by the Industrial and Commercial Bank of China (ICBC), had failed. This product was issued in 2010 and raised approximately CNY3 billion for the Zhenfu Energy Group, a mining company based in Shanxi province. The CTP was intended to yield 10 per cent per annum and had a maturity of three years. The financing provided was effectively a collateralised loan; Zhenfu's shareholders sold 49 per cent of the company to the trust product and pledged to buy back this stake at maturity. They also invested CNY30 million in the product directly.

However, Zhenfu ran into legal problems regarding its other fundraising practices and, as investigations continued, most of its mining operations were suspended. As a result, the company was unable to repay the trust product upon maturity. Investors in the product lodged their complaints with ICBC and alleged that they had not been properly informed of the risks and that sales personnel had effectively portrayed the investment as guaranteed.

Ultimately, the investors were reimbursed their principal in full, though it is unclear whether investors incurred minor interest losses. ICBC initially asserted that it was not responsible for the product directly, but came under increasing pressure from investors. The authorities appear to have pushed the bank to find a solution to the problem. It reportedly extended a loan to Huarong Asset Management Company, which is one of the four large asset management companies founded in the aftermath of the 1997 debt crisis to acquire non-performing assets (Anderlini and Wildau 2014). Huarong reportedly used the funding to purchase the stake in Zhenfu from the CTP at around 95 per cent of its face value, allowing investors to be reimbursed.

These events illustrate the difficulties of accurately assessing risks arising from WMP investments. Although ICBC had only been marketing the product and had no legal responsibility for its performance, it was compelled to organise a rescue, which ensured that investors did not lose their principal. These forms of contingent liabilities are not recorded on banks' balance sheets. Nonetheless, the history of bailouts has reportedly led to the common investor perception that CTPs, and unguaranteed WMPs more generally, are implicitly guaranteed by the issuing bank or the government.

Graph 5
WMP Maturities
Gross issuance in 2014, excluding CTPs*



* Shares do not sum to 100 per cent due to rounding
Sources: RBA; WIND Information

funds to repay investors as WMPs mature, effectively bringing them onto their balance sheets.

Another concern flagged by Chinese authorities relates to banks engaging in a practice known as 'pooling'. Pooling refers to a bank combining funds raised through separately issued WMPs into a single pool of funds and investing it as one portfolio. In 2013, the CBRC banned banks from pooling WMP funds, requiring them instead to map WMPs to their investments one-to-one (CBRC 2013). However, to date not all banks have ceased to operate WMP pools, probably because they are operationally easier to manage and it takes time to change systems and operations.

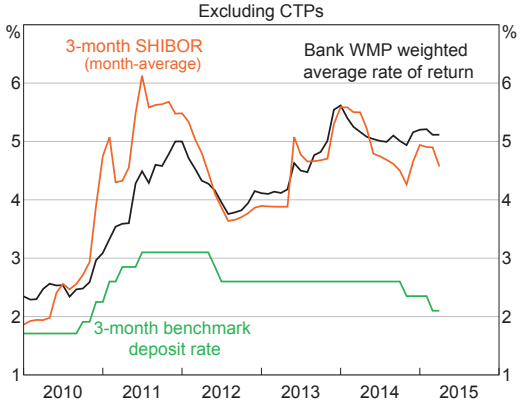
A lack of transparency in many parts of the WMP sector may also mean that investors do not have the information to price these risks correctly. WMP prospectuses issued by banks generally feature only generic statements informing potential investors that the products are not deposits and carry investment risks, and they assign a standardised risk rating. However, there is little useful information about which investments will be funded, the indicative portfolio allocations are extremely general and asset class descriptions are limited.

Moreover, a pattern of WMP bail-outs overseen by Chinese authorities and financial institutions has apparently led many investors to regard all WMPs as implicitly guaranteed and risk free, despite the contrary legal status (see 'Box A: The "Credit Equals Gold #1" Collective Trust Product Default'). As there is no track record of 'unresolved' WMP defaults, banks are reluctant to be the first to default on a product which they have issued. Chinese authorities have frequently noted their concern about the resulting existence of moral hazard issues in (some of) China's financial markets (PBC 2014, p 155).

The pricing of bank WMPs – that is, excluding CTPs – supports the notion that investors largely perceive these predominantly unguaranteed WMPs as being guaranteed by banks (which in turn are often presumed to be backed by the government). In particular, the returns offered on both unguaranteed and guaranteed WMPs track money market rates fairly closely, which could mean that investors believe they are essentially gaining exposure to banks rather than the underlying assets (Graph 6). Further, the yield spread between unguaranteed and principal-guaranteed WMPs has been stable over recent years and is notably smaller than credit spreads between banks and riskier borrowers in China (Graph 7). For example, the size of the spread is similar to that between bonds issued by state-owned banks and other large, often state-owned, companies in China.

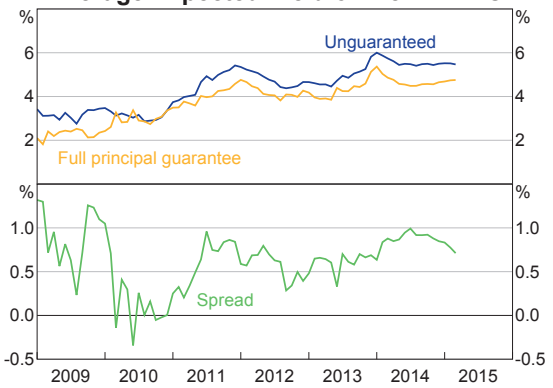
If banks were to compensate investors in the event of a default, their partners in WMP issuance are unlikely to be able to share this burden, as most channel firms, including trust companies, appear to have relatively low levels of capital and limited fundraising capabilities. The ratio of shareholders' equity to assets under management is around 2 per cent for trust companies. The recent introduction by the CBRC of a fund aimed at supporting troubled trust companies may, however, reduce the burden on banks in selected circumstances by providing a clearer mechanism for managing distressed trust

Graph 6
Interest Rates and Bank WMP Returns
Excluding CTPs



Sources: CEIC Data; RBA

Graph 7
Average Expected Yield on New WMPs



Sources: RBA; WIND Information

assets.[9] The capacity of securities firms and fund management subsidiaries to absorb losses on WMP investments is likely to be lower still.

While it is difficult to evaluate the size of unreported contingent liabilities arising from off-balance sheet WMPs, the estimated stock of WMPs within our coverage as at 30 June 2014 amounted to 11 per cent of total banking system assets (and 16 per cent of total deposits), of which three-quarters is not legally guaranteed. Using our estimate of total WMPs outstanding as at the end of 2013, more than a quarter of these WMP assets would have to fail before the aggregate Common Equity Tier 1 capital ratio of the banking system fell below the 5 per cent minimum designated by Chinese banking regulators.[10] However, this presumes that banks would have access to sufficient liquidity to meet such claims; capital ratios could fall further in the event of declining asset values and 'fire-sale' dynamics.

This exercise also does not include losses incurred on bank assets not related to WMPs, which would also be likely to increase in times of stress. Moreover, while smaller Chinese banks (i.e. not state-owned or joint-stock commercial banks) generally report capital ratios that are well above the Basel III minimum requirements, they accounted for around 45 per cent of WMPs issued in 2014 and therefore have more significant off-balance sheet exposures relative to their capital.

Conclusion

Wealth management products have become a sizeable and important feature of China's financial system. Banks have a central role in the issuance of WMPs and retain control of the investment decisions for a large proportion of products. While it is difficult to obtain precise figures, our estimates suggest that the stock of outstanding WMPs was at least CNY17 trillion as at 30 June 2014, and that the majority of these were invested in loans or debt securities. WMPs invest in a wide range of industries, including industries that are vulnerable to weak property market conditions or those experiencing overcapacity. Most WMPs are not explicitly guaranteed by the issuing bank so investors legally

9 Trust firms must contribute 1 per cent of their net assets to the fund, with the payment adjusted annually based on the previous year's assets. Trust firms will also be required to make additional contributions to the fund when they issue new trust products. Funds can be accessed as a last resort when trust firms face liquidity shortages, enter bankruptcy proceedings, or are shut down by regulators (CBRC 2014).

10 More recent data necessary for this calculation are not available. Chinese regulators conducted more formal stress tests in early 2014. These included a scenario involving banks absorbing losses of 30 per cent on on- and off-balance sheet WMPs invested in credit assets (though excluding products invested in bonds and deposits). Only one bank's capital adequacy ratio fell below 9 per cent (PBC 2014, p 157).

assume the risk of these products. A key issue is whether the presumption of implicit guarantees is upheld or the authorities allow failing WMPs to default and investors to experience losses arising from these products.

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Recent Developments in Asset Management

Fiona Price and Carl Schwartz*

The global asset management industry has grown rapidly following the global financial crisis. International standard-setting bodies and national regulators are working to better understand and, if necessary, address potential financial stability risks from this industry. A particular concern is that, in the event of a significant negative shock to current favourable conditions, some funds may experience substantial redemptions, and so be forced to engage in asset 'fire sales' that could be destabilising for the financial system. This article provides background on international developments, as well as some Australian context.

Introduction

Asset managers invest funds on behalf of clients through collective investment vehicles ('investment funds') or separate accounts. Asset managers act as agents rather than principals, providing investment services to clients for a fee. The clients bear all credit, market and liquidity risks and share any losses or gains made by the investment fund or separate account.[1] In this sense, investments with asset managers differ from deposits with banks which can be redeemed at par.

The asset management industry offers potential benefits to financial stability by diversifying risks across a large range of market participants and providing an alternative to banks as a source of funding for the real economy. However, asset managers can also give rise to risks of their own: the risks posed by leveraged hedge funds and bank-like money market funds (MMFs) have been demonstrated in past episodes internationally.[2] A particular concern in the current environment is that if market conditions deteriorated sharply, some funds may experience bank-like 'runs' and engage in asset 'fire sales' that could be destabilising for the financial system. This concern reflects strong growth in the asset management industry in recent years as investors search for yield, at the same time as liquidity has declined in some markets due to banks reducing their market-making activities in line with their lower appetite for risk and tighter financial regulation. In recent years, international standard-setting bodies and national regulators have taken steps to enhance monitoring and regulation to address the potential for this industry to pose risks to financial stability.

Industry Characteristics

Size and growth

Asset managers are estimated to have had around US$76 trillion in assets under management (AUM) globally at the end of 2013 (Graph 1).[3] While the figures are not directly comparable, this is equivalent to more than half of global banking assets.[4] Total global AUM more than doubled in size over the past decade or so. In particular, growth has been strong for North American asset managers (Graph 2)

* The authors are from Financial Stability Department.

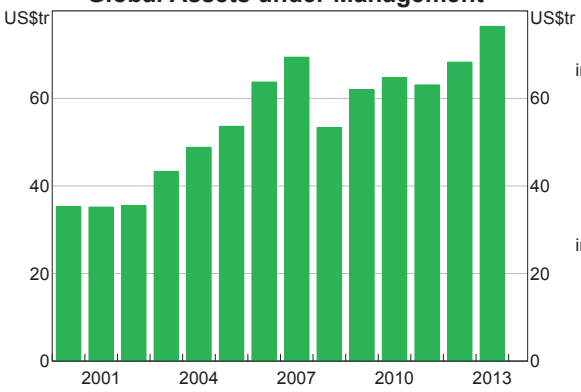
1 For investment funds, clients are equity shareholders in the fund. For separate accounts, a single institutional investor has direct ownership of the assets in the separate account.

2 See Edwards (1999) for discussion on the collapse of Long-Term Capital Management's highly leveraged hedge fund and IOSCO (2012a) for coverage of the events in the US MMF industry during the global financial crisis.

3 This estimate, taken from IMF (2015), is based on the AUM of the world's top 500 asset managers at the end of 2013. However, it will include double counting due to cross-investment among asset managers.

4 Global banking system assets are the aggregate of banking system assets in 20 jurisdictions plus the euro area (FSB 2014). Banking system assets across jurisdictions are subject to definitional differences.

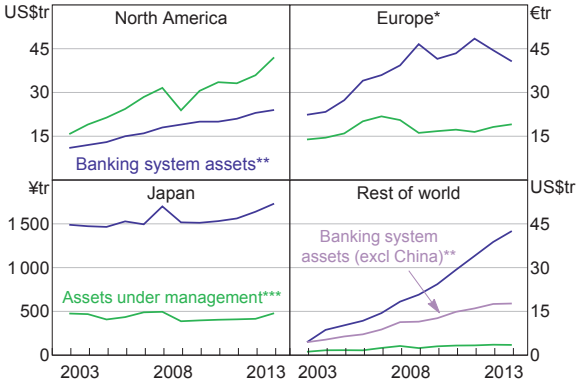
Graph 1
Global Assets under Management*



* The assets under management of the world's 500 largest asset managers; includes cross-invested assets among asset managers

Sources: IMF; Towers Watson

Graph 2
Bank and Asset Management Industries
Across regions



* Europe includes the euro area, Switzerland and the United Kingdom

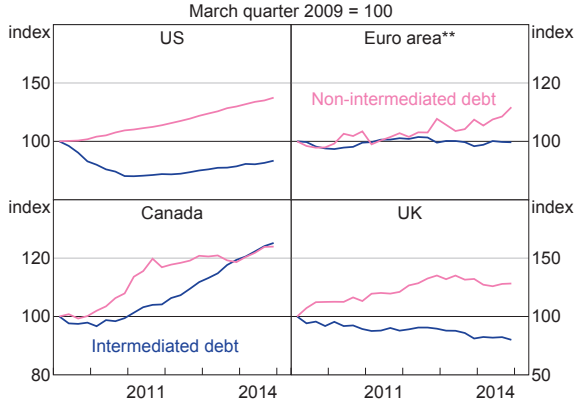
** Banking system assets are subject to definitional differences

*** The assets under management of the world's 500 largest asset managers; by manager domicile; includes cross-invested assets among asset managers

Sources: FSB; RBA; Towers Watson

and, more recently, among bond funds in a range of jurisdictions. Growth in AUM in the post-crisis period has been assisted by the low interest rate environment, which has supported growth in asset values and prompted investors to search for yield. At the same time, regulatory reforms and balance sheet repair by banks in some countries – both in response to the crisis – have encouraged non-intermediated debt funding (Graph 3).

Graph 3
Private Non-financial Corporations' Debt Funding*
March quarter 2009 = 100



* All currencies translated to home currencies

** Public and private non-financial corporations

Sources: European Central Bank; Office for National Statistics; RBA; Statistics Canada; Thomson Reuters

Concentration

Available data suggest that AUM in the asset management industry are more concentrated than assets in the banking industry, with nearly 20 per cent of AUM managed by the five largest asset managers at the end of 2013 compared with around 10 per cent of banking assets in the five largest banks (Table 1). The data show that AUM of the largest asset manager are bigger than assets of the largest banks both in dollar terms and as a share of the industry.

Types of clients and funds

Clients of asset managers can either be retail investors (individuals) or institutional investors (e.g. pension funds, insurance companies, mutual funds and hedge funds). Generally, around two-thirds to three-quarters of asset managers' client base by value are institutional investors.[5]

Asset managers' investment funds can either be public or private, with public funds accessible to both retail and institutional investors, and private

5 Around three-quarters of European asset managers' client base were institutional investors in 2014 (EFAMA 2014). In Australia, an estimated two-thirds of AUM were sourced from institutional investors in 2009 (Australian Trade Commission 2010); this proportion has likely increased more recently due to the 2013 and 2014 increases in the superannuation guarantee boosting superannuation fund balances.

Table 1: Largest Asset Managers and Banks[a]
End December 2013

Asset manager	AUM	Per cent of total AUM	Bank	Assets	Per cent of total assets
	US$b	Per cent		US$b	Per cent
BlackRock	4 324	5.7	Industrial and Commercial Bank of China	3 125	2.2
Vanguard Group	2 753	3.6	HSBC Holdings	2 671	1.9
Allianz Group	2 393	3.1	China Construction Bank	2 538	1.8
State Street Global	2 345	3.1	BNP Paribas	2 495	1.8
Fidelity Investments	2 160	2.8	Mitsubishi UFJ Financial	2 489	1.8
J.P. Morgan Chase & Co.	1 602	2.1	J.P. Morgan Chase & Co.	2 416	1.7
Bank of New York Mellon	1 583	2.1	Agricultural Bank of China	2 405	1.7
AXA Group	1 532	2.0	Bank of China	2 292	1.6
Capital Group	1 339	1.8	Barclays	2 225	1.6
BNP Paribas	1 325	1.7	Deutsche Bank	2 220	1.6
Top 10	**21 355**	**27.9**	**Top 10**	**24 875**	**17.9**

(a) Since some asset managers' funds will be institutional investors in the funds of other asset managers, there will likely be double counting in the AUM
Sources: FSB; RBA; SNL Financial; Towers Watson

funds (and separate accounts) only accessible to institutional investors. Investment funds are generally open-ended, closed-ended or exchange-traded.

- Open-ended funds allow investors to redeem their shares directly from the fund on a continuous or periodic basis (e.g. daily, monthly or quarterly). Many open-ended funds offer daily liquidity (IMF 2015). The number of a fund's shares varies over time and the share price is generally determined by the fund's net asset value (NAV).
- Closed-ended funds have a fixed number of shares that are traded among investors on stock exchanges. The share price is determined by demand and supply rather than the fund's NAV.
- Exchange-traded funds (ETFs) have characteristics of both open-ended and closed-ended funds, though they are typically referred to as open-ended funds.[6] The number of an ETF's shares can vary over time. The ETF's shares are traded between the ETF and authorised participants (usually broker-dealers) in the primary market. Authorised participants can trade these shares with investors in the secondary market, and these shares can then be traded among investors on stock exchanges. Authorised participants can engage in arbitrage trading, which usually results in the ETF's share price being close to the fund's NAV.

Pension funds and funds of life insurance corporations perform similar functions to investment funds, though these funds have a long-term liability to pay the beneficiaries (i.e. pension and life insurance claims). While this feature lowers redemption risk, these funds could still pose financial stability risks through channels such as asset fire sales or their interconnections with other financial institutions (CGFS 2011).

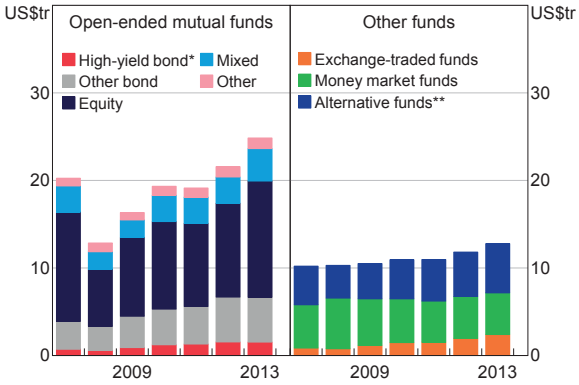
Investment strategies

Open-ended mutual funds (excluding MMFs) are the largest type of fund and are estimated to have held 41 per cent of total global AUM at the end of 2013 (IMF 2015). These funds generally invest in either bonds, equities, or a mixture of bonds and equities; within this type of fund, equity funds hold the largest share of AUM (Graph 4). Separate accounts, which

6 'Box A: How Do ETFs Work?' in Kosev and Williams (2011) provides more information on the structure of ETFs.

manage the cash of single institutional investors, are not shown in Graph 4. These accounts are estimated to have held 36 per cent of total global AUM at the end of 2013 (IMF 2015). Less is known about their asset allocation since their investment strategies vary depending on the client's mandate. However, the Securities Industry and Financial Markets Association notes that the large separate accounts managed by surveyed asset managers have limited leverage and limited holdings of illiquid securities (SIFMA 2014).

Graph 4
Global Assets Under Management
By collective investment vehicle type



* Includes advanced economy high-yield bond funds and emerging market bond funds
** Includes private equity funds and hedge funds
Sources: IMF; Investment Company Institute; RBA

In recent years, the AUM of funds investing in less liquid asset classes and pursuing more complex investment strategies has increased, which is likely to reflect investors' search for yield. At the same time, banks have reduced their market-making activities in less liquid markets due to regulatory reforms and their decreased risk appetite, which has contributed to reduced liquidity in these markets (CGFS 2014; Cheshire 2015). However, the strong investor demand for less liquid assets may have masked any structural decline in liquidity, so market participants might be overestimating liquidity. According to CGFS (2014), there is little evidence to suggest that asset managers have adjusted their investment funds' liquidity buffers or redemption terms to reflect any changes in the liquidity risks associated with their bond holdings.

Asset Management and Systemic Risk

Asset managers and their funds may have certain characteristics or engage in activities that create or amplify risk. They often undertake maturity and liquidity transformation, sometimes with leverage. Relative to banks, the financial stability concern is less about whether these characteristics or activities result in significant losses, since a broad range of clients will share these losses among themselves and, unlike claims on a bank, clients should be prepared to accept losses on their investment fund claims. Rather, the focus is on whether asset managers and their funds can spread distress to other parts of the financial system and to the real economy through the behaviour of asset managers and their clients.

The literature tends to focus on two main channels through which asset managers or their funds could transmit risk to the rest of the financial system: the market channel and the counterparty channel (see, for example, OFR (2013)).[7]

The market channel

Asset managers could potentially cause destabilising falls in asset prices if forced to liquidate assets to meet redemptions, particularly if this involves less liquid asset positions. This could arise, for example, if a fund or an asset manager faced an adverse shock that led to a loss of confidence. Open-ended funds that offer daily redemptions are susceptible to bank-like runs.[8]

If clients consider the fund to have insufficient liquid assets to meet its future redemptions without considerably affecting the fund's NAV, they may quickly try to redeem their funds. Depending on

7 In their methodologies for identifying non-bank non-insurer global systemically important financial institutions, the FSB and IOSCO also identified the substitutability transmission channel. This is where the distress or failure of an asset manager or a fund that provides a critical function or service could spread distress to market participants that heavily rely on this function or service, particularly if there are limited ready substitutes available in the market (FSB and IOSCO 2015).

8 ETFs are generally considered likely to have lower redemption risk than open-ended funds that offer daily liquidity due to their structure. IMF (2015) provides some discussion on redemption risk at ETFs.

the fund's liquidity portfolio, run-like conditions may force an asset fire sale and, depending on the pace and scale of the ensuing price adjustment, spread distress to other financial institutions holding these assets or similar assets. Even in the absence of run-like conditions, asset fire sales may still arise if a highly leveraged fund becomes subject to margin calls and liquidity constraints, or if asset managers quickly 'herd' out of an asset class.

The counterparty channel

Risks can also be transmitted through large exposures among asset managers and between asset managers and other financial institutions. The asset management industry has direct connections with many other financial institutions, including those that provide services to asset managers (e.g. broker-dealers and banks) and those that serve as counterparties for derivative contracts and portfolio investments (e.g. banks and insurance companies). In the United States, the Office of Financial Research (OFR) contends that asset managers and their funds have become increasingly connected to other financial institutions over the past decade or so (OFR 2013).

Banks in particular provide a large range of services to the asset management industry, including broker-dealer services, custodial services and the provision of credit. Some of the services provided by banks may involve asset managers giving collateral to banks that can be used for the banks' own purposes. This is referred to as the *re-use* of collateral or the *rehypothecation* of collateral.[9] While this re-usable collateral offers benefits to the financial system, such as enhancing liquidity, it can also transmit counterparty risks.

- Collateral re-use can lead to the build-up of leverage-like 'collateral chains' between banks and asset managers, increasing the risk of contagion (Singh 2011). Fischer (2015) notes that chains of interconnections based on market-valued collateral are vulnerable to distress and that longer chains of interconnections make it difficult for firms within the chain to fully understand their counterparty risks.
- If an asset manager or its broker-dealer were to experience distress, or an asset manager became concerned about the extent to which its assets had been rehypothecated, it might recall those rehypothecated assets. The broker-dealer would then have to return the equivalent amount of securities provided by the asset manager, which could put it into distress (FSB 2013a). If a broker-dealer were to fail, asset managers might have limited access to their rehypothecated assets. This could have implications for their fund's solvency if leverage has been obtained. For example, Aragon and Strahan (2012) found that hedge funds using Lehman Brothers as a broker-dealer were more likely to fail than otherwise similar funds following the Lehman bankruptcy.

As well as through exposures to other financial institutions, risks can also be transmitted through intragroup exposures. Exposures among entities within the same financial conglomerate increase the risk of contagion (The Joint Forum 1999). Even if the other entities within the group are relatively isolated from a distressed entity, potential exists for damage to that institution's brand. More than half of the largest 25 asset managers are owned by banks or insurance companies (IMF 2015). In fact, Table 1 shows that some of the largest asset managers are in the same conglomerate as the largest banks.

Recent International Regulatory Developments

International standard-setting bodies, international organisations and national regulators have taken steps to enhance monitoring and regulation of the asset management industry. This includes the package of post-crisis reforms that address 'shadow banking' more generally and, more recently, further work that builds on this in line with the

9 FSB (2013a) defines the 're-use' of collateral as any use of securities delivered in one transaction in order to collateralise another transaction and the 'rehypothecation' of collateral as the re-use of *client* assets (i.e. where the intermediary has an obligation to safeguard its client's assets).

industry's strong growth amid the low interest rate environment. For example:

- In response to the vulnerabilities in MMFs and the gaps in their regulation exposed by the global financial crisis, the International Organization of Securities Commissions (IOSCO) released policy recommendations for MMFs in 2012 (IOSCO 2012b). In the United States, the Securities and Exchange Commission recently adopted major changes to the regulation of its large MMF sector (SEC 2014). Institutional prime MMFs, considered to be the most susceptible to runs, are required to more clearly differentiate their product from bank deposits by floating their NAV rather than setting it at 'the buck'.[10] All non-government MMFs have been provided with new tools to address the risk of runs, including liquidity fees and the temporary suspension of redemptions.
- In 2012 and 2013, IOSCO released principles relating to liquidity risk management practices in collective investment schemes, including specific principles for the suspension of redemptions and the valuation of assets (IOSCO 2012c; IOSCO 2013a; IOSCO 2013b).
- The Financial Stability Board (FSB) issued its policy framework for shadow banking entities in 2013, which included policy tools designed to mitigate risks posed by investment funds that are susceptible to runs, such as those involved in credit intermediation with maturity and liquidity transformation and/or leverage (FSB 2013b). These tools included: redemption gates; the suspension of redemptions; redemption fees or restrictions; side pockets;[11] illiquid investment limits; liquidity buffers; concentration limits; leverage limits; and restrictions on the maturity portfolio of assets.
- An FSB and IOSCO workstream is continuing to develop methodologies for identifying non-bank non-insurer global systemically important financial institutions. In its second consultative document, this workstream focused on developing separate methodologies for investment funds and asset managers, as activities undertaken at both the asset manager and investment fund level were considered to potentially pose systemic risks (FSB and IOSCO 2015).
- In 2013, the OFR released a report commissioned by the US Financial Stability Oversight Council (FSOC) which included a discussion on the potential financial stability risks posed by the asset management industry (OFR 2013). And in December 2014, the FSOC sought public comments on the potential risks to US financial stability from asset management products and activities, particularly risks associated with liquidity and redemptions, leverage, operational functions and resolution (FSOC 2014).
- In its April 2015 *Global Financial Stability Report*, the International Monetary Fund suggested several improvements for the oversight of the asset management industry, including: enhancing microprudential supervision; incorporating a macroprudential perspective into the oversight of the industry; improving liquidity regulations; considering tools that effectively price-in the cost of liquidity, including minimum redemption fees since funds' redemption fees have declined over the past decade due to competitive pressures; and accounting for the products and activities of an asset manager or investment fund when determining its systemic importance (IMF 2015).
- The FSB is currently undertaking work focusing on the potential financial stability risks posed by current market liquidity issues, including those associated with asset management activities, as well as the potential longer-term financial stability risks posed by asset management activities (FSB 2015).

10 Institutional prime MMFs are only accessible to institutional investors and invest primarily in commercial paper issued by financial institutions. In the United States, these MMFs are now required to sell and redeem their shares based on the current market-based value of their underlying assets (i.e. have a floating NAV) rather than maintain a stable NAV, which is generally set at US$1 (i.e. 'the buck').

11 Side pockets are the legal separation of the impaired or illiquid portion of a fund's portfolio.

Australian Asset Management Industry

The Australian asset management industry is estimated to have had A$2.6 trillion AUM at the end of March 2015 (Table 2). This is equivalent to around 3 per cent of global AUM and around 75 per cent of the total financial assets of Australian authorised deposit-taking institutions (ADIs). Superannuation funds and funds of life insurance corporations accounted for almost 70 per cent of total AUM, while investment funds accounted for 12 per cent of total AUM.[12] The remaining AUM was sourced from funds placed with investment managers by other domestic institutions and overseas investors. The industry's AUM has more than doubled over the past decade, largely driven by the strong growth in superannuation fund balances. Conditions for the Australian asset management industry are importantly linked to global markets, given interlinkages between markets and more direct exposures, including through funds outsourced to global asset managers.

Superannuation funds are the largest sector of the Australian managed funds industry and are prudentially regulated and supervised by the Australian Prudential Regulation Authority (APRA), except for self-managed superannuation funds (SMSFs), which are overseen by the Australian Taxation Office. The FSB and IOSCO consider that pension funds pose a low risk to global financial stability (FSB and IOSCO 2015), and there are a number of features also present in the Australian superannuation industry to limit systemic risk.

Table 2: Australian Assets under Management[(a)]
End March 2015

	Consolidated assets	Share of total AUM
	A$ billion	Per cent of total consolidated assets
Superannuation funds	1 509	58
Life insurance corporations[(b)]	254	10
Investment funds	311	12
of which:		
– public unit trusts[(c)]	276	11
– cash management trusts[(d)]	25	1
All managed funds institutions	**2 073**	**79**
Other funds placed with investment managers[(e)]	546	21
Total	**2 619**	**100**
Memo item:		
– ADIs[(f)]	*3 341*	*na*

(a) Wholesale trusts are captured to the extent that managed funds institutions and other funds placed with investment managers are invested in wholesale trusts; components may not add up due to rounding
(b) Includes superannuation funds held in statutory funds of life insurance corporations
(c) Public unit trusts are investment funds that are open to the general public and allow investors to either redeem their units directly from the trust or dispose of their units on a secondary market
(d) Cash management trusts are broadly equivalent to MMFs in other advanced economies
(e) Includes the funds of other domestic institutions, such as government bodies and general insurers, and overseas investors
(f) At end December 2014; total financial assets of Australian banks and other depository corporations
Sources: ABS; RBA

12 Superannuation funds outsource a large part of their asset management, including 'effective outsourcing' to independent asset managers and 'nominal outsourcing' to affiliated asset managers (Liu and Arnold 2010).

- Superannuation funds have lower liquidity risk since superannuation is compulsory and investors cannot access their superannuation until they retire and reach the preservation age (currently between 55 and 60 years old). Also, there is limited evidence of switching between funds, which is likely to be due to investor disengagement (Industry Super Network 2010). While some funds delayed processing switching requests during the global financial crisis due to insufficient liquid assets, there was no evidence of large-scale switching between funds or investment strategies.
- The majority of superannuation funds' liabilities have little or no direct leverage.
- Available data suggest a low degree of concentration and interconnectedness among superannuation funds.
- The majority of superannuation fund assets are held in defined contribution funds, which potentially have less incentive to search for yield compared with defined benefit funds since they do not offer a guaranteed income stream (Antolin, Schich and Yermo 2011).

That said, the superannuation industry's relatively large size warrants ongoing attention to potential risks. Because they make similar investment decisions and are exposed to common shocks, superannuation funds could contribute to procyclicality. Also, these funds and their (less-regulated) service providers are highly interconnected and there is a high degree of concentration among some of their service providers (Donald *et al* 2014). While liquidity risk is currently somewhat limited by the preservation rules and investor disengagement, there is potential for it to become more pronounced as a larger proportion of fund members move from the contribution phase to the drawdown phase.

In addition to the industry being mostly represented by superannuation funds, other features of the Australian asset management industry should serve to lower systemic risk relative to the asset management industries in other advanced economies.

- Under the *Corporations Act 2001*, retail funds are required to suspend withdrawals if their 'liquid assets' are less than 80 per cent of total assets, limiting fire-sale pressure.[13] This feature was demonstrated during the financial crisis: many mortgage funds suspended redemptions in the face of increased redemption demand, limiting the need to liquidate assets.[14] While some other advanced economies allow funds or the regulator to suspend redemptions, a fund may be reluctant to take this action without the legal requirement and the regulator may not have sufficient information to suspend redemptions in a timely manner.
- The hedge fund sector is relatively small. In a 2013 review, the Australian Securities and Investments Commission (ASIC) found the sector to have low levels of leverage and concluded that these funds do not pose significant systemic risk to the Australian financial system (ASIC 2013). In recent years, ASIC has improved disclosure requirements for hedge funds open to retail investors.

Conclusion

While the asset management industry provides benefits to the financial system and the real economy, it also poses potential risks to financial stability. Since the global financial crisis, international standard-setting bodies and national regulators have taken steps to better understand and, where necessary, address the risks posed by the asset management industry. This includes steps taken in response to the crisis to address 'shadow banking' activities, and further attention in recent years in line with industry growth associated with the rise in investors' search for yield. These efforts are ongoing.

13 Assets that are considered to be 'liquid' include cash, bills, marketable securities, property of a prescribed kind or other property that the responsible entity reasonably considers able to be realised for its market value within the period provided for in the scheme's constitution for satisfying withdrawal requests. Under certain conditions, a non-liquid fund can offer withdrawals out of available cash or particular assets. For more information, see sections 601KA and 601KB of Chapter 5C of the Corporations Act.

14 Lowe (2015) discusses two episodes of redemption pressure on Australian property-related trusts.

There are a number of features of the Australian asset management industry that should serve to limit systemic risk. Nonetheless, the Australian authorities will continue to engage internationally and domestically to better understand and, if appropriate, address the risks posed by the industry.

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Skin in the Game – Central Counterparty Risk Controls and Incentives

Louise Carter and Megan Garner*

The increasing systemic importance of central counterparties (CCPs) has seen recent policy debates focus on the ability of CCPs to withstand a crisis effectively. CCPs maintain prefunded financial resources to cover the potential losses arising from the default of a clearing participant. This article discusses the incentives created by the composition of these resources, and draws out the role of transparency and governance in ensuring these incentives are effective.

Introduction

CCPs play a key role in managing post-trade risks in financial markets. A CCP stands between the counterparties to a financial market trade and makes good on the obligations that each has to the other under the terms of that trade. As a result, participants in a centrally cleared market are not directly exposed to credit or liquidity risks arising from the party on the other side of a trade. Instead, participants create exposures directly with the CCP through the process of novation.[1]

The role CCPs have played in the functioning of financial markets has increased in importance since the global financial crisis.[2] Recognition of the benefits of central clearing has driven reforms in a number of jurisdictions to encourage the use of CCPs in over-the-counter (OTC) derivatives markets, including requirements for the mandatory central clearing of certain OTC derivatives transactions.[3] A number of CCPs operating in global OTC derivatives markets are systemically important in several jurisdictions.

In line with their growing systemic importance, international standards on risk management of CCPs have been strengthened through the release of the *Principles for Financial Market Infrastructures* (the Principles) by the Committee on Payment and Settlement Systems (CPSS, now the Committee on Payments and Market Infrastructures (CPMI)) and the International Organization of Securities Commissions (IOSCO) (CPSS-IOSCO 2012a). As part of this, requirements for CCP recovery tools have been introduced to promote continuity of critical CCP services in periods of extreme stress.[4] To maintain the continuity of critical services in the event that these recovery tools prove ineffective, jurisdictions have also begun to implement resolution regimes for CCPs.[5]

* The authors are from Payments Policy Department, and would like to thank Matthew Boswell, Matt Gibson, Jenny Hancock and Mark Manning for their comments in preparing this article.

1 Novation is the process whereby the contract between the original parties to a trade is replaced by two contracts: one between the buyer and the CCP; and one between the seller and the CCP.

2 CFR (2011) discusses the role of CCPs, the risks they manage and the benefits of central clearing in the Australian context in further detail.

3 Australia has also passed legislation to provide for mandatory central clearing of certain derivatives products, in line with the Leaders' Statement from the 2009 G20 Pittsburgh Summit (G20 2009).

4 CPMI-IOSCO issued guidance on CCP recovery tools in its October 2014 report, *Recovery of Financial Market Infrastructures* (CPMI-IOSCO 2014).

5 The Financial Stability Board published guidance on the application of the 'Key Attributes of Effective Resolution Regimes for Financial Institutions' to CCPs in October 2014 (FSB 2014).

Nevertheless, the increasing systemic importance of CCPs has seen recent policy debates focus on the ability of CCPs to withstand a crisis effectively (JP Morgan Chase & Co 2014; LCH.Clearnet Group 2014; CME Group 2015; Cœuré 2015; Tarullo 2015). Some have argued that consideration should be given to the need for additional or more detailed regulatory requirements, including the need to specify the amount of a CCP's capital (the CCP's 'skin in the game') that is allocated to meet losses in the event of a participant's default, and to increase the total loss-absorbing capacity of CCPs, for example by creating dedicated CCP recapitalisation funds (JP Morgan Chase & Co 2014). Regulators have acknowledged the need to examine these issues further and will do so as part of a detailed work program on CCP resilience, recovery and resolution to be progressed over the coming year (Cœuré 2015; FSB 2015). Any proposals will have to be considered in the context of the incentives they create for the prudent risk management of a CCP, from the perspective of both the CCP and its clearing participants.

This article discusses how incentives can depend on the composition of a CCP's prefunded financial resources, which are maintained to cover the potential losses arising from a clearing participant's default. The discussion is restricted to CCPs that are listed companies, since this is the prevailing ownership structure for most current CCPs.[6] The size of a CCP's contribution to its total prefunded resources must appropriately balance the incentives for prudent risk management between a CCP and its participants. However, the effectiveness of these incentives in delivering a sound risk management framework ultimately depends on how much control each party has over a CCP's risk management framework. A CCP's risk management framework must therefore be transparent, available to all stakeholders and have governance arrangements in place that enable stakeholders to assert appropriate influence over its settings.

6 CCPs can also be user owned.

CCP Risk Controls

In the normal course of business a CCP maintains a matched book, as it stands between counterparties with opposite positions, and is not exposed to market risk. However, in the event of a clearing participant default, the CCP must continue to meet its obligations to its surviving participants and the CCP faces potential losses until such time as it can close out its exposures arising from the default.[7] These exposures arise from changes in the value of a defaulted participant's contracts with the CCP. CCPs apply a range of risk controls to manage potential losses in such a default event. These risk controls typically fall into three categories:[8]

- Margin: a 'defaulter-pays' resource whereby each clearing participant posts collateral to cover the risks associated with its positions with the CCP. Margin can usually only be accessed by the CCP in the event of default by the posting participant (i.e. margin posted by one participant cannot be used to cover losses arising from the default of another – it is not 'mutualised'). CCPs use variation margin to cover current exposures, with margin collected from those clearing participants with mark-to-market losses and paid out to those with mark-to-market gains. CCPs also collect initial margin to cover potential future exposures – the risk of adverse price changes from the time of the last variation margin payment to the time at which a defaulted participant's positions can be closed out (the close-out period). CCPs often also collect additional margins, for example to cover heightened risks associated with liquidating large or concentrated positions.

7 This article focuses on potential losses arising from a participant default. A CCP may also face risks outside of its core clearing business (such as general business risk). To the extent that a CCP does face such risks, the CCP is required to hold capital against these risks under the Principles (and the Reserve Bank's corresponding Financial Stability Standards for Central Counterparties: see RBA (2012)).

8 These risk controls build on the framework discussed in Carter, Hancock and Manning (forthcoming), which also covers the *ex ante* risk controls CCPs apply to manage their exposures (e.g. participation requirements).

- Pooled prefunded financial resources: predominantly 'survivor-pays' resources, which are used in cases where margin posted by the defaulted clearing participant is insufficient to cover losses. Pooled prefunded financial resources, commonly known as a 'default fund' or 'guaranty fund', typically comprise prefunded mutualised contributions from clearing participants and prefunded contributions from the CCP. The total value of a CCP's prefunded pooled resources is generally calibrated to cover the losses faced by the CCP in the event of the default of the participant with the largest exposures (or, in the case of CCPs that are systemically important in multiple jurisdictions, the two participants with the largest exposures) in 'extreme but plausible' financial conditions.
- Recovery tools: prefunded pooled financial resources are commonly supplemented with *ex post* promissory contributions from clearing participants, known as 'assessments'. To ensure that losses can be allocated comprehensively, CCPs are also increasingly introducing additional loss-allocation tools, such as haircutting of participants' variation margin gains.[9]

The sequence in which a CCP applies these risk controls – from margin through to pooled prefunded resources and recovery tools – is known as the CCP's 'default waterfall'. The combined value of these resources defines the value of losses arising from a participant default that a CCP could absorb without entering into insolvency.

Regulatory requirements

The CCP risk management controls described above are formalised by the CPSS-IOSCO Principles. The Principles establish a set of minimum requirements for CCPs, which are designed to promote the safe and efficient provision of CCP services, limit systemic risk, and foster transparency and financial stability.

In particular, the Principles include minimum loss absorbency requirements related to a CCP's default waterfall, to enable a CCP to deal effectively with the default of one or more participants. Reflecting the importance of defaulter-pays protections, a CCP is required to collect initial margin from its clearing participants to cover at least 99 per cent of the estimated distribution of potential future exposures during the close-out period.[10] A CCP is also required to maintain a prefunded buffer of financial resources to cover additional losses that could arise if a large participant were to default in stressed market conditions. CCPs that are systemically important in multiple jurisdictions or that clear complex products such as credit default swaps must hold additional financial resources to cover the default of any two participants.[11]

Although there are no minimum requirements on the composition or order of use of a CCP's prefunded resources, or any explicit requirements regarding the inclusion of a CCP's own funds in the default waterfall, the Principles do acknowledge the importance of the incentives created by the composition of a CCP's default waterfall. In providing for discretion in the composition of a CCP's default waterfall, the Principles seek to allow for a variety of CCP structures and operating environments. In implementing the Principles in their respective jurisdictions, a number of authorities have allowed for similar discretion.

By contrast, the harmonised regulatory framework for CCPs in the European Union (EU) – the European Markets Infrastructure Regulation (EMIR) – explicitly addresses the inclusion of a CCP's own funds in the default waterfall.[12] Under EMIR, a CCP is required to contribute a minimum amount of capital to the default waterfall that is at least 25 per cent of its

9 For further discussion of recovery tools, see CPMI-IOSCO (2014) and Gibson (2013).

10 Under the Principles, CCPs must also exchange variation margin to regularly mark clearing participants' positions to market.

11 All Australian CCPs and overseas CCPs licensed to provide clearing services in Australia are subject to this requirement.

12 Regulation (EU) Number 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

minimum regulatory capital requirement.[13] EMIR also stipulates that these resources must be drawn before the default fund contributions of non-defaulting clearing participants, in the event that a defaulted participant's margin and other contributions were exhausted.

Similarly, in the context of an application by domestic CCPs – ASX Clear and ASX Clear (Futures) – for recognition in the EU, the Reserve Bank has issued a supplementary interpretation of its Financial Stability Standards for Central Counterparties ((CCP Standards) which implement the Principles in Australia). This supplementary interpretation applies to domestically licensed CCPs in Australia that offer clearing services to clearing participants that are either established in the EU or subject to EU bank regulation (RBA 2014). The interpretation clarifies the Bank's expectation that a CCP's own resources should make up a material proportion of its pooled financial resources. In addition, a sufficient proportion of such resources should be drawn first in the event that a defaulted participant's margin and other contributions were exhausted.

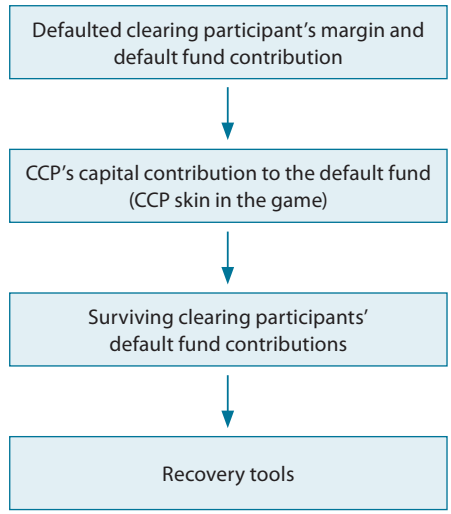
CCP risk management in practice

In practice, a number of CCPs apply default waterfalls of a similar structure. In a typical default waterfall, illustrated in Figure 1, losses arising from a clearing participant default would initially be absorbed using the defaulted participant's margin and its contribution to the default fund. If these defaulter-pays resources were insufficient, remaining losses would be applied first to the CCP's capital contribution to the default fund, followed by the mutualised contributions of the surviving clearing participants. Any remaining losses would be covered using the CCP's recovery tools, for example assessments called from the CCP's clearing participants.

A number of CCPs, including Chicago Mercantile Exchange Inc. (CME Inc.), Eurex Clearing, ICE Clear

13 Under EMIR, CCPs must hold capital against each of the following risks: operational and legal risks; credit, counterparty and market risks; business risks; and wind-down or resolution.

Figure 1: Typical CCP Default Waterfall



Source: RBA

Credit and LCH.Clearnet Limited (LCH.C Ltd), apply such a waterfall (Table 1). However, the default waterfall described above is not applied universally. Some CCPs build on the typical waterfall by applying additional layers. For example, ASX Clear (Futures) breaks participant contributions to the default fund into two tranches and would apply additional rounds of CCP capital after each tranche was exhausted. Also, Japan Securities Clearing Corporation (JSCC) would apply a second round of CCP capital concurrently with surviving participants' contributions. Other CCPs depart more significantly from the typical default waterfall, perhaps for legacy reasons or due to the nature of the markets cleared, the participant base or the ownership structure of the CCP. Examples include ASX Clear, which does not collect participant contributions, and the US-based Options Clearing Corporation, which excludes CCP capital from the waterfall.

A further, highly publicised example is the Korean CCP KRX. The default of a clearing participant in December 2013 resulted in losses that exceeded the defaulter's collateral and, in accordance with KRX's rules, remaining losses were allocated to the default fund contributions of surviving participants (ISDA 2014).

Table 1: CCP Default Waterfalls[a]

CCP	Jurisdiction	Total pre-funded pooled resources[b]	Millions
ASX Clear	Australia	ASX Clear capital:	A$250
ASX Clear (Futures)	Australia	ASX Clear (Futures) capital:	A$120
		Participant contributions, first tranche:	A$100
		ASX Clear (Futures) capital:	A$150
		Participant contributions, second tranche:	A$100
		ASX Clear (Futures) capital:	A$180
CME Inc. Base service	United States	CME Inc. capital:	US$100
		Participant contributions:	US$3 338
CME Inc. Interest Rate Swaps service	United States	CME Inc. capital:	US$150
		Participant contributions:	US$2 473
Eurex Clearing	Germany	Eurex Clearing capital:	€50
		Participant contributions:	~€3 340
ICE Clear Credit	United States	ICE Clear Credit capital:	US$50
		Participant contributions:	US$1 834
JSCC Interest Rate Swaps service	Japan	JSCC capital:	¥2 000
		Participant contributions:	¥39 800
		Additional JSCC capital:	¥2 000[c]
LCH.C Ltd SwapClear service	United Kingdom	LCH.C Ltd capital:	£30
		Participant contributions:	£2 726

(a) As at: end December 2014 for Eurex Clearing; end March 2015 for CME Inc.'s Base and Interest Rate Swaps services, ICE Clear Credit and JSCC's Interest Rate Swaps service; end April 2015 for LCH.C Ltd's SwapClear service; and June 2015 for ASX Clear and ASX Clear (Futures)
(b) In order of application following use of defaulter's resources
(c) Used concurrently with participant contributions
Sources: Selected CCP Websites; RBA

The event prompted the Korean Financial Services Commission to seek changes to legislation to ensure that CCP capital would be applied in the waterfall prior to the surviving participants' contributions to the default fund (Financial Services Commission 2015).

Incentives

The composition of a CCP's default waterfall creates incentives for clearing participants and the CCP. These incentives derive from the resources, or skin in the game, contributed by each party to the default waterfall. That is, each party is concerned about the risk that the funds it has contributed to the default waterfall will be used to cover losses arising from a clearing participant default. Each party's skin in the game can create incentives for prudent risk management by ensuring that each party bears a portion of the cost of a participant default. This can mitigate free-rider problems. It can also reduce the effect of information asymmetries associated with risk-taking and risk management that may arise between a CCP and its participants and between each of the participants of the CCP.[14] The strength of these incentives depend on where a particular

14 Free-rider problems may arise if participants do not bear the costs or risks associated with their positions at the CCP and consequently build positions with little regard to these costs or risks. Information asymmetries may arise because the CCP does not have complete information about the activities of its clearing participants outside of the CCP (and is therefore unable to fully assess the probability of that participant's default) and because each participant in the CCP does not have complete information about the CCP's risk management framework or the positions of other participants in the CCP.

party's contribution is positioned in the default waterfall, the size of this contribution and the value of resources that precede it.

Resources contributed by clearing participants

Clearing participants contribute to the default waterfall at several stages, in both a defaulter-pays and a survivor-pays capacity.

The primary defaulter-pays component in the waterfall is clearing participants' margin. Margin imposes an opportunity cost on a clearing participant that is directly linked to the risk on its portfolio, thereby providing the incentive for participants to manage the risk they bring to the CCP. This mitigates the issues associated with the free-rider problem and information asymmetries discussed above. Indeed, the Principles note that in allocating losses arising from a clearing participant default '… a [CCP] should first use assets provided by the defaulted participant, such as margin or other collateral, to provide incentives for participants to manage prudently the risks, particularly credit risk, they pose to [the CCP]' (CPSS-IOSCO 2012a, p 79, also reflected in the Bank's CCP Standards, RBA 2012, p 54). Margin also imposes a cost on a participant from walking away from its obligations, thereby reducing the incentive for strategic default (RBA 2009).

Since a defaulted clearing participant's contributions to the default fund would be used before other prefunded resources in the default fund, such contributions also provide incentives for a clearing participant to manage its own risks and not default strategically. However, depending on the size of the contribution relative to initial margin, these incentives may be less powerful than the defaulter-pays incentives arising from initial margin, since it is less immediately and directly linked to the flow of transactions submitted by that participant to the CCP for clearing. Rather, clearing participants' contributions are typically determined as a share of the CCP's total pooled prefunded resources, which will also typically be based on other participants' outstanding positions with the CCP.[15]

The survivor-pays nature of prefunded contributions to the default fund creates additional incentives for clearing participants. The risk that participants' contributions will be used to absorb losses arising from the default of another clearing participant encourages each participant to monitor the broader risk management framework of the CCP to reduce the probability of this risk crystallising. For example, a clearing participant will have the incentive to conduct due diligence on a CCP's participation requirements, its ongoing credit assessments of clearing participants, its margin methodology, the structure of its default waterfall and its readiness to manage a default. In this sense, clearing participants will often treat an exposure to a CCP similarly to any other credit exposure; that is, they will undertake a full assessment of the creditworthiness of the CCP as a counterparty, evaluate the probability that a loss is incurred and estimate the potential size of that loss.

The risk that losses will be allocated to the default fund can also encourage participants to proactively support a CCP's default management process to ensure that losses are minimised. In particular, many CCPs that clear OTC derivatives recognise and rely on this incentive, for example when requiring that participants stand ready to provide traders to the CCP (by way of secondment) to support the management of a default. Some CCPs also encourage competitive bidding in any auction of a defaulted clearing participant's positions by drawing first on the default fund contributions of those participants that bid least competitively.

The strength of incentives created by clearing participants' contributions will depend on their

15 The total value of pooled prefunded resources is generally calibrated to cover the losses faced by a CCP in the event of the default of the participant with the largest exposures or, in the case of CCPs that are systemically important in multiple jurisdictions, the two participants with the largest exposures. Nevertheless, CCPs typically calculate each participant's contribution to the pooled prefunded resources as a pro-rata share based on the risk that participant brings to the CCP – for example, based on each participant's share of total initial margin. This provides some incentive for a participant to manage its positions.

relative size and positioning within the default waterfall. Participants' contributions to a default waterfall that follows the typical sequencing outlined above are less likely to be used to cover losses if defaulter-pays resources and/or the CCP's own capital account for a large proportion of a CCP's default waterfall. All else being equal, such a scenario could result in participants having a limited incentive to take an interest in the risk management of the CCP or to actively support the CCP's default management process.

The allocation of losses to surviving clearing participants at later stages in the default waterfall (e.g. via recovery tools such as assessments and haircutting of participants' variation margin gains) will also provide incentives for clearing participants to support the CCP's default management process and to monitor the CCP's risk management framework. However, the positioning of these resources later in the typical default waterfall, and the relatively low likelihood that these resources would be used, may result in such incentives being somewhat weaker than those arising from prefunded contributions to the default fund.

Resources contributed by the CCP

The incentives arising from a CCP's contribution to the default waterfall have been widely discussed recently (JP Morgan Chase & Co 2014; LCH.Clearnet Group 2014; CME Group 2015; Cœuré 2015). As with surviving clearing participants, CCPs have an incentive to minimise the risk that their own resources will be used to cover losses from the default of a clearing participant. This exposure encourages the CCP's owners to manage risks prudently, for example by setting appropriate margin requirements and through monitoring of participants. The question then arises as to how large this exposure needs to be to generate the optimal incentive for the CCP.

Ultimately, a CCP's total loss-absorbing capacity must be sufficient to cover the potential losses faced by the CCP during periods of financial market stress. However, the distribution of losses among the contributing parties can significantly influence incentives. As discussed above, to encourage sound risk management and minimise free-rider problems and the effect of information asymmetries, each party should contribute to the CCP's total loss-absorbing capacity in proportion to the level of risk that they bring to the CCP. However, unlike clearing participants, the CCP does not have proprietary exposures in the markets it clears. Rather, the CCP maintains a balanced book at all times, which becomes unbalanced only in the event of a clearing participant's default.[16]

Nevertheless, the CCP has ultimate control over its risk management framework and faces an incentive for prudent risk management that derives from its contribution to the default waterfall. This is similar to the incentive arising from non-defaulting participants' contributions – that is, the CCP has an incentive to ensure that its risk management framework minimises the potential losses it may face in the event of a clearing participant default. The strength of this incentive is determined by the value of the CCP's resources at risk in the event of a participant default. That is, the CCP's incentives for prudent risk management are likely to be optimised by requiring its skin in the game to be a material portion of its own capital – and this would be true irrespective of the size of the CCP's skin in the game relative to the size of its total default waterfall.

The strength of the incentive created by a CCP's skin in the game also depends on its position in the default waterfall. Positioning the CCP's contribution to the default waterfall directly after the prefunded resources of a defaulted clearing participant would maximise the CCP's incentives to manage risk conservatively, while maintaining the generally accepted defaulter-pays principle. In this situation, the CCP has an incentive to set margin as high as it can in order to preserve its own capital. The CCP will do so within the limits set by the preferences

16 That is, although a CCP may become a transmission channel for financial market stress – by allocating losses to participants as part of the default waterfall or in recovery – it is not itself an initial trigger for such stress (Heath, Kelly and Manning 2015).

of its clearing participants, who would balance the opportunity cost of posting initial margin (which affects a participant's willingness to trade) against the reduced risk of bearing losses arising from the default of another clearing participant (Carter *et al* forthcoming).

There are also threshold effects associated with appropriately sizing a CCP's skin in the game. For instance, the contributions of a number of the CCPs in Table 1 (above) account for between 1 and 6 per cent of prefunded pooled resources. All other things equal, small changes to a CCP's skin in the game around these low levels are unlikely to result in material changes in the balance of clearing participant and CCP incentives for prudent risk management. Conversely, a very large increase in a CCP's contribution to the default waterfall relative to clearing participant contributions may reduce participants' incentives to take an active interest in the CCP's broader risk management framework.[17]

Factors other than incentives are also relevant for determining the appropriate size of a CCP's contribution to the default waterfall. For example, replenishment of the CCP's capital contribution may be more difficult and costly than replenishment of the same total value of contributions from a dispersed group of clearing participants. If a CCP's skin in the game accounts for a significant proportion of its balance sheet, replenishment of its contribution to the waterfall may require the CCP to raise significant external funds which, all other things equal, may prove difficult in a period of financial market stress.

The role of governance and transparency

The ordering and relative sizes of contributions by the CCP and by clearing participants to the default waterfall influence the incentives of each party to monitor and manage risks to the CCP. However, the effectiveness of these incentives in delivering a sound risk management framework also depends on how much control each party has over a CCP's risk management framework (Kroszner 2006).

Ideally, the structure of a CCP's default waterfall should ensure that the party that is best placed to set prudent risk controls has the greatest incentive to do so. Clearing participants are able to respond directly to incentives presented by the margin component of their contributions to the waterfall, by changing their portfolio of trades and the corresponding risk that they bring to a CCP. Accordingly, in the event of a default, the defaulted participant's contributions to the default waterfall should be used first, since it is the ultimate decision-maker regarding its exposures to the CCP. In addition, the CCP's contribution to the default waterfall should be used first to absorb losses that exceed the defaulter's collateral, as the CCP is the ultimate decision-maker regarding its overall risk management framework.

The concept of control over a CCP's risk management framework is also relevant for clearing participants' contributions to the pooled prefunded resources that are included in the default waterfall. However, a clearing participant's ability to act on the incentives created by this component of its contributions may be limited. Specifically, a clearing participant cannot act on incentives related to the CCP's broader risk management framework unless it has a clear understanding of that framework, as well as a voice in the governance of the CCP.

In this regard, details of a CCP's risk management framework, such as its default management and loss allocation procedures, must be transparent, available to all stakeholders and clearly define the extent to which the CCP has discretion over certain actions. This requirement for transparency is reflected in the Principles. In particular, the Principles (and the Reserve Bank's corresponding CCP Standards) set out specific disclosure requirements regarding a CCP's publication of data, operating rules, and key policies and procedures. CCPs are also required to regularly compile and publicly disclose information relevant to the CPSS-IOSCO *Principles for Financial*

17 A large amount of CCP skin in the game relative to total participant contributions may be optimal where participant monitoring of a CCP's risk management framework is costly. For example, when a CCP has a large number of very small participants.

Market Infrastructures: Disclosure Framework and Assessment Methodology (CPSS-IOSCO 2012b), and, from January 2016, meet the CPMI-IOSCO *Public Quantitative Disclosure Standards for Central Counterparties* (CPMI-IOSCO 2015).

In addition, a CCP's governance arrangements should provide all parties potentially exposed to losses associated with the CCP with effective channels to assert appropriate influence over the CCP's risk management framework (Kroszner 2006). This fundamental requirement is also reflected in the Principles (and the Reserve Bank's corresponding CCP Standards), which require a CCP's governance arrangements to 'include appropriate consideration of the interests of participants, participants' customers, relevant authorities and other stakeholders' (CPSS-IOSCO 2012a, p 27). This includes mechanisms for participant representation on a CCP's board, participant and user committees and consultation processes for material changes to a CCP's risk management framework.

Conclusion

The composition of a CCP's default waterfall creates various incentives for clearing participants and the CCP. These incentives all need to be balanced to ensure appropriate risk management outcomes are delivered. In the face of different operating environments, market structures and types of participants, there are likely to be a range of alternative default waterfall structures where the incentives of a CCP and its participants are effectively aligned. Accordingly, there is no single optimal default waterfall structure or quantitative measure of the resources used within a default waterfall that would apply in all circumstances.

However, for a CCP's default waterfall to encourage effective risk management, it must ensure that those with control over the risk management framework have the incentives to deliver prudent outcomes and that those who are exposed to losses have influence over the CCP's risk management framework. The amount of a CCP's own funds contributed to the default waterfall should therefore be material to the CCP, regardless of the materiality of this contribution to the total size of the default waterfall. One way to achieve this might be to link the CCP's contribution to a CCP's total regulatory capital, as occurs under EMIR. In the event of a clearing participant default, a material part of the CCP's capital should be used first to absorb any losses in excess of a defaulter's collateral.

In addition, the defaulter-pays and survivor-pays resources contributed by clearing participants to the default waterfall provide participants with an incentive to control their exposures to the CCP and take an interest in the broader risk management framework of the CCP. In order for this incentive to be effective, the CCP's risk management framework must be transparent and clearing participants must have appropriate input into this framework.

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