Bulletin

SEPTEMBER QUARTER 2012

Reserve Bank

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The *Bulletin* is published under the direction of the Publications Committee: Christopher Kent (Chairman), Ellis Connolly, Jacqui Dwyer, Peter Stebbing, James Holloway and Chris Thompson. The Committee Secretary is Paula Drew.

The *Bulletin* is published quarterly in March, June, September and December and is available at www.rba.gov.au. The next *Bulletin* is due for release on 20 December 2012.

For printed copies, the subscription of A$25.00 pa covers four quarterly issues each year and includes Goods and Services Tax and postage in Australia. Airmail and surface postage rates for overseas subscriptions are available on request. Subscriptions should be sent to the address below, with cheques made payable to Reserve Bank of Australia. Single copies are available at A$6.50 per copy if purchased in Australia.

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Bulletin Enquiries

Information Department
Tel: (612) 9551 9830
Facsimile: (612) 9551 8033
Email: rbainfo@rba.gov.au

ISSN 0725–0320 (Print)
ISSN 1837–7211 (Online)

Print Post Approved
PP 243459 / 00046

Forecasting Business Investment Using the Capital Expenditure Survey

Natasha Cassidy, Emma Doherty and Troy Gill*

Business investment is a key driver of economic growth and is currently around record highs in Australia as a share of GDP. In compiling forecasts for business investment, the Reserve Bank uses a variety of different indicators, including information from liaison as well as survey measures of firms' investment intentions. The most comprehensive survey is the Australian Bureau of Statistics' (ABS) quarterly survey of Private New Capital Expenditure and Expected Expenditure (Capex survey). While firms' expectations of capital expenditure from the Capex survey are a useful guide for forecasting business investment, the relatively large forecast errors suggest that the Capex expectations data should be used in conjunction with other sources of information.

Introduction

Business investment accounted for around 17 per cent of Australia's GDP in the first half of 2012 and is forecast to increase further over the next year, driven by investment in large-scale mining projects. As outlined in Connolly and Glenn (2009), the Bank uses a variety of models, data sources and indicators to forecast business investment. Both the Bank's extensive liaison program, covering a range of businesses across different industries and regions, and private sector business surveys provide information on whether firms intend to increase or decrease their capital expenditure in the future.[1] Information from liaison as well as private providers of data on key projects also helps to construct forecasts of investment, while data on capital imports and non-residential building approvals are used by the Bank as another guide to near-term investment trends.

But the most comprehensive source of information on planned business investment is the ABS survey of Private New Capital Expenditure and Expected Expenditure (Capex survey).[2] This differs from other surveys in that it reports firms' actual capital expenditure in the reference quarter, as well as their estimates of future expenditure over a period of up to one and a half years ahead.

Outline of the Capex Survey

The quarterly Capex survey contains estimates of actual and expected new capital expenditure for private businesses across a broad range of industries. It is released eight weeks after the end of each quarter and around one week prior to the release of the national accounts. The survey provides information on both spending in the most recent quarter (in both nominal and real terms) as well as firms' intended investment spending in the future (in nominal terms only). Expectations for a particular financial year are surveyed from around six months prior to the start of that year, resulting in six progressive estimates of capital spending (and one final reading of actual spending). As an example, the December quarter 2010 Capex survey provided

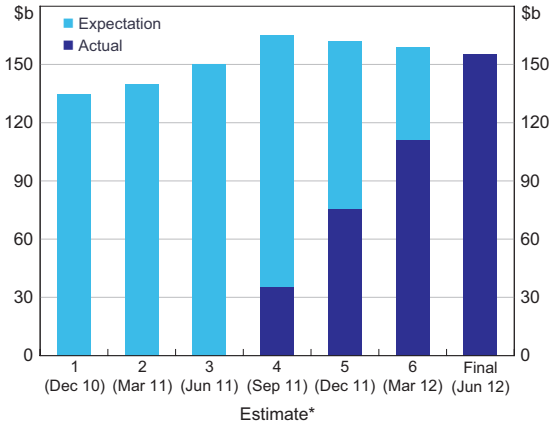
* The authors are from Economic Analysis Department.

1 Park (2011) demonstrated that there was a short-term positive correlation between trend quarterly growth in business investment and business survey measures of capital spending.

2 See ABS Cat No 5625.0 'Private New Capital Expenditure and Expected Expenditure, Australia'.

the first reading of firms' expectations for capital spending in 2011/12 (Graph 1).[3]

Graph 1
Capital Expenditure Survey
Timing of estimates for 2011/12

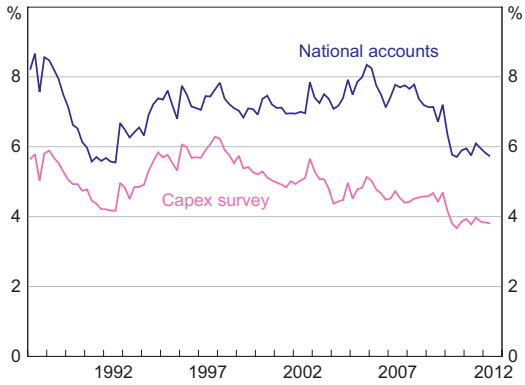


* Quarter in which the estimate was published in brackets
Source: ABS

The Capex survey data are key inputs into the national accounts measure of business investment. However, there are some important differences between the coverage of, and concepts used in, the two releases. First, the Capex survey excludes firms from a number of key industries – namely agriculture, health care, education and public administration – which accounted for 17 per cent of economic output and 7 per cent of private investment in 2010/11. Second, the Capex survey provides disaggregated capital expenditure for some industries on a quarterly basis, whereas investment volumes by industry is only available in the annual national accounts (and includes public corporations). Finally, the Capex survey provides estimates of expenditure on machinery & equipment and buildings & structures, whereas the national accounts measure of business investment also includes estimates of mineral & petroleum exploration and investment in research & development, software, and livestock & orchards.

The ABS uses the Capex survey as the key indicator for the quarterly national accounts measure of machinery & equipment investment, but the national accounts measure also includes industries not sampled in the Capex survey. As a result, the Capex measure of spending only captures around two-thirds of total machinery & equipment investment (Graph 2). There can be large differences between growth in the Capex and national accounts series at times, particularly around turning points in the cycle; the mean absolute difference between quarterly growth in the two series over the past 20 years or so is 1.8 percentage points, although this has narrowed in recent years (Table 1). Nevertheless, there is a reasonably close correlation between the two measures.

Graph 2
Machinery & Equipment Investment
Share of nominal GDP

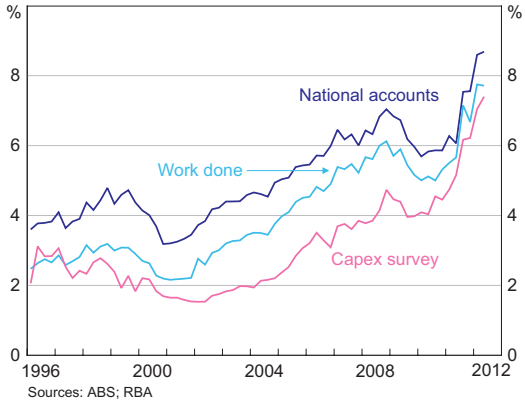


Sources: ABS; RBA

In contrast to machinery & equipment investment, the primary indicators for quarterly buildings & structures investment are the two 'work done' surveys – the Building Activity Survey and the Engineering Construction Survey (Graph 3). These surveys are released around the same time as the Capex survey. However, there are important conceptual differences between how investment is recorded in the work done surveys and how it is

3 Firms provide three figures for each survey: actual expenditure in the reference quarter, a short-term expectation and a longer-term expectation. For a given financial year, say 2011/12, the first estimate was available in the December quarter 2010 survey as a longer-term expectation. The third estimate was available from the June quarter 2011 survey as the sum of both shorter-term expectations and longer-term expectations. In the next three quarters (the fourth, fifth and sixth estimates, respectively), the estimates are derived from actual expenditure (for the completed part of 2011/12) and expected expenditure (for the rest of the year). The final reading in the June quarter 2012 survey provided actual expenditure in 2011/12.

Graph 3
Buildings & Structures Investment
Share of nominal GDP



Sources: ABS; RBA

captured in both the Capex survey and the national accounts. These differences have implications for the timing of when investment is reported by these surveys. In the work done surveys, estimates of construction are based on the value of work physically done on a building or engineering site in the quarter, as reported by builders, whereas the Capex survey measures the purchases of buildings and engineering in the quarter, as reported by businesses (that is, the builders' clients).

The ramp-up in large-scale mining engineering projects – where the timing of work and transfer of ownership can differ substantially – has made the distinction between the work done surveys and the Capex survey increasingly important. For example, a structure that has been constructed offshore and then imported, such as part of a modular liquefied natural gas (LNG) processing plant, is recorded in the Engineering Construction Survey only once it

Table 1: Quarterly Indicators of Business Investment Growth
Mean absolute difference, percentage points

	National accounts investment		
	Machinery & equipment	Non-residential building and engineering[a]	Engineering
Capex survey			
Machinery & equipment			
– Full sample	1.8		
– Past 3 years	1.1		
Buildings & structures			
– Full sample		7.1	
– Past 3 years		4.2	
Buildings & structures (Mining)			
– Full sample			9.1
– Past 3 years			7.1
Surveys of work done[b]			
Building & engineering			
– Full sample		1.9	
– Past 3 years		3.1	
Engineering			
– Full sample			3.3
– Past 3 years			4.4

(a) Buildings & structures
(b) Building Activity Survey and Engineering Construction Survey
Sources: ABS; RBA

has been imported and installed on-site in Australia. In contrast, both the Capex survey and the national accounts record such investment by the mining company as ownership progressively changes (typically approximated by progress payments made during its construction).[4] The rising importance of these types of high-value mining-related structures means that there has been a closer relationship between the Capex survey and national accounts measures of buildings & structures investment in recent years (Table 1).

How Useful is the Capex Survey for Forecasting?

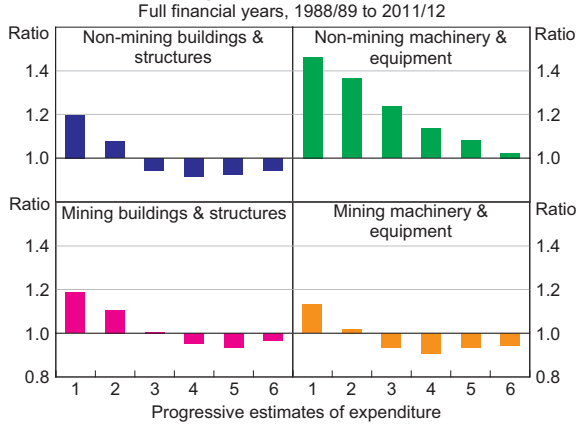
The capital expenditure data for the latest quarter are useful for estimating growth in the corresponding business investment component of GDP for the same quarter, as the Capex survey is released one week earlier than the national accounts. Rather than simply using the published quarterly change in the Capex data as the estimate, the accuracy of the estimates of the national accounts measures can be enhanced by estimating simple regressions to find the best relationship between quarterly movements in the Capex and national accounts series. This approach adjusts for any systematic differences between the two series; other indicators can also be included in the regression to improve the relationship.

The Capex survey information on firms' expected capital spending, available for a period of up to one and a half years ahead, are used by the Bank to guide near-term forecasts of business investment. However, translating the Capex expectations data into an investment forecast is not straightforward. First, the expectations data need to be adjusted for certain biases in firms' expectations. The adjusted nominal capital expenditure estimates then need to be converted into a profile for the national accounts measure of nominal investment, taking into account the historical differences between the two measures (which reflect differences in concepts and coverage); this nominal profile must then be combined with forecasts of investment prices to generate a forecast for real investment.

Firms' expectations of future capital expenditure can differ from their realised capital expenditure because circumstances change (for example, economic growth may turn out stronger than expected) and because they systematically misjudge future expenditure (owing to difficulty planning well in advance and certain tendencies firms have when responding to the survey). In order to be meaningful, the expectations data must be adjusted for any such systematic bias. The degree to which expected capital expenditure over- or underestimates the actual outcome can be illustrated with a 'realisation ratio', calculated as the ratio of the actual and expected outcome for a given period. Realisation ratios tend to vary depending on how far ahead the estimates are made, the type of investment, the industry undertaking the investment and the size of the firm. Accordingly, these different tendencies need to be taken into account when adjusting the expectations data.

Later estimates of capital expenditure for the full financial year tend to be more accurate (with a realisation ratio closer to 1) than earlier estimates (Graph 4). This improvement in accuracy is consistent with the inclusion of actual capital expenditure data as the financial year progresses, as well as more certainty

Graph 4
Average Realisation Ratios
Full financial years, 1988/89 to 2011/12



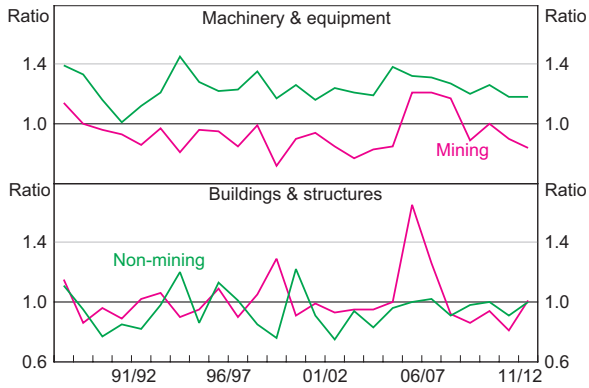
Sources: ABS; RBA

4 For more detail on how mining investment is recorded in ABS publications, see ABS (2012).

around firms' capital spending at shorter horizons. This pattern is particularly noticeable for machinery & equipment investment in the non-mining sector; early estimates tend to substantially underestimate actual capital expenditure, such that actual expenditure is on average nearly 50 per cent higher than the first estimate, but this error diminishes with time. For the mining sector, the first estimate of machinery & equipment investment also tends to be an underestimate, but subsequent estimates tend to overstate the amount of investment that will be undertaken, with little improvement in accuracy as the financial year progresses. A similar pattern is evident for buildings & structures investment (in both the mining and non-mining sectors). These differing tendencies are likely to reflect small firms accounting for a larger proportion of machinery & equipment investment in the non-mining sector; many small businesses do not report any expected capital expenditure, thereby contributing to the underestimation (Burnell 1994). Elsewhere, the tendency to overestimate investment may reflect unanticipated delays in the construction of large buildings & structures projects, and mining projects in general.

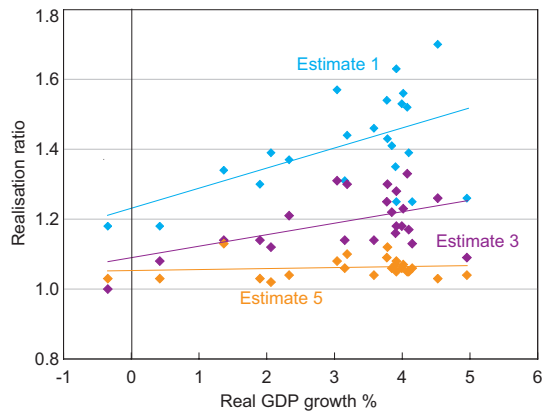
Realisation ratios also tend to fluctuate through time, broadly consistent with changes in business conditions (Graph 5). The future trading conditions a firm expects as it formulates its capital expenditure plans may be very different to the trading conditions prevailing at the time that the capital spending is due to be undertaken. As a result, conditions may be more positive or negative than expected, leading firms to revise their near-term capital expenditure plans. For example, in the mid 2000s, commodity prices increased much more quickly than mining firms expected, resulting in much stronger investment than they had planned initially (in contrast to the usual pattern of actual expenditure falling short of expectations). For more detail on how the Capex survey has tracked the progress of the mining investment boom, see 'Box A: A Case Study of Mining Investment'. The tendency for realisation ratios to vary with business conditions is stronger at longer horizons, reflecting the greater uncertainty about conditions further out (Graph 6). It is also stronger for machinery & equipment than buildings & structures investment, and for non-mining firms rather than mining firms, possibly owing to the longer lead times for buildings & structures and mining projects. In general, the volatility of realisation ratios over time lessens for progressive Capex estimates, which again probably reflects the inclusion of actual capital expenditure data in full-year estimates as the financial year progresses, as well as more certainty for firms at shorter horizons.

Graph 5
Realisation Ratios
For expectations at the start of the financial year*



* Estimate 3
Sources: ABS; RBA

Graph 6
Machinery & Equipment Realisation Ratio and Real GDP Growth
Financial years

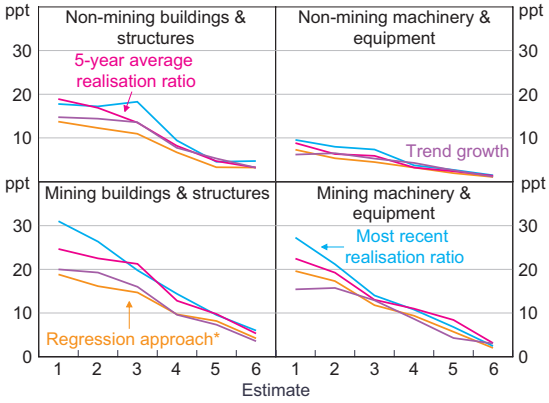


Sources: ABS; RBA

To generate more accurate forecasts from Capex expectations, the data need to be adjusted to account for these characteristics. First, sectors and asset types should be adjusted separately given different tendencies to over- or underestimate future capital expenditure. However, the choice of the appropriate realisation ratio to apply, for each estimate, asset type and sector, is difficult to determine. If the realisation ratio tended to vary randomly, a longer-run average would be likely to be most accurate. In contrast, if the realisation ratio tended to be more persistent, say because it reflected short-run economic dynamics, a shorter average might be more accurate. However, realisation ratios may also be influenced by longer-run business cycle fluctuations, which these approaches may not adequately capture. One alternative approach is to use a simple regression, whereby the current year realisation ratio is estimated as a function of the previous year's realisation ratio (as realisation ratios have demonstrated some persistence year-to-year) and a measure of business conditions (such as from the NAB business survey).

For expectations of capital expenditure growth in a financial year, the regression approach generally produces more accurate forecasts of the actual outcome than using the previous year's realisation ratio, a five-year average realisation ratio, or a naïve forecast of long-run average growth (Graph 7). Moreover, this result generally holds across estimates, asset types and sectors (except perhaps for mining machinery & equipment, in which case a forecast of longer-run average growth tends to perform best) and also against other regression approaches using GDP forecast errors or commodity prices as indicators of cyclical shocks. Nonetheless, the errors are still quite large. For example, for mining buildings & structures, if at the beginning of the financial year (estimate 3) the best estimate using the regression approach was for zero growth, the results suggest that the actual outcome would be between a rise of 15 per cent and a fall of 15 per cent only half of the time. In particular, early estimates of machinery & equipment investment

Graph 7
Capex Expectations Errors
Mean absolute error, year-average growth



* Explanatory variables are previous year's realisation ratio, business conditions, and a constant (for mining, the business conditions variable is omitted)
Sources: ABS; RBA

are little better, if at all, than a naïve forecast based on long-run average growth, suggesting that these estimates are impressionistic at best. Errors for the realisation-ratio adjustment approaches generally decline with progressive estimates, as the full-year estimates include progressively more actual data, but the errors for estimate six remain surprisingly large, given that three quarters of actual data are available at this time. Forecasts of growth in non-mining machinery & equipment capital expenditure tend to be more accurate than forecasts in the other categories, in line with generally lower growth in this type of investment.

While the full-year expectations data tend to typically attract more attention, the Capex survey from the third estimate includes shorter-term expectations data (that is, the quarter-ahead or half-year expectations). This can also be used for forecasting purposes and provide an indication of how spending will be apportioned through the year. The results indicate that using the quarter-ahead forecasts available in the fourth and sixth estimate produces forecasts that perform as well, or better, than other forecasting approaches. However, the errors generally remain large, tentatively suggesting that a firm's expectations do not improve significantly with shorter horizons.

Box A

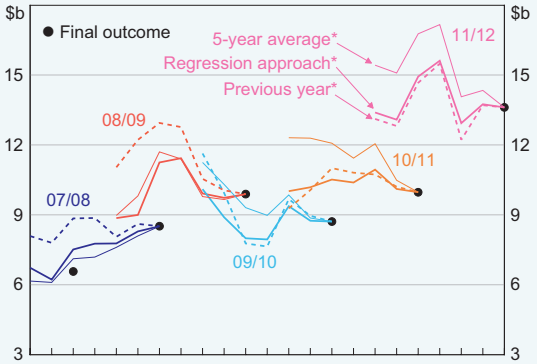
A Case Study of Mining Investment

The recent trends in mining investment provide a case study of the usefulness of the Capex survey in forecasting business investment. The latest Capex data suggest that mining capital expenditure fell by 7 per cent in 2009/10, reflecting deferrals of spending by mining firms following the global financial crisis and associated falls in commodity prices. In the two years to June 2012, mining investment increased by over 130 per cent and is expected to post a further sharp increase in 2012/13, underpinned by work on large-scale LNG projects.

The Capex survey shows how mining companies pared back expectations for capital spending in 2008/09 and 2009/10 during the global financial crisis (Graph A1). Expectations for machinery & equipment spending were scaled back somewhat more aggressively than expectations for buildings & structures investment, which is consistent with spending on buildings & structures investment having a longer lead time.

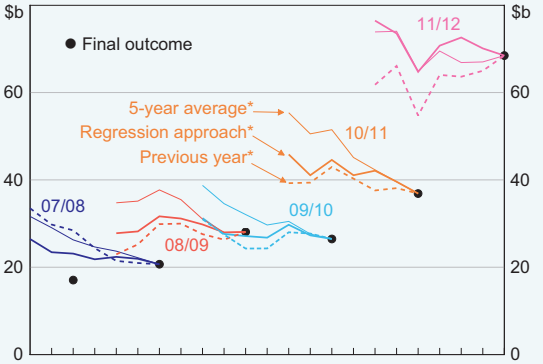
The Capex survey also predicted the sharp rises in mining investment over the past two years well in advance. The large increase in 2010/11 was predicted by the first Capex estimate for that year, made in the December quarter 2009. At that time, an adjustment of the raw Capex data using the range of approaches outlined in the article would have suggested that mining buildings & structures expenditure in 2010/11 could have increased by between 50 and 110 per cent (Graph A2). Over the course of the next 18 months, however, mining companies responding to the Capex survey gradually revised down their expectations of capital expenditure in 2010/11, resulting in realised spending on buildings & structures investment around 40 per cent higher than in 2009/10, somewhat lower than initially envisaged. Similarly, the Capex survey pointed to a large rise in mining buildings & structures investment in 2011/12, starting with the first estimate for that year made in the December quarter 2010. Again, using a

Graph A1
Machinery & Equipment – Mining
Expectations vintages



* Realisation ratio estimation method
Sources: ABS; RBA

Graph A2
Buildings & Structures – Mining
Expectations vintages



* Realisation ratio estimation method
Sources: ABS; RBA

range of adjustments to the raw Capex data at that time would have suggested an increase in mining buildings & structures capital expenditure in 2011/12 of between 70 and 105 per cent. Expectations of spending were also revised a little lower over time, with the latest Capex survey suggesting that mining buildings & structures investment in 2011/12 increased by 85 per cent.

If used on their own, the Capex expectations data have tended to overpredict the upswing in mining investment over the past two years, with the realisation ratios for both 2010/11 and 2011/12 at the low end of historical experience. This may be because the mining projects under way are large and complex in nature – particularly the projects in the LNG sector – and there have been unanticipated delays in work on these projects. Indeed, the latest expectations data for 2012/13, contained in the June quarter 2012 Capex survey, suggest that mining capital expenditure could increase by anywhere between 30 and 50 per cent. Forecasters must translate these expectations into forecasts for the corresponding national accounts measures, and to gauge the effect on GDP growth they would also need to forecast investment prices over the next year. The experience of the past few years shows that the forecast errors are non-trivial for mining investment, and highlights the fact that the Capex forecasts need to be interpreted with caution and augmented by other quantitative and qualitative data.

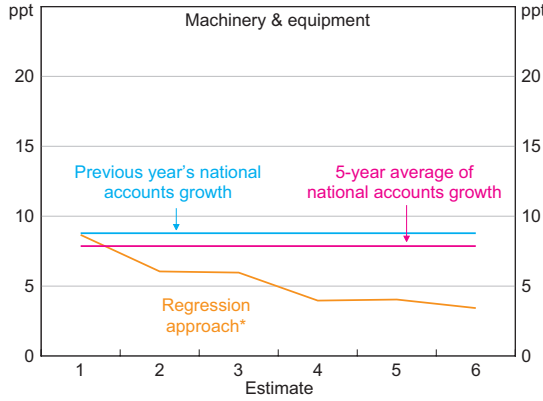
Comparison with the National Accounts

For the Capex survey to be used to forecast the national accounts measure of business investment, these Capex forecasts must be translated into profiles for the corresponding components of business investment, taking account of the differences in terms of the concepts and coverage of the series. To assess the usefulness of Capex expectations, the errors of Capex year-average growth expectations (based on the regression approach) relative to actual growth in the national accounts measure can be compared with two naïve forecasts: year-average growth in the national accounts in the previous financial year and the average growth in the previous five years.[5]

As noted earlier, quarterly movements in the Capex and national accounts measures of machinery & equipment are highly correlated (in both real and nominal terms). However, as the Capex measure has a narrower industry focus, and the national accounts measure also incorporates data from other sources, the two measures can diverge (see Graph 2). This introduces an additional source of error when using Capex expectations to forecast movements in the national accounts measure of machinery & equipment investment. Aside from forecasts based on the first Capex estimate, the Capex expectations outperform both of these naïve forecasts, although for the fourth to sixth estimates the outperformance will partly reflect the inclusion of actual data as the financial year progresses (Graph 8).

As with machinery & equipment investment, the Capex and national accounts measures of buildings & structures investment move in a broadly similar fashion, but owing to the various differences outlined earlier, quarterly and annual changes in the series often differ, sometimes by a substantial margin (see Graph 3). Once again, this introduces an additional source of error when using Capex forecasts to predict movements in the national accounts measure of buildings & structures investment.

Graph 8
Capex Expectations Errors
Mean absolute error from growth in national accounts



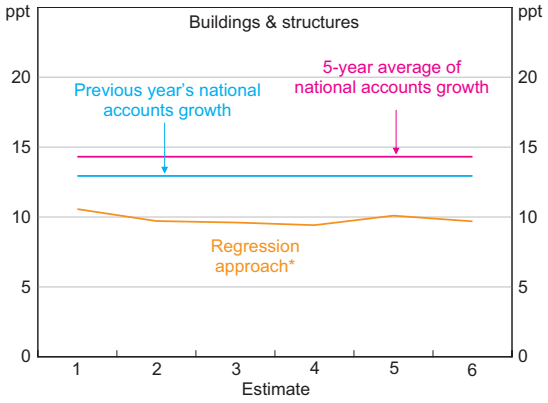
* Explanatory variables are previous year's realisation ratio, business conditions and a constant
Sources: ABS; RBA

The sizeable errors in predicting the actual Capex measure of buildings & structures investment using Capex expectations are compounded when the expectations are used to predict movements in the national accounts measure. As a result, Capex expectations (based on the regression approach) produce large mean absolute errors when used to forecast annual growth in the national accounts measure of buildings & structures investment, but nonetheless easily outperform naïve forecasts (Graph 9). It is notable that little improvement in forecast accuracy is observed with progressive estimates.

This analysis can be put into context by looking at the implications of the June quarter 2012 Capex survey, which provides the third estimate of capital expenditure in 2012/13. The adjusted expectations data (based on the regression approach) imply that the national accounts measure of buildings & structures investment will increase to around 9¾ per cent of GDP, though the results suggest that there is only a 50 per cent chance that the outcome will be between 9 and 10½ per cent of GDP. The same

5 This illustrative analysis using full-year Capex forecasts, for both machinery & equipment and buildings & structures investment, could be replicated using the various half-year and quarter-ahead Capex forecasts.

Graph 9
Capex Expectations Errors
Mean absolute error from growth in national accounts



* Explanatory variables are previous year's realisation ratio, business conditions and a constant
Sources: ABS; RBA

analysis would imply machinery & equipment investment will increase slightly to around 6 per cent of GDP, with a 50 per cent chance that the outcome will be between 5¾ and 6¼ per cent of GDP.

Conclusion

Capex forecasts of nominal growth in capital expenditure that are based on expectations data are useful for forecasting growth in the national accounts measures of business investment. They provide a guide to general trends in investment, both across industries and over the near term. In order to generate meaningful forecasts of investment, however, the Capex expectations data need to be adjusted for their systematic bias and their tendency to fluctuate with the business cycle. A simple regression that does this tends to outperform naïve forecasts of growth in national accounts investment. However, the analysis in this article suggests that there are large forecast errors associated with using the Capex survey. Accordingly, forecasts derived from the Capex survey must be interpreted with a fair degree of caution by forecasters, and its use as a forecasting tool should be augmented with other qualitative and quantitative information.

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Supply-side Issues in the Housing Sector

Wing Hsieh, David Norman and David Orsmond*

Supply-side factors can affect the responsiveness of new dwelling construction to changes in housing demand. Recent reports and liaison with industry participants point to a range of supply-side rigidities in the Australian housing market, including the length and complexity of the planning process, issues related to the provision and funding of infrastructure, land ownership and geographical constraints, and other challenges related to infill development. In recognition of this, governments have made some progress in addressing these concerns.

Introduction

Despite being just 3–4 per cent of GDP, the construction of new houses and apartments tends to have a significant effect on overall developments in the Australian economy, reflecting the volatility in new dwelling investment, its strong links with spending on household durables and its sensitivity to interest rate movements. While the factors that underpin housing demand have traditionally been the focus when explaining the cycles and trends in new dwelling construction, it has been increasingly recognised that supply-side factors can add to the cost of housing construction and impede the ability of the housing industry to respond in a timely manner to changes in demand (see, for instance, COAG Reform Council (2011), National Housing Supply Council (2011), Productivity Commission (2011), Yates (2011) and Housing Supply and Affordability Reform (HSAR) Working Party (2012)).

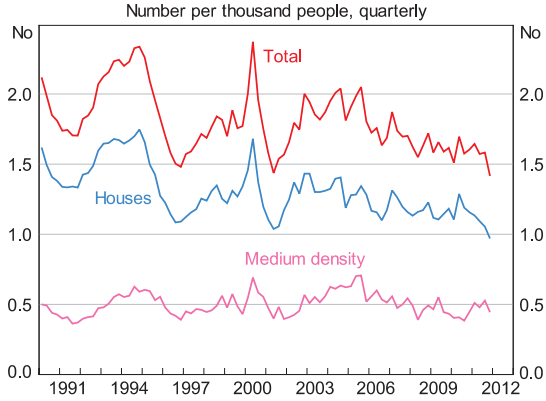
As part of its business liaison, the Reserve Bank regularly meets with a wide range of developers, builders, state and local government agencies and housing industry associations across Australia. Drawing on these discussions as well as recent industry reports, this article summarises the factors that industry participants suggest are the main supply-side rigidities within the housing sector. The article also discusses recent policy initiatives that aim to address these concerns.

* The authors are from Economic Analysis Department.

Recent Developments in Dwelling Construction

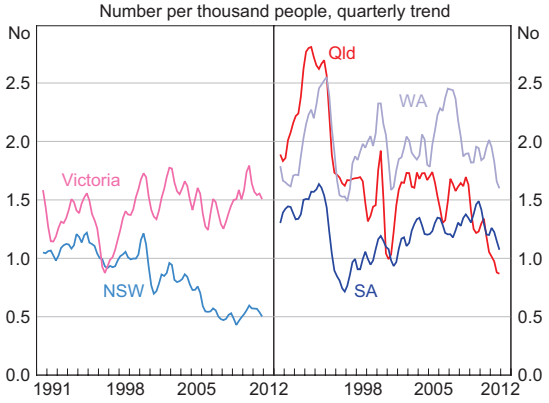
Housing demand fundamentals were strong over much of the past decade, underpinned by a high rate of population growth, relatively low unemployment rates and the strong growth in household income. At the same time, however, the number of new residential dwellings built relative to the size of the Australian population declined, although there was considerable variation between the states (Graphs 1 and 2). These developments have led some

Graph 1
Residential Building Completions
Number per thousand people, quarterly



Sources: ABS; RBA

Graph 2
Residential Building Completions by State
Number per thousand people, quarterly trend



Sources: ABS; RBA

commentators and industry participants to suggest that supply-side constraints have played a role in explaining the weak level of housing construction activity in Australia over the past decade. While most industry participants note that demand-related factors have weighed heavily on housing construction in the past few years – including the reduced willingness of households to take on debt following the global financial crisis – looking ahead, they point out that the ability of the housing sector to respond to an increase in demand will depend on how well a range of supply-side issues are addressed.

Overview of the Process for Greenfield and Infill Housing Developments

Housing supply policies and processes are largely the domain of state governments and local councils. State governments generally set the outer urban boundary of their capital cities and, in conjunction with local councils, determine the areas in which they will permit new dwellings to be built. New dwellings can be built either on the city fringe ('greenfield developments') or within existing urban areas ('infill developments'). Historically, between one-half and three-quarters of new dwellings have been built in existing urban areas; the main exception is Perth where the majority of new development is for free-standing homes on greenfield sites. Infill developments include large medium-density developments (primarily former industrial, or 'brownfield' sites) as well as low-rise medium density developments (less than four storeys) and single homes that are usually built by small and medium-sized developers.

The process of converting vacant land into a dwelling can be divided into six broad (and in some cases overlapping) stages:

- **Land identification and release:** Identification by state government of an area that has urban development potential; this stage may include the development of a strategic plan.
- **Rezoning to residential:** Rezoning of the identified land for residential purposes by local councils and state agencies; this is often initiated by a developer but may be initiated by the government in line with its strategic plan.
- **Detailed site planning and approval:** Involvement of the relevant agencies to provide basic infrastructure such as roads, water, schools and health facilities. Determination of the level of infrastructure fees paid by the developer to the state government, local council and/or infrastructure providers.
- **Subdivision and development support:** Typically initiated by the developer and usually the responsibility of a local council; covers issues such as the layout of local roads, lot sizes and streetscapes.
- **Major civil works and issuing of titles:** Development of the engineering designs for the subdivision and provision of services, usually in stages for large release areas; titling of lots.
- **Development approval and dwelling construction:** Housing design approval by local council and construction.

Industry participants note that impediments and delays can occur at each of these steps. While it is difficult to be definitive, in recent years the process to convert farmland to new dwellings seems to

have taken around six or more years, although the amount of time, and the time taken at each stage, has varied across the capital cities and even within local councils of the same city.[1] For infill development, the process is shorter given the presence of existing infrastructure, but it has often taken around five years to move from a brownfield site to housing construction, depending on variables such as the extent of any contamination to the site and opposition to development plans. The time taken to build single dwellings in infill areas is usually shorter, but again can be subject to significant delays.

Housing Supply Impediments

Several supply-side factors have been cited in recent official reports and by industry participants as being responsible for delaying the availability of new residential developments and raising the cost of their provision (see, for instance, the National Housing Supply Council (2010), Productivity Commission (2011) and HSAR Working Party (2012)). The factors identified can be broadly classified into four inter-related groups.

Complexity of the planning process

The complex planning issues and delays that occur at each stage in the process are commonly cited as 'front and centre' when it comes to understanding why housing supply has not been more responsive to changing demand factors. Industry participants argue that the following factors lengthen the time it takes to negotiate development approvals and create uncertainty about the likelihood of its eventual success:

- a lack of coordination between the various agencies involved, including local councils, utility and other infrastructure providers, as well as state planning and environmental departments
- uncertainty about planning standards, development assessment policies and state and federal environmental laws, all of which can change during the development process
- negotiation of infrastructure requirements, and delays in governments or utility providers installing infrastructure
- insufficient resources at councils to assess zoning and development applications quickly
- limited scope for automatic approval of complying building applications
- local opposition to urban expansion and high-density developments (see also below).

While there are sound reasons for councils and government agencies to impose stringent tests during the planning phase, the uncertainty and time typically taken to settle planning issues can increase the cost and risk of housing development. In particular, because developers incur holding costs on land (both the cost of financing its acquisition and land tax), the time it takes to get through the planning process increases total development costs. And since the economic viability of a new development is ultimately capped by the prices of existing housing in nearby areas, increases in costs due to a protracted planning process can make new housing developments unviable.

Provision and funding of infrastructure

Residential landholdings cannot be developed unless there is sufficient infrastructure – primarily water, sewerage, transport and energy – in place to service the new residences. Historically, state governments covered the cost of providing infrastructure for new housing from general tax revenue. Over recent decades, state policies have shifted toward user-funding of infrastructure, which has meant a significant increase in the private cost of development. Infrastructure charges raise the final sale price, reduce developer margins and/or lower the value of the undeveloped land, all of which can make the process of housing development less viable.

There are three broad types of infrastructure costs: charges to cover the provision of utilities such as water, electricity and sewage for new developments;

1 While this article concentrates on supply-side issues in capital cities, there is evidence that the issues raised affect regional cities to some extent as well.

charges by the state government for roads and other transport services; and charges by councils to fund community services for new and existing residents (including parks, childcare centres, libraries, community centres, recreation facilities and sports grounds). Developers often fund at least half of new utility and transport infrastructure in Sydney, Brisbane, Perth and Adelaide. However, the way this occurs varies among the state capitals. In Sydney, a fixed-rate levy is typically paid to the state government; in south-east Queensland, developers pay the state or local council a negotiated fee to arrange the infrastructure; while in Perth and Adelaide, developers negotiate directly with utility providers and the departments of transport. In many cases, developers in these cities may be able to recover some of this cost from subsequent developments that share the use of this infrastructure, although this entails a financing cost until the urban boundary catches up. In contrast, in Melbourne the state government funds most of these costs. With regard to community infrastructure charges for greenfield developments, in all capital cities these are generally charged to developers. The cost of this infrastructure charge can vary significantly across councils.

In addition to the cost itself, uncertainty surrounding the eventual level of the infrastructure charges is also a challenge. Infrastructure costs imposed by councils or utility providers in a number of states can be subject to negotiation on a case-by-case basis, and so can vary considerably across developments in ways that are difficult to predict upfront.

Infrastructure charges also apply to infill developments. While they are generally lower than for greenfield developments due to the presence of existing services, these charges can also vary significantly across sites, largely based on the adequacy of existing infrastructure. Infill infrastructure charges tend to be calculated as a share of the construction cost, but they too can be subject to negotiation between the builder and council concerned.

Land ownership and geographical constraints

An additional impediment to the conversion of identified greenfield land to market-ready lots can be the structure of land ownership at the city fringe. In north-west Sydney and in pockets around Perth, land on the urban fringe is fragmented by 'market garden' style blocks. As these cities have grown in size, having multiple owners at the fringe makes it more difficult and costly to consolidate and bring large parcels of land to market. Liaison contacts note that existing landholders often resist selling for lifestyle reasons and/or because their price expectations exceed the current market valuation. Fragmented ownership of land can also be an issue for infill development if developers are unable to accumulate a sufficient number of adjacent lots to make high-density development viable.

Too much concentration of ownership of land zoned for development at the fringe can, in principle, also be an issue. There have been occasional concerns about developers with large holdings of zoned land 'drip feeding the market' with small parcels in order to maintain the price of land at the fringe. Nonetheless, the general feeling among most housing industry participants, and reaffirmed recently by HSAR Working Party (2012), is that concentrated land holdings are not a widespread issue given the significant tax and interest holding costs involved; recent falls in greenfield land prices support this contention (see below for further details).

Expanding the city fringe further can also be particularly difficult in cities such as Perth and Sydney that have natural geographical constraints. In Perth, the coastal sands in the metropolitan region that are easy to build on have already been developed and the remaining englobo land – land identified as eligible for housing but not yet rezoned or serviced – involves considerable geological and infrastructure issues. In Sydney, there is a high risk of flooding in regions close to the Nepean River that lies west of the city's major growth centres, and there are large national parks to the north and south of the city.

Public attitudes towards infill development

Much of the future demand for new housing in each capital city is expected to be met by development in infill areas. As noted, infill development also faces some of the challenges discussed above, particularly those associated with the complex planning process. However, an additional barrier to the flexibility of the supply of new infill dwellings occurs when there is community opposition to development.[2] Proposed developments can attract opposition from existing residents concerned about the possible change in the character of the suburb, environmental issues, the increase in congestion and/or perceived loss of value in their homes.

In some instances, these concerns can result in developments not being approved or only being approved with restrictions that make the projects less viable. Council requirements are sometimes perceived to lack transparency, and there are claims of development applications being refused for criteria not specified in advance. Councils, on the other hand, claim that many of these issues arise when developers do not engage with them earlier in the process, which would have enabled the councils to identify aspects that were unlikely to be subsequently approved. In other cases, developers may secure council approval, but then be subject to legal challenges from the local community. The costs of holding land while developers negotiate with the local community and council or engage in disputes can render a project unprofitable by the time it is eventually completed. These types of concerns may increase over time as more residents move to the inner-city areas, and thereby boost the number of people consulted when considering future development approvals.

Impact on the Overall Cost of Development

It is difficult to estimate accurately the impact that supply impediments have had on the total cost of housing development. As noted, infrastructure charges are, in principle, explicit, but nonetheless vary considerably by state and location. In addition, many of the factors highlighted above incur an indirect cost by lengthening the time it takes to progress through the development stages, which requires longer finance periods than would otherwise be required. Furthermore, regulatory issues can increase the risk of development, which in turn raises the expected margin required before a development can proceed.

Nonetheless, information is available to assess the impact of some of these factors on the total cost of greenfield and infill development, at least in representative suburbs in the capital cities. Data commissioned for the National Housing Supply Council from Urbis (2011) indicate that the cost of infrastructure in a typical three-bedroom greenfield location in Sydney in 2010 was around $44 000 per lot, though other reports suggest that this could be as high as $70 000 in other suburbs of Sydney (Table 1). The cost of infrastructure was somewhat lower in Perth and Brisbane, at between $20 000 and $30 000 in the same period, with again a wide variation within cities. These estimates were much lower in Adelaide, though in liaison, industry participants suggested that costs were typically closer to those charged in Brisbane.[3] In contrast, infrastructure charges were lower at around $12 000 in Melbourne since developers cover only community infrastructure. For infill developments, the cost of infrastructure varies based on the location of the site; Urbis (2011) estimates that the cost for a two-bedroom apartment was around $15 000 for a typical development in Sydney and Brisbane, but only a few thousand dollars in Melbourne and Perth.

2 The redevelopment of existing blocks of apartments is also challenging, and requires agreement by all owners.

3 The difference is likely to reflect Urbis's (2011) choice of suburb, since Salisbury in Adelaide is a relatively established suburb with reasonable existing infrastructure.

Table 1: Greenfield Infrastructure Development Charges
Thousands of dollars per lot in 2010

City	Indicative cost[(a)]	Range
Sydney	44	15–70
Melbourne	12	12–17
Brisbane	26	15–40
Perth	21	na
Adelaide	7	na

(a) Selected regions are Kellyville (Sydney), Wollert (Melbourne), Redbank Plains/Springfield (Brisbane), Wellard (Perth) and Salisbury (Adelaide)
Sources: Productivity Commission (2011); RBA; Urbis (2011)

In addition to infrastructure charges, there can be a range of other government charges on housing development that vary by state. These typically added a further $13 000 to costs for greenfield developments in Sydney and $8 000 to the costs for Melbourne in 2010, with either land taxes or council rates quite sizeable in these cities (Table 2). In contrast, in Brisbane and Perth these charges add only marginally to the cost of infrastructure, since other forms of government charges are of minimal importance.[4]

Overall, aggregating these taxes and charges imposed by governments for representative suburbs in each state, Urbis (2011) estimates that in 2010 government charges (excluding GST) levied on developers amounted to around $60 000 per greenfield dwelling in Sydney, and between $20 000 and $30 000 per greenfield dwelling in other cities. For infill developments, total government charges levied on developers were typically around half those for greenfield developments, at $20 000 to $25 000 per apartment in Sydney and Brisbane and around $10 000 per apartment in Melbourne and Perth. The lower figure for infill development relative to greenfield development reflects the significantly smaller charges for infill infrastructure.

These data suggest that in 2010, government charges (excluding GST) added around 5 per cent to the cost of each greenfield dwelling in Melbourne, 10 per cent in Brisbane and Perth, and a bit less that 15 per cent in Sydney. The percentages were much lower for infill apartments, with government charges adding around 2½ per cent to the overall cost of building infill apartments in Melbourne and Perth and around 5 per cent in Sydney and Brisbane. These charges can be quite significant compared with the margins earned by developers of dwellings: Urbis (2011) data indicate that between 9–14 per cent of the final sale price was retained as gross profit for developers (from which they would have needed to pay overheads), with the margin for Sydney greenfield developments much lower. These margin levels may also account for the concerns that industry representatives note in regard to the indirect costs and risks associated with the uncertainty of the eventual amount of the government charges, and more broadly the delays they face during the planning period that add to the indirect cost of construction.[5]

Government Response

It is widely accepted that some planning regulation is important and that new housing infrastructure needs to be funded. However, there has been recognition by governments at all levels that current policies may impose unduly complex and prolonged restrictions and thereby raise the costs and limit the flexibility

4 GST levied on the final sale price of new dwellings adds a further $50 000 for infill apartments and houses in Sydney, or around $40 000 for houses in other states (with these differences fully reflecting differences in the cost base from which GST is levied).

5 A further implication from these data is that construction costs amount to around half of the final sale price of new dwellings and, as noted by Urbis (2011) and Kelly, Weidermann and Walsh (2011), are significantly higher (in levels) for apartments than for houses. The data also show that land acquisition is a high share of the total development cost. In contrast to the costs of construction, land acquisition costs vary significantly by state, although this variation is sensitive to the representative suburb selected in each of the capital cities.

Table 2: Development Costs and Margins
Thousands of dollars per dwelling in 2010; selected regions[a]

	Sydney	Melbourne	Brisbane	Perth
Greenfield[b]				
Total development costs	500	366	307	311
Of which:				
Land	135	55	25	38
Construction	214	221	202	196
Services and finance	94	68	51	52
Government charges[d]	58	21	29	25
– Infrastructure and council fees	44	12	27	22
– Transfer duties[e]	8	3	1	2
– Land tax and council rates	5	5	1	1
Margins (per cent)[f]	3	10	9	14
Infill[c]				
Total development costs	487	438	425	464
Of which:				
Land	90	35	45	71
Construction	283	314	283	297
Services and finance	90	78	77	85
Government charges[d]	24	11	21	12
– Infrastructure and council fees	14	3	17	7
– Transfer duties[e]	5	2	2	4
– Land tax and council rates	5	6	2	1
Margins (per cent)[f]	10	14	14	12

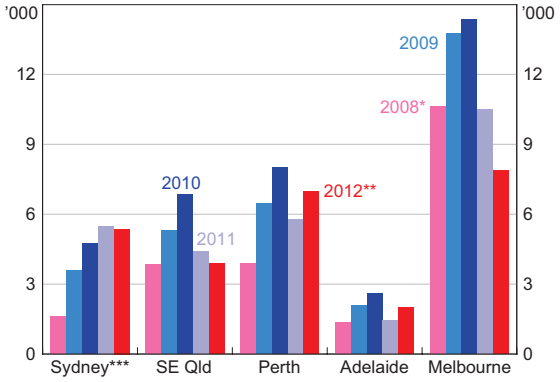
(a) Selected greenfield regions are Kellyville (Sydney), Wollert (Melbourne), Redbank Plains/Springfield (Brisbane), Wellard (Perth); selected infill regions are Mascot (Sydney), Brunswick (Melbourne), Indooroopilly (Brisbane) and East Perth (Perth)
(b) Assumes a three bedroom house
(c) Assumes a two bedroom apartment in a multistorey block of 50 apartments
(d) Excludes GST on final sale price; net GST paid during development is zero as GST payments are fully remitted
(e) Includes stamp duty paid by developers, but excludes stamp duty paid by final buyers
(f) Calculated as gross profit divided by final sale price; gross profit estimates are calculated as the sale price minus total development costs and GST paid on final purchase price
Sources: RBA; Urbis (2011)

of housing supply. In response to these concerns, greater attention has been paid to these issues in recent years at state and local levels, as well as by intergovernmental bodies such as the Council of Australian Governments (COAG), and several studies and policy initiatives have already been undertaken.

One response has been to accelerate the release of greenfield land. For example, the Victorian Government widened the urban growth boundary for Melbourne in mid 2010, adding 43 600 hectares of additional land, and a further 6 000 hectares was added this year. Likewise, there have been a number of rezonings undertaken in Adelaide in 2010 and 2011 that have seen large tracts of new land released. In part reflecting these efforts, the number of developed lots released increased significantly in the capital cities in 2009 and 2010 (Graph 3).[6]

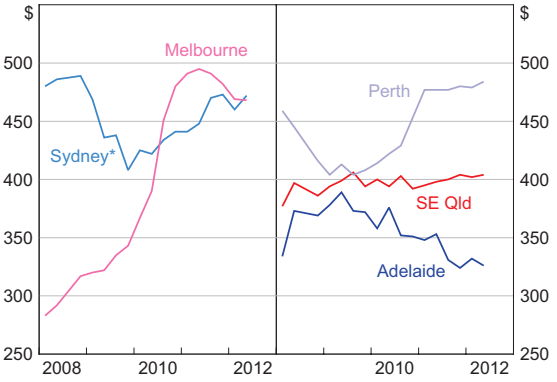
6 The number of new lots released has fallen significantly since 2010 as developers pulled back on new projects due to weak demand.

Graph 3
New Land Releases
Number of lots per annum



* Calculated as number of sales annually plus change in stock of land
** First six months, annualised
*** Includes Wollongong and Newcastle
Sources: Research4/Charter Keck Cramer; RBA

Graph 4
Median Land Price by City
Per square metre



* Includes Wollongong and Newcastle
Source: Research4/Charter Keck Cramer

Since then, in the context of soft demand conditions, land prices have fallen in Adelaide and have come down somewhat in Melbourne (Graph 4). These rezoning actions have relaxed the first two steps in the land development process outlined earlier, which should enable new supply to be able to be brought to market more rapidly as demand strengthens over time.

A second response has been the establishment of centralised state authorities to deal with major new residential development proposals. Most mainland states now have such authorities operating – including Development Facilitation Services in Queensland and the Development Assessment Panel in Western Australia – with a number having been established within the past two years. The purpose has been twofold. In some cases, the authority is intended to address community opposition to infill development, balanced in some instances by an earlier focus on community engagement and concerns. In other cases, the purpose of the authority has been to streamline the development process by acting as a coordinator between the multiple government agencies and infrastructure providers involved. Thus far, there have been mixed responses as to whether these authorities have achieved their stated aims, and some states have returned greater control to local councils.

A third response has been to streamline the approvals process by allowing projects that are code compliant to be approved within certain time frames and with a simpler application process. For example, the residential design 'R-code' in Perth has been expanded to reduce restrictions on higher-density developments, and in Sydney, complying developments can be assessed within 10 days. Indeed, HSAR Working Party (2012) reported that greater use of code complying assessment was helping to reduce development costs and increase housing supply. In a related development, there has also been greater emphasis on precinct planning in Melbourne and Adelaide, whereby councils approve and publish a development plan for a broad growth area that then acts as a framework against which individual development submissions are assessed. This has given more clarity about what is permissible prior to commencing planning, and is reported to have taken perhaps six months off the total time required to bring new land to market.

A fourth response has been efforts to cap infrastructure costs in Sydney and Brisbane. In New South Wales, the state government imposed a $20 000 cap per lot on local council charges in infill areas and a $30 000 cap per lot in greenfield areas, although around 20 councils have been granted exemptions. In Brisbane, charges for infrastructure

have been capped at $20 000 for dwellings with one to two bedrooms and $28 000 for dwellings with three bedrooms or more, which has reduced charges in some areas but has reportedly seen other councils that previously charged less raise their levies. However, these caps in Sydney and Brisbane do not cover all possible charges for infrastructure. Ultimately, these difficulties reflect the challenge of funding infrastructure, since any reductions in developer-financed funding need to be replaced with revenue from other sources so as to enable councils to continue to provide a full range of services to the local area.

Looking Ahead

A range of supply-side issues in the housing sector has received considerable attention by state and local governments in recent years and efforts have been undertaken to increase the ability of housing supply to better respond to changes in demand. In the Bank's liaison, industry representatives generally report that the changes in policies introduced to date have made some difference to the time, cost and risk involved in undertaking new residential developments, although they caution that the supply process remains challenging. Given the difficulties involved in satisfying the large number of stakeholders involved in the housing supply process, it is likely that these important issues will remain on the policy agenda for some time.

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Chinese Urban Residential Construction

Leon Berkelmans and Hao Wang*

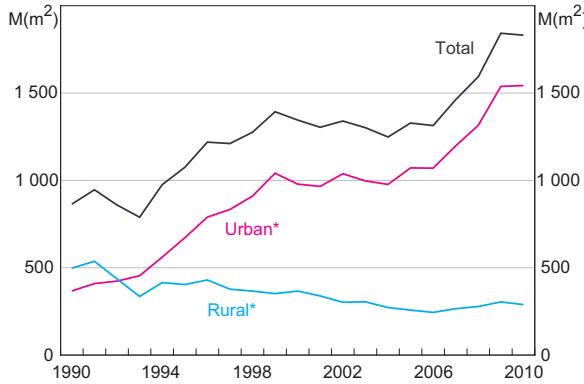
Rapid urbanisation in China has been a key driver of global steel demand and therefore demand for iron ore and coking coal. This article considers the medium- and long-term prospects for residential construction in China and their implications for steel consumption. Residential construction is projected to remain at a high level for the next couple of decades. Steel consumption in this sector is expected to be boosted further by demand for higher quality buildings. Some alternative scenarios are considered, examining both upside and downside risks.

Introduction

In 2010, China constructed more residential floor space than the entire dwelling stock in Australia. This high level of construction follows two decades of strong growth, during which the amount of annual floor space completed more than doubled. All of this increase in residential construction has been driven by construction in urban areas, while construction in rural areas has stagnated (Graph 1).[1]

Residential construction is an important source of Chinese growth; directly, dwelling investment is estimated to have accounted for around 9 per cent of GDP in 2011, compared with 5½ per cent in 2004 (Graph 2). As a consequence, China's increased appetite for raw materials has resulted in a significant increase in Australian commodity exports, especially for iron ore and coking coal. This article looks at some factors that are integral to the residential construction boom in China – such as urban population, dwelling size and dwelling demolitions – and also considers

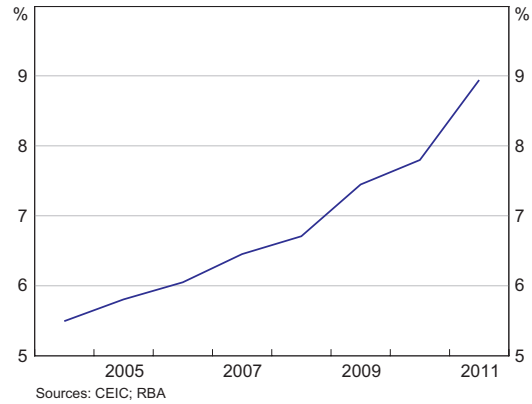
Graph 1
China – Residential Floor Space Completed



* Urban floor space completed plus rural floor space completed with construction that uses a 'reinforced concrete structure'; rural is total minus estimated urban floor space

Sources: National Bureau of Statistics of China; RBA

Graph 2
China – Dwelling Investment
Per cent of nominal GDP



Sources: CEIC; RBA

* The authors are from Economic Group.

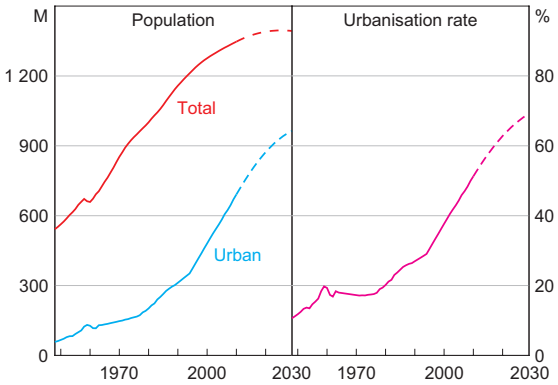
1 Urban residential floor space construction reported here is different from the official data published by the National Bureau of Statistics of China. The measure here includes rural residential buildings with a 'steel structure', which accounts for 70 per cent of total rural construction in 2010. These buildings, which would usually be multistorey, are treated as urban construction because most of these buildings are believed to be located in areas that will later be reclassified as urban. More details can be found in Berkelmans and Wang (2012).

the medium- and long-term outlook for the sector. Further details can be found in the related Research Discussion Paper, Berkelmans and Wang (2012).

Factors Influencing Residential Construction Growth

Although total population growth has slowed since the introduction of the family planning policy in 1978, urban population growth has remained high (Graph 3). This trend has been underpinned by large flows of rural migrants to urban areas, accompanied by the large-scale transformation of rural land into urban land. This upward trend is projected to be sustained in the medium term, with China's urban population expected to increase by 42 per cent over the next two decades; by 2030, roughly 70 per cent of the country's population is projected to be living in urban areas.[2] By comparison, Australia's urbanisation rate is almost 90 per cent, while the urbanisation rate is more than 80 per cent in the United States.[3] Despite the continued increase in China's urban population, the growth rate is expected to slow over the next 20 years.

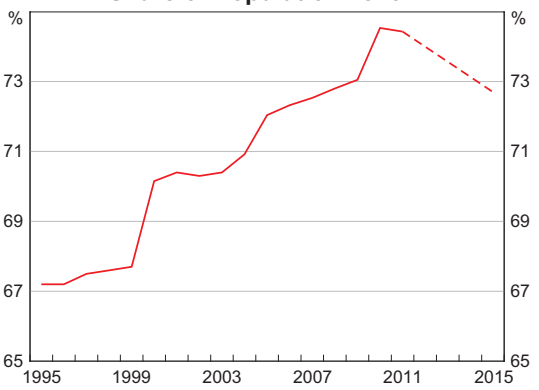
Graph 3
China – Population*



* Dashes indicate projections
Sources: CEIC; RBA; United Nations

Strong urban housing demand in recent years has been influenced by the population's age structure (Graph 4). With a large number of people born between 1986 and 1990, the share of the population aged between 15 and 64, who are potentially looking to rent or purchase a home, is likely to be close to its peak (Rush 2011).

Graph 4
Share of Population 15–64*



* Dashes indicate projections
Sources: CEIC; RBA; United Nations

Increases in average living space have accompanied the rise in demand associated with the growing urban population. Chinese urban residential floor space per capita is estimated to be around 22½ square metres in 2010, more than double its level in 1990 (Graph 5).[4] As China develops further, and incomes rise, floor space per capita is projected to continue its upward path. If the relationship between incomes and dwelling size is consistent with international experience, and the Chinese economy grows along the path projected in World Bank and Development Research Center of the State Council, the People's Republic of China (2012), then floor space per capita should increase to around 35 square metres by 2030.[5]

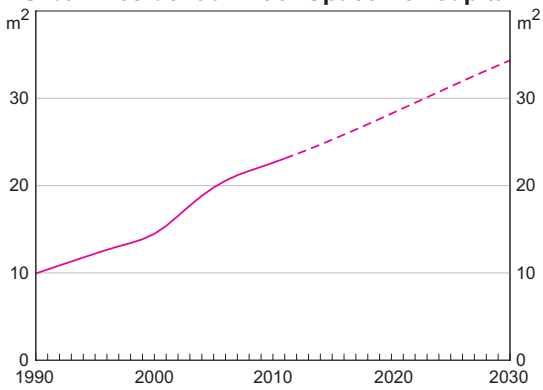
2 The total and urban population forecasts presented in this paper closely follow the methodology used by United Nations (2012).

3 These urbanisation rates are based on definitions applied by each country's statistical agency, so there are limitations to comparability.

4 This paper quotes a smaller average dwelling size than official estimates because the official estimates are based on non-agricultural household registration (hukou) population, which is smaller than the actual urban population (Beijing Municipal Bureau of Statistics 2006).

5 The World Bank and the Development Research Center has economic growth gradually falling from an average of 8.6 per cent per year during 2011–2015 to 5.0 per cent per year in 2026–2030.

Graph 5
Urban Residential Floor Space Per Capita*



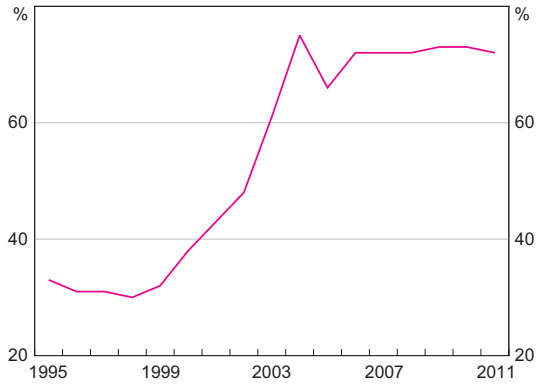
* Dashes indicate projections
Sources: CEIC; RBA

This compares with levels of approximately 60 square metres in Australia and the United States.[6]

Just as higher incomes increase the demand for floor space, they also increase the demand for higher quality buildings. As a result, demolitions are running at a high level as low quality buildings are replaced with higher quality buildings. According to the State-owned Assets Supervision and Administration Commission of the State Council (SASAC), around 1.8 billion square metres of residential floor space were demolished between 2008 and 2010. This volume of demolition was equivalent to around 40 per cent of the total urban residential floor space constructed during this period (SASAC 2011). According to estimates of the urban dwelling stock, this corresponds to an annual demolition rate of around 4.5 per cent. This rate is expected to decline over the next two decades to levels more consistent with international norms of about 2 per cent.

The sequence of housing reforms introduced since the early 1980s has facilitated a strong response of supply to demand pressures. Until the late 1990s, many residential properties were provided at a heavily subsidised rate by the government or state-owned enterprises. Since residents had to repay these subsidies upon gaining the right to sell, and relinquish the capital gain, the residents had very little appetite to purchase property as an investment. The housing reforms enabled private property ownership and allowed certain properties to be traded at a market price (known as 'commodity building'). This saw a large increase in private construction, albeit partially offset by a reduction in state-sponsored construction. Consequently, over the past two decades, commodity building has increased significantly as a share of urban residential property constructed (Graph 6). The number of people owning multiple properties has also increased (Huang 2011).

Graph 6
Commodity Building Share of Official Urban Residential Construction*



* Commodity building is housing available on the private market
Sources: CEIC; RBA

The Outlook for Residential Construction

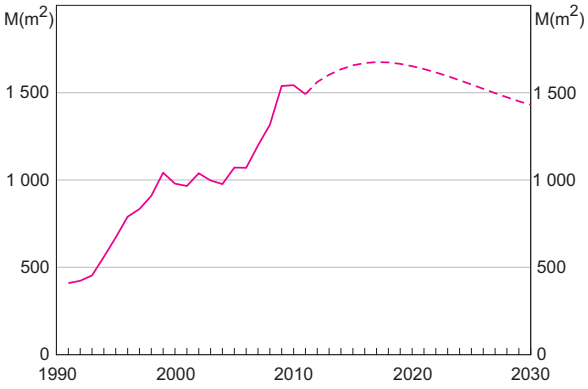
The projected increase in the urban population, greater demand for larger apartments and the trends in demolition can be used to formulate a projection for total urban residential construction. This projection points toward an increase in residential construction in the coming years, though at a slower pace than in the recent past (Graph 7). The level of urban residential construction is expected to peak by the end of this decade, at a level that is about 12 per cent higher than in 2011. Thereafter, urban

6 These numbers are based on RBA calculations and data from the Australian Bureau of Statistics and International Energy Agency (IEA 2004, 2007).

residential construction is expected to decline, but nevertheless remain at high levels. By 2030, it is expected that urban residential construction will be at a similar level to the current scale of construction.

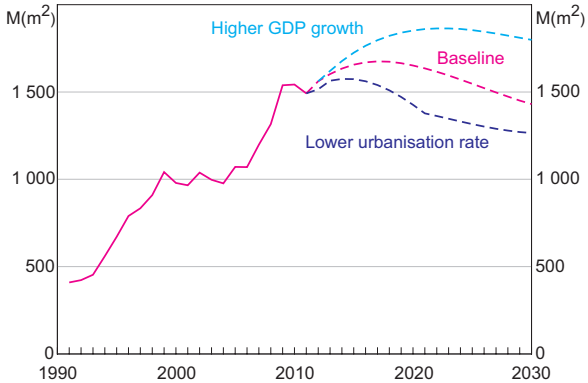
Of course, these central projections are subject to considerable uncertainty, and their sensitivity to the underlying assumptions can be considered. First, suppose that the per capita growth of the economy remains above 8 per cent per annum for the next two decades (compared with an average of 6 per cent in the central projection), along with an unchanged profile for the population and urbanisation. In this case, the peak in residential construction would occur much later, as wealthier urbanites would demand larger living space (Graph 8). Construction would peak in 2023, at a level approximately 25 per cent above 2011 levels. Alternatively, a lower path can be projected by assuming an urbanisation path more in line with the United Nations' urbanisation projections as they stood in 2009, which were significantly below the current vintage. In this case, the peak in residential construction is basically at hand. These alternatives, among others, are detailed further in Berkelmans and Wang (2012).

Graph 7
Urban Residential Floor Space Construction*



* Dashes indicate projections
Sources: CEIC; RBA

Graph 8
Urban Residential Floor Space Construction – Alternative Assumptions*



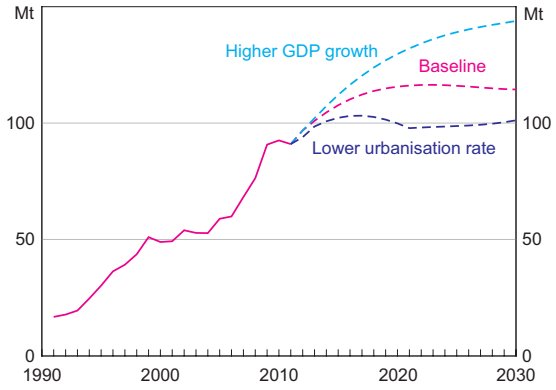
* Dashes indicate projections
Sources: CEIC; RBA

The Implications for Steel Demand

Steel intensity – the average amount of steel used per square metre of floor space – can vary depending on the type of building structure, the height of the building and other features. Taller buildings – required to accommodate higher population densities in cities across China – require more steel per square metre of floor space in order to maintain structural integrity. Also, a sizeable increase in automobile ownership in the coming years is likely to stimulate demand for buildings with underground car parking, which also requires more steel to be used per square metre of living space (Baker and Hyvonen 2011). For these reasons, even though growth in residential construction is likely to decline over the coming decades, the growth of steel demand is not likely to decline to the same extent. Indeed, average steel intensity has increased steadily over the past 30 years. Some estimates suggest that the average steel intensity for newly constructed apartments in China is currently around 60 kilograms of steel per square metre (Hu *et al* 2010; Walsh 2011).

The increase in average steel intensity means that the steel consumed by residential construction is projected to peak several years after aggregate construction is projected to peak (Graph 9). According to the central projection, the peak steel requirement is expected to occur around 2023. This represents an approximate 30 per cent increase over the current levels. Graph 9 also shows the implied pattern of steel use in construction under the two alternative assumptions discussed above.

Graph 9
Steel Used in Residential Construction*

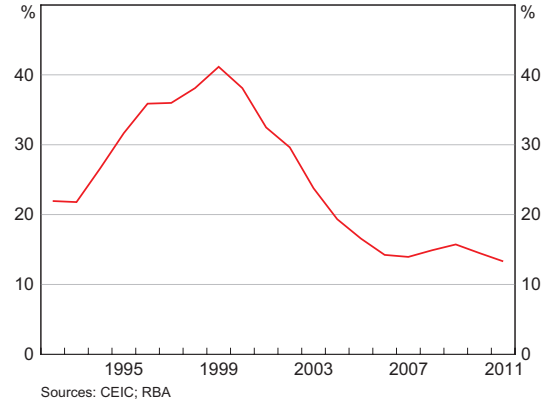


* Dashes indicate projections
Sources: CEIC; RBA

While steel demand from urban residential construction is projected to moderate from 2023, the outlook for the steel sector depends on more than just the outlook for construction. Indeed, notwithstanding the growth of steel used in residential construction, the share of steel demand accounted for by residential construction in China has declined over the past decade (Graph 10). Among other things, this is attributable to a surge in the production of manufactured products. Nonetheless, the needs of the Chinese residential sector augur well for Chinese steel consumption.

A large share of China's iron ore used for steelmaking is imported, and Australia is well placed to retain its position as the largest supplier of iron ore to China in the coming years, particularly given the relatively low cost of extraction of iron ore in Australia. China's imports of coking coal are also expected to remain elevated in the coming years, though less than 10 per cent of China's coking coal demand is met through imports, of which Australia is a large supplier.

Graph 10
Residential Construction Share of Steel Demand



Sources: CEIC; RBA

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Labour Market Dynamics: Cross-country Insights from Panel Data

Laura Berger-Thomson and Nyssa Roberts*

This article uses household-level survey data on income and employment to compare labour market dynamics across a range of advanced economies, including Australia.[1] The analysis focuses on how changes in employment status are distributed within countries and how those distributional patterns vary internationally. There are many similarities across the countries studied. In particular, lower-income households are more likely to have moved into or out of employment but less likely to move region. But there are also differences across countries. For example, adults in the United States are more likely to change their employment status than in other countries examined. Furthermore, the probability of men entering and leaving employment is closer to that for women in Australia than it is in the other countries examined.

Labour Market Performance and Characteristics

This article provides a comparison of labour market dynamics in the 2000s in Australia, Germany, the United Kingdom and the United States, prior to the global downturn in 2008–2009. It examines the distribution of changes in employment across income, age and gender. Understanding the distribution of these changes across different types of individuals and households provides insights into the reasons why changes in aggregate employment differ across countries. The distribution of changes can also have important implications for aggregate activity that may be missed by looking at the aggregate data alone; for example, aggregate consumption could decline by more if job losses are concentrated among workers from low-income households with a high marginal propensity to consume.

There were notable differences in the aggregate labour market performance of the countries examined over the period from 2000 to 2007. For most of this time, unemployment rates in Australia and the United States were trending down, while the unemployment rate in the United Kingdom was broadly flat. In contrast, the unemployment rate in Germany increased in the early 2000s, then fell noticeably from the beginning of 2005. There were also some differences in labour market characteristics. The United States had the smallest share of part-time workers of all the countries examined over this period, at 13 per cent, whereas the share was at or above 20 per cent in Australia, Germany and the United Kingdom (Graph 1). Partly reflecting this, average annual hours worked per worker were highest in the United States, equating to around 35 hours per week, but were lowest in Germany at 28 hours per week.[2]

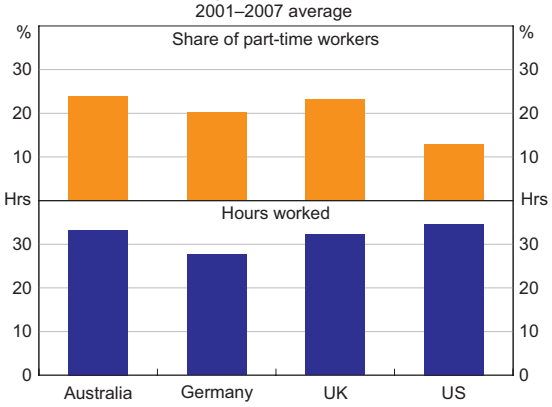
Aggregate data also contain some information about the distribution of employment. As would be expected, employment rates are highest in the prime working years (ages 25–54) across all countries in our sample, with many individuals in full-time

* Laura Berger-Thomson is from Economic Analysis Department. Nyssa Roberts was in Economic Analysis Department during her secondment from the Bank of England.

1 The data used in this article were made available to the authors by the cross-national equivalent file (CNEF) project at the College of Human Ecology at Cornell University, Ithaca, NY.

2 This will partly reflect differences in the number of public holidays and weeks of annual leave, which are generally around two weeks in the United States and four weeks in the other countries over the period of interest.

Graph 1
Part-time Employment and Hours Worked*
2001–2007 average



* Hours worked in a year; average per week
Source: OECD

Graph 2
Employment Rates by Age and Gender
2001–2007 average*

* 2005–2007 for Germany
Source: OECD

study when younger than 25 years and retired when older than 54 years (Graph 2). Employment rates of women are lower than for men for almost all age groups, with the difference most pronounced in the oldest age group. The difference between employment rates of men and women is greatest in Australia for individuals over 24 years relative to the other countries examined, particularly for those of prime working age.

The cross-country differences in these aggregate employment outcomes not only reflect the state of the economy over the period of interest, but labour market institutions and policies relating to education, family support and retirement, as well as cultural norms. These factors also influence the distribution of changes in employment examined in the remainder of this article. Relative to the other countries, the United States has low unemployment benefits relative to average wages, low minimum wages and employment protection legislation that is less strict (Table 1). Government family support payments, which include maternity pay and childcare support, are also the lowest of the countries examined, which is likely to be an important cause of high rates of sole parent employment and high rates of child care usage (Table 2). Further, workers in the United States tend to retire later than in other countries, which is likely to partly reflect the low levels of retirement income relative to average wages (Table 3). All of these factors contribute to the United States' relatively high labour force participation, particularly of women. The exception is in the younger age group, where employment rates are partly held down by the high share of individuals in full-time education. Students in the United States are generally less likely to work than students in other countries, which in part reflects the ability of students to access loans for living expenses as well as for tuition (although this is also possible in Germany) and cultural factors.

In contrast, Germany has stricter employment protection legislation and relatively generous benefits, particularly retirement benefits which accords with its citizens tending to retire relatively early. Family benefits are relatively generous and childcare usage for children under three years old is low. Australia and the United Kingdom generally sit somewhere in between the United States and Germany on these characteristics.

Insights from Panel Data

Aggregate data, however, can provide only limited information about changes in the employment experience of individuals. To assess these, we use data from the cross-national equivalent file (CNEF) of panel datasets for the four countries. Since the data

Table 1: Labour Market Institutions
2004

	Short-term unemployment benefit replacement rate[a]	Minimum wages share of average full-time wages	Trade Union membership	Strictness of employment protection legislation[b]
	Per cent	Per cent	Per cent of workforce	
Australia	64	50	22	1.47
Germany	74	na	22	2.39
United Kingdom	67	36	29	1.10
United States	57	25	12	0.65

(a) For a single-earner family with two children on average wage; family qualifies for cash housing assistance or social assistance top-ups if available
(b) Version 2 of this indicator; synthetic indicator of the strictness of regulation on dismissals and the use of temporary contracts, where 0 is the least restrictive and 6 is the most restrictive
Source: OECD

Table 2: Work and Family
2004

	Sole parent employment rate[a]	Government family support[b]	Childcare participation under 3 years[c]	Gender pay gap[d]
	Per cent	Per cent of GDP	Per cent	Per cent
Australia	62	2.9	29	14
Germany	66	2.1	9	25
United Kingdom	53	3.2	26	23
United States	75	0.7	36	20

(a) For parents 15–64; 2006 for Australia, 2007 for other countries
(b) Government spending on child care, parental leave and other maternity payments, day care/home help services and family allowances
(c) 2005
(d) Difference between median earnings of men and women, relative to median earnings of men
Source: OECD

Table 3: Education, Employment and Retirement
2004

	Education rate[a] (employment rate in education)		Age of entry to tertiary education[b]	Effective retirement age[c]	Retirement income replacement rate[d]
	Age 15–19	Age 20–24	Years	Years	
Australia	78 (47)	39 (65)	18.6	63.1	53
Germany	93 (24)	44 (45)	20.1	61.3	61
United Kingdom	69 (41)	36 (37)	18.8	63.0	41
United States	84 (26)	35 (59)	19.4	64.2	45

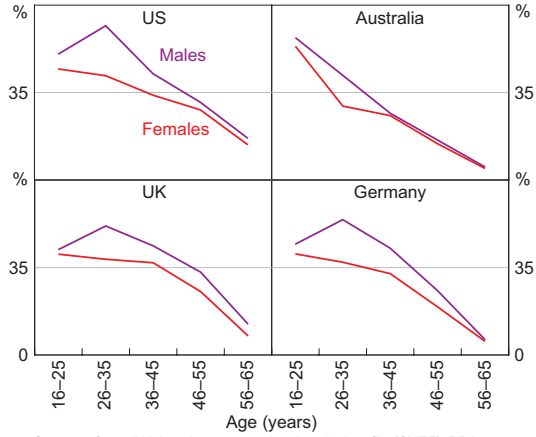
(a) Share of individuals in education
(b) 20th percentile of the distribution
(c) For men
(d) For men on average wage at national retirement age; 2006
Source: OECD

are derived from a range of surveys, the availability of survey waves and some aspects of the data differ across countries (see Appendix A for more information). Nonetheless, the dataset provides key labour market variables standardised across countries along with demographic information. Since the US data are only biennial (for the sample examined), all of the labour market movement statistics cited in this article reference two-year periods; within period changes are not measured. It is also important to note that the dataset used in this analysis does not enable identification of the reasons why a particular individual's employment has changed; only the outcome is observed.

Many things about an individual's employment can change, but arguably the biggest change is entry into or exit from employment itself. On average over the early to mid 2000s, around a quarter to a third of individuals had moved from not being employed to being employed two years later. The probability of entering employment generally declines with age, reflecting the fact that young adults are more likely to be in education and then enter the workforce, and the fact that older people are more likely to have retired from the workforce (Graph 3). Entry into employment generally peaks in the 26–35 year age group for men, and in the younger age group for women, presumably reflecting the fact that the 26–35 year age group covers the key childbearing years for women, and that women are more likely than men to take time out of the workforce to look after children. The probability of 16–25 year olds entering employment is highest in Australia. This is consistent with the high rates of student employment described in Table 3, which may reflect cultural norms and the high rates of university participation in Australia (which suggests that students come from a broader cross-section of the population).

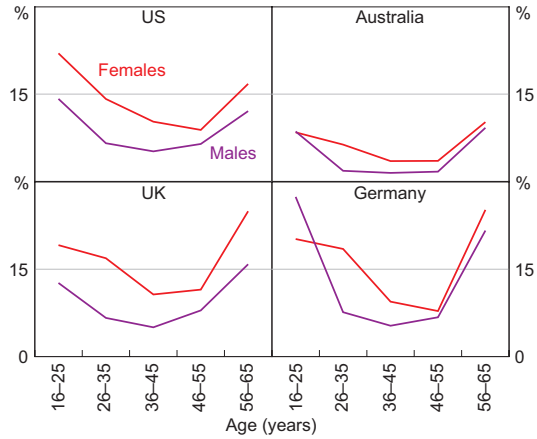
It is clear that life-cycle factors also play an important role in determining exit from employment by age and gender, with those nearing retirement age much more likely to exit employment than almost all other age groups (Graph 4). The other age group

Graph 3
Probability of Entering Employment
2001–2007 average; by age and gender



Sources: Cornell University, cross-national equivalent file (CNEF); RBA

Graph 4
Probability of Exiting Employment
2001–2007 average; by age and gender



Sources: CNEF; RBA

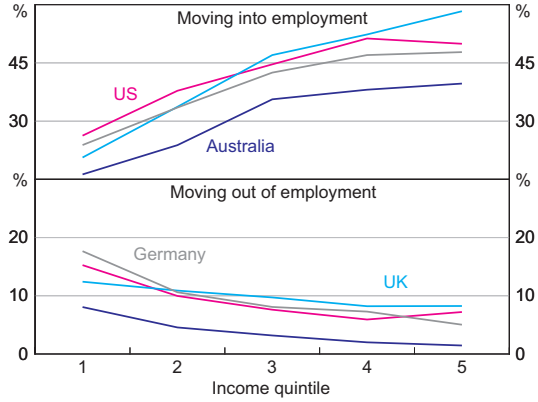
with a high probability of exiting employment is the youngest age group; young people may leave employment to pursue study and are also the age group most likely to be made redundant (since they have a higher share of casual employment and lower levels of human capital, for example). The U-shaped relationship between the share leaving employment and age is most pronounced in Germany and least pronounced in Australia. The U-shaped distribution also tends to be less pronounced for women, with women aged 26–35 almost as likely to exit

employment as the younger age group. Overall, women are more likely to exit employment than men, with the difference particularly large in the key childbearing years of 26–35 years. The difference between the probability of exiting for men and women is, on average, greatest in the United States and the United Kingdom, with the result for the United States somewhat surprising given the high rates of female employment and child care usage. Factors other than child rearing decisions may be driving the difference, since these countries have very different levels of government support for families and the gaps also exist in the youngest and oldest age groups. Interestingly, rates of entry and exit into employment for men and women are closest in Australia, which is somewhat at odds with the aggregate data that suggest that employment rates of women are noticeably below those of men of prime working age.[3]

The income profiles of those entering into, and exiting from, employment also show similar patterns across countries. Focusing on employment changes by household income for prime-age individuals (aged 26–54), those from lower-income households were more likely to exit employment than those from higher-income households (Graph 5).[4] This relationship is most pronounced in Germany, and least pronounced in the United Kingdom. This may partly reflect the nature of the work done by these lower-income employees, which is generally less knowledge intensive (and thus experience will not be as highly valued), as well as the greater cyclicality of the industries in which they work.[5] Government policies are also likely to have been influential. Excluding Germany, where the labour market performance was noticeably different to the other countries over this period, the percentage point difference between the probability of lower-income workers losing employment and higher-income workers losing employment is greatest in the United States, which has the lowest score for strictness of employment protection legislation, and lowest in the United Kingdom. Individuals from higher-income households are more likely to enter employment than those from low-income households.[6]

It is particularly interesting that the ranking of entry and exit rates across countries are the same; Australia has the lowest entry and exit rates, whereas the United Kingdom generally has the highest. This may seem surprising given that Australia had a low unemployment rate and labour market churn –

Graph 5
Probability of Employment Change
2001–2007 average; by household disposable income quintile*



* Previous income for moving out of employment and current income for moving into employment; for 26–55 year olds, adjusted for the age of the household head

Sources: CNEF; RBA

3 This can be reconciled by the fact that in the CNEF, employment rates of women in Australia are much closer to those of men than in the other countries studied.

4 This is because income is generally shared between household members and employment decisions of the eldest and youngest households are less likely to be influenced by income. The measure of income used is total household income equivalised for the number of people in the household (that is, household income divided by the number of people in the household where the first adult has a weight of 1, additional adults have a weight of 0.7 and children have a weight of 0.5). The income quintiles are also adjusted for the age of the household head; the income quintiles are calculated for each age group separately and then put together. With the age of the household head highly correlated with the age of the partner, using a more comprehensive measure of age makes little difference. For individuals moving out of employment, household income in the previous year is used as a benchmark, to control for the effect on income of exiting employment.

5 Importantly, the income quintiles are age-adjusted, so this controls for experience gained over a long time period.

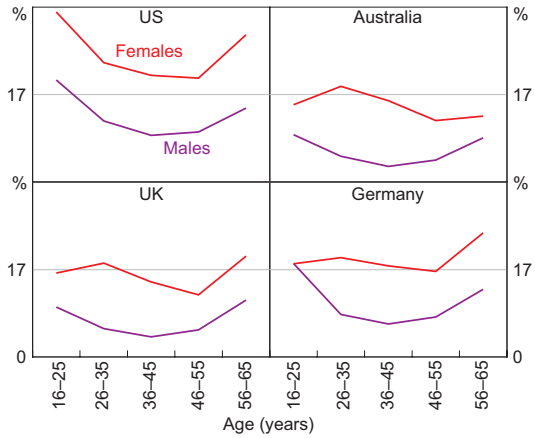
6 This is true when both previous period and current period income (to account for the income effect of gaining work) are used. The relationship between gaining work and income is strongest when the current period's income is used, consistent with the higher opportunity cost of not working for those able to earn a high salary.

leaving one job for another – might be expected to be greater in a tight labour market. However, as noted earlier, the change in employment status is measured over two-year periods, so it may capture more non-employment for voluntary and structural reasons than for cyclical reasons.

As well as recording whether an individual is employed or not at the time of the survey, the CNEF also contains a variable that indicates whether they were employed in the previous year and, if so, whether that was on a part-time or a full-time basis.[7] Overall, the greatest flows between labour market states are for people moving between full-time and part-time employment, as well as for those moving from non-employment to part-time employment.

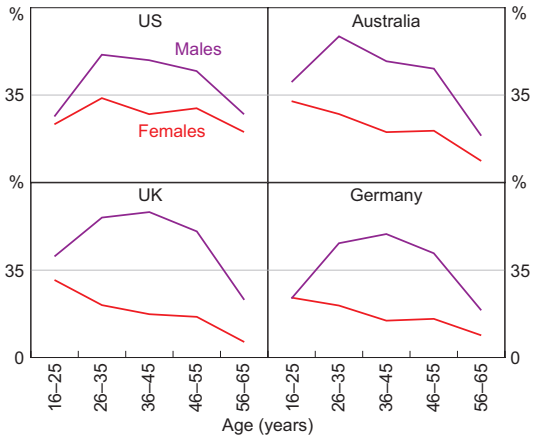
By age and gender, the results accord with a life-cycle interpretation of employment decisions. Women, particularly those in the key childbearing years, are more likely to move from full-time to part-time employment, consistent with their higher probabilities of both leaving work and being employed part-time (Graph 6). They are also more likely to move from not working to part-time employment. Men, in contrast, are more likely to move to full-time employment from part-time employment, with the relationship exhibiting an inverse U-shape across age (Graph 7). This is also true of their moves from non-employment to full-time employment. In terms of exiting employment, except in the key childbearing age group, women are as likely as men to move from full-time hours to non-employment, and less likely to move from part-time hours to non-employment than their male counterparts. Since the data examined above suggest that women are more likely to exit employment based on employment status at the time of the survey rather than average hours, this suggests that women in the labour market in the base period may be more likely to experience a short spell of non-employment (lasting for less than a year), but are less likely to experience long-term non-employment. This is more difficult to link to particular labour market institutions, but is consistent with women taking voluntary spells out of the labour force and with evidence that women tend to be employed in industries that are less sensitive to variations in the economic cycle.[8]

Graph 6
Probability of Move from Full-time to Part-time Employment
2000–2007 average; by age and gender



Sources: CNEF; RBA

Graph 7
Probability of Move from Part-time to Full-time Employment
2000–2007 average; by age and gender



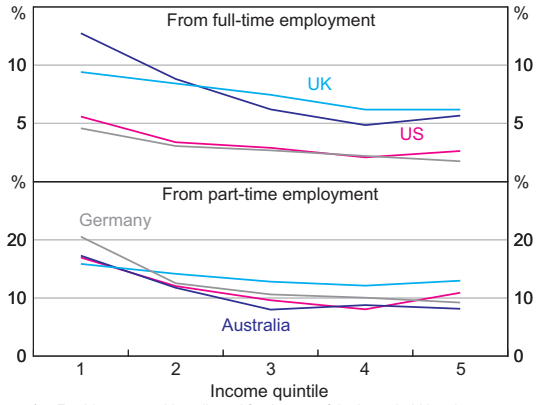
Sources: CNEF; RBA

7 The variable is constructed using total hours worked over the year, so it cannot distinguish between part-time work for a full year and full-time work for part of the year.

8 For example, women are more likely to be employed in the public sector than are men, whereas cyclical industries such as construction are heavily male dominated.

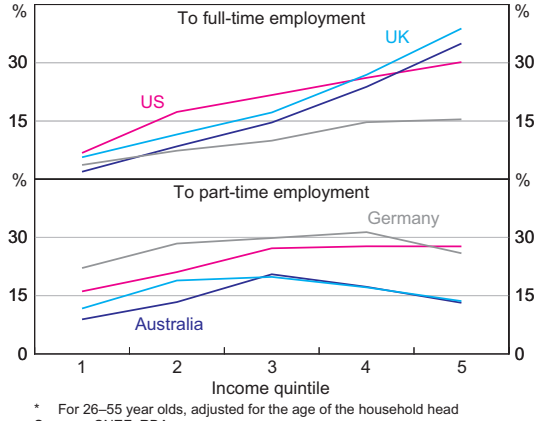
Workers from lower-income households are more likely to have an extended period of non-employment than individuals from higher-income households, both when preceded by full-time employment or part-time employment (Graph 8). Higher-income households are more likely to leave an extended period of non-employment, and when they do so are more likely to enter full-time employment, whereas individuals from lower-income households are more likely to work fewer hours in a year once they gain employment, consistent with these households being more likely to have spells of non-employment (Graph 9).

Graph 8
Probability of Leaving Employment
2000–2007 average; by previous household disposable income quintile*



* For 26–55 year olds, adjusted for the age of the household head
Sources: CNEF; RBA

Graph 9
Probability of Leaving Non-Employment
2000–2007 average; by current household disposable income quintile*



* For 26–55 year olds, adjusted for the age of the household head
Sources: CNEF; RBA

Labour Market Mobility

This section examines two aspects of labour market mobility – geographical mobility and mobility across industries. The CNEF applies a standard definition of industries to each country and this article uses nine industries in total due to sample size limitations.[9] For geographical mobility, the CNEF includes information on where a person lives based on US states, UK regions,[10] the German Länder and the Australian states and territories. For the largest states in Australia, information is also available on capital cities and the rest of the state. The different sizes of the regions across the countries and the average population per region make comparison across countries more difficult to interpret, but the analysis is illustrative nonetheless.[11]

In these data, the United States and the United Kingdom have the largest share of working-age adults moving between regions, while Australia and the United States have the highest share moving between industries (Graphs 10 and 11). The differences across countries imply that the average size of a region, and by implication the distance between residences, does not explain much of the variation in geographic mobility across countries. The average size of the regions in the United Kingdom (which has high mobility) is the smallest, followed by German Länder, states in the United States (which has the highest mobility) and then Australian states are the largest (even accounting for the separation of Sydney from the rest of New South Wales and Melbourne from the rest of Victoria).

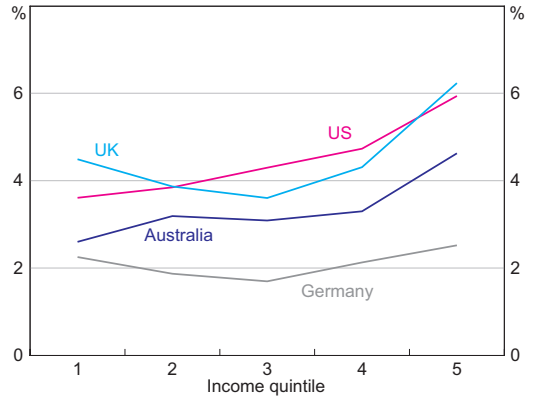
Consistent with higher geographical mobility being associated with lower financial and time costs of

9 The sectoral mobility figures exclude those individuals that had more than one consecutive survey where they were unemployed.

10 Regions in the United Kingdom are divided into Inner London; Outer London; Rest of South East; South West; East Anglia; East Midlands; West Midlands Conurbation; Rest of West Midlands; Greater Manchester; Merseyside; Rest of North West; South Yorkshire; West Yorkshire; Rest of Yorkshire and Humberside; Tyne and Wear; Rest of North England; Wales; and Scotland.

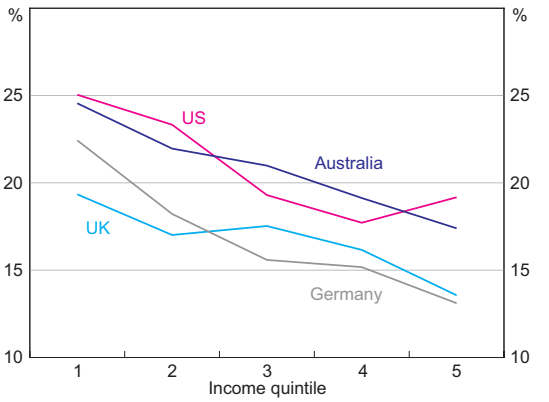
11 Of these, the differences in population are much smaller, with the difference at most a factor of two.

Graph 10
Share of Workers who Moved Region
2001–2007 average; by previous household disposable income quintile*



* Adjusted for the age of the household head
Sources: CNEF; RBA

Graph 11
Share of Workers who Changed Industries
2001–2007 average; by previous household disposable income quintile*



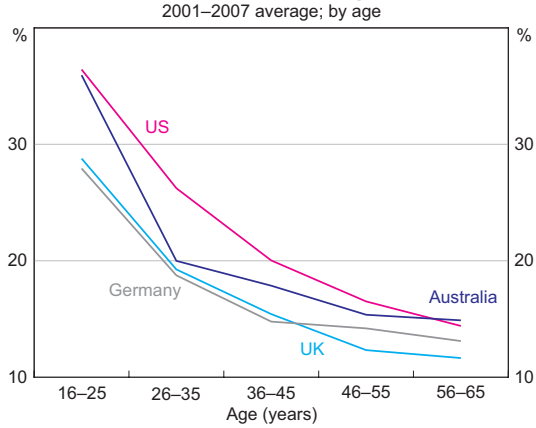
* Adjusted for the age of the household head
Sources: CNEF; RBA

moving, such as relocating children to different schools, in all countries around three-quarters of those individuals who moved region did not have children under 16 living at home.[12] Individuals from higher-income households are more likely to move region, consistent with these people being better able to meet the costs of moving and, potentially, there also being higher gains from moving for these people. In Germany, in contrast, the share of households moving was roughly constant across income quintiles. Generally, 26–35 year olds were the most likely to move region, while 46–65 year olds were much less likely to move region. One reason for this could be that the benefits to a geographical move are realised over time and so there is less incentive for older people to move. Older people may also have more established employment and social networks, which impose a higher cost of moving, although, acting against this, they tend to have fewer dependent children living at home.

The share of workers moving from one industry to another is much higher than the share moving region, and the relationship with income is reversed, with the probability of changing industries declining with income. Given the correlation between income and education, the same relationship holds for education as well. Since age is controlled for in the income brackets, this relationship is not likely to reflect the experience of workers. Rather, it could reflect the more specialised nature of higher-income professions, which increases the opportunity cost of changing industries.

The probability of changing industries declines with age, with the probability of a 16–25 year old changing industries more than double that of a 56–65 year old in each country studied (Graph 12). As with regional moves, this could reflect the fact that the benefits to changing industries are realised over time and so there is less incentive for older people to move,

Graph 12
Share of Workers who Changed Industries
2001–2007 average; by age



Sources: CNEF; RBA

12 The dataset only identifies children of household heads.

and also that the opportunity cost may be greater for older people since they are more experienced.

Surprisingly, individuals that changed industries or moved between regions do not appear to record consistently better pay outcomes than those that do not move. In Germany, the United Kingdom and the United States, individuals that change industries are less likely to record a labour income increase than those that do not change, and this relationship holds across almost all income and age groups in each year. In Australia, however, individuals from households in the lowest income quintiles that changed industries were more likely to have increased their incomes than those that did not change, while those in higher-income households were less likely to see an increase in income from a change. In all countries, individuals from low-income households that moved regions were more likely to have increased their incomes than those that did not change, while individuals from higher-income households were less likely. This suggests that moves by lower-income households tend to be motivated by economic considerations, whereas those by higher-income households may be influenced by other factors, such as the location of extended family or other lifestyle considerations.

Conclusion

The CNEF dataset allows a comparison of the distribution of employment changes across countries. It shows that the distribution of employment changes across a range of demographic variables is broadly similar in Australia, Germany, the United Kingdom and the United States in the 2000s. Overall, individuals from lower-income households were more likely to have a change in some aspect of their employment, whether that was their overall employment status or hours worked in a year. They were also much more likely to move industry. In contrast, individuals from higher-income households were more likely to move region than those from lower-income households. Younger individuals were more likely to have a change in some aspect of their employment, consistent with their more marginal attachment to employment and emerging family responsibilities. However, there were significant differences across countries in some areas, particularly for females, implying that government policies and social norms about labour force participation for females in families with young children are likely to be important. Employment protection policies and social benefits appear to be important in explaining the participation of lower-income households.

Appendix A

The cross-national equivalent file (CNEF) is a collection of panel datasets where the data provided has been standardised across countries. The Australian data in the CNEF are a subset of the information available in the Household, Income and Labour Dynamics in Australia (HILDA) survey, the German dataset comes from the German Socio-Economic Panel (SOEP), the United Kingdom dataset comes from the British Household Panel Survey (BHPS),[13] and the United States dataset comes from the Panel Study of Income Dynamics (PSID).[14]

Since the data are derived from a range of surveys, the availability of survey waves differs considerably across countries. Data for the United States are only available biennially from 1997, with the latest available survey for 2007 (Table A1).[15] Surveys for all other countries are available annually, with the Australian and German survey waves available up to 2009, and the United Kingdom survey available for 2008. Survey reference periods and collection

13 British Household Panel Survey, Data files and associated documentation, ESRC Research Centre on Micro-social Change, The Data Archive (distributor) Colchester, 2012.

14 Panel Study of Income Dynamics, public use dataset. Produced and distributed by the Institute for Social Research, Survey Research Center, University of Michigan, Ann Arbor, 2012.

15 For most surveys, the actual survey waves are available for more years, but the CNEF data are released with a lag. For example, the 2009 PSID survey is available, but not in the CNEF, reflecting the time/effort required to standardise the various country surveys.

Table A1: Survey Data Collection and Availability

	Survey collection period	Survey reference period for hours data	Survey begins	Survey ends
Australia	Majority Sep–Oct	Previous financial year	2001	2009
Germany	Majority Jan–Apr	Previous calendar year	1984	2009
United Kingdom	Majority Sep–Dec	Sep–Aug immediately preceding interview	1991	2008
United States	Mar–Nov	Previous calendar year	1970	2007

Sources: BHPS; CNEF; HILDA; PSID; SOEP

periods also differ somewhat, and reference periods within surveys can also differ across variables. When the hours variable is examined, the reference period differs across countries. Thus the German and United States hours data are lagged by one year when used. Data on disposable income for the United Kingdom are imputed for the 2007 survey.

The CNEF is of considerable benefit since it standardises data from the various surveys so they are more easily comparable, and also constructs variables that are not available in some of the individual surveys (of which disposable income is the most important for this article). However, the easy comparability comes at the cost of the limited selection of variables included. For example, the data only identify people as employed or not employed. There are also no data on individual or household assets or liabilities.

Disclaimers

The data (and tabulations) used in this article were made available through the ESRC Data Archive. The data were originally collected by the ESRC Research Centre on Micro-social Change at the University of Essex (now incorporated within the Institute for Social and Economic Research). Neither the original collectors of the data nor the Archive bear any responsibility for the analyses or interpretations presented here.

The HILDA-CNEF dataset is an equivalised subset of data from the Household, Income and Labour Dynamics in Australia (HILDA) survey provided through the CNEF project at Cornell University. The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this article, however, are those of the authors and should not be attributed to either FaHCSIA, the Melbourne Institute or Cornell University.

Exploration and the Listed Resource Sector

Thomas Williams*

A great deal has been written about the importance of the resource sector in Australia; however, most of this focuses on the few large companies that dominate the landscape. The numerous small companies in the sector are discussed less often. These small companies have become an important part of the exploration stage of the commodity production process, particularly in areas that have not previously yielded discoveries. Junior explorers tend to rely almost exclusively on listed equity to finance their operations and the boom in commodity prices over the past decade has meant that these companies have had little trouble raising equity. The resource boom has also resulted in a sharp rise in listings of new resource companies – to the point where nearly half of all listed companies on the ASX are now in the resource sector.

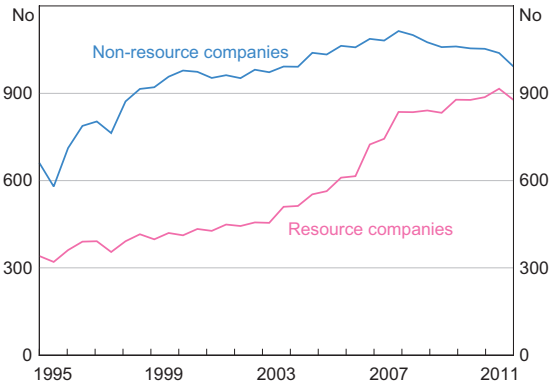
Introduction

The resource boom has had a major impact on the Australian economy over the past decade, increasing real domestic incomes and fostering an investment boom. One outcome of the boom is that resource companies now account for around a third of the market capitalisation of companies listed on the Australian Securities Exchange (ASX), up from around 15 per cent a decade ago. The number of listed resource companies has also risen significantly, with resource companies now accounting for just under half of all listed companies, compared with one-third in 1995. This article examines these small companies and the importance of listed equity in their capital structure.

The Nature of the Listed Resource Sector in Australia

The resource sector has become an increasingly large component of the listed equity market in Australia over the past decade, with the number of resource companies more than doubling over this period (Graph 1). This increase has been broad based across the resource sector, although the increase has been more pronounced for companies involved in mineral exploration and production than for those in the energy industry.[1] The resource sector comprises a few large and generally highly profitable companies, along with a large number of small companies that generate little or no revenue from their operations in any given year (Graph 2). These small companies

Graph 1
ASX-listed Companies

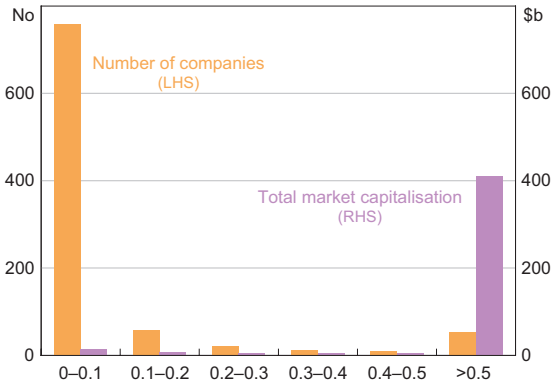


Source: Morningstar

* The author is from Domestic Markets Department.

1 This breakdown is based on the Global Industry Classification Standard (GICS). Energy companies include those involved in oil, gas and coal industries.

Graph 2
The Listed Resource Sector
June 2012

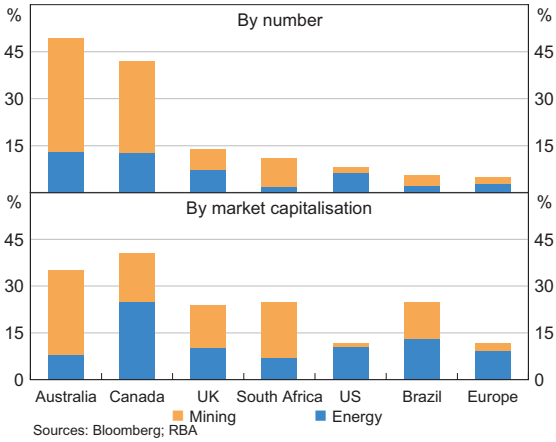


Sources: Bloomberg; RBA

with market capitalisations of less than $200 million are often referred to as 'juniors'.

Australia has a much larger proportion of its listed sector concentrated in resource stocks (by both number and market capitalisation) than most other countries, including major commodity exporters (Graph 3). While resource companies from some other regions have larger absolute market capitalisations, these are generally concentrated among a few very large stocks.[2] These regions also tend to have a more diversified listed market generally, while the Australian market is heavily weighted towards resource and financial stocks. The exception to this is Canada, which also has a high share of resource stocks and a large number of very small companies.

Graph 3
Listed Resource Companies
Per cent of total listed companies, June 2012



Sources: Bloomberg; RBA

The Role of Junior Explorers

Of the 800 or so small listed resource companies in Australia, the overwhelming majority are engaged in exploration activities (Table 1). Exploration is the first step in the resource production process. Exploration expenditure totalled $7 billion in 2011, accounting for around 10 per cent of total mining investment. It is an investment in knowledge about the key characteristics of a resource deposit and must be undertaken before production can proceed. Once a discovery is made there is an evaluation of the deposit to determine the feasibility of extracting and selling the resource. A project that is deemed viable will then move into a construction phase and finally the operating phase. A 'junior explorer' will generally have no projects that have progressed to the operating phase, because they tend to sell their discoveries to larger operators who develop the resource deposits.

Exploration is required for the continued discovery of resources and is particularly important for commodities that have low proven reserves relative to production (such as oil).[3] However, it is also important for commodities in which there are large proven reserves, for example bulk commodities such as coal and iron ore, as it can allow for higher-quality and/or lower-cost deposits to be identified. Expenditure on bulk commodity exploration increased significantly over the past decade as

2 For example, as of 30 June 2012 the two largest US resource companies, Exxon Mobil and Chevron, had a combined market capitalisation of A$580 billion. This compares to the combined market capitalisation of A$440 billion for the entire listed resource sector in Australia.

3 In 2011, exploration expenditure as a share of the total value of exports was around 10 per cent for oil and gas but only 1–2 per cent for iron ore and coal.

Table 1: Listed Junior Explorers[a]
June 2012, per cent

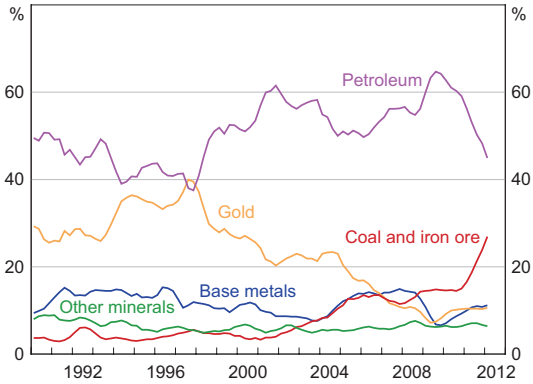
	Number	Share of all listed resource companies	Share of total resource company market capitalisation
Oil and gas[b]	110	87	8
Coal and consumable fuels	63	75	22
Aluminium, steel and diversified miners	275	78	5
Gold and other precious metals	189	75	19
Total	**637**	**78**	**7**

(a) Companies with no revenue producing operations, except for oil and gas companies
(b) It is assumed that oil and gas companies are junior explorers if they have a market capitalisation of less than $200 million, because data regarding project stages are not available
Sources: Bloomberg; Intierra; RBA

demand for these commodities rose strongly and now accounts for around 30 per cent of total exploration expenditure in Australia (Graph 4).

Junior explorers generate a sizeable proportion of total resource discoveries and are particularly important at the earliest stages of the exploration process. Geoscience Australia estimates that they accounted for around 60 per cent of total discoveries of gold and base metals between 1960 and 2002 (Maritz 2003). They are also responsible for an increasing share of exploration expenditure, with estimates suggesting that junior explorers currently account for up to half of total exploration expenditure, compared with around a third a decade ago (Schodde 2011).[4]

Graph 4
Resource Exploration in Australia*
Share of total expenditure, by commodity sought



* Four-quarter rolling average
Sources: ABS; RBA

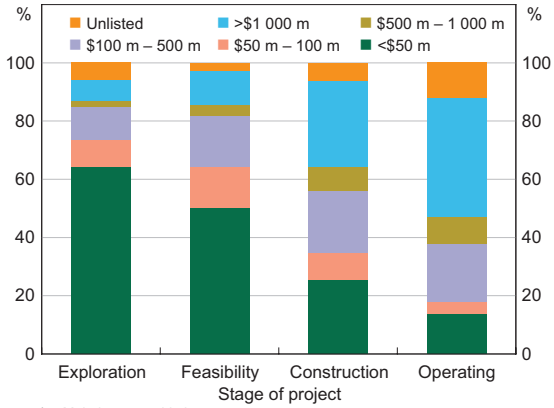
While small operators have always been a part of the exploration phase of developing resource endowments in Australia, the increase in their importance is due in part to the withdrawal of larger companies from exploration activities in recent years (Economic Development and Infrastructure Committee 2012). In Australia and globally, many large companies downsized their internal exploration units in the 1990s in response to historically low commodity prices. Large companies have also chosen to focus most of their remaining exploration efforts on brownfield sites (those where there has already been an existing discovery), as this is generally less risky, cheaper and simpler than searching for resources in new locations (known as greenfield exploration). Advances in technology have also meant that these companies can extract more resources from known deposits than was possible previously. In addition, technological improvements have lowered costs, making it possible for junior explorers to fill the gap left by the withdrawal of these larger companies. More recently, high commodity prices have provided a strong incentive for larger companies to quickly

4 Metals Economics Group estimates that junior explorers account for around 40 per cent of global exploration, up from 25 per cent in 2000 (Chender 2011).

expand production from current deposits, rather than undertake greenfield exploration.

Discoveries by junior miners are usually sold to larger operators with the scale and expertise to exploit a deposit (Graph 5). Mergers and acquisition activity indicates that small companies tend to sell their mining leases to mid-cap producers, rather than the large resource companies, as their discoveries are usually not of sufficient scale to interest them initially.[5] After the sale, the explorer will typically revert to exploring for other deposits.

Graph 5
Ownership of Mining Projects*
Percentage of total number of projects, by size of owner

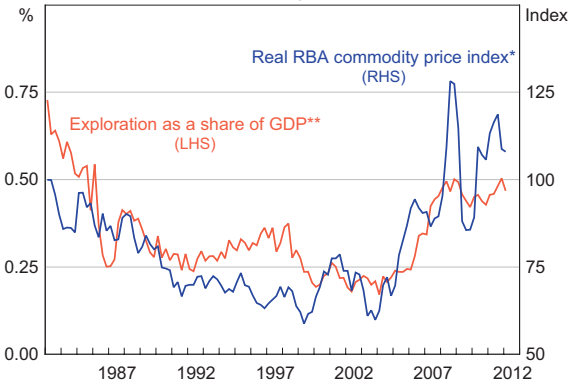


* Majority ownership interests
Sources: Intierra; RBA

Resource exploration is relatively cyclical, increasing during periods when commodity prices are high and declining when they are low (Graph 6). This occurs because higher prices make any potential discovery worth more and tend to make exploration in marginal areas more attractive. Not surprisingly, junior explorers also find it easier to obtain funding during periods of high prices. Expenditure on exploration as a share of GDP reached a multi-decade low in the early 2000s as commodity prices fell to unusually low levels, but has since increased to its highest level since the mid 1980s. The recent increase has been driven primarily by the increase in exploration for iron ore and coal.

5 Where a mid-cap producer is defined as a company with market capitalisation between $200 million and $1 billion.

Graph 6
Exploration Expenditure and Commodity Prices



* In Australian dollars; deflated using GDP deflator; March 1983 = 100
** Includes mineral and petroleum exploration
Sources: ABS; RBA

Funding of Junior Explorers

The resource sector is the only industry sector in Australia where listed companies make up a substantial portion of the total number of businesses (Table 2).[6] This is largely explained by the fact that listed equity is the only viable source of funding for businesses conducting high-risk exploration activities. The diversified investor base provided by an exchange listing also helps support the capital-intensive nature of resource exploration.

Ordinarily, firms will first seek to use internal funding (i.e. retained profits) to finance their activities as this usually has the lowest opportunity cost. If external funding is required then firms will prefer to use debt financing in the first instance, with external equity usually a last resort.[7] Large resource firms typically follow this model of funding because they have operations that generate positive cash flows, which usually allow significant retained earnings and a capacity to service debt repayments. In fact, these cash flows have been so large in recent years that a few of these companies have conducted share buybacks.

6 Businesses include companies and other unincorporated structures such as sole traders, partnerships, etc.

7 External equity financing is typically the most expensive source of capital.

Table 2: Number of Listed Companies
By industry, 2011, per cent

	Share of total businesses	Share of total companies
Resources	10.8	47.4
Rental, hiring & real estate services	0.1	15.4
Agriculture	0.0	4.8
Manufacturing	0.3	4.3
Other services	0.0	3.6
Construction, transport & other	0.0	1.3
Wholesale & retail trade	0.0	0.8
All sectors	**0.1**	**5.5**

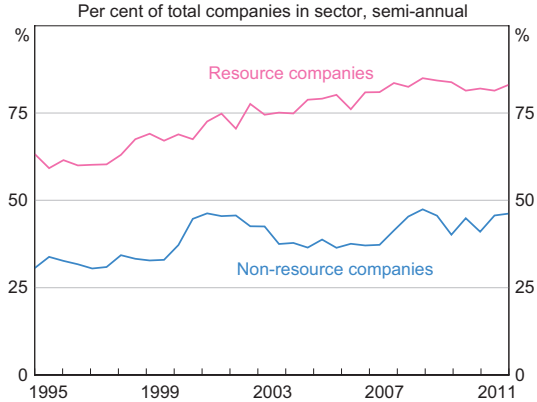
Sources: ABS; Dun & Bradstreet (Australia); Morningstar; RBA

In contrast, junior explorers rely largely on listed equity to fund themselves because they generally produce little in the way of consistent revenue and so are unable to rely on internal sources of capital. A lack of stable earnings and the risky nature of exploration also make it difficult for them to obtain debt funding. Given their inherently speculative nature, around 80 per cent of junior resource companies record a net loss in any given year, although if these companies make a discovery, the payoff is usually very large (Graph 7). It is this high-risk/high-return profile that makes these companies attractive to some investors. These investors will typically spread out their investment over a number of companies, with the expectation that a few of them will make discoveries and provide a large payoff.

By listing on equity markets, junior explorers are also able to periodically re-tap their equity investor base (Graph 8). These secondary raisings are usually conducted to fund further exploration activity when the explorer fails to make a discovery (Graph 9). This ability to periodically raise equity, along with the fact that most of these companies have little or no debt, means that very few of these companies get wound-up despite their tendency to make losses (Schodde 2009).[8] The proceeds from secondary

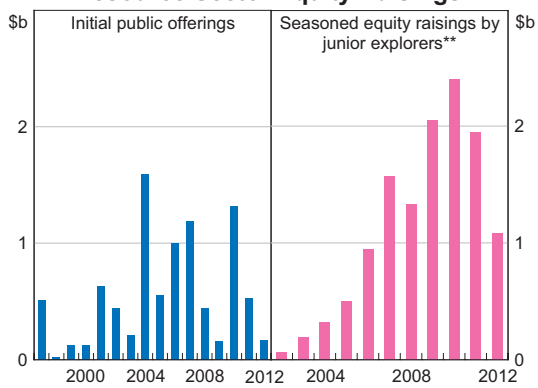
8 Even if the company is unable to raise more equity, it is rare for them to delist. Most of these companies will simply remain as 'shell' companies until they are bought out or are able to raise more equity.

Graph 7
Loss-making Companies
Per cent of total companies in sector, semi-annual



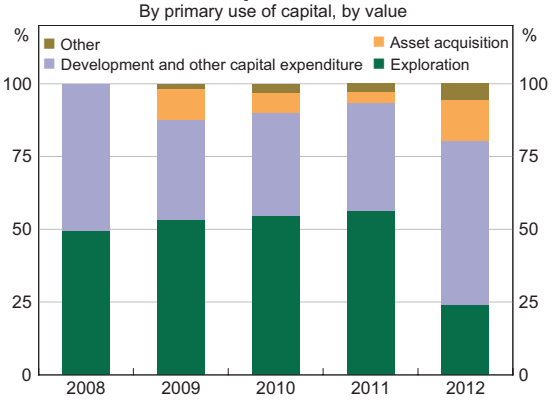
Sources: Morningstar; RBA

Graph 8
Resource Sector Equity Raisings*



* 2012 data year-to-date
** Mining companies with no projects in the operating phase and market capitalisation <$200 m; oil and gas companies with market capitalisation <$200 m
Sources: ASX; Intierra; RBA

Graph 9
Seasoned Equity Raisings by Junior Explorers*
By primary use of capital, by value



* Mining companies with no projects in the operating phase and market capitalisation <$200 m; oil and gas companies with market capitalisation <$200 m; 2012 data year-to-date
Sources: Intierra; RBA

equity raisings may also be used to develop a discovery themselves, or in partnership with another company, although this is less common.

Junior explorers receive little funding from private equity. The start-up nature of junior explorers and their high-risk/return profile would suggest that they are relatively well suited to the venture capital model of investment. However, private equity funding in both Australia and overseas is concentrated in industries such as information technology and clean energy. One reason for this is that exploration companies provide limited scope for private equity managers to add value and control risk through participation in management of the company (Maritz 2003). Another possible explanation is that exploration companies typically return to the market for capital every couple of years, regardless of the initial success of the company, which may be a deterrent to private equity investors.

An analysis of the share registries of junior explorers suggests that large resource companies have only minimal holdings, which indicates that large resource companies rarely 'sponsor' these small companies.[9] Instead, equity raising data indicate that institutional investors hold most of the equity in these companies.

Conclusion

Junior exploration companies are an important part of the resource sector, particularly at the earliest stages of the exploration process. This makes them essential to the ongoing viability of the resource sector in Australia as greenfield discoveries add to the stock of proven reserves. Throughout the resource boom these companies have had little trouble raising equity; however, their access to capital is likely to be constrained when commodity prices fall.

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9 Large resource companies typically have wholly owned unlisted subsidiaries rather than ownership stakes in small listed companies.

Financial Regulation and Australian Dollar Liquid Assets

Alexandra Heath and Mark Manning*

Liquid assets with low credit and market risk have a number of uses in financial markets, such as providing collateral against short-term funding or credit exposures that arise between counterparties to financial transactions. This article examines the existing sources of demand for Australian dollar-denominated liquid assets. Given relatively low levels of government debt in Australia, demand for these assets has been increasing relative to supply for some time. A further increase in demand arising from regulatory changes designed to improve the management of liquidity risk and counterparty credit risk will accentuate this trend.

Introduction

Liquid assets play an important role in the financial system. They are generally defined as financial assets, such as cash and government securities, that can be readily used to fund payments, even in stressed market conditions. These assets are central to liquidity and credit risk management in financial markets. They are commonly used as collateral to obtain short-term funding and manage counterparty credit risks in derivatives transactions. Liquid assets, particularly those that also have low credit and market risk, are also an important asset class for a range of institutional investors, such as official sector managers of foreign exchange reserves.

A number of regulatory reforms designed to increase the stability of the financial sector in the wake of the global financial crisis are set to increase demand for liquid assets, both globally and locally. In particular, the Basel Committee on Banking Supervision (BCBS) is introducing the Liquidity Coverage Ratio (LCR), which will require banks to have sufficient *high-quality* liquid assets (HQLA) to meet the outflows associated with a 30-day stress scenario. This is a much more demanding metric than is currently applied in most jurisdictions. Regulatory changes designed to improve credit risk management in over-the-counter (OTC) derivatives markets are also likely to add to the demand for liquid assets.

In Australia, the supply of HQLA, such as Commonwealth Government securities (CGS), is low relative to the size of the financial sector, reflecting consistent budget surpluses over a number of years prior to the global financial crisis. Although the supply of government bonds has increased since 2007, it remains very low by international standards and relative to the needs of the financial system.

This article first discusses the existing and prospective demand for Australian dollar-denominated HQLA, and then considers the supply of assets that is available to meet these various needs. The article goes on to discuss the options available to private market participants and policymakers, respectively, to alleviate any possible adverse implications for the smooth operation of financial markets.

* This work was started while Alexandra Heath was in the Domestic Markets Department. Mark Manning is in the Payments Policy Department. We would like to thank Matthew Boge, Guy Debelle, David Jacobs, Greg Moran and many other colleagues for comments on this paper. We would also like to thank Shaun Collard, Sara Ma and Paul Ryan for assistance with the data.

The Demand for A$ Liquid Assets

Banks and other financial institutions require liquid assets to support their activities. Banks, in particular, need to hold assets that can be exchanged for cash at short notice to manage their day-to-day needs. Banks need liquid assets to help them manage the risks inherent in using short-term liabilities to fund longer-term assets, such as loans. Financial institutions active in derivatives markets also typically need to hold an inventory of liquid assets for use as collateral to fund their trading and hedging activities. To fulfil these roles, there needs to be reasonable certainty about the value of these assets.

At the beginning of 2007, before the global financial crisis, liquid assets accounted for around 6 per cent of Australian banks' total domestic assets (Table 1). A large share of liquid assets was in the form of unsecured securities issued by other banks: holdings of short-term paper, such as bank bills and certificates of deposit (CDs) accounted for 56 per cent of liquid assets, and a further 10 per cent was held in long-term bank paper. In normal market conditions, prime bank bills and CDs can be sold readily with very little impact on the prevailing price and are about as liquid as government bonds.[1] The importance of unsecured bank paper as a source of liquidity was highlighted as the financial crisis emerged in the second half of 2007. Issuance of these securities increased significantly, with most taken up by other banks to increase their capacity to access liquidity from the RBA (Boge and Wilson 2011).

In contrast, only around 6 per cent of liquid assets were either CGS or semi-government debt. Some of these securities would have been held under a repurchase agreement (repo). In this context, a repo transaction is very similar to an outright transaction because the cash receiver transfers the title of the security to the cash provider for the term of the repo, and is entitled to re-use the security in other transactions.[2] In Australia, the repo market plays an important role in helping banks and other financial institutions to accommodate large and variable cash flows, while managing any associated credit risks (Wakeling and Wilson 2010). Most repo market activity in Australia makes use of government securities rather than private securities. In aggregate, banks are usually small net purchasers of securities under repo, as they fund the trading operations of non-bank securities dealers and borrow securities from nominees and pension funds.

Institutional investors, such as official reserve managers, sovereign stabilisation funds and pension funds, demand liquid assets to fulfil mandates that emphasise capital preservation and the capacity to meet periodic cash flows. Official reserve managers, for instance, tend to hold a significant share of their reserves in safe, liquid assets in foreign currencies that enable them to conduct intervention as needed, while many sovereign stabilisation funds also focus on safety and capital preservation. Insurance companies and pension funds, on the other hand, have long-term liabilities and aim to match these by investing in long-term, but liquid, assets, such as long-dated government bonds. The International Monetary Fund (IMF) estimates that almost half of the government bonds on issue globally are held by these institutional investors (IMF 2012).

Demand for Australian dollar-denominated liquid assets from non-resident investors, such as official reserve managers, has increased fivefold since 2000. This is partly due to an increase in these investors' funds under management, and partly due to increasing diversification of their portfolios across a range of AAA rated sovereign securities (IMF 2012). As a result, the share of these assets held by non-resident investors has doubled since 2000 to around 60 per cent (Graph 1). More than three-quarters of the stock of CGS are held by non-resident investors. Given the nature of this demand, these assets are often passively managed,

1 The Australian Financial Markets Association (AFMA) is responsible for determining the set of prime banks, which must have low credit risk and contribute significantly to the liquidity of the market. Currently there are only four prime banks: ANZ, Commonwealth Bank, National Australia Bank and Westpac. For more details, see RBA (2012a).

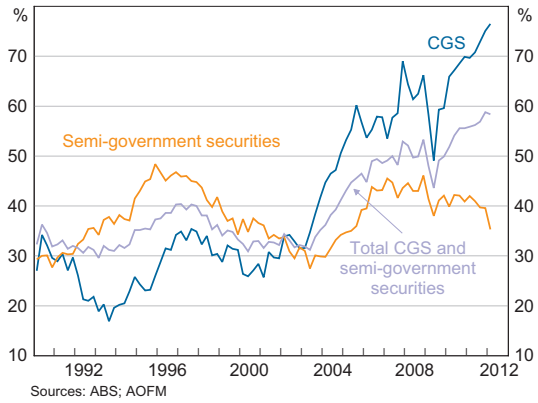
2 This is different to re-hypothecation, which occurs when banks and brokers re-use securities that have been pledged by their clients as collateral for their own transactions.

Table 1: Australian Banks' Assets
Domestic books

	March 2007		March 2009		March 2012	
	$ billion	Share[(a)]	$ billion	Share[(a)]	$ billion	Share[(a)]
Liquid assets[(b)]	**98**	**6**	**199**	**8**	**270**	**10**
– CGS and semis[(c)]	6	6	29	15	82	30
– Short-term bank paper	54	56	94	47	59	22
– Long-term bank paper	9	10	42	21	79	29
– Other[(d)]	28	29	33	17	50	18
Total bank assets	**1 640**		**2 411**		**2 636**	

(a) Share of total A$ assets (per cent), subcomponents are the share of liquid assets
(b) While deposits with other banks are a store of liquidity, they do not contribute to the stock of liquidity held by the banking system as a whole, since the recipient banks will, in turn, need to hold additional liquidity against these deposits; consequently, they are excluded from this table
(c) Semi-government securities are issued on behalf of state and territory governments
(d) Includes notes and coins, A$ debt issued by non-residents and securitised assets (excluding self-securitised assets)
Sources: ABS; APRA; RBA

Graph 1
Foreign Ownership of Australian Government Debt
Share of total market value



Sources: ABS; AOFM

that is, held to maturity. This reduces the 'free float' available to satisfy the demands of other participants in the Australian financial market.

As part of the extensive regulatory reform agenda in response to the global financial crisis, changes are set to take place that will have significant implications for the demand for HQLA across the financial system.

Basel III liquidity standards

During the global financial crisis, many assets that had been liquid in normal market conditions performed very poorly when volatility in financial prices increased. In particular, many highly rated assets experienced sharp price falls and/or became illiquid (IMF 2012). This experience led the BCBS to fundamentally reappraise its regulatory rules around the management of liquidity risk (BCBS 2010a) and the capitalisation of trading book assets (BCBS 2012).

Most notably, as part of the Basel III rules, the BCBS has established new minimum standards for the size and composition of banks' liquid assets. In particular, from the beginning of 2015 the LCR will require banks to have a sufficient quantum of the highest-quality liquid assets, a subset of the liquid assets considered in Table 1, to meet the outflows associated with a 30-day stress scenario. This is a significantly more stringent test than the five-day stress scenario that is currently being used in Australia, and is consistent with proposed changes to liquidity standards under consideration by APRA before the global financial crisis.[3] Under the LCR, HQLA are defined as assets that are unencumbered, easily and immediately convertible into cash with little or no loss of value *under stressed market conditions* and, ideally, are eligible for repurchase transactions with the central

3 APRA will impose the LCR requirements on all authorised deposit-taking institutions (ADIs), with the exception of those currently under the Minimum Liquidity Holdings regime. The latter are typically small ADIs with retail-based businesses. These institutions will continue to have a simple quantitative liquidity ratio requirement.

bank. In Australia, APRA has defined the highest-quality liquid assets as cash, central bank reserves, CGS and semi-government securities.[4] The BCBS has explicitly excluded short-term unsecured obligations of financial institutions, such as bank bills and CDs, from counting towards the LCR.

Changes to Australian banks' balance-sheet management practices are already apparent in the share and composition of their liquid asset holdings (Table 1). These have been driven partly by heightened market discipline since the onset of the global financial crisis, and partly by the need to prepare for the introduction of Basel III. The share of liquid assets has increased steadily since 2007 and was 10 per cent at the beginning of 2012. The share of government securities increased to 30 per cent of liquid assets, while the share of other banks' short-term paper more than halved. At the same time, holdings of other banks' long-term bonds also increased to almost 30 per cent, in part reflecting banks' adjustment to other Basel III reforms that will limit the maturity mismatch between banks' assets and liabilities.

Despite this, APRA estimates that banks would have needed around $300 billion more HQLA at the end of 2011 to cover the outflows estimated for the 30-day stress scenario under the LCR framework as articulated by the BCBS (2010a).[5] The BCBS has estimated that the global shortfall of HQLA for banks that do not meet the LCR is at least €2 trillion (BCBS 2010b; IMF 2012). Banks could reduce these shortfalls to some extent between now and 2015 by adjusting their business models to lower the net outflows that need to be covered in the stress scenario (the denominator of the LCR). Furthermore, the LCR is subject to an observation period and therefore the specific parameters used to set requirements could potentially be refined. Nevertheless, the magnitude of the estimated shortfall suggests that there will be a significant further increase in demand for HQLA.

Regulation of OTC derivatives

The global financial crisis revealed that some OTC derivatives markets, such as the credit default swap market, were a significant source of uncertainty and risk. In many cases, the size of exposures was not transparent to counterparties or regulators, and prevailing risk-management arrangements were not adequate to control the build-up of counterparty credit exposures or to prevent the transmission of distress between financial institutions. These observations have led to a number of regulatory initiatives.

Most notably, at the Pittsburgh Summit in September 2009, the leaders of the G-20 committed to central clearing for all standardised OTC derivatives by the end of 2012 and to higher capital requirements for non-centrally cleared derivatives.[6] Since some OTC derivatives are not well suited to central clearing, the G-20 subsequently endorsed the development of international standards for bilateral margin requirements on non-centrally cleared derivatives, to improve counterparty risk management in those markets and ensure that there are no disincentives to central clearing (BCBS-IOSCO 2012).

While variation margin is already typically exchanged in cash under existing bilateral arrangements between financial institutions, the expansion of both central clearing and initial margining of non-centrally cleared transactions will increase the demand for assets that can be used to cover initial margin requirements. The collateral eligibility criteria for many central and bilateral counterparties

4 Currently, APRA has determined that there are no assets that qualify as so-called HQLA2, which is a category of assets that are likely to be slightly less liquid in stressed market conditions. In other jurisdictions, the types of financial assets that might qualify for this category include covered bonds and corporate bonds.

5 This calculation is on a consolidated banking group basis, whereas Table 1 presents data for banks' domestic books only.

6 In many jurisdictions, including Australia, legislative frameworks are being established that will allow for the implementation of mandatory central clearing requirements for certain classes of derivatives and counterparties. In Australia, however, the Council of Financial Regulators has concluded that in the first instance, industry-led solutions and economic incentives should be the preferred route to increased central clearing; mandatory requirements will only be imposed if desired outcomes are not reached within an acceptable time frame (Council of Financial Regulators 2012).

are broader than HQLA. However, assets with low credit and liquidity risk are often preferred so that, in the event of a default, the holder of collateral can manage any cash flow requirements that it may have until its exposure can be extinguished. Indeed, in practice, in many markets initial margin calls are predominantly settled in cash. As a result, demand for HQLA may be expected to increase further.

To illustrate the broad magnitude of the increase in demand for collateral in Australia from this source, we consider potential margin requirements on the two largest classes of OTC derivatives currently held on Australian banks' books. These are single-currency interest rate swaps and foreign exchange swaps and forwards (including cross-currency swaps). The notional value of these derivatives held by Australian banks was $8.5 trillion and $4.3 trillion, respectively, in March 2012 (Table 2).

It is likely that, as a result of either regulatory requirements or commercial incentives, single-currency interest rate swaps will largely move to central clearing because the capacity to do so is well established. However, the increase in demand for collateral to meet margin obligations arising from these transactions is likely to be relatively limited for two reasons. First, margins are based on the central counterparty's multilateral net exposures to individual participants. Second, the prices of these assets are relatively stable. Hence, initial margins posted against single-currency interest rate swaps may be in the order of just 0.02 per cent of notional amounts outstanding (LCH.Clearnet 2011).

Table 2: Australian Banks' Derivative Positions[a]

Notional amounts outstanding,[b]
A$ trillion, March 2012

OTC interest rate contracts	
– Forwards	1.0
– Swaps	8.5
– Other[c]	2.2
OTC foreign exchange contracts	
– Forwards	2.2
– Swaps	2.2
– Other[c]	0.3
Credit derivatives[c]	0.2
Other[c]	0.3

(a) Includes Australian-owned banks and Australian branches and subsidiaries of foreign banks
(b) Notional amounts outstanding include bilateral positions between Australian banks; there is therefore some double counting
(c) Includes some exchange-traded derivatives
Source: APRA

In contrast, the increase in demand for collateral to meet initial margin requirements associated with Australian banks' positions in foreign exchange derivatives is likely to be substantial. These positions will, at least in the short term, remain bilaterally cleared since no central counterparty yet offers a central clearing service for most classes of these derivatives.[7] Estimates of the potential increase in demand for Australian dollar-denominated HQLA from posting initial margin on foreign exchange derivatives are sensitive to the margin rate, the share of Australian banks' notional outstanding positions involving the Australian dollar, and the degree to which gross notional outstanding positions can be reduced through bilateral netting. Margin rates could be as high as 6 per cent,[8] but approved internal models that are expected to be widely used in practice are likely to produce lower rates, possibly closer to 3 per cent. Assuming that around 50 per cent of the gross outstanding value of foreign exchange derivatives involves the Australian dollar and that net exposures are around 50 per cent of gross outstanding exposures (which is plausible given the available data), the potential collateral needed to meet initial margin requirements could be around $35 billion.

7 In those jurisdictions in which mandatory central clearing obligations are being introduced, current indications are that most classes of foreign exchange derivatives are (or are likely to be) exempt. This, at least in part, reflects difficulties in integrating a central counterparty with the existing settlement infrastructure for foreign exchange swaps and forward contracts. See Manning, Heath and Whitelaw (2010).

8 BCBS-IOSCO (2012) proposes that entities apply a margin rate on non-centrally cleared foreign exchange derivatives exposures of 6 per cent where approved internal models are not used.

The Supply of A$ High-quality Liquid Assets

The discussion above highlights that institutions in the Australian financial system demand HQLA for a variety of purposes and that there will be a significant increase in demand for such assets. For a given currency, the assets that tend to be most liquid in conditions of financial stress, after cash and cash-like assets, are domestic government securities. This arises because the public sector is generally more likely than private sector participants to maintain its creditworthiness due to its unique ability to tax the population and/or expand the money supply. Hence the markets for government securities are most likely to continue to function without significant loss of value. Indeed, it is common for the price of government securities to increase relative to other financial asset prices in these conditions because of their ability to maintain their value.

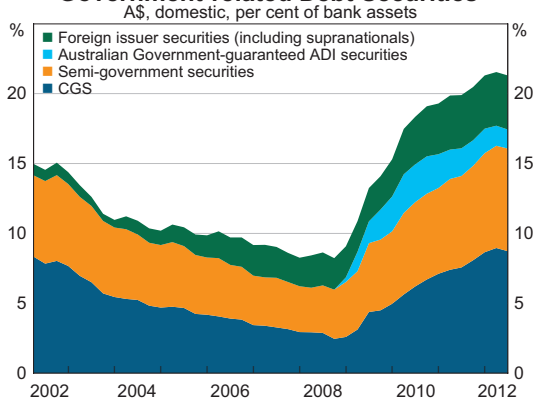
At present there is around $240 billion outstanding in CGS, representing around 17 per cent of GDP and around 9 per cent of bank assets (Graph 2). The semi-government bond market is similar in size.

The level of CGS outstanding fell to as low as 4 per cent of GDP in 2008, primarily as a result of successive fiscal surpluses and a policy of maintaining the stock of nominal bonds at around $50 billion, which in 2003 was judged to be consistent with a liquid CGS market. In combination with the increase in demand from offshore investors, these trends led to a significant fall in the stock of CGS available for other uses such as collateral and to meet regulatory requirements.

In response, the Australian Government announced that it would expand the amount outstanding of CGS to $75 billion in May 2008. The fiscal response to the global financial crisis subsequently led to an increase in the stock of CGS to around 17 per cent of GDP at present. While this is projected to decline in coming years, the government has committed to issuing sufficient CGS to maintain a liquid market, which has been assessed to be in a range of between 12 and 14 per cent of GDP (Australian Government 2011).

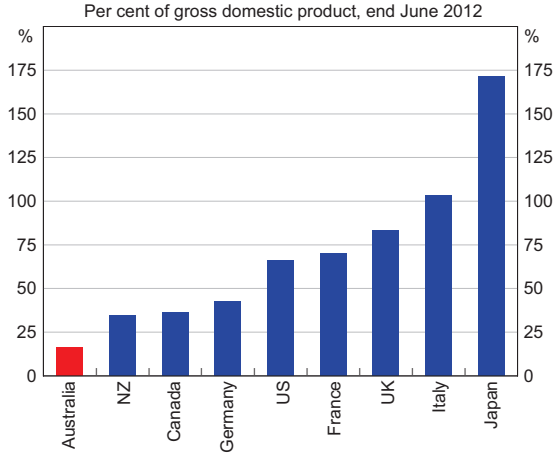
Notwithstanding a noticeable improvement in the functioning of the CGS market as a result of the increase in issuance, the size of CGS outstanding remains very low relative to GDP, or any other nominal benchmark, by international standards (Graph 3). The relative scarcity of CGS is also reflected in the yields on Australian Government bonds, which are very low by international standards, after adjusting for the general level of the interest rate structure (RBA 2012b).

Graph 2
Government-related Debt Securities
A$, domestic, per cent of bank assets



Sources: ABS; AOFM; APRA; RBA; state and territory treasuries

Graph 3
Gross Central Government Debt Outstanding
Per cent of gross domestic product, end June 2012



Sources: Agence France Trésor; AOFM; Bank of Canada; Bundesrepublik Deutschland Finanzagentur GmbH; IMF; Ministry of Economy and Finance (Italy); Ministry of Finance Japan; New Zealand Debt Management Office; UK Debt Management Office; US Department of the Treasury

Responses to a Shortage of Liquid Assets

Demand for Australian dollar-denominated HQLA is likely to increase much faster than the projected increase in the supply of CGS and semi-government securities. Furthermore, evidence from the United States suggests that the velocity of collateral, measured by the number of times a given security is re-used or re-hypothecated, has been falling, partly due to regulation as well as increased demand from clients for collateral assets to be protected (Singh 2011).[9] This will exacerbate any pressures in the market for collateral. There have been a number of responses, both internationally and domestically, and in both the public and private sectors, to alleviate these pressures.

The private sector response

Internationally, the prospect of increasing and competing demands on a limited pool of HQLA has raised concerns in the private sector regarding the costs of meeting liquidity and collateral requirements.[10] In practice, the private sector has at least four ways of responding to these developments:

- Third-party collateral management services that allow market participants to *increase the efficiency of collateral usage* are well established, but are likely to become more heavily utilised. In the Australian context, for example, commercial bank providers of such services are already active and the ASX Group is working with Clearstream Banking Luxembourg to develop a centralised collateral management service linked to the domestic financial market infrastructure.
- Internationally, there has been an increase in demand for so-called *collateral transformation,* or *collateral upgrade services*, whereby one party exchanges low-quality or illiquid assets with another for high-quality assets that meet some collateral eligibility criteria. Some concerns have been raised about the risks that might arise for the lender of the high-quality assets under such exchanges (Bank of England 2012). It has, however, also been acknowledged that this activity may have a role to play, as long as associated risks are understood and appropriately managed (FSA 2012).
- Central and bilateral counterparties are, where appropriate, increasingly likely to accept a *broader set of collateral assets* than HQLA to satisfy initial margin obligations. Some central counterparties already accept a relatively wide range of collateral assets. The CPSS-IOSCO Principles for Financial Market Infrastructures (CPSS-IOSCO 2012) suggest that central counterparties should prefer collateral 'with low credit, liquidity and market risks'. It is acknowledged, however, that other assets may be 'acceptable collateral for credit purposes if an appropriate haircut is applied'. Similarly, in relation to collateral exchanged for non-centrally cleared transactions, BCBS-IOSCO (2012) emphasises that 'to the extent that collateral is exposed to credit, market, liquidity and FX risks … appropriately risk-sensitive haircuts should be applied'.
- With demand for HQLA increasing more rapidly than supply, the inevitable adjustment in yields will trigger some *portfolio reallocation*. Where they have discretion in their investment decisions, and the appetite to assume some credit, liquidity or market risk, some investors would be expected to substitute into higher yielding assets.

Ultimately, these responses will drive the system to a new equilibrium. Indeed, were it not for segmentation in markets, and restrictive mandates or regulatory requirements that constrain some market participants in their investment decisions, prices might be expected to have adjusted already in anticipation of these developments. To the extent that adjustments may in practice take some time,

9 Having observed some institutions' difficulties in reclaiming posted collateral during the global financial crisis, policymakers in many jurisdictions are likely to implement regulatory reforms that reinforce the trend towards a lower collateral velocity.

10 See, for example, Cameron (2012, pp 17–20) and *The Economist* (2012, p 78).

and potentially be disruptive, central bank policy is likely to play an important role in reducing the costs of transition.

Central bank policy will also be a key factor in shaping the eventual new equilibrium. For instance, collateral eligibility criteria in the private sector will typically reflect the assets that the central bank is willing to accept in its operations, and the access that different participants in financial markets have to central bank money. For example, the willingness of central counterparties to accept a broader range of collateral may be affected by the nature of their access to the central bank. More generally, the way that central banks respond to a collateral shortage in pursuit of their own policy objectives will influence the effectiveness of any independent measures taken by the private sector.

The central bank response

Heightened demand for liquid assets, and in particular HQLA, could affect central banks' operations and policy objectives in a number of ways. First, for many central banks, including the RBA, repurchase agreements play a central role in open market operations. The availability of eligible collateral can therefore influence the effectiveness of monetary policy operations. It can also have implications for the smooth functioning of high-value payment systems, which generally rely on the provision of intraday liquidity against eligible collateral to facilitate real-time gross settlement.

Second, to the extent that increasing demand for eligible collateral assets drives up the price of those assets, banks' costs of funding and the costs of trading would be expected to rise. This could, in turn, lead to a decline in key financial activities, such as foreign exchange and interest rate hedging, which support many transactions in the broader economy.

Finally, and relatedly, financial stability risks could also arise if financial institutions were unable to access sufficient liquidity and were forced to meet any shortfall by selling illiquid assets at fire-sale prices.

In contrast to private sector financial institutions, a central bank can increase the supply of cash to its desired level by using its balance sheet. Given this unique capability, a central bank can provide a vehicle to transform a range of financial system collateral into cash. One way this can be done is by expanding the set of securities that are eligible for standard central bank repo operations.[11] The RBA has done this on a number of occasions over the past decade, both in response to the structural decline in the availability of CGS before the global financial crisis and in response to the increase in demand for central bank liquidity as market conditions became distressed during the crisis.[12] During this period, the RBA took a number of steps, including expanding the list of eligible securities to include residential mortgage-backed securities (RMBS) issued by the collateral provider (so-called 'self-securitised' securities) as a way of increasing liquidity without increasing systemic risks that arise from financial institutions holding securities issued by other financial institutions.[13] This episode highlights the importance of the central bank as a source of liquidity in times of stressed financial markets. The RBA has sought to accommodate any differentiation in credit or liquidity risk between collateral assets by applying appropriate haircuts, which are reviewed and adjusted as necessary on a regular basis.

The RBA has taken a similar stance in responding to the structural shortage of HQLA to meet ADIs' requirements under the LCR. In particular, ADIs may be able to establish a committed liquidity facility (CLF) from the RBA to help meet these requirements (APRA 2011), which in many ways is merely a formal extension of the RBA's existing arrangements. Under

11 The central bank's balance sheet can also be expanded by outright asset purchases.

12 The current list of eligible securities is available at <http://www.rba.gov.au/mkt-operations/resources/tech-notes/eligible-securities.html>.

13 To require that there were no related-party features on eligible securities would have implied a degree of cross-holdings in the banking system such that other systemic risk issues would have come to the fore. Indeed, the systemic risks associated with large cross-holdings might have been expected to crystallise precisely when institutions needed to use these securities to access RBA liquidity.

the CLF, participating ADIs will be permitted (at a price) to access a pre-specified amount of liquidity (determined by APRA) by entering into repurchase agreements outside the RBA's normal market operations. All the securities that are eligible for the RBA's normal market operations will also be eligible for the CLF. In addition, the RBA will allow ADIs to present certain related-party assets, including self-securitised RMBS and asset-backed securities.

In establishing the CLF, the RBA has effectively committed to perform collateral transformation, at a penalty rate, on assets that do not have the defining features of HQLA. The RBA will receive a fee of 15 basis points in return for this commitment (RBA 2011). This level has been set to capture the liquidity premium component of the yield differential between the assets eligible under the CLF and government securities (Debelle 2011).[14] APRA's effective prudential supervision, including an explicit requirement that ADIs take all reasonable steps to reduce their need for the CLF, further ensures that ADIs face strong incentives to manage their liquidity risk appropriately.

The way in which the structural shortage of HQLA and the need to meet the Basel III prudential standards have been resolved in Australia highlights the importance of balancing regulatory goals against other policy objectives. In this case, the regulatory objectives of self-reliance and improving liquidity management in the banking sector need to be balanced against the objective of having liquid, and therefore more stable, financial markets for securities that are integral to the efficiency of the financial system.

The impending increase in demand for collateral-eligible assets arising from regulatory reforms in the market for OTC derivatives may require a similarly flexible response from the RBA – and indeed other central banks around the world. To the extent that the additional demand cannot be satisfied by the combination of private sector responses described above, or at least not on a sufficiently timely basis, central banks may need to revisit their policies around central bank liquidity. Consistent with this, the RBA recently revised its access policy to require that systemically important central counterparties maintain Exchange Settlement Accounts (ESAs) at the RBA.[15] This recognises the increasingly important role of central banks in facilitating liquidity management for critical financial market infrastructure, particularly given the expansion in the use of centralised infrastructure to OTC markets.

Conclusion

At the international level, there is concern that the increase in demand for HQLA, driven both by regulatory changes and market discipline in the aftermath of the global financial crisis, could lead to a substantial rise in the price of these assets. This could in turn increase the cost of key financial risk-management activities in both the financial sector and the wider real economy. While these changes are rightly intended to improve financial system stability, they could also have an important effect on financial system efficiency.

Australia confronted increasing demands on a limited pool of Australian dollar-denominated HQLA for many years before the global financial crisis. Relatively low levels of government debt were not sufficient to meet the day-to-day needs for liquid assets of financial institutions and the growing demand for these assets from offshore institutional investors. In response, the RBA increased the supply of assets that could be used to generate liquidity by broadening the range of eligible collateral that could be used in the RBA's daily open market operations. During the global financial crisis, the range of eligible collateral was expanded even further.

14 The rationale for pricing the facility to capture the liquidity premium on eligible assets relative to government securities is that the RBA is seeking to replicate the economics of how the LCR would be met in the absence of a structural shortage of HQLA.

15 In Australia, central counterparties are eligible to hold ESAs with the RBA and are therefore eligible to access liquidity against eligible collateral. Following a recent policy change, any licensed central counterparty deemed to be systemically important to Australia is now *required* to hold an ESA with the RBA (see RBA 2012c).

While there has been some increase in the stock of government securities over recent years, this will not be sufficient to cover additional demands coming from two sources. The first is the introduction of new liquidity standards that will come into force for ADIs in 2015. The second source of extra demand is for collateral to support derivatives market activity. In response, the RBA has committed to provide liquidity to ADIs against a very broad range of collateral in return for a fee, and has also revised its policy around access to central bank facilities. In many ways, this is a formal extension of existing liquidity-providing operations. ✠

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The Chinese Banking System

Grant Turner, Nicholas Tan and Dena Sadeghian*

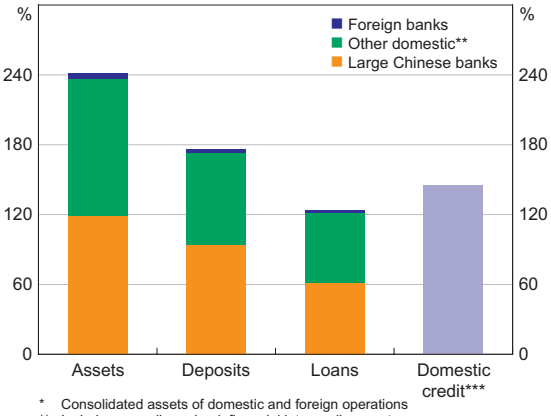
The Chinese banking system is critical to the functioning of the Chinese economy, being the main conduit through which savings are allocated to investment opportunities. Banking activity in China has grown rapidly over the past decade in association with the expansion of the Chinese economy, and the Chinese banking system now includes some of the world's largest banks. Chinese banks have become more commercially orientated over this period, although the Chinese Government retains considerable influence over their activities. This article examines the size and structure of the Chinese banking system and the key characteristics of banking activity in China. The regulatory and institutional arrangements for banking in China are also outlined.

Size and Structure of the Chinese Banking System

The Chinese banking system is large relative to the size of the Chinese economy and has expanded significantly over the past decade. Consolidated banking system assets (including assets in Chinese banks' foreign branches and subsidiaries) were equivalent to around 240 per cent of GDP at the end of 2011, up from around 200 per cent in the early 2000s (Graph 1). Domestic credit is estimated to be equivalent to 145 per cent of GDP. This credit-to-GDP ratio is high relative to countries with similar levels of per capita income (IMF 2011a). Other funding sources in China are less developed than intermediated credit: debt securities outstanding (excluding central government and central bank debt) and equity market capitalisation are each equivalent to around 30–40 per cent of GDP.[1]

The five largest banks in China are, in order of decreasing size, Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Bank of China (BOC), Agricultural Bank of China (ABC) and the Bank of Communications (BCOM). Together these banks account for around one half of Chinese banking system assets and deposits. These banks are majority-owned by the Chinese state, but have private sector shareholders through their listings on the Hong Kong stock exchange. (See Box A for background on the evolution of the Chinese banking system, including the restructuring and public listing

Graph 1
Chinese Banking System*
Per cent of nominal GDP, 2011



* Consolidated assets of domestic and foreign operations
** Includes a small non-bank financial intermediary sector
*** Includes renminbi loans, entrusted loans, trust loans, letters of credit and bank-accepted bills
Sources: CEIC; China Banking Regulatory Commission (CBRC); RBA; banks' annual reports

* Grant Turner and Nicholas Tan are from Financial Stability Department; Dena Sadeghian is from Economic Group.

1 The comparison between the bank credit and the debt securities markets as funding sources in China is complicated by the fact that Chinese banks are the main purchasers of corporate bonds in the primary market. China's equity market is relatively small, partly because numerous Chinese non-financial companies have raised equity capital offshore, particularly on the Hong Kong stock exchange.

Box A
Evolution of the Modern Chinese Banking System

Prior to the late 1970s, the Chinese banking system consisted of only one bank – the People's Bank of China (PBC). The PBC was part of the Ministry of Finance and its role in China's planned economy was primarily to collect revenues from state-owned enterprises and allocate investment funds approved through the budget (Jiliang 2004; Pei and Shirai 2004; Walter and Howie 2011).

The modernisation of the Chinese banking system began in 1978 with the establishment of three specialised banks: the ABC assumed rural banking activities from the PBC; BOC became responsible for foreign currency transactions and international business; and CCB focused on servicing the construction industry. In 1984, the ICBC was established to take over industrial and commercial banking activities from the PBC, which subsequently began to act as China's central bank and financial sector supervisor. The Chinese Government also permitted the establishment of a number of other domestic banking institutions from the late 1980s, including BCOM. In an effort to separate policy-related lending from commercial banking in China, three policy banks were created in the mid 1990s (China Development Bank, Import and Export Bank of China, and Agricultural Development Bank of China), and a law was enacted establishing the four specialised banks (ABC, BOC, CCB and ICBC) as state-owned commercial banks responsible for managing their own operations and risks, in accordance with prudential regulations.

The moves to commercialise the Chinese banks occurred against a backdrop of earlier misdirected lending and poor bank performance. Much of the Chinese banks' lending during the late 1980s and 1990s was to state-owned enterprises, many of which were loss-making and reliant on bank credit to continue financing their activities, but ultimately did not repay these loans (Lardy 1999). Bank lending had also contributed to a boom and subsequent bust in the real estate and stock markets in the early 1990s (Huang 2006). As a result, banks' non-performing loans increased significantly: by the late 1990s the large state-owned banks' aggregate non-performing loan (NPL) ratio exceeded 30 per cent (Huang 2006).[1] These banks were severely undercapitalised at this time (relative to minimum international regulatory standards) and had only small loan loss provisions (Lardy 1999).[2]

The Chinese Government commenced an extended process of restructuring the four largest state-owned Chinese banks in 1998, injecting a total of US$33 billion of capital into them, financed by the sale of bonds to the same banks (Table A1). Four asset management companies (AMCs) were then established in 1999, one for each bank. These AMCs were tasked with purchasing, resolving and selling the banks' NPLs. The AMCs purchased US$168 billion of NPLs in 1999–2000, at face value, which they

1 Smaller banks and the policy banks also reportedly had very high non-performing loans, but reliable data are not readily available (Lardy 1999).

2 Non-bank financial intermediaries, such as finance and trust companies, also suffered from bad lending, as well as poor governance. A number of these companies failed during the late 1990s, including the high-profile Guangdong International Trust and Investment Company (GITIC), which had US$5.6 billion in registered claims during liquidation, including US$4.7 billion from international investors. Underlying problems within the financial system exposed by the failure of GITIC and other non-bank lenders have been credited by some observers as a catalyst for subsequent banking system reforms (Walter and Howie 2011).

Table A1: Restructuring of the Four Largest State-owned Chinese Commercial Banks

	BOC	CCB	ICBC	ABC	Total	*Memo: share of banks' assets*[(a)]
						Per cent
Initial capital injection in:	1998	1998	1998	1998		
US$ billion	5	6	10	11	33	3½
Initial NPL disposal in:[(b)]	1999–2000	1999–2000	1999–2000	1999–2000		
US$ billion	32	45	49	42	168	15½
Subsequent capital injection in:	2003	2003	2005	2008		
US$ billion	23	23	17	19	81	3½
Subsequent NPL disposal in:[(c)]	2004	2004	2005	2008		
US$ billion	33	15	86	117	252	8
Establish shareholding company in:	2004	2004	2005	2009		
IPO in:	2006	2005	2006	2010		
US$ billion	13	17	22	22	74	2

(a) Simple average of the four banks' shares at their respective times
(b) Value of NPLs removed from banks' balance sheets; purchased at face value
(c) Value of NPLs removed from banks' balance sheets; the purchase price was typically around 50 per cent of this
Sources: Liu (2004); Ma and Fung (2002); banks' annual reports

partly financed by selling (low-yielding) bonds to the banks. Only loans originated prior to 1996 were purchased by the AMCs because the performance of loans originated after that date was deemed to be a consequence of banks' own credit decisions rather than government policy (Peiser and Wang 2002; Pei and Shirai 2004).

All four banks underwent further recapitalisation and disposal of NPLs in the 2000s, and were subsequently listed on the Hong Kong and Shanghai stock exchanges. The four banks' initial public offerings (IPOs) raised a combined US$74 billion in return for around 15–25 per cent of these companies' equity; the IPOs of ICBC and ABC were the largest recorded in the world at the time. Some large global banks became strategic minority shareholders in the state-owned Chinese banks, assisting their commercialisation.

China has undertaken a number of other banking system reforms in addition to restructuring its largest banks. Upon joining the World Trade Organization in 2001, China agreed to a five-year timetable of changes aimed at opening up its banking system to foreign competition; by 2006, locally incorporated foreign-owned banks were allowed to apply for a licence to offer unrestricted local currency services to Chinese individuals. In 2003, the China Banking Regulatory Commission (CBRC) was established to assume responsibility for banking sector regulation and supervision, separating this from the functions

of monetary policy and financial system stability that continued to reside with the PBC. The CBRC has been active in strengthening prudential standards and oversight over recent years, contributing to improvements in governance, risk management practices and transparency among Chinese banks. For example, large commercial banks in China now have independent directors on their boards, as well as independent risk management functions, and make regular financial disclosures. China is also an important part of the international financial regulatory community via its membership of the G-20, FSB and Basel Committee on Banking Supervision (BCBS). The Chinese authorities intend to start implementing the Basel III international bank capital standards from the start of 2013 – the beginning of the internationally agreed phase-in period for these standards.

The Chinese banking system was resilient to the direct financial effects of the 2008–2009 global financial crisis, in large part because it was focused on a strongly growing domestic market and had little exposure to overseas wholesale funding markets. In response to the sharp downturn in external demand, the Chinese authorities implemented substantial economic stimulus through a rapid expansion in bank credit, which was largely directed to government infrastructure projects. The increase in banks' credit in 2009 was equivalent to about 30 per cent of GDP. The sizeable amount of government-mandated lending is likely to have slowed the ongoing commercialisation of the Chinese banks, and may have added to their credit risks.

of the largest Chinese banks.) They are also among the largest banks globally; according to The Banker (2012), by assets they were ranked 5th, 12th, 13th, 15th and 37th in the world in 2011. Furthermore, BOC has been classified as a global systemically important bank by the Financial Stability Board (FSB 2011).[2]

The rest of the Chinese banking system is mostly accounted for by other domestically owned banks. This group includes 12 smaller listed commercial banks, three 'policy' banks, a postal savings bank, more than one hundred 'city commercial' (regional) banks, and around three thousand small credit cooperatives and rural financial institutions. There is also a small, but fast-growing, non-bank financial intermediary sector that includes finance companies and trust companies. Foreign-owned banks, in aggregate, represent only a small part of the Chinese banking system, at less than 2 per cent of total assets. This is despite there being 37 locally incorporated foreign banks and 77 foreign banks operating under a branch licence at the end of 2011. Foreign banks have been unable to penetrate the Chinese market beyond this small share because they have had difficulty competing for domestic customers on price, quantity and product, and have faced regulatory restrictions on some activities. For example, foreign banks face restrictions when applying for a licence to provide local-currency services to Chinese individuals, engage in derivatives transactions or issue renminbi bonds.

Institutional and Regulatory Arrangements

The institutional and regulatory arrangements for banking in China differ from those in many other banking systems. The Chinese Government is still extensively involved in the banking system through its majority ownership of the largest Chinese banks and the Chinese authorities retain considerable influence over banks' lending and deposit-taking activities. These arrangements mean that incentives within the Chinese banking system differ from those in banking systems that are predominantly privately owned and controlled.

The Chinese Government has majority ownership of banks that account for more than half of Chinese banking system assets, mainly through equity stakes of around 60–90 per cent in each of the five largest commercial banks. The government's equity shareholdings are owned by Central Huijin (a subsidiary of the sovereign wealth fund, China Investment Corporation, which invests in financial institutions), the Ministry of Finance and, to a lesser extent, some state-owned enterprises. In addition, the government is the sole owner of the three policy banks and has controlling stakes in a number of smaller commercial banks. As majority owner, the Chinese Government appoints the senior management of these banks.

The PBC conducts monetary policy in a managed exchange rate environment; it sets explicit targets for growth in the money supply and guides both the quantity of bank lending and its distribution across sectors of the economy. Bank lending decisions in China can therefore sometimes reflect government policy priorities rather than purely commercial considerations. Consistent with this, a significant (and disproportionate) share of bank credit in China is extended to state-owned enterprises and government infrastructure projects.

Reserve requirement ratios (RRRs) are one of the tools used by the PBC to control the supply of money in the Chinese banking system.[3] The RRR is the proportion of deposits a bank must hold as reserves with the central bank; these funds are not available to be lent out to customers or invested. In recent years, RRRs have been adjusted to largely offset the effect on money and credit of the injections of liquidity associated with the government's foreign exchange

2 See RBA (2012b) for a discussion of the methodology used by the FSB to identify global systemically important banks.

3 The PBC also uses open market operations to manage liquidity in the banking system. These operations involve the PBC engaging in outright and repurchase transactions of PBC securities with commercial banks and other approved financial institutions.

operations. Currently, the benchmark RRRs are 20 per cent for large banks and 18 per cent for most smaller banks. However, under its policy of 'dynamic differentiated reserve requirements' introduced in early 2011, the PBC can tailor RRRs to individual banks according to their holdings of capital and their rate of credit growth. This policy aids the PBC's influence over lending to particular sectors or industries – for example, RRRs were lowered for some branches of ABC earlier this year to boost lending in rural areas. Chinese banks' reliance on deposit funding, coupled with low remuneration on required reserves, means that high RRRs impose a large opportunity cost on banks. Moreover, as RRRs must be met on a daily basis (based on a 10-day rolling average of the stock of deposits), banks tend to hold a buffer of excess reserves – across the system this buffer averaged 1½ per cent of deposits during 2011.[4]

The PBC also sets benchmark interest rates on banks' deposits and loans at various maturities (Table 1). Benchmark deposit rates have constituted a ceiling on actual deposit rates, except for large-value deposits, for which banks are permitted to pay higher rates. In contrast, benchmark lending rates have generally placed a floor on actual lending rates, and over the past couple of years an increasing share of bank loans have been priced above benchmark rates. This situation has ensured the profitability of Chinese banks' intermediation activities, given that non-deposit funding represents only a small part of their funding liabilities. In June and July 2012, the Chinese authorities announced that actual rates on all bank deposits were permitted to exceed the relevant benchmark by up to 10 per cent, while lending rates could be as much as 30 per cent below benchmark (previously a 10 per cent discount was allowed).[5] Analysts have speculated that this additional interest rate flexibility will result in the compression of margins at some Chinese banks, to the extent that banks take the opportunity to raise deposit rates in an environment of slower deposit growth. According to PBC (2012), most commercial banks have responded by raising their demand and 1-year deposit rates above benchmark levels, often by the full 10 per cent allowed.

The CBRC requires banks to satisfy a number of quantitative controls on their balance sheets, in addition to imposing minimum capital requirements in line with international regulatory norms. These include: a maximum loan-to-deposit ratio of 75 per cent; a minimum liquidity ratio (liquid assets/current liabilities) of 25 per cent; and a minimum provision coverage ratio (provisions/non-performing loans) of 150 per cent. These regulatory ratios are set at conservative levels, which should contribute to greater bank soundness, all else being equal. On the

Table 1: Chinese Benchmark Interest Rates
As at end August 2012

	Deposit	Lending
Demand	0.35	na
3-month	2.60	na
6-month	2.80	5.60
1-year	3.00	6.00
2-year	3.75	na
3-year	4.25	6.15
5-year	4.75	6.40
> 5-year	na	6.55

Source: CEIC

4 The respective interest rates paid on required reserves at the PBC and excess reserves at the PBC are around 1.6 per cent and 0.7 per cent.

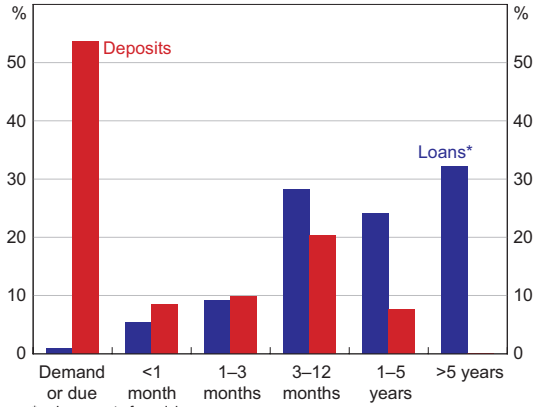
5 Rates on residential mortgages to first home buyers were permitted to be up to 20 per cent below benchmark prior to June 2012.

other hand, history elsewhere has shown that strict quantitative regulations can have unintended effects – for example, required loan-to-deposit ratios might lead banks to invest in non-loan assets that prove riskier than their traditional loan business. More generally, banks may take actions to circumvent regulations, including through their off-balance sheet activities.

Characteristics of Banking Activity

The Chinese banking system is largely focused on traditional financial intermediation between savers and borrowers in China. Consistent with this, around two-thirds of Chinese banks' income comes from these activities (CBRC 2011). Chinese banks largely fund themselves from domestic deposits (around 70 per cent of system liabilities); the share of banks' funding sourced from debt capital markets is fairly small (Table 2). About half of banks' deposits are from non-financial corporations, with households accounting for most of the remainder. By maturity, around 45 per cent of banks' deposits are held on demand; this share appears to be higher for the five largest commercial banks (Graph 2).

Graph 2
Large Chinese Banks' Loans and Deposits
Share of total by maturity, 2011



* Loans net of provisions
Source: banks' annual reports

Table 2: Chinese Banking System Balance Sheet
As at end June 2012, per cent

Assets	Share of total assets	Liabilities	Share of total liabilities
Foreign assets	2.5	Foreign liabilities	0.8
Reserve assets	14.1	Liabilities to central bank	0.8
Claims on government	5.6	Bonds issued	6.7
Other claims[a]	73.3	Liabilities to corporations and households	80.3
Non-financial corporations	40.0	Non-financial corporations	33.5
Households	11.5	Households	31.2
Other financial corporations	21.8	Other financial corporations	13.3
		Other sectors	2.3
Other	4.5	Other[b]	11.4
Total	100.0	Total	100.0
Memo items			
Loans for domestic use	46.9	Total deposits	69.6
Local currency loans	47.0	Corporate deposits[c]	34.1
Foreign currency loans	2.9	Household deposits	31.2

(a) Includes loans, bonds, equities and other financial derivatives
(b) Includes retained earnings and other capital
(c) Includes deposits of non-financial corporations and 'other financial corporations'; excludes non-deposit liabilities
Source: CEIC

On the asset side, domestic loans represent around 50 per cent of banking system assets. The majority of banks' loans are to large and medium-sized non-financial corporations (including state-owned enterprises). Loans to small businesses account for around 20 per cent of loans, while household loans account for less than one-quarter of banks' total loans – a lower share than in many other banking systems, including those elsewhere in Asia.

System-wide data from the PBC and more disaggregated data from the five largest commercial banks indicate that banks' loans are fairly evenly spread between short-term maturities (i.e. less than one year), medium-term maturities (1–5 years) and long-term maturities (greater than five years) (Graph 2). The average term of banks' lending has increased steadily since the early 2000s, driven by increased investment project financing (IMF 2011b). This has increased the maturity mismatch between banks' loans and deposits. While this mismatch exposes Chinese banks to funding liquidity risks (as is typically the case for banks), a lack of investment alternatives for most depositors and the high government ownership stake in Chinese banks are two factors that arguably contribute to the stability of banks' sizeable short-term deposit base. In addition, the Chinese banks hold a large stock of liquid assets, which can act as a buffer against cashflow shortfalls in the near term.

Banks' non-loan assets mostly include their holdings of debt securities. Most of these are issued by government (largely the central government and the PBC) and 'other financial corporations', although banks also hold a small amount of non-financial corporate debt securities. In addition, the four largest commercial banks hold bonds relating to the financing of their previous restructuring; these bonds were about 3 per cent of their assets at the end of 2011. Around 15 per cent of banks' assets are held as central bank reserves, reflecting the PBC's reserve requirements plus a small buffer of excess reserves.

The foreign assets of the Chinese banking system are relatively small. These assets are mainly held by the five largest Chinese banks, which operate in numerous foreign markets.[6] Nonetheless, with the exception of BOC (22 per cent), the share of these banks' foreign assets in total assets is low (1–7 per cent), and well below that of large banks from other countries.

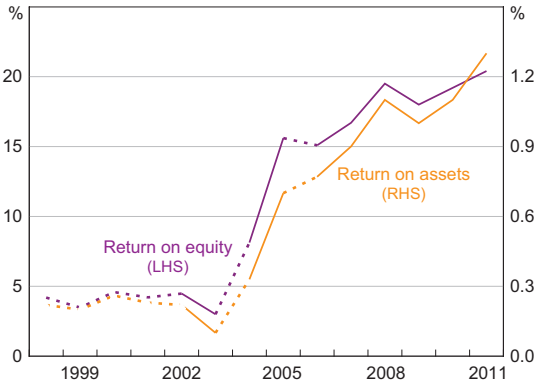
Chinese commercial banks have maintained strong profitability over recent years, recording aggregate after-tax returns on equity of 15–20 per cent per annum (Graph 3). Profit growth has been supported by rapid expansion in banks' lending over this period (Graph 4). Banks have been able to largely fund this increased lending through deposit growth, which has been supported by robust economic conditions and high saving rates in China. Chinese banks' recent returns are well above the rates recorded during the early 2000s, which were less than 5 per cent. The pick-up in banks' profitability in recent years has been driven by a marked reduction in non-performing loans and improvements in cost management.

An indicator of the average profitability of Chinese banks' interest-earning activities is provided by their net interest margins, which have remained at fairly high levels of about 2½–3 per cent over recent years. As shown in Table 1, the regulation of deposit and lending rates in China means that Chinese banks benefit from high average spreads on their intermediation activities. Chinese banks' actual net interest margins are well below the spreads between benchmark loan and deposit rates, however, reflecting the low returns actually earned on their reserve assets held with the PBC and their holdings of debt securities.

The performance of Chinese banks' loan portfolios has continued to improve since the phased removal of NPLs from the largest banks' balance

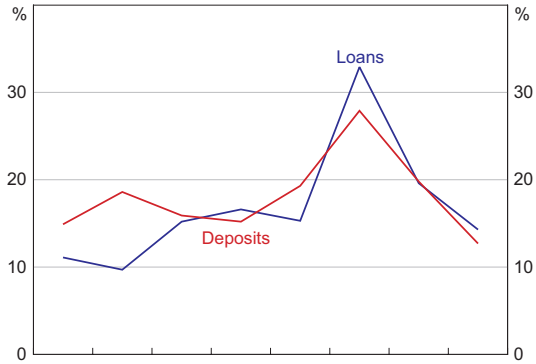
6 ICBC and BOC operate in around 30 countries, while all five banks operate in Hong Kong, Singapore and South Korea. The large Chinese banks operate in Australia under a branch licence, with the exception of ABC, which has a representative office. BOC also operates in Australia under a subsidiary licence.

Graph 3
Chinese Banks' Profitability*



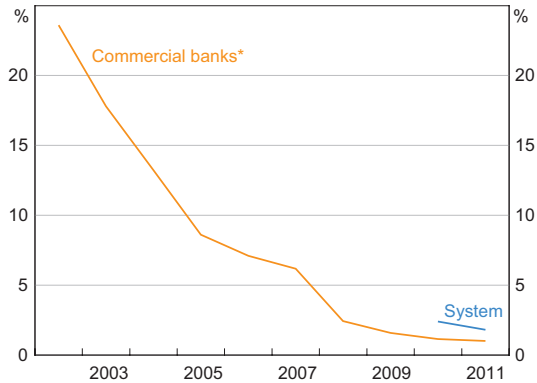
* Data after 2002 is for commercial banks only; dashed lines are pre-tax, solid lines post-tax
Sources: CBRC; Garcia-Herrero, Gavila and Santabarbara (2006); Rowe, Shi and Wang (2011)

Graph 4
Chinese Banks' Loan and Deposit Growth



Source: CBRC

Graph 5
Chinese Banks' Non-performing Loans
Share of total loans



* Data for 2002–2004 are for large commercial banks only
Sources: CBRC; CEIC

sheets between 2004 and 2008 (see Box A). The aggregate NPL ratio for commercial banks declined from 2.4 per cent at the end of 2008 to 1.0 per cent at the end of 2011; the comparable ratio for the entire banking system was higher at 1.8 per cent (Graph 5). By sector, the NPL ratio on commercial banks' residential mortgage loans (0.3 per cent) was much lower than on their corporate loans (1.1 per cent) and personal loans (1.1 per cent). The relatively low NPL ratio for residential mortgages accords with international experience, but might have been assisted by conservative home lending standards and low household indebtedness in China.[7]

The improvement in banks' loan performance over the past few years has coincided with a period of strong growth in nominal incomes and credit in China. This has added a large portion of new loans, which tend to have relatively low rates of non-performance, to the total stock of credit. Some commentators have expressed concerns about how Chinese banks' loan portfolios will perform in the event of less favourable economic and financial conditions. The prospective performance of loans made during the policy-induced surge in lending in 2009 is also a source of concern.

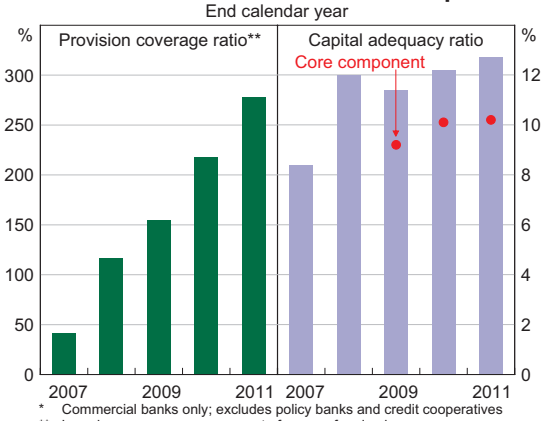
Even so, over recent years Chinese banks have significantly strengthened their provision and capital buffers, which should help them deal with any future increase in problem loans or other adverse shocks. In response to rapid credit growth, the CBRC raised banks' minimum provision coverage ratio – provisions as a share of NPLs – from 100 per cent to 150 per cent over 2009–2010; it also required banks' provisions to be no lower than 2½ per cent of total loans. By the end of 2011, commercial banks'

7 For example, mortgages typically have relatively low loan-to-valuation ratios, with down payments of around 30–40 per cent of the value of the property having been required by authorities over recent years (RBA 2012a).

aggregate provision coverage ratio had risen to about 280 per cent (Graph 6). Chinese commercial banks' total capital ratio increased from about 8½ per cent in 2007 to 12.7 per cent at the end of 2011.[8] Around 80 per cent of banks' capital at the end of 2011 was in the form of 'core' capital – that is, capital instruments with the greatest ability to absorb losses. The strengthening in Chinese commercial banks' capitalisation during this period was partly due to ABC's receipt of government capital in 2008 and its IPO in 2010. Strong earnings growth has also helped commercial banks accumulate capital over recent years, although the effect on their capital ratios has been partly offset by fast growth in risk-weighted assets. Overall, Chinese commercial banks' aggregate capital ratio remains well above minimum international regulatory standards, but below those observed in most other emerging market banking systems, including those in the Asian region.

Banks' off-balance sheet activities have been growing strongly in association with tighter quantitative controls on balance sheets. Chinese banks' off-balance sheet activities generate fee income and include their contingent liabilities (such as bank-accepted bills, entrusted loans, and letters of credit), as well as the sale of wealth management products (WMPs).[9]

Graph 6
Chinese Banks' Provisions and Capital*



* Commercial banks only; excludes policy banks and credit cooperatives
** Loan loss reserves as a per cent of non-performing loans
Sources: CBRC; CEIC

Issuance of WMPs has grown sharply over the past few years given the very low returns offered by deposits; according to PBC estimates, the stock of commercial banks' off-balance sheet WMPs grew by 46 per cent over the year to September 2011, to CNY3.3 trillion (equivalent to 4 per cent of commercial banks' total assets in 2011). In response to the growth in some off-balance sheet activities and concerns that they have been used to circumvent banking regulations, the Chinese authorities have taken a number of regulatory actions, including requiring banks to: bring their trust lending activities back onto their balance sheets; incorporate deposits placed by firms seeking bank-accepted bills or letters of credit in their reserve requirement calculations; and improve their disclosure to investors of the risks associated with WMPs. The authorities have also imposed capital requirements on trust companies.

Conclusion

Over the past few decades the Chinese banking system has evolved from a monobank system to a more commercially orientated banking system governed by a stand-alone supervisor and a central bank. The system now includes five of the world's largest commercial banks and numerous other smaller commercial banks and institutions. The banking system is large relative to the Chinese economy and dominates capital allocation in

8 The capital adequacy ratio of the banking system was –3 per cent in 2003 (CBRC 2010).

9 A bank-accepted bill is a bank guarantee that a bill (typically issued by a corporate borrower) will be paid as specified. A letter of credit is a bank guarantee that a seller will receive payment for a good or service in the event that a buyer fails to pay. Letters of credit are often used in international trade transactions. An entrusted loan is lending between private companies, with banks acting as an intermediary that does not take on credit risk, but may assume other risks. A WMP is a high-yielding investment product, typically sold by trust companies to high net-worth investors or non-financial companies. The money raised is pooled and lent out to companies at interest rates above those charged on bank loans. Many trust companies are affiliated with banks and their WMPs are often sold through banks' outlets; while the banks do not explicitly guarantee the returns of investors in WMPs or entrusted loans, there are concerns that they will do so to protect their reputations.

China. The Chinese Government continues to be substantially involved in the banking system through its majority ownership of the largest banks, and the Chinese authorities retain considerable influence over banks' lending and deposit-taking activites. Chinese banks largely fund themselves from domestic deposits and lend primarily to large and medium-sized domestic businesses, including state-owned enterprises. Chinese banks' profitability and capitalisation have improved considerably over the past decade, as have standard measures of asset performance. These improvements have occurred in an environment of strong growth in nominal incomes and credit in China. It is unclear how the Chinese banking system will perform in a less favourable environment.

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The Pricing of Crude Oil

Stephanie Dunn and James Holloway*

Arguably no commodity is more important for the modern economy than oil. This is true in terms of both production and financial market activity. Yet its pricing is relatively complex. In part this reflects the fact that there are actually more than 300 types of crude oil, the characteristics of which can vary quite markedly. This article describes some of the key features of the oil market and then discusses the pricing of oil, highlighting the important role of the futures market. It also notes some related issues for the oil market.

Introduction

The crude oil market is significantly larger than that for any other commodity, both in terms of physical production and financial market activity (Table 1). The value of crude oil production is more than twice that of coal and natural gas, 10 times that of iron ore and almost 20 times that of copper. Crude oil is the most widely used source of fuel, supplying around one-third of the world's energy needs. It is also used to produce a variety of other products including

Table 1: Physical and Financial Market Size of Major Commodities
2011, US$ billion

	Physical market[a]		Financial market (exchange-traded)	
	Annual production	Annual exports	Annual turnover	Open interest[b]
Oil	3 250	2 211	40 194	288
Natural gas	1 578	530	3 160	38
Coal	1 203	187	40	3
Iron ore	318	164	8[d]	1[d]
Rice[c]	285	22	58	1
Corn[c]	245	27	2 865	48
Wheat[c]	200	43	1 257	27
Copper	173	51[e]	13 726	93
Gold	139	156[e]	9 362	85
Soybeans[c]	119	45	6 540	70
Sugar[c]	93	32	3 614	28

(a) RBA estimates based on volumes and indicative world prices
(b) Open interest is the total dollar value of futures and options contracts outstanding that are held by market participants at the end of each month; averaged over the year
(c) Physical market data are for 2011/12 US financial year
(d) Includes exchange-traded swaps
(e) Export data are for 2010
Sources: ABARES; Bloomberg; BP (2012); Bureau of Resource and Energy Economics; Commodity Futures Trading Commission; International Copper Study Group; RBA; United Nations Comtrade; United States Department of Agriculture

* The authors are from International Department.

plastics, synthetic fibres and bitumen. Accordingly, changes in the price of crude oil have far-reaching effects.

The pricing mechanism underlying crude oil is, however, not as straightforward as it might appear. Almost all crude oil sold internationally is traded in the 'over-the-counter' (OTC) market, where the transaction details are not readily observable. Instead, private sector firms known as price reporting agencies (PRAs) play a central role in establishing and reporting the price of oil – the two most significant PRAs being Platts and Argus Media.

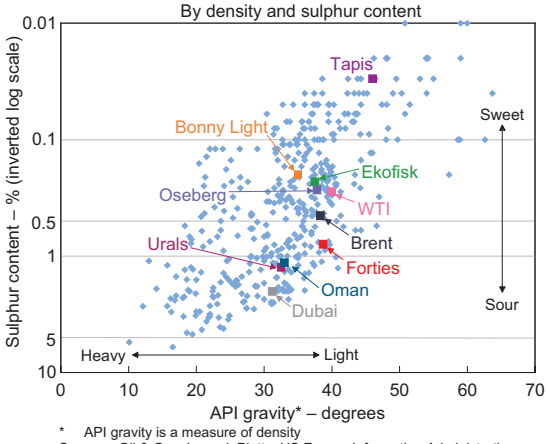
Characteristics of Crude Oil

Crude oil varies in colour from nearly colourless to tar black, and in viscosity from close to that of water to almost solid. In fact, there are more than 300 different types of crude oil produced around the world, all of which have different characteristics (Graph 1). Two of the most important characteristics are density (or viscosity) and sulphur content.[1] High-quality crude oils are characterised by low density (light) and low sulphur content (sweet) and are typically more expensive than their heavy and sour counterparts.[2] This reflects the fact that light crude oils produce more higher-value products (such as gasoline, jet fuel and diesel) than medium or heavy density crudes, while sweet crude oils require less processing than sour crudes (since sulphur is a harmful pollutant that needs to be removed to meet air quality standards).

When a barrel of crude oil is refined, around 40–50 per cent is used to produce petrol (gasoline), with the remainder better suited to producing products such as diesel, heating oils and jet fuel (kerosene), heavy bitumen, as well as the petrochemicals used to produce dyes, synthetic detergents and plastics (Graph 2). The precise proportions depend on the quality of the particular crude oil (as well as the specification of the refinery), with differences in the prices of the various grades of crude oil influenced by differences in demand for the various end products as well as by the supply of the different grades of crude oil.

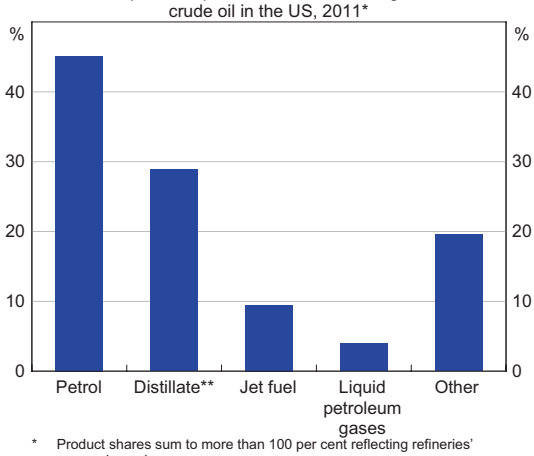
Although publicly traded international oil companies are commonly viewed as the dominant players in the oil market, state-owned national oil companies actually account for a much larger share of reserves and production (Table 2). The two largest oil-producing companies in the world are

Graph 1
Crude Oils
By density and sulphur content



* API gravity is a measure of density
Sources: Oil & Gas Journal; Platts; US Energy Information Administration

Graph 2
A Barrel of Crude Oil
Share of products produced from an average barrel of crude oil in the US, 2011*



* Product shares sum to more than 100 per cent reflecting refineries' processing gain
** Distillate includes heating oil and diesel fuel
Source: US Energy Information Administration

1 Other important characteristics include the amount of salt water, sediment and metal impurities.

2 The use of the terms 'sweet and sour' stems from the early days of the oil industry when prospectors would judge a crude oil's sulphur content according to its taste and smell.

Table 2: Top 10 Oil Companies

Rank	Company	Nationality	State-owned	Production 2010	Reserves End 2011
				Per cent of total	
1	Saudi Aramco	Saudi Arabia	Yes	12.1	17.4
2	NIOC	Iran	Yes	5.2	9.9
3	PdV[(a)]	Venezuela	Yes	3.6	13.9
4	Pemex	Mexico	Yes	3.5	0.7
5	CNPC	China	Yes	3.4	1.7
6	KPC	Kuwait	Yes	3.1	6.7
7	Exxon Mobil	United States	No	2.9	0.8
8	INOC	Iraq	Yes	2.9	9.4
9	BP	United Kingdom	No	2.9	0.7
10	Rosneft	Russia	75%	2.8	1.2

(a) Excludes Venezuela's oil sands; if they are included, PdV's reserves exceed those of Saudi Aramco
Sources: BP (2012); Oil & Gas Journal; Petroleum Intelligence Weekly (2011)

Saudi Aramco and the National Iranian Oil Company, who account for around 12 per cent and 5 per cent of global oil production, respectively. In total, national oil companies control around 60 per cent of oil production and more than 80 per cent of the world's proven oil reserves. The five largest publicly traded oil-producing companies (the 'super-majors') – Exxon Mobil, BP, Chevron, Royal Dutch Shell and Total – each account for around 2–3 per cent of global oil production and collectively just 3 per cent of reserves.

The Market for Oil

Crude oil is largely traded in the OTC market where it is not directly observable. The prevalence of OTC trading in both the physical and financial oil markets is well suited to the heterogeneous nature of crude oil, which often requires specifically tailored contracts. Around 90 per cent of physical crude oil is traded under medium- and long-term contracts. Crude oil for physical delivery can also be traded in the 'spot market', although this is less common owing to the logistics of transporting oil.

These 'spot' transactions in oil are perhaps more accurately described as near-term forward transactions, as most 'spot' deliveries take place more than 10 days after entering into the contract, with some deliveries reportedly taking up to 60 days. This is generally much longer than for other commodities; for example, the US Henry Hub natural gas spot price specifies next-day delivery, while the spot price for metals on the London Metal Exchange (LME) specifies delivery within two days. Typically, a 'spot' transaction in the oil market is a one-off deal for physical oil that is not covered by long-term contracts because the buyer has underestimated its requirements and the producer has surplus crude beyond what it is committed to sell on a term basis. Accordingly, these transactions represent the price of the marginal barrel of oil in terms of supply and demand.

While physical crude oil can be purchased from organised exchanges by entering into a futures contract, only around 1 per cent of these contracts are in fact settled in terms of the physical commodity. Futures contracts are standardised contracts traded on organised exchanges, specifying a set quantity (usually 1 000 barrels) of a set type of crude oil for future delivery. The two key oil futures contracts are the New York Mercantile Exchange (NYMEX) WTI light sweet crude and the Intercontinental Exchange (ICE) Brent contracts.

Trading in the financial market for crude oil typically includes hedging activities by consumers and producers, as well as speculation and arbitrage by financial institutions. While information on the amount of activity in the futures market is readily available (because it occurs on organised exchanges), much less is known about trading in oil on the OTC financial market due to the lack of transparency in these markets. Swaps and options are reportedly the most commonly traded OTC financial contract.[3] Forward contracts for oil are another commonly traded OTC instrument, with each contract specifying a price and a future delivery date. These contracts are typically more flexible than futures contracts, reflecting the fact that they are generally not standardised and are traded off-exchange.

Turnover and open interest in the exchange-traded market for crude oil (along with other commodities) has increased markedly over the past decade, reflecting the introduction of electronic trading platforms and the increasing number of non-traditional participants in commodity futures markets. Exchange-traded turnover in crude oil remains noticeably higher than for any other commodity, reflecting the importance of crude oil in the global economy, with crude oil production easily outstripping that of other commodities (Table 1). However, as a share of annual production, exchange-traded turnover of crude oil is actually less than it is for some other commodities, such as copper and gold and some agricultural products like soybeans and sugar.[4]

Oil Benchmark Prices

With so many different grades of oil, there is actually no specific individual market price for most crude oils. Instead, prices are determined with reference to a few benchmark oil prices, notably Brent and West Texas Intermediate (WTI) (Graph 3).[5] Brent is produced in the North Sea and is used as a reference price for roughly two-thirds of the global physical trade in oil, although it only accounts for around 1 per cent of world crude oil production (Table 3). WTI is produced in the United States and has traditionally dominated the futures market, accounting for around two-thirds of futures trading activity. However, futures market trading in Brent has increased significantly in recent years to be now close to that for WTI, reinforcing Brent's role as the key global benchmark (Graph 4). As discussed below, Brent's dominance as a benchmark has benefited from the fact that it is a seaborne crude and, unlike WTI (which is a landlocked pipeline crude), can readily be shipped around the world.

Table 3: Global Crude Oil Production
Share by benchmark and region, 2011, per cent

Brent[(a)]	1
WTI	1
Europe (excl Brent)	20
United States (excl WTI)	16
Middle East	33
Asia	10
Rest of world	19

(a) Includes Brent, Forties, Oseberg and Ekofisk (BFOE)
Sources: BP (2012); Purvin & Gertz Inc.; RBA; Statistics Norway; UK Department of Energy and Climate Change; US Energy Information Administration

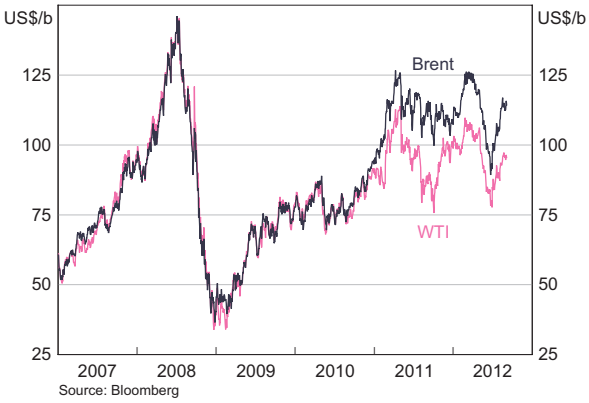
These benchmarks form the basis for the pricing of most contracts used to trade oil in the physical (and financial futures) markets. For oil transactions undertaken in the spot market, or negotiated via term contracts between buyers and sellers, contracts specify the pricing mechanism that will be used to calculate the price of the shipment. So-called 'formula' pricing is the most common mechanism,

3 See Campbell, Orskaug and Williams (2006) for more details.

4 Some of the difference in the ratio of futures turnover to physical production may reflect different average futures contract maturities across commodities.

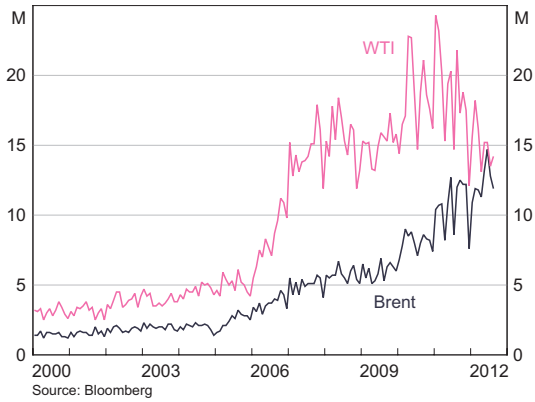
5 Dubai-Oman is another commonly used benchmark, typically employed to price crude oil exports from the Middle East to Asia. Tapis was also an important Asian benchmark but, as discussed later in the text, there has been an increasing shift towards Brent in Asia in recent years. The Argus Sour Crude Index (ASCI) is another benchmark that has become increasingly important. It is typically used for pricing crude oil exports to the United States and is derived from the prices of three sour crude oils produced in the United States.

Graph 3
Global Oil Prices



Source: Bloomberg

Graph 4
Trading in Crude Oil Futures
Volume, contracts per month



Source: Bloomberg

and it anchors the price of a contracted cargo to a benchmark price, with various price differentials then added or subtracted.

These price differentials relate to factors such as the difference in quality between the contracted and benchmark crude oils, transportation costs and the difference in the refinery's return from refining the contracted and benchmark crudes into the various petroleum products. For example, a barrel of Brent is generally worth more than a barrel of Dubai (a medium sour crude oil) because Brent will yield more high-value gasoline, diesel and jet fuel than Dubai without the need for intensive refining. However, the actual magnitude of the Brent-Dubai spread will depend on the relative prices of these petroleum products at the time when the oil is sold to the refineries, along with the location and the spare capacity in those refineries that can easily convert lower-quality crude oil into higher-yielding petroleum products. Reflecting changes in these fundamental determinants, the Brent-Dubai spread has fluctuated within a range of around US$0–15 per barrel.

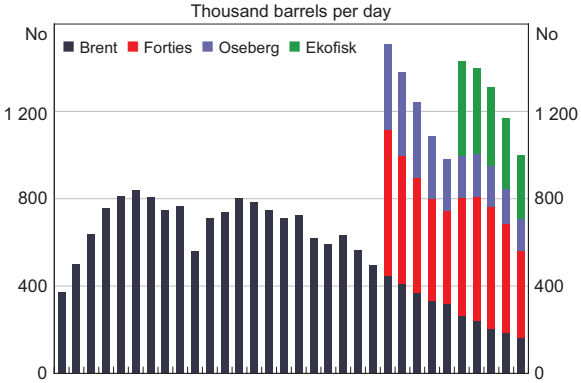
These benchmark prices used in formula pricing are usually based on either (i) 'spot' prices determined by PRAs (for example, a 'spot' price published by Platts called Dated Brent); or (ii) prices determined in futures markets (for example, the assessed WTI price published by the PRAs). Oil companies often reference more than one benchmark price depending on the final destination; for example, Saudi Aramco typically employs the Brent benchmark to price oil exports to Europe, Dubai-Oman for exports to Asia and the Argus Sour Crude Index for exports to the United States.

These particular crudes emerged as benchmarks due to several distinctive characteristics. Brent developed as a benchmark owing to favourable tax regulations for oil producers in the United Kingdom, in addition to the benefits of stable legal and political institutions (Fattouh 2011). Ownership of Brent crude oil is well diversified, with more than 15 different companies producing it, which helps to reduce individual producers' pricing power.[6] Brent can also be used by a variety of buyers, given that it is a light sweet crude oil that requires relatively little processing.

The physical infrastructure underlying Brent is also well developed. When the Brent benchmark was established in the mid 1980s, its production was initially reasonably large and stable, which is an important characteristic of a benchmark as it guarantees timely and reliable delivery. Although the volume of Brent crude oil produced has declined over time, three other North Sea crudes have been added to the Brent benchmark basket over the past decade, such that it now comprises Brent, Forties, Oseberg and Ekofisk (BFOE; Graph 5). The

6 Brent crude oil is actually a mixture of crude oil produced from around 20 different fields in the North Sea and collected through a main pipeline system to the terminal at Sullom Voe in the Shetland Islands, Scotland. In 1990, the Brent pipeline system was commingled with the Ninian pipeline system (also located in the North Sea). For this reason, it is sometimes referred to as Brent Blend.

Graph 5
BFOE Production Volumes
Thousand barrels per day



Sources: BP (2012); RBA; Statistics Norway; UK Department of Energy and Climate Change

combination of these four alternatively deliverable grades has allowed the Brent benchmark to retain a reasonable volume of production. And while there are concerns about the adequacy of production volumes in the future, the depth and liquidity of the Brent futures market has nevertheless increased noticeably in recent years.

If alternative crude oils cannot be delivered against a benchmark, declining production volumes can weaken the status of that crude oil as a benchmark. This is because it becomes a less accurate barometer of current supply and demand as it becomes traded less frequently, and lower traded volumes enable individual market participants to influence the price more easily. Malaysian Tapis – which was previously a key benchmark for the Asia-Pacific region – is a case in point. Tapis's benchmark status has faded away in recent years owing to declining production volumes; recently, only a single cargo of Tapis has typically been available for export each month, down from around 8 cargoes per month in previous years.[7] This compares with around 45 cargoes per month currently for the Brent benchmark. Declining production volumes, coupled with the absence of any alternative similar crude oils produced in the region, have seen refiners and producers shift to benchmark against other prices, predominantly Brent.

7 See Platts (2011) for more details.

The emergence of WTI as a benchmark was also assisted by the presence of secure legal and regulatory regimes in the United States. WTI was established as a benchmark in 1983 and its status increased in prominence as the depth and liquidity of its futures contract expanded. Like Brent, WTI is a light sweet crude that is available from a broad range of producers. Similarly, several different types of crude can be delivered against the WTI contract, including sweet crudes from Oklahoma, New Mexico and Texas, as well as several foreign crude oils. WTI crudes are delivered via an extensive pipeline system (as well as by rail) to Cushing, Oklahoma.[8] Recently, however, the system has struggled to cope with the increasing volumes of crude oil flowing through Cushing. This has resulted in persistent inventory bottlenecks, owing to Cushing's limited storage capacity and its landlocked location. These bottlenecks have weighed on the WTI price in recent years, to the point where it is now significantly influenced by local supply and demand conditions, in addition to those for the world as a whole (as indicated by the divergence between WTI and Brent oil prices shown in Graph 3). This has weakened WTI's status as a global benchmark.

Pricing the Benchmark Crudes: Brent and WTI

The methods employed by the price reporting agencies to assess Brent and WTI prices are quite different, reflecting the different physical and financial frameworks around them.

Brent

The mechanism for determining the Brent price is quite complex and involves a number of different prices including Dated Brent, ICE Brent futures and Brent forwards prices.

Dated Brent is regarded as the 'spot' price for Brent, and appears to be the most commonly used reference price for the physical sale and purchase of oil. It represents the price of a cargo of Brent crude oil

8 With a population of less than 8 000, Cushing is a major oil storage and transport hub that holds around 5–10 per cent of the US oil inventory.

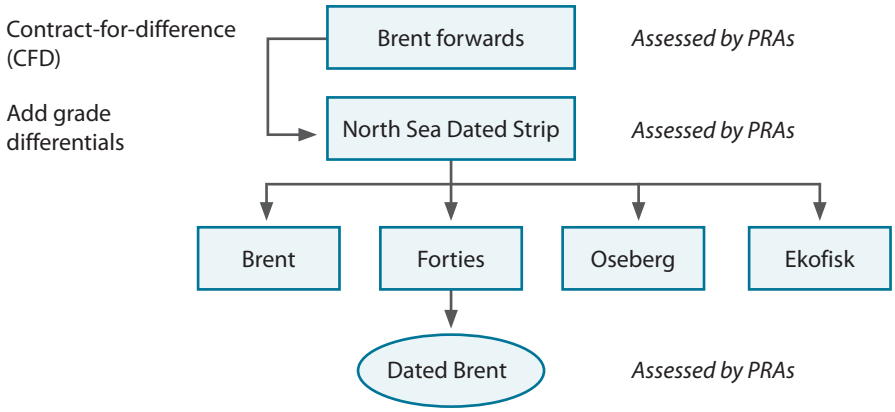
that has been assigned a date, between 10–25 days ahead, for when it will be loaded onto a tanker.[9] However, very few physical Dated Brent trades are actually priced on an outright basis and in any event are not directly observable. In these circumstances, the Dated Brent price is assessed by a PRA using information from both the physical and financial markets. For physical trades, which are not observed by an exchange, the PRAs rely on traders voluntarily submitting trade information to them.

A typical assessment process for Dated Brent starts in the forward market, as shown in Figure 1.

Brent forwards (or 25-day BFOE) are a physically deliverable OTC forward contract specifying a delivery month (but not a precise date) at which the cargo will be loaded.[10] The '25-day' name reflects that buyers are notified of the loading dates for their cargoes 25 days ahead of delivery (Platts 2012). The PRAs typically assess three Brent forward prices covering a period up to three months ahead.[11]

The PRAs then assess the contract-for-difference (CFD) prices. CFDs are a relatively short-term swap between the 'floating' (or uncertain) price of Dated Brent at the time of loading and a fixed price at a future date (the Brent forward price). They are used to hedge against, or speculate on, movements in the Brent market. As such, CFDs provide the link between the Brent forward price and the Dated Brent price, albeit at some time in the future. By taking assessments of weekly CFD values for the next eight weeks and combining them with the second month Brent forward price, the PRAs can construct a set of implied future Dated Brent prices up to eight weeks ahead – that is, a forward Dated Brent curve. Using this curve, the implied Dated Brent prices for the period 10 to 25 days ahead can be calculated – the average of which is known as the North Sea Dated

Figure 1
Deriving the Dated Brent Price with a Liquid Forward Market



Sources: Argus Media (2012); Platts (2012); RBA

9 A loading date is usually a period of three days during which crude oil is loaded onto tankers as specified by the operator of the oil terminal (where the oil is stored prior to delivery to refiners) or offshore loading facility.

10 Being a seaborne crude, the forward contract for Brent involves trading in large volumes of oil (a standard Brent shipment is 600 000 barrels), which is beyond the capability of most small traders; as a result, very few traders participate in this market, with between 4 and 12 traders participating each day. In contrast, WTI is a pipeline crude with much smaller trading lots and a correspondingly greater number of participants in the physical market (around 30 to 35 different buyers and sellers).

11 The Brent forward contract can be physically settled or, more commonly, cash-settled, where traders offset their positions in a 'daisy chain', which is created when a circle of at least three traders is formed: A sells to B, who sells to C, who sells to A. The circle is closed by financial settlement of price differences rather than physical delivery.

Strip. Combining this with the grade differentials for each of the four crudes in the Brent basket gives an outright price for each of Brent, Forties, Oseberg and Ekofisk. The cheapest of which then becomes the final published daily quote for Dated Brent. This is typically Forties as it is the lowest quality of the four crudes in the Brent basket.

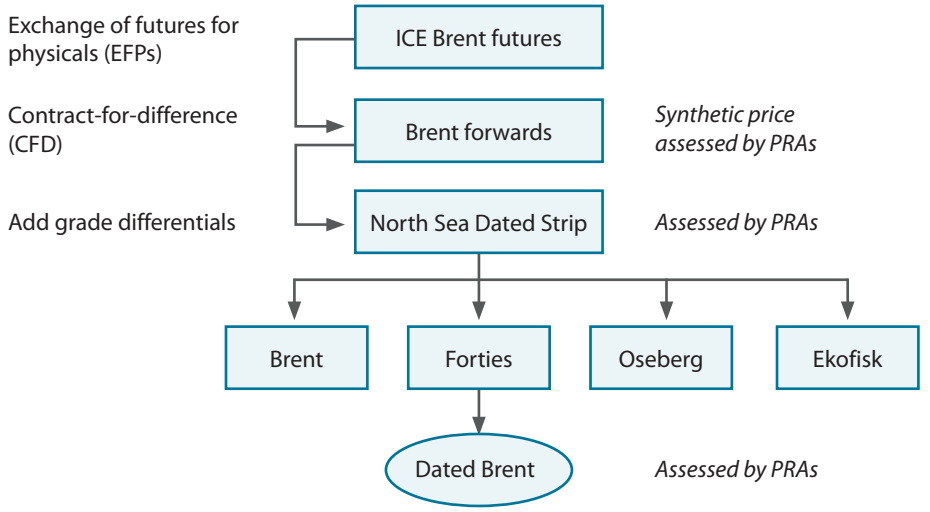
Occasionally, however, there is insufficient liquidity in the Brent forward market to use this as the starting point. In that case, the assessment instead starts in the futures market. As shown in Figure 2, a synthetic Brent forward price is derived by combining the ICE Brent futures prices with 'exchange of futures for physicals' (EFPs) values.

The ICE Brent futures contract specifies the delivery of 1 000 barrels of Brent crude oil at some determined future date. The contract is settled in cash, with an option for delivery via an EFP contract. Whereas futures contracts are highly standardised and traded on exchanges, EFPs are a more flexible contract that allow traders to convert a futures position into physical delivery, enabling traders to choose delivery location, grade type and trading partner. EFPs take place off-exchange, at a price agreed to by both parties.

Once a price for Brent forwards has been derived, the Dated Brent price can then be determined as previously.

While Dated Brent has traditionally been the most commonly used price in physical contracts, an increasing number of producers – including Saudi Arabia, Kuwait and Iran – have begun to adopt Brent futures prices as their preferred benchmark.[12]

Figure 2
Deriving the Dated Brent Price when the Forward Market is Illiquid



Sources: Argus Media (2012); Platts (2012); RBA

West Texas Intermediate

There is only one main instrument that underlies the WTI benchmark price: the NYMEX Light Sweet Oil futures contract.[13] This reflects the large and very liquid futures market for WTI, which since its inception in 1983 has almost entirely replaced its forward market. The WTI futures contract allows for physical delivery when left open at expiry, specifying 1 000 barrels of WTI to be delivered to Cushing,

12 One example of this is BWAVE, which is a weighted average of ICE Brent prices in a trading day, weighted by volume. This price is typically used for certain exports of Middle Eastern crude oils to Europe.

13 This is the main WTI contract. ICE also offers a cash-settled WTI futures contract, although open interest in this contract is much smaller than for the NYMEX contract.

Oklahoma – although it also allows for the delivery of several other domestic and foreign light sweet crudes against the futures contract. However, only a very small proportion of WTI futures contracts are actually physically settled, mostly via EFPs.

Reflecting the absence of a significant forward market, the PRAs' assessed physical 'spot' price for WTI is determined differently to that for Dated Brent. The 'spot' price for WTI reported by the PRAs is typically the most recent and representative NYMEX WTI front-month (contract nearest to expiry) futures price in a period immediately prior to the price assessment time (which varies between the PRAs).[14] At contract expiry, the PRAs' reported price reflects the new front-month futures price plus the 'cash roll' (the cost of rolling a NYMEX futures contract forward into the next month without delivering on it).

The Price Reporting Agencies

The PRAs clearly play a key role in identifying the price of the benchmark crudes, as outlined above. Although the different PRAs' price assessments are typically very close to each other, they employ slightly different methods in determining the daily quoted benchmark prices for Dated Brent and WTI. On occasion, the differences in the assessed prices for the various benchmarks can be more noticeable, particularly for less liquid crudes such as Tapis (where the difference across PRAs can be up to US$5 per barrel).

While the PRAs publish general information on their methodologies, the far-reaching impact of the PRAs' quoted prices suggest that more precise information would help to increase confidence in the soundness of the oil market. For example, it may be useful to know how the PRAs applied their discretion to exclude various bids and offers, how often this is done and why, and how they have used their judgement to determine reported prices in the absence of any actual deals. Reflecting such concerns, at the direction of the G-20, a review of PRAs by the International Organization of Securities Commissions (IOSCO) and other relevant international organisations is currently in progress.[15]

Price Discovery in the Oil Market

Given that oil prices are essentially jointly determined in both the physical and financial markets, it is no easy task to disentangle the effect of each market in the price discovery process with any precision. Nevertheless, futures markets appear to play an important role in the pricing of oil, perhaps more so than for other commodities. Indeed, there is a view that crude oil price levels are essentially determined in the futures market.[16]

This is clearest for WTI where PRAs identify the 'physical' price directly from the deep and liquid futures market, and where there is no significant parallel OTC market. It is less obvious, however, for Brent. While Brent forward prices are typically used by the PRAs to derive the Dated Brent price, as noted above Brent forward and futures markets are directly linked via EFPs. Many large oil market players reportedly hold Brent forwards and futures in their portfolios, arbitraging between the two instruments, such that the prices of Brent futures and forwards typically converge.

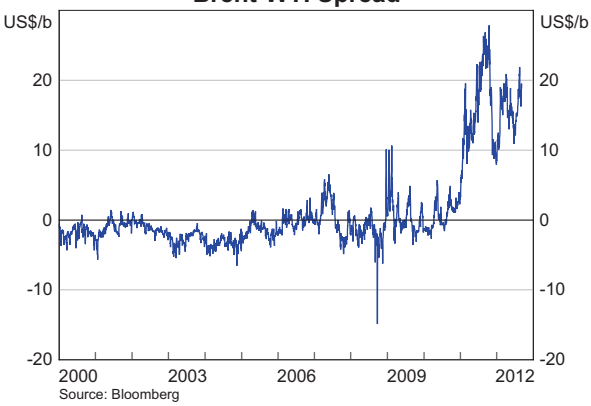
The complexity of the oil pricing arrangements makes it difficult to demonstrate convincingly that benchmark oil prices fully reflect physical supply and demand conditions rather than the actions of uninformed financial speculators. Nevertheless, movements over time in the price differentials for the various benchmark crudes are broadly consistent with changes in demand and supply. The Brent-WTI spread provides a good example of the influence of such factors on oil price differentials (Graph 6). Prior to 2011, Brent and WTI prices generally moved in tandem, with the spread largely reflecting the costs of transporting Brent-referenced crude oils to the United States. In recent years, however, increased volumes of crude oil from North Dakota and Canada have flowed

14 To derive the physical WTI price, the PRAs combine the assessed futures price with the assessed EFP differential. That said, Platts' physical WTI price has been the same as its assessment of the WTI futures price for the past few years, reflecting an EFP differential equal to zero over the same period.

15 See G-20 (2010, 2011) for more details.

16 See, for example, Mabro (2008) and Fattouh (2011).

Graph 6
Brent-WTI Spread



Source: Bloomberg

into Cushing, leading to a build-up in inventories. Most pipelines flow from the rest of North America into Cushing, making it difficult to move the extra crude oil out of Cushing. This has led to persistent inventory bottlenecks, which have weighed heavily on the price of WTI over the past 18 months, leading the Brent-WTI spread to widen to US$10–30 per barrel.[17] The recent widening of the Brent-WTI spread is also likely to reflect concerns about declining production volumes in the North Sea.

More transparent information about oil reserves, daily production volumes and demand-driven factors could assist more efficient pricing in the oil market. Information about the demand for oil is often not known until well after the period for which it is reported. On the supply side, there is ongoing concern regarding the accuracy of various countries' reported production volumes, while oil reserve estimates are subjective and depend on partial information and project feasibility. There have been steps towards greater transparency in the oil market; for example, the Joint Organisations Data Initiative (JODI) was established in 2001 to provide accurate and timely crude oil data on production, consumption, trade, refining and inventories. Nonetheless, there is still scope to increase country coverage and data quality.

17 In contrast, the Brent-Louisiana Light Sweet (LLS) spread has continued to move closely around zero. LLS is produced in the United States and is similar quality to WTI; however, LLS is a waterborne crude and is therefore not subject to the same inventory bottlenecks as WTI.

Conclusion

The current pricing framework for crude oil is complicated, as is the nature of price discovery. Global crude oil trade is currently priced according to the prices of a handful of benchmark crudes, which make up less than 5 per cent of total crude oil produced. Yet these benchmark crude oils are facing problems of their own. The prolonged divergence of the WTI price from other major benchmark prices has impaired its benchmark status, leading some oil-consuming and oil-producing companies to shift to other benchmarks. On the other hand, production volumes for the Brent basket are declining, leading to concerns regarding its own robustness as a benchmark. Regulators and the industry are working together, under the auspices of the G-20, to ensure that prices for crude oil are determined in a transparent manner and continue to reflect physical fundamentals.

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The Lucky Country

Glenn Stevens, Governor*

Address to The Anika Foundation Luncheon
Supported by Australian Business Economists and Macquarie Bank
Sydney, 24 July 2012

Thank you for coming today to support the Anika Foundation.[1]

Before I proceed I want also to thank Macquarie Bank for their support, once again, in providing today's venue and sustenance, and the Australian Business Economists for their continuing organisational support for these annual functions.

It is slowly becoming better recognised that the Australian economy's relative performance, against a very turbulent international background, has been remarkably good. Many foreign visitors to Australia comment on this relative success and I have noticed an increase in the number of foreign companies interested in investing in Australia as a result, notwithstanding our domestic tendency towards the 'glass half empty' view.

But some observers – admittedly not the majority – still harbour concerns about the foundations of recent economic performance and question the basis for confidence about the future. There are several themes to these doubts, but the common element is that recent relative success owes a certain amount to things that will not continue – to luck – and that our luck may be about to turn.

Rapid growth in Chinese demand for resources, for example, has been of great benefit to date, but what if the Chinese economy suffers a serious downturn?

Another potential concern is dwelling prices. Australia saw a large run-up in dwelling prices and household borrowing until a few years ago. Some other countries that saw this subsequently suffered painful corrections and deep recessions, associated with very stressed banking systems. Can Australia escape the same outcome?

A further theme is the focus on the funding position of Australian financial institutions, insofar as they raise significant amounts of money offshore. Could this be a weakness, in the event that market sentiment turns? Actually, this is another version of the old concern about the current account deficit: what will happen if markets suddenly do not want to fund our deficit? It has long been a visceral fear among Australian officials and economists that global investors will suddenly take a dim view of us. The same sorts of concerns of organisations such as the International Monetary Fund and the ratings agencies seem to lie behind a perpetual question mark about Australia and its financial institutions.

It is unlikely we will ever be able to change definitively the views of all the sceptics. And – let us be clear – we should welcome the sceptics. Perhaps some of their concerns are valid. The Reserve Bank gives a lot of thought to these issues; we certainly do not dismiss them. We should always be wary of the conventional wisdom being too easily accepted. We should never, ever, assume that 'it couldn't happen here'.

* I thank Mark Hack for assistance in preparing these remarks, and Ryan Fox for help in understanding the difficulties in comparing dwelling prices across countries.

1 The Anika Foundation raises funds to support research into adolescent depression and suicide. See <http://www.anikafoundation.com/>.

It is in that vein that I wish to pose a set of questions that are thrown up by these sceptical views. In particular:

- How much of the recent relatively good performance was due to luck? To what extent did we improve our luck by sensible policies, across a range of economic and financial fronts?
- Are there signs of any of the things going wrong that people typically worry about?
- And if there are, or were to be, such signs, could we do anything about it?

To begin, I shall restate some key metrics.

These charts really require no exposition (Graphs 1, 2 and 3). The message is clear. It is fair to conclude that, given the circumstances internationally, the Australian economy has exhibited more than acceptable performance over recent years. This conclusion would stand whether comparisons were made either against most other countries, or against our own historical experience.

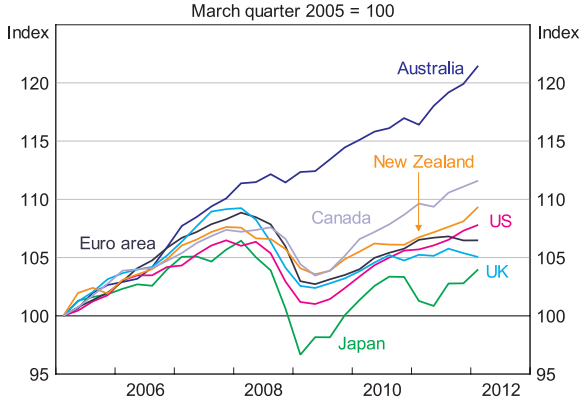
Why was it that Australia did not have a deep downturn in 2009 when so many other countries did? And why was it that we have returned to reasonable growth, when others have struggled to do so?

These questions have been answered on numerous occasions. There are several elements.

First, the Australian banking system went into the crisis in reasonable shape. To be sure, there were some poor lending decisions during the preceding period of easy credit and there was, in hindsight, too much reliance on wholesale funding. But among major institutions, credit quality issues have turned out to be manageable. Asset quality was not as good among some of the regional banks, and even less so among some foreign banks operating in Australia, but the problems have not been insurmountable.

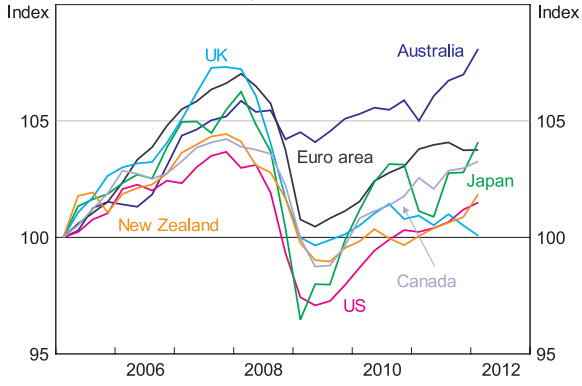
Some observers might counter that the banks received assistance with wholesale fundraising in the form of the government guarantee. But the banks paid for that, and it was an appropriate response at

Graph 1
Real GDP
March quarter 2005 = 100



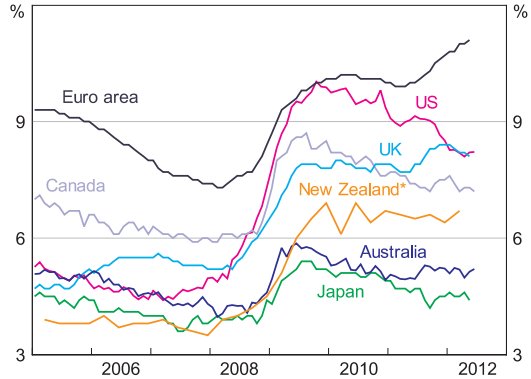
Sources: ABS; Statistics New Zealand; Thomson Reuters

Graph 2
Real GDP per Capita
March quarter 2005 = 100



Sources: ABS; Statistics New Zealand; Thomson Reuters; US Census Bureau

Graph 3
Unemployment Rates



* Quarterly data
Sources: ABS; Thomson Reuters

a time of massive market dislocation when all their peers were receiving like assistance – and much more. Moreover the banks have neither had, nor needed, access to this for some time now and the stock of guaranteed liabilities outstanding has fallen by about half from its peak level, as issues mature or are repurchased.

So our banking system, while not entirely free from blemishes, was nonetheless in pretty good shape overall. Banks were able to raise capital privately in the depths of the crisis. The lowest rate of return among any of the major banks over a year during the crisis period was about 10 per cent. The Australian Government has not needed to take an ownership stake in a financial institution.

Second, Australia had scope for macroeconomic policy stimulus, which was used promptly and decisively. Interest rates were lowered aggressively, from a high starting point, lowering debt-servicing burdens at a rapid rate. The fiscal stimulus was one of the larger ones, as a percentage of GDP, among the various countries with which we can make comparisons. The evidence suggests that these macroeconomic measures were effective in sustaining growth.

Thirdly, the rapid return to growth of the Chinese economy saw demand for energy and resources strengthen again after a brief downturn in late 2008 and the first couple of months of 2009. This reversed the fall in Australia's terms of trade, and in fact pushed them to new highs, which led to a resumption of the historic investment build-up that had already begun. It benefited the whole of Asia, which staged a very pronounced V-shaped recovery on the back both of the Chinese measures and things other countries did themselves.

A fourth element that many people add is that the exchange rate fell sharply, which was an expansionary impetus for the economy. But of course the exchange rate was responding endogenously to the various shocks and policy responses, and has since reversed the fall. It was doing what it was supposed to do. Perhaps the real point is that the right exchange rate system was implemented nearly 30 years ago, and that it was allowed to work.

So Australia had these things going for it.

Was this all just luck?

We could not deny that our geography – thought for much of our history to be a handicap because of the distance from European and American markets – combined with our natural resource endowment has provided a basis for the country to ride the boom in Asian resource demand. We did not create that, though we still have to muster the capability to take sustained advantage of it.

But a well-managed and well-supervised banking system is not an accident.[2] Years of careful work both by banks and APRA went into that outcome.

Nor was the ability to respond forcefully, but credibly, with macroeconomic policy just luck. You don't suddenly acquire the credibility needed to ease monetary policy aggressively while the exchange rate is heading down rapidly. Authorities in lots of countries would not feel they could do that. At an earlier point in time we probably would not have felt we could have done it either. The credibility needed to do it comes from having invested in a well-structured framework, and having built a track record of success in containing inflation, over a long period. The floating exchange rate is an integral part of that framework.

Likewise, you can't have a major fiscal easing and expect it to be effective if there are concerns about long-run public debt dynamics, as recent debate elsewhere in the world shows. You need to have run a disciplined budget over a long period beforehand, so that the amount of debt you have to issue in a crisis does not raise questions about sustainability. In

2 Canada's banking system was sound like Australia's, which has helped it outperform their G7 peers. But the large neighbour to which Canada exports about 20 per cent of its GDP has held it back. Australia's exposure to Asia, as opposed to Canada's exposure to the United States, presumably helps to explain Australia's stronger growth outcome relative to Canada's. Australia's terms of trade experience has also been stronger than Canada's.

both the monetary and fiscal areas, of course, having used the scope we had so aggressively, it was also necessary, as I argued in 2009, to reinvest in building further scope, by returning settings to normal once the emergency had passed.

So, yes, Australia has had its share of luck. But to explain the outcomes, we need also to appeal to factors that didn't just happen by accident.

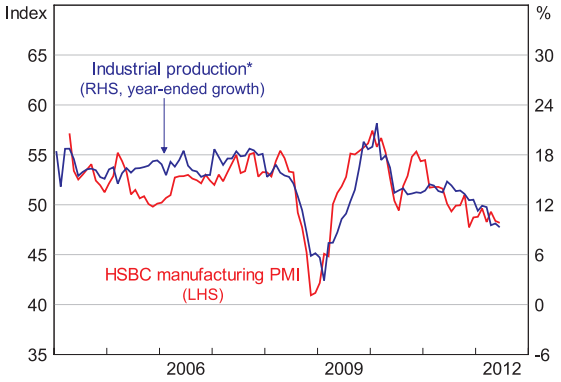
Of course, that doesn't mean we still couldn't have problems. Even if success to date hasn't been due to luck alone, perhaps our luck could turn so bad that all our efforts at good policymaking could be overwhelmed.

Let us then take a look at some of the potential pressure points that people sometimes worry about. The first is the Chinese economy.

One of the data series people pay a lot of attention to is the Chinese version of the so-called 'Purchasing Managers' Index'. The usual commentary surrounding such indexes invariably refers to the '50' level as the threshold between growth and contraction in the sector of the economy being examined.

But what have these PMIs actually been saying about the Chinese economy? Properly calibrated, as in this chart, they suggest that growth in China's industrial production has been running at about 5 percentage points below average, which means it is just under 10 per cent (Graph 4). But it is a long way from a contraction. We did actually see Chinese IP contract for several months in 2008; we are not seeing that at present.

Graph 4
China – Activity Indicators



* RBA estimates
Sources: CEIC; Markit Economics; RBA

The conclusion I draw is that the Chinese economy has indeed slowed over the past year or so. It was intended that a slowing occur. But the recent data suggest that, so far, this is a normal cyclical slowing, not a sudden slump of the kind that occurred in late 2008. The data are quite consistent with Chinese growth in industrial output of something like 10 per cent, and GDP growth in the 7 to 8 per cent range.

To be sure, that is a significant moderation from the growth in GDP of 10 per cent or more that we have often seen in China in the past five to seven years. But not even China can grow that fast indefinitely and there were clearly problems building from that earlier breakneck pace of growth. Inflation rose, there was overheating in property markets and no doubt a good deal of poor lending. It is far better, in fact, that the moderation occur, if that increases the sustainability of future expansion.

Moreover, the Chinese authorities have been taking well-calibrated steps in the direction of easing macroeconomic policies, as their objectives for inflation look like being achieved and as the likelihood of slower global growth affecting China has increased. Prices for key commodities are lower than their peaks, but are actually still high.

So far, then, the 'China story' seems to be roughly on course. It is certainly true that we will feel the effects of the Chinese business cycle more in the future than we have been accustomed to in the past. That presents some challenges of economic analysis and management. But even so, it may be better to be exposed to a Chinese economy with a high average, even if variable, growth rate, than, say, to a Europe with a very low average growth rate that is apparently also still rather variable.

Next I turn to dwelling prices. As everyone knows, dwelling prices rose a great deal over the decade or more from 1995, and not just in Australia. This occurred globally. The fact that it was a widespread

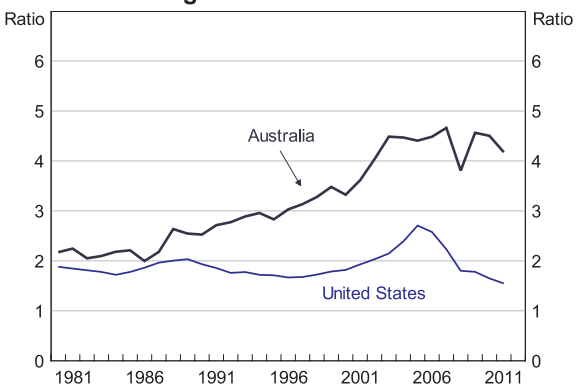
phenomenon is a hint that we should be wary of explanations that are solely domestic in their focus. It suggests that the global dwelling price dynamic had a lot to do with financial factors – and there is little doubt that finance for housing became more readily available.

In various countries prices have subsequently fallen. In the United States, for example, prices are down by about 30 per cent from their peak, though they look like they have now reached bottom. In the United Kingdom the fall was smaller – at about 15–20 per cent. In Australia, the decline since the peak has been about 5 to 10 per cent, depending on the region. There are of course prominent examples of particular localities or even individual dwellings where price falls have been much larger.

Scaled to measures of income, Australian dwelling prices on a national basis have in fact declined and are now about where they were in 2002 (Graph 5). That is, housing has become more 'affordable'. Four or five years ago we supposedly had a housing affordability 'crisis'. Now it seems that the problem some people fear is that of housing becoming *even more* affordable.

Are dwelling prices overvalued? It's very hard to be definitive on that question. There are two aspects to the claim that they might be. The first is that prices relative to income are higher than they were 15 or 20 years ago. If this ratio is somehow mean-reverting, then either incomes must rise a lot or prices must fall. It could be that this analysis is correct, but the problem is that there is no particular basis to think that the price to income ratio 20 years ago was 'correct'. There are reasons that might be advanced for why the ratio might be expected to be higher now than then – that the mean has shifted – though again there is little science to any quantification for such a shift. In any event, arguments that appeal to historical averages for such ratios lose potency the longer the ratio stays high. In Australia's case the ratio of prices to income on a national basis has been apparently at a higher mean level – about 4 to 4½ – for about a decade now.

Graph 5
Dwelling Price to Income Ratios*



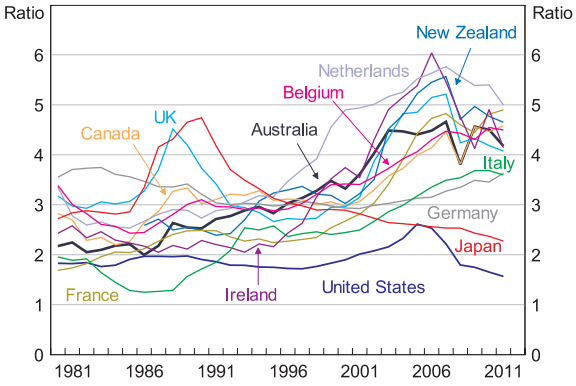
* Average dwelling prices to average household disposable income
Sources: ABS; Federal Reserve; RP Data-Rismark; Thomson Reuters; US Census Bureau

The second support for the claim that dwelling prices are overvalued is the observation that they seem high in comparison with other countries. In seeking to make such comparisons, though, there are serious methodological challenges. The key difficulty is in sourcing comparable data on the *level* of prices across countries. Such data are, at best, pretty sketchy. With that caveat very clearly in mind, consider the following two charts.

Simply comparing Australia and the United States, it is hard to avoid the impression that gravity will inevitably exert its influence on Australian dwelling prices. But if we put these two lines on a chart with a number of other countries with which we might want to make comparisons, the picture is much less clear (Graph 6).[3] To the extent that we can make any meaningful statements about international relativities, the main conclusion would be that Australian dwelling prices, relative to income, are in

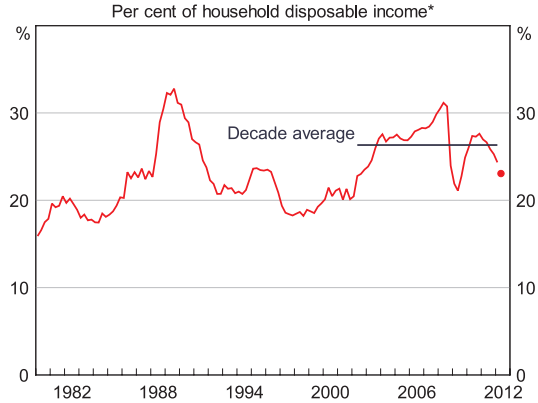
3 These comparisons use average (rather than median) dwelling prices and average household income. Average dwelling prices are estimated using nationwide (urban and regional) prices for both houses and apartments (mostly for the privately owned housing stock); dwelling price data are taken either from transaction price information or from data on national capital stocks. Average household disposable income is sourced from national accounts data. Note that alternative income measures give slightly different results, and Australia's relativity is somewhat higher when using broader income measures that incorporate the taxation and social welfare system.

Graph 6
Dwelling Price to Income Ratios*



* Average dwelling prices to average household disposable income
Sources: BIS; Bloomberg; CREA; Halifax; Japan REI; OECD; Quotable Value; RP Data-Rismark; Thomson Reuters; UN; national sources (statistical agencies, central banks and government departments)

Graph 7
Repayments on New Housing Loans
Per cent of household disposable income*



* Housing loan repayments calculated as the required repayment on a new 80 per cent LVR loan with full documentation for the nationwide median-price home; based on capital city house price data prior to 1990; household disposable income is before interest payments; RBA estimate for June quarter 2012
Sources: ABS; RBA; REIA; RP Data-Rismark

the pack of comparable countries. In this comparison, the United States seems the outlier.

None of this can be taken to say definitively that Australian dwelling prices are 'appropriate', or that there is no possibility they will fall. It is a very dangerous idea to think that dwelling prices cannot fall. They can, and they have. The point is simply that historical or international comparisons, to the extent they can be made, do not constitute definitive evidence of an imminent slump. At the very least, the complexity of making these comparisons suggests we ought to look at some other metrics in thinking about the housing market.

One would be the performance of the associated mortgages. Here, the main story is that not much has changed. Arrears remain low and if anything have been edging down over the past year. That in turn is not altogether surprising given that debt-servicing burdens have declined (Graph 7).

As a result of lower house prices and therefore lower loan sizes, somewhat lower interest rates and a good deal of income growth, the repayment on a new loan on a median-priced house as a share of average income is now at its lowest for a decade (except for the 'emergency' interest rate period in 2009).

It is true that a low unemployment rate is a key factor helping here, but it is also true that the proportion of households that are ahead on their mortgage payments is also high – with some evidence pointing to over half – which would provide a buffer of some months for those households in the event a period of lower income was experienced. If we look at applications for possessions of dwellings, they have been running at about 0.15 per cent of dwellings on an annualised basis. Such applications have actually declined since their peak in both New South Wales and Victoria, though they have risen over the past couple of years in Western Australia and Queensland. In the United States the most comparable figure for repossessions – 'foreclosures started' – peaked at over 2 per cent of dwellings.

The conclusion? We should never say a crash couldn't happen here, and the Reserve Bank continues to monitor property markets and the performance of mortgages quite closely, as we have for many years. But it has to be said that the housing market bubble, if that's what it is, seems to be taking quite a long time to pop – if that's what it is going to do. The ingredients we would look for as signalling an imminent crash seem, if anything, less in evidence now than five years ago.

What then about funding vulnerabilities?

The pre-crisis period saw too much 'borrowing short to lend long', and too much reliance on the assumed availability of market funding. Banks everywhere have been adjusting away from that model over recent years, Australian banks among them. The share of offshore funding has fallen, and its maturity has been lengthened (Graph 8).

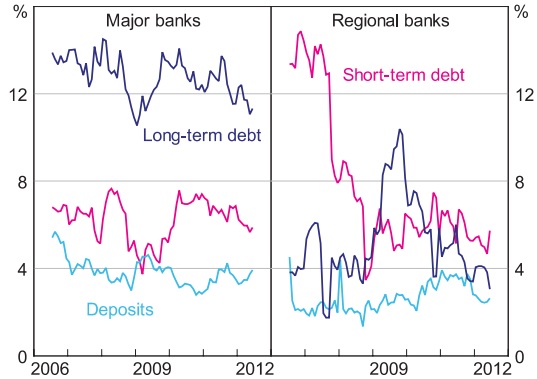
The flip side of this is of course the rise in domestic deposit funding, which has occasioned such competitive behaviour in the market for deposits.

Interestingly enough, while we have been told over the years how Australian banks were doing the country a favour by arranging the funding of the current account, they have stopped doing this over the past year without, apparently, any dramatic effects. As measured in the capital account statistics, there has been a net outflow of private debt funding over the past two years, offset roughly by increased inflow of foreign capital into government obligations (Graph 9). This has occurred with a net decline in government debt yields and a net rise in the exchange rate. The current account deficit has, in other words, been easily 'funded' without the assistance of banks borrowing abroad – in fact, while they have been net repayers of funds borrowed earlier.

A reasonable conclusion is that the degree of vulnerability to a global panic of any given magnitude appears to have diminished, rather than grown, over the past few years. It hasn't completely disappeared, and it would not be sensible to expect it would, unless we were pursuing a policy of financial autarky. But there is little reason to assume that Australian institutions are somehow unusually exposed to these risks compared with most of their counterparts overseas.

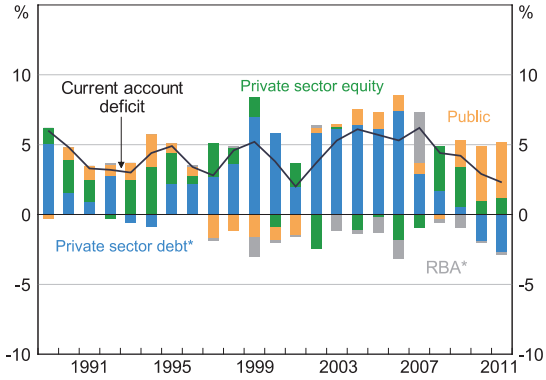
In the end, of course, any bank's ability to maintain the confidence of its creditors is mainly about its asset quality. That brings us back to lending standards, the macroeconomic environment, and so on. One would think that, overall, things look relatively good

Graph 8
Offshore Funding of Banks in Australia*
Per cent of funding



* Adjusted for movements in foreign exchange rates; wholesale debt is on a residual maturity basis
Sources: APRA; RBA

Graph 9
Australian Capital Flows
Net inflows, per cent of GDP



* Adjusted for US dollar swap facility in 2008 and 2009
Sources: ABS; RBA

in Australia, compared with the world's trouble spots. Think for just a moment about the holdings of government debt on the books of banks in any number of other countries, and about the state of public finances of many of those countries.

The arguments I have presented amount to saying that some necessary adjustments have been occurring gradually and reasonably smoothly. China's growth had to moderate. It has slowed, but it hasn't collapsed. Housing values and leverage in Australia couldn't keep rising. They haven't. Dwelling prices have already declined, relative to income, and it is in fact not obvious that they are particularly

high compared with most countries. Housing 'affordability' has improved significantly; over 99 per cent of bank-held mortgages are being serviced fully.

Banks have reduced their need for the sort of funding that might be difficult to obtain in a crisis situation. The current account deficit is being funded by a combination of direct equity investment, and flows into high-quality Australian dollar-denominated assets, the latter at costs that have been falling. In fact, the Commonwealth of Australia, and its constituent States, are at present able to borrow at about the lowest rates since Federation.

Markets do not, then, seem to be signalling serious concerns about Australia's solvency or sustainability. But markets can be wrong sometimes. They can sometimes be too optimistic (and other times too pessimistic). So even though we don't face immediate problems, we should ask: what if something went wrong? Below I consider a few possibilities.

If the thing that goes wrong is a major financial event emanating from Europe, the most damaging potential transmission channel would be if there were a complete retreat from risk, capital market closure and funding shortfalls for financial institutions. Let me emphasise, importantly, that this is not occurring at present and if it did occur it would be a problem for a great many countries, not just Australia. But in that event, the Australian dollar might decline, perhaps significantly. We might find that, in an extreme case, the Reserve Bank – along with other central banks – would need to step in with domestic currency liquidity, in lieu of market funding. The vulnerability to this possibility is less than it was four years ago; our capacity to respond is undiminished and, if not actually unlimited, is not subject to any limit that seems likely to bind. An alternative version of this scenario, if it involved the sort of euro break-up about which some people speculate, could be a flow of funds *into* Australian assets. In that case our problem might be not being able to absorb that capital. But then the banks would be unlikely to have serious funding problems.

If the thing that goes wrong is a serious slump in China's economy, the Australian dollar would probably fall, which would provide expansionary impetus to the Australian economy. But more importantly, we could expect the Chinese authorities to respond with stimulatory policy measures. Even if one is concerned about the extent of problems that may lurk beneath the surface in China – say in the financial sector – it is not clear why we should assume that the capacity of the Chinese authorities to respond to them is seriously impaired. And in the final analysis, a serious deterioration in international economic conditions would still see Australia with scope to use macroeconomic policy, if needed, as long as inflation did not become a concern, which would be unlikely in the scenario in question.

If dwelling prices in Australia did slump, then there would be obvious questions about how that dynamic could play out. In such circumstances people typically worry about two consequences. The first is a long period of very weak construction activity, usually because an excess of stock resulting from previous over-construction needs to be worked off. But we have already had a fairly protracted period of weak residential construction; it's hard to believe it will get much weaker, actually, at a national level. The second potential concern is the balance sheets of lenders. This scenario is among those routinely envisaged by APRA's stress tests over recent years. The results of such exercises always show that even with substantial falls in dwelling prices, much higher unemployment and associated higher levels of defaults, key financial institutions remain well and truly solvent.

Of course, it can be argued that the full extent of real-life stresses cannot be anticipated in such exercises. That's a reasonable point. But we actually had a real-life stress event in 2008 and 2009. The financial system shows a few bruises from that period, but its fundamental stability was maintained.

Conclusion

Most Australians I encounter who return from overseas remark how good it is to be living and working here. We are indeed 'lucky' in so many ways, relative economic stability being only one of them.

But what matters more is what we do with what we have. Not every good aspect about recent performance is down to luck. By the same token there are things we can do to improve our prospects – or, if you will, to make a bit of our own future luck. Some of the adjustments we have been seeing, as awkward as they might seem, are actually strengthening resilience to possible future shocks. Higher – more normal – rates of household saving, a more sober attitude towards debt, a reorientation of banks' funding, and a period of dwelling prices not moving much, come into this category.

The years ahead will no doubt challenge us in various ways, including in ways we cannot predict. But what's new about that? Even if the pessimists turn out to be right on one or more counts, it doesn't follow that we would be unable to cope. Acting sensibly, with a long-term focus, has as good a chance as ever of seeing us through whatever comes our way.

Most of all, and to return to the whole point of today's event, we have much to live for. We want to do everything we can to ensure the next generation can share the positive outlook that most Australians have (almost) always had. That is why the Anika Foundation's work is so important, and why your presence here today is so valuable. Thank you again for your support.

Bank Regulation and the Future of Banking

Philip Lowe, Deputy Governor

Remarks to the 41st Australian Conference of Economists
Melbourne, 11 July 2012

Thank you for inviting me to be part of this panel on Bank Regulation and the Future of Banking.

As you know, the world of bank regulation has seen a lot of activity in recent years. This activity has coincided with a rethinking of the role of financial institutions in our societies. It has also coincided with market-based pressures to change the way that financial institutions manage their risks.

Many of the regulatory changes are quite complex and my fellow panellists – John Laker and Steven Münchenberg – are better placed than me to discuss the details. Instead, what I would like to do is to talk first about some of the implications of these changes for the financial system, including the consequences of making financial intermediation more expensive. I would then like to highlight a few of the broad regulatory issues that we are likely to confront over the years ahead.

The Increased Cost of Financial Intermediation

First, the higher cost of financial intermediation.

Prior to the financial crisis, credit spreads were low, leverage was easily available, financial institutions had become highly interconnected and large maturity mismatches were common. You might remember, it was the time of the 'Great Moderation' – many financial assets were priced for perfection and many financial institutions had based their business models on the assumption that little would go wrong.

For a while, everything looked to be working out quite well; financial institutions were highly profitable and global growth was strong. But in reality, risk was being underpriced and there was too much leverage, and little was done to address the building vulnerabilities.

The result has been that the citizens of many advanced economies have paid a heavy price. There has also been a serious erosion of trust in the financial sector globally, with the banking industry suffering considerable 'brand damage'. Quite rightly, many people question how global banks, with their sophisticated risk models and their highly paid staff, could have managed risks so poorly. Fortunately, in contrast to these global developments, the Australian banks have fared considerably better. But because finance is a global industry, some of the consequences of the events abroad are being felt here as well.

In the wake of this experience, it is not surprising that regulators and, to some extent the financial institutions themselves, have sought to address the various problems. Capital ratios are being increased, and the quality of capital is being improved. Maturity transformation is being reduced. And banks are holding more liquid assets. These changes are occurring not just because of new regulations, but also because they are being demanded by the marketplace.

Together, these various changes are increasing the cost of financial intermediation conducted across

the balance sheets of banks. In effect, the choice that our societies are making – partly through our regulators – is to pay more for financial intermediation and, perhaps, to have less of it. The benefit that we hope to receive from paying this higher price is a safer and a more stable financial system.

This choice has a number of related implications, and I would like to mention just a couple of these.

The first concerns lending spreads and the return on bank equity.

In particular, loan rates are likely to be higher relative to short-term money market rates than would otherwise have been the case; in effect, some of the incidence of the higher cost of financial intermediation falls on the borrowers. In addition, if banks are safer, then, all else constant, some of the incidence of high cost of financial intermediation should also fall on the owners of bank equity who should be willing to accept lower returns. But, of course, the story does not stop here. Lower returns on equity are likely to increase the incentive for bank management to take on new risks in an attempt to regain earlier rates of return. Lower rates of return may also lead to renewed efforts at cost cutting. This could have some positive effects, but if it were to involve cuts to the risk-management function, cost cutting could create new risks. And finally, to the extent that investors realise that credit and other risks are higher than they had previously thought, they might want more compensation for holding bank equity despite the efforts to make banks safer.

These various effects are quite complicated and they will take time to play out. The one change that we have already seen very clearly is a rise in loan rates relative to the cash rate. For example, during the 10 years prior to 2007, outstanding variable mortgage rates averaged 150 basis points above the cash rate. Today, this difference is around 270 basis points.

This increase is due partly to the global loss of trust in financial institutions, which has led to all banks paying more for funds in capital markets. It is also due to the strong competition for deposits domestically, with banks prepared to pay large premiums for liabilities that are called 'deposits' rather than 'wholesale funding'. It is worth pointing out that a similar dynamic is also occurring in a number of other countries where there is strong demand for deposits, including the United Kingdom, Sweden and New Zealand. In Australia, while public attention has clearly focused on the widening spread between the mortgage rate and the cash rate, there has been much less attention paid to the fact that reductions in the cash rate have not been passed through fully into deposit rates. Only a few years back, depositors did well to be paid an interest rate close to the cash rate on their at-call deposits, and not long before that they were paid well below the cash rate. In stark contrast, today there are a number of deposit products that pay about 2 percentage points above the cash rate.

In effect, what we are seeing as a result of both market and regulatory developments is an increase in most interest rates in the economy relative to the cash rate. This is something that the Reserve Bank has spoken about at length and it has been an important factor in the setting of monetary policy over recent years. In particular, this increase in interest rates relative to the cash rate has been offset by the Bank setting a lower cash rate than would otherwise have been the case. While it is difficult to be too precise, the cash rate today is in the order of 1½ percentage points lower than it would have been in the absence of these developments.

A second broad implication of the increase in the cost of financial intermediation is that there is likely to be less of it, particularly across the balance sheets of banks. This effect is being compounded by a reduced appetite for debt by the private non-financial sector.

One area where banks are likely to find it more difficult than in the past is in lending to large businesses. Given the current pricing, many large businesses can raise funds more cheaply in capital markets than banks can, even where the credit rating

of the business is lower than the bank. In part, this reflects the brand damage done to banking which is unlikely to be repaired any time soon. With banks paying more for funds, and being subject to a range of regulatory requirements, they are likely to find it hard to intermediate between savers and the large borrowers that can go directly to the savers. This will, no doubt, provide opportunities for some banks as they help businesses connect directly with these savers, but other banks will need to focus even more on lending to households and small and medium businesses. These structural changes will bear close watching over the years ahead.

Some Regulatory Issues

I would now like to turn to the related topic of the future direction of financial regulation. This is obviously a very broad topic, but there are three issues that I would like to touch on. These are: the importance of system-wide supervision; the regulation of innovation in the financial system; and the interconnections between financial institutions.

First, the importance of supervision.

One of the clearest lessons from financial history is that the financial sector has an uncanny ability of finding ways of connecting savers with borrowers. When obstacles are put in the way, detours are often found. New forms of financing pop up. New institutions develop. New products come into play. We saw numerous examples of this in Australia in earlier decades, and there are many overseas examples as well, some of which are quite recent.

This intrinsic flexibility of finance is one reason why the international regulatory community is spending a lot of time thinking about so-called 'shadow banking'. There is a legitimate concern that current efforts to tighten regulation will push activities off banks' balance sheets, in time creating new risks to the global financial system. While tighter rules were clearly needed in some areas, we need to remain aware of the limitations of rules alone.

Looking back over the global experience of recent years, it seems that in some jurisdictions rules have been viewed as a substitute for supervision. This has been a mistake. The preservation of financial stability cannot be achieved by rules alone. It requires active and competent supervision.

Importantly, a good supervisor needs a whole-of-system focus. The supervisor needs to think about the consequences of institutions following similar strategies. It needs to examine closely the interconnections between financial institutions, including those outside the formally regulated sector. It needs to examine developments in aggregate credit growth, construction activity and asset prices, and how these aggregates are distributed across the country. And it needs an understanding of how the competitive dynamics in the system are changing. And then having thought about these issues, the supervisor must be willing, and able, to act and constrain activities that pose unacceptable risks to the financial system. Judgement, not rules, is the key here.

On this score, Australia has been well served by APRA's approach to supervision, which has had an industry-wide focus. APRA has been supported in doing this by the Reserve Bank and by the Council of Financial Regulators which has regular discussions about system-wide developments. It is important that as the new rules are agreed and implemented, this strong focus on system-wide supervision is retained.

The second issue – and one that has probably not received the attention that it deserves – is how regulation should deal with financial innovation.

Over many decades, our societies have benefited greatly from innovation in the financial system. Financial innovation has delivered lower cost and more flexible loans and better deposit products. It has provided new and more efficient ways of managing risk. And it has helped our economies to grow and our living standards to rise.

But financial innovation can also have a dark side. This is particularly so where it is driven by distorted remuneration structures within financial institutions, or by regulatory, tax or accounting considerations. Problems can also arise where the new products are not well understood by those who develop and sell them, or by those who buy and trade them.

Over recent times, much of the innovation that we have seen has been driven by advances in finance theory and computing power, which have allowed institutions to slice up risk into smaller and smaller pieces and allowed each of those pieces to be separately priced. One supposed benefit of this was that financial products could be engineered to closely match the risk appetite of each investor. But much of the financial engineering was very complicated and its net benefit to society is debateable. Many of the products were not well understood, and many of the underlying assumptions used in pricing turned out to be wrong. Even sophisticated financial institutions with all their resources did not understand the risks at a microeconomic and system-wide level. As a result, they took more risk than they realised and created vulnerabilities for the entire global financial system.

Recently, a number of commentators have turned their attention to how society might improve the risk-return trade-off from financial innovation, in particular the question of how we obtain the benefits that innovation can deliver while reducing the risks. Doing this is not easy, but a common thread to a number of the proposals is for greater public sector oversight of areas where innovation is occurring.

There are considerable challenges here, but it is useful to think about how this might be done in practice. I suspect that the answer is not more rules, for it is difficult to write rules for new products, especially if we do not know what those new products will be, and the rules themselves can breed distortions. But to return to my earlier theme, one concrete approach is for supervisors and central banks to pay very close attention to areas where innovation is occurring: to make sure that they understand what is going on and to test, and to probe, institutions about their management of risks in new areas and new products. And ultimately supervisors need to be prepared to take action to limit certain types of activities, or to slow their growth, if the risks are not well understood or not well managed.

The third issue is the interconnections between financial institutions.

These institutions, by their very nature, are often highly interconnected: they hold one another's liabilities and they trade with one another extensively in financial markets. These interconnections are an important part of a well-functioning financial system and they have tended to increase over time as finance has become more important to economies and more globalised. However, these interconnections bring risks, and addressing these risks has been an important element of the global regulatory reform work over recent times.

There are a number of dimensions to this work. These include moves requiring foreign banks to set up subsidiaries, rather than branches, and efforts to increase margining in financial markets. But the one dimension that I would like to talk a little about is the greater use of central counterparties. These counterparties replace bilateral connections with connections to a central entity whose job it is to manage risk. By doing so, they hold out the promise of a more stable financial system.

There are, however, some complications, so in pursuing these benefits we need to proceed with care.

While a central counterparty reduces bilateral exposures, it does create a single point of failure – if the central counterparty fails every participant is affected. This means that the risk-management practices of the central counterparty are very important, and designing and implementing the appropriate regulatory arrangements is an ongoing task. So too is understanding the implications of any

increase of demand for collateral assets that might arise due to greater use of central counterparties.

Another complication is that it is typically quite costly for every participant in financial markets to become a member of a central counterparty. This means that some participants need to use the services of another institution that is a member of a central counterparty. If many participants use the same intermediary institution, then an extensive set of new bilateral interconnections will have been created and this introduces new risks that need to be managed. Indeed, since there are economies of scale in the provision of these intermediary services, there is a clear potential for concentration.

A third complication is that there is not a single central counterparty and not all dealings in financial instruments will go through a central counterparty. The issue of how various central counterparties relate to one another, and compete with one another, is important. So too is understanding how the bilateral exposures between institutions change when some types of transactions go through a central counterparty and others do not.

These are difficult issues and it is important to get the details right. I encourage you all to think about them and to remain actively involved in the debates.

Conclusion

Finally, it is worth repeating that the Australian banks have fared better than many of their international peers over recent years. This is partly because of the strong economic outcomes in Australia as well as APRA's approach to regulation and supervision. But it also reflects the Australian banks' higher lending standards than in some other parts of the world and their relatively limited exposure to innovative, and ultimately quite risky, financial products.

While Australia did not have a financial crisis, the North Atlantic crisis is having a significant impact on our financial system. This is occurring through the tightening of regulation and though developments in the marketplace. Many of these changes are positive and, over time, they should enhance the safety and resilience of our financial system. But as these changes take place, all those interested in finance need to do their best to understand the impact on the cost and availability of finance. And we should not lose sight of the importance of system-wide supervision, including understanding the innovations in both the Australian and the global financial systems.

Thank you.

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Most of the publications listed below are available free of charge on the Bank's website (www.rba.gov.au). Printed copies of these publications, as well as a wide range of earlier publications, are also available on request; for details refer to the enquiries information at the front of the *Bulletin*.

Statement on Monetary Policy

These statements, issued in February, May, August and November, assess current economic conditions and the prospects for inflation and output.

Financial Stability Review

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

Annual Reports

- *Reserve Bank of Australia Annual Report*
- *Payments System Board Annual Report*
- *Equity & Diversity Annual Report*

Research Discussion Papers (RDPs)

This series of papers is intended to make the results of current economic research within the Bank available for discussion and comment. The views expressed in these papers are those of the authors and not necessarily those of the Bank.

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Conference Volumes

Conference volumes have been published on the Bank's website since 1993. The most recent titles are:

- *The Australian Economy in the 2000s,* December 2011
- *Reserve Bank of Australia 50th Anniversary Symposium,* July 2010
- *Inflation in an Era of Relative Price Shocks,* May 2010
- *Lessons from the Financial Turmoil of 2007 and 2008,* October 2008
- *The Structure and Resilience of the Financial System,* November 2007
- *Demography and Financial Markets*, October 2006
- *The Changing Nature of the Business Cycle*, October 2005

Other Publications

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- *A Variation to the Access Regime for the ATM System: Conclusions,* August 2012
- *Consultation on New Financial Stability Standards,* August 2012
- *Guidance Note: Interpretation of the Surcharging Standards* (Revised Draft), August 2012
- *Strategic Review of Innovation in the Payments System: Conclusions,* June 2012
- *A Variation to the Surcharging Standards: Final Reforms and Regulation Impact Statement*, June 2012
- *Review of the Regulatory Framework for the EFTPOS System: Consultation on Options for Reform*, June 2012
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