Stress-Testing Australia's Housing Market

Abstract

The recent increase in sales and prices of Australian houses has reignited debate about the state of the country’s property market, one of the few in the world that did not experience a significant correction following the global financial crisis of 2007-2008. Indeed, Australian house prices have had 15 years of almost uninterrupted growth, defying the warnings of doomsayers and raising concerns for policymakers at the Reserve Bank of Australia and elsewhere.
Stress-Testing Australia’s Housing Market

BY GLENN LEVINE AND FRED GIBSON

The recent increase in sales and prices of Australian houses has reignited debate about the state of the country’s property market, one of the few in the world that did not experience a significant correction following the global financial crisis of 2007-2008. Indeed, Australian house prices have had 15 years of almost uninterrupted growth, defying the warnings of doomsayers and raising concerns for policymakers at the Reserve Bank of Australia and elsewhere (see Chart 1).

This paper adds to the current debate by modeling the Australian housing and mortgage market to study the effect of substantial but plausible external and domestic shocks. Similar studies have examined Australian housing as a single market, ignoring the very important differences among the states. Australia’s oft-cited “two-speed economy” has implications for each region that we examine in detail. Adding much-needed granularity, we consider the implications of shocks for each state housing market.

The evidence on the Australian housing market is mixed. We conclude that, for Australia as a whole, house prices are currently near fair value, although there is substantial variation among the states. House prices in Victoria are slightly overvalued and particularly vulnerable to adverse shocks. South Australia and Western Australia, by contrast, appear undervalued currently. As expected, Western Australian house prices are highly exposed to a downturn in the global economy and a fall in commodity prices. House prices in New South Wales, Queensland, the Australian Capital Territory, Tasmania, and the Northern Territory appear close to fair value.

It is important to examine house prices and vulnerabilities at the state level. Household investors typically invest in only one state, while institutional investors, lenders, mortgage insurers, and others connected to housing will have varying levels of exposure across states. It suggests that state-specific housing policy could be beneficial, particularly when the market is overheated.

Recent history

The nationwide median house price drifted steadily higher through the early 1990s, then began to surge in the latter part of the decade. In the 2000s, the median price rose nearly continuously until peaking in the second quarter of 2010. Prices then cooled a little as households cut back on debt, but rose after that to reach levels in early 2014 that are approaching their peaks in real terms.

Auction clearance rates, which measure the proportion of homes put up for auction that are sold in a given week, provide a high-frequency gauge of housing activity. These rose through 2013 to above 80% for Sydney in the fourth quarter, to nearly 75% in Melbourne, and to lesser rates in other state capitals. The increase fanned debate within the Reserve Bank of Australia and in the media about whether a bubble was forming in Australian housing.

We begin, therefore, by reviewing several valuation metrics for Australian property. Taking a longer view, it appears that even with the latest acceleration the market has not yet reached bubble levels and indeed may have cooled somewhat in recent years. The ratio of house prices to incomes advanced dramatically from 1998 to 2004 (see Chart 2) but has since pulled back in somewhat choppy fashion. Similarly, house prices surged ahead of rents from 2000 to 2004, but that ratio too has since stabilized. Initially this was due to rising rents but more recently comes via slower house price growth (see Chart 3).

The rise in household debt from 1990 to 2007 (see Chart 4) suggests that the market could cool if property buyers become less willing to hold large amounts of debt. Aus-
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Australia’s rising household debt can be partly explained by the structural downtrend in interest rates since the early 1990s, which allowed households to borrow more and manage higher debt ratios. Yet international comparisons confirm that Australian household debt ratio remains elevated.

Average loan-to-value data are not readily available but can be computed in the aggregate. Chart 5 shows this as the ratio of average housing finance commitments to median dwelling prices. Following an increase in leveraging from 1990 to 2000, this gauge of loan-to-value fell to 1994 levels and then stabilized.

One sign of an overheated market would be growth in speculation, but here the evidence is mixed. The share of house purchases made by investors increased from the mid-1980s to 2004 before stabilizing, but it has risen again with the latest uptick in housing activity (see Chart 6). The investor share is near the 2004 peak of 40%.

Looking back over the much longer term, Chart 7 tracks real dwelling prices back to 1880. Prices were fairly stable as late as 1960, although there was a noticeable jump when price and rent controls were relaxed in 1949. Controls persisted in some states into the 1960s, but prices began a pronounced run-up over subsequent decades. In Sydney and Melbourne, house prices tripled from 1970 in real terms. The price-to-income ratio shows a similar rise over this period, and rents have almost kept pace with house prices, with only a modest increase in the price-to-rent ratio.

The structural downtrend in inflation and interest rates that began in the early 1980s was an important driver of Australian house prices. This, along with limitations on earlier state-level data, is why our model uses data from 1983 onward. Given our assumptions, we do not believe that a longer time horizon would appreciably alter the findings.

Housing versus other asset classes

Housing investors have enjoyed strong returns over the past two decades. Table 1 shows a breakdown of inflation-adjusted cumulative asset returns since 1995 and 2000 across stocks, bonds and property. Stocks have generally been a poor investment, partly reflecting the disastrous performance during the global financial crisis and the Australian stock market.
market’s weak recovery. The Standard & Poor’s 500 has risen 168% since its mid-2009 lows, compared with the ASX200’s modest 70% rise. Government bonds have offered a solid (risk-free) return, particularly since 1995, as interest rates have trended lower.

International comparisons

Property has been a good investment for many years. Since 2000, every state except New South Wales has experienced outsize returns as domestic tax changes, a strongly performing economy, rising hard-commodity prices, and an abundance of cheap credit pushed state housing markets higher.

Property prices rose sharply in many countries during the five years prior to the 2007 global financial crisis, as easy lending and abundant credit helped stoke demand (see Chart 8). Australian house prices had been rising since the late 1990s, lifting the market ahead of others around the world. Notably, Australia’s price runup was even steeper than that of the U.S. Even at the market peak in 2006, U.S. price-to-income measures appeared less stratospheric than those in Australia, Canada or the U.K. (see Chart 9). Yet while the subsequent bust sent both the U.K. and U.S. into deep recessions and painfully long recoveries, Australia, like Canada, managed to avoid a serious housing correction.²

¹ Note also that the price-to-income ratio in Chart 9 uses disposable income per capita to ensure cross-country comparability, compared with Chart 2, which uses disposable income per household.
² Note that the U.K. and Canada figures in Charts 8 and 9 are mean house prices, whereas figures for Australia and the U.S. are medians. This likely overstates the house price level and increase in the U.K. and Canada where median values are unavailable.

Table 1: Real Returns by Asset Class

<table>
<thead>
<tr>
<th></th>
<th>Property</th>
<th>10-yr government bond</th>
<th>Stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>65.2</td>
<td>39.5</td>
<td>-</td>
</tr>
<tr>
<td>Victoria</td>
<td>78.1</td>
<td>59.9</td>
<td>-</td>
</tr>
<tr>
<td>Queensland</td>
<td>60.0</td>
<td>56.4</td>
<td>-</td>
</tr>
<tr>
<td>South Australia</td>
<td>67.8</td>
<td>69.9</td>
<td>-</td>
</tr>
<tr>
<td>Western Australia</td>
<td>89.4</td>
<td>79.1</td>
<td>-</td>
</tr>
<tr>
<td>Tasmania</td>
<td>57.7</td>
<td>62.0</td>
<td>-</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>71.8</td>
<td>71.5</td>
<td>-</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>66.0</td>
<td>70.3</td>
<td>-</td>
</tr>
<tr>
<td>Australia</td>
<td>70.7</td>
<td>54.1</td>
<td>57.6</td>
</tr>
</tbody>
</table>

Source: Moody’s Analytics
This was not merely coincidence. Australia and Canada have many similarities, beginning with legal, political and social institutions that share British roots. Both experienced booms in the prices of their dominant commodities, which also pushed up the value of their currencies and crowded out other export industries. Their financial sectors mirror each other, with Australia’s “Big Four” banks accounting for around 80% of the mortgage market and Canada’s “Big Five” holding 85% of the nation’s banking assets.

This market concentration helped keep bank profits healthy prior to the global financial crisis in both countries and may have reduced the incentive for banks to engage in subprime or other risky lending. In the U.S., by contrast, the large number of banks, thrifts and credit unions generates fierce competition for borrowers while making it difficult for regulators to police lending practices.

Securitization also plays a limited role in the Canadian and Australian housing markets. Less than 10% of Australia’s mortgage market is securitized (though this rose to around 25% prior to the financial crisis), while around 20% of Canadian mortgage loans are securitized. With the bulk of Australian and Canadian mortgage loans staying on banks’ books, lenders have a clear incentive for caution.

Mortgage regulations are also similar in the two nations. In Australia, mortgage insurance lowers risk-weighted asset requirements under APRA’s standardized risk weight model where the loan-to-value ratio exceeds 80%; thus in practice, virtually all loans with LTVs above 80% are insured. Canada’s government insures nearly all mortgages via the Canadian Mortgage Housing Corp. These policies mitigate lenders’ exposure to downturns and limit the deterioration in credit quality.

The Canadian house price boom from 1995 to 2007 appears moderate relative to Australia’s, but it is comparable once adjusted for income growth. Canadian house prices doubled over the period, while Australian prices nearly tripled, yet price-to-income ratios in both countries tracked each other relatively closely, as Australian incomes also rose more sharply. Notably, both markets quickly began rising again after the financial crisis. Australian house prices have since risen 26%, while Canada’s are up 31%. Canada’s price-to-income valuation is above Australia’s, suggesting that it may be more vulnerable to a near-term correction.

“I think that when you put it fully into international perspective—that is, don’t just compare with the U.S., compare with a whole range of countries—it’s actually a lot harder to make the case that they’re grossly overpriced and due for a crash. After all, we’ve been around this level of house prices/income for 10 years—[it’s] taking a long time to burst if it is a bubble.”


Policymakers in both countries have noted the recent runups in housing. The RBA has voiced concern about house prices and, in particular, the increased use of self-managed super funds to bankroll housing investment. In the absence of more targeted restrictions or macroprudential controls, rising housing activity will likely preclude further monetary easing from the RBA even as growth in the rest of the economy remains tepid. The Canadian government, meanwhile, has been actively trying to cool its housing market: tightening lending rules, reducing the maximum loan length from 30 to 25 years, and cutting the maximum allowable loan-to-value ratio from 80% to 65%. Canada’s housing market is starting to cool, largely in line with the government’s stated goals. Average monthly housing starts have fallen around 15% since new mortgage rules were introduced in mid-2012. If Australian house prices continue to increase while the economy fails to improve enough to justify higher interest rates, the RBA may be forced to consider alternative methods to cool housing activity.

One point worth noting is that international analysts—including U.S. investment banks and multilateral agencies such as the International Monetary Fund—tend to emphasize the global nature of the housing and credit boom. On that basis they often conclude that the Australian market is overvalued, while analysts from the local banks tend to be more sanguine. Australia’s favourable tax regime for property investors—particularly the ability to deduct cash flow shortfalls against taxable income (called negative gearing)—stringent bankruptcy laws, the lack of available land for develop-

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6 Super funds refer to compulsory retirement saving accounts that are usually managed by a professional fund manager. For several years now these funds have been allowed to be used to fund housing investment. The RBA has been concerned that this could signal increased speculation in the market and that people were using their retirement funds for risky investments. This is still only a small part of the housing market but has been growing very quickly.

7 See, for example, G. Minack, “Living in a Bubble,” Morgan Stanley Research (August 16, 2010).

8 Negative gearing allows losses on investments such as property, where rents do not cover interest costs associated with servicing the mortgage, to be offset against taxable income.
Have house prices been stress-tested?

Australia’s housing and mortgage markets have shown few signs of stress since the global financial crisis, largely because they have not been subjected to sizable shocks. The Australian economy avoided recession in 2009, with unemployment peaking at just 5.9%. In light of the strong job market, housing cooled but did not crash.

We begin our stress-testing exercise by considering Australia’s housing market from a consumer’s point of view. Australia’s homeownership rate is around 70%, virtually unchanged since the 1970s. We consider three measures of affordability for each state:

- the price-to-income ratio,
- the price-to-rent ratio, and
- the share of income required for mortgage payments.

The three gauges tell a broadly similar story, namely that prices are high relative to historical averages but have cooled since peaking five to 10 years ago.

A healthy housing market should display a stable price-to-income ratio. As Chart 10 shows, aside from a blip in the late 1980s (because of a recession-driven temporary fall in prices), Australia’s ratio trended steadily higher from 1980 across most states but then rose sharply from the mid to late 1990s until 2005 as house prices surged. In recent years, this affordability measure has stabilized in most states as prices have flattened and incomes have grown slowly. Nevertheless, the price-to-income ratio remains elevated relative to historical averages.

The rise in price-to-income ratios has been relatively uniform across most states, which may suggest common national-level drivers. New South Wales is the main exception: its ratio is well above those of other states, and house prices there started to accelerate from around 1995. Victoria is somewhere between New South Wales and the rest of the country. Affordability has improved over the past couple of years as prices have flattened and incomes have grown slowly.

House price-to-rent ratios should also be stable over time, reflecting stable consumer and investor risk preferences. For Australia, this measure follows a trend similar to the price-to-income ratio (see Chart 11), with both measures pulled higher by the initial surge in house prices. The price-to-rent ratio began to rise in the mid-1990s, peaking around 2005 as rents also started to rise. Since 2007, as prices have flattened but rents have continued to increase, this gauge has trended lower in most states. It suggests that prices are still high relative to historical averages but that the gap has eased, or at least stabilized, over the past eight years. New South Wales looked particularly overvalued by this measure in 2004, but has since normalized as rents rose 6% per year from 2005 to the end of 2013.

The final gauge is the ratio of mortgage payments to income. This tends to be more volatile than the two other measures, as the cost of borrowing is affected by monetary policy changes. The ratio measures the average share of wage and salary income allocated to housing, with 30% often thought of as a reasonable upper limit.

Predictably, measures across Australian states tend to move in sync because of central bank rate decisions and common house price trends over much of the past three decades (see Chart 12). Despite trending downward in recent years as house prices plateaued and interest rates fell, mortgage payments still take an outsized share of income. This is partly explained by our method for calculating mortgage payments as well as our income measure, which excludes nonwage income. Even so, it suggests that houses in most states may be overvalued. Despite low interest rates and a cooling in house price growth, mortgage payments as a share of income remain at or above historical averages in most states.

9 We have called this a state-level study, but for several data series, including house prices, state data are proxied by capital city data. One can just as easily assume the reverse and call this a capital-city study, using state-level data to proxy capital cities.

10 Data limitations at the state level dictate that we use a different measure of income to that used in Chart 2. This is explained in Appendix A.

11 The mortgage payments ratio is the average monthly payment needed to pay off a mortgage over 30 years as a share of monthly income. We chose an LTV of 80%, as 20% is considered a typical down payment and mortgage loans at origination cluster at this rate and since an LTV above 80% automatically requires mortgage insurance. Better data on average outstanding loans would provide a clearer picture of mortgage burdens.

12 Australian Bureau of Statistics census data show that in 2011 9.9% of Australian households faced mortgage payments above 30% of income, compared with 8.4% in 2006. All states increased over this period, with New South Wales, Victoria, and Western Australia above 10%. This includes all households, including those without a mortgage.
The rise in commodity prices is often cited as a reason for surging house prices, particularly in mining-dependent states such as Western Australia and the Northern Territory. Chart 13 shows the total rise in house prices from 2004 to 2012, which corresponds with the period of elevated global commodity prices, plotted against mining as a share of gross state product in each state. A linear regression shows that for every 1% of a state’s economy dedicated to mining, house prices rose by an additional 3 percentage points during the mining boom. We utilize this link between house prices and the commodity boom in the modeling methodology below.

Australia’s housing shortage

Australia’s population has risen 52% since 1980, and the supply of housing has not kept pace, partly because of a complicated system for releasing development land across three tiers of government. Chart 14 uses figures from the National Housing Supply Council and shows each state’s housing shortage in June 2011 as a share of demand, assuming that supply and demand were equal in January 2001.13

New South Wales, Queensland, and Western Australia all have sizeable shortfalls, while Victoria and South Australia are close to balanced. The Northern Territory’s small population and housing supply mean its shortage is likely overstated. It is difficult to quantify the nationwide shortage, but there is evidence of a moderate shortfall in most states that likely supports prices. We have included a measure of housing supply in our model.

Summary of methodology

We utilize these stylized facts in our model of the Australian housing market.14 The model ties house prices to their long-term drivers—rents, incomes, and the user cost of capital—but allows prices to fluctuate in the short term in line with business cycle drivers. Moreover, we assume that Australia’s housing market is driven by the broader economy and that, in turn, house price changes can influence state-level economic performance. Finally, we have modeled house prices by state, where we see considerable heterogeneity. House prices in Western Australia, for example, should be more sensitive to global commodity prices than those in the Australian Capital Territory.

Results: Houses a bit undervalued...

We compare current house prices to their predicted value under the long-run house price equation. Table 2 shows that in most states, house prices are close to fair value—defined as within 10% of the model-predicted values—or slightly undervalued. This aligns with our thinking on the housing market and the baseline forecast, which sees near-term house prices rising in most states. Note that these figures are not a forecast but rather an assessment of the current disequilibrium. A market that is undervalued today could, for example, revert to equilibrium through higher house prices or through lower rents or incomes.

Victoria is the only state that is currently overvalued after house prices surged across the second half of 2013. Average rents in Victoria are low, possibly because of excessive supply, which lowers the equilibrium house price. House prices in New South Wales are the highest in the country but fairly valued relative to long-run drivers. Incomes and rents are above

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13 The first year in the National Housing Supply Council study was 2001, and so it was chosen as the equilibrium year. This likely understates the current extent of the housing shortage in most states.

14 See Appendix A for a more detailed methodology.
the national average and New South Wales residents gain an outsized benefit from negative gearing, which helps to support current valuations.

Western Australia was overvalued in 2005, but now is undervalued, as prices have been flat for six years, although incomes and rents have risen. Western Australia rents have risen 10% per year since 2005 while incomes have risen 7% per year. House prices in South Australia rose only slightly in 2013 while incomes grew strongly, pushing house prices into undervalued territory. Queensland house prices also appear slightly undervalued, although prices in Brisbane, which we have used in the model, may not proxy well for the entire state. Unit prices on the Gold Coast, for example, continue to fall because of oversupply. Tasmania, Northern Territory and the ACT are close to fairly valued.

...Partly because of low interest rates

Most housing markets have gone from overvalued in 2005 to fairly valued or slightly undervalued today. This is partly because of the flattening in prices, especially compared with solid growth in wages and rents. Yet it may be slightly misleading, because our long-run equation incorporates interest rates, which are at historical lows. The recent uptick in house prices is partly a response to lower interest rates. To account for this, we have recalculated the model-generated fair value under a more normal interest-rate environment, calibrating it to an RBA cash rate of 4.5%, which we consider the current neutral rate. The results are shown in the column labeled “Normal I.R.” of Table 2 and show that under a more normal interest-rate environment, most state housing markets are near fair value, while Victoria is comfortably overvalued. Interest rates have a large effect on equilibrium house prices, with the current low-rate environment accounting for around 7% of current valuations in most states.\(^{15}\)

### Chart 15: International Shocks

Peak-to-trough house price fall, %

<table>
<thead>
<tr>
<th>Country</th>
<th>Global recession</th>
<th>Global slowdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>-2.8</td>
<td>-2.8</td>
</tr>
<tr>
<td>New South Wales</td>
<td>-8.5</td>
<td>-8.5</td>
</tr>
<tr>
<td>Victoria</td>
<td>-12.7</td>
<td>-12.7</td>
</tr>
<tr>
<td>Queensland</td>
<td>-11.9</td>
<td>-11.9</td>
</tr>
<tr>
<td>South Australia</td>
<td>-10.2</td>
<td>-10.2</td>
</tr>
<tr>
<td>Western Australia</td>
<td>-5.4</td>
<td>-5.4</td>
</tr>
<tr>
<td>Tasmania</td>
<td>-8.9</td>
<td>-8.9</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>-4.7</td>
<td>-4.7</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Australia</td>
<td>-10.4</td>
<td>-10.4</td>
</tr>
</tbody>
</table>

*Highly negative=undervalued; +/-10%=fairly valued; Highly positive=overvalued

Source: Moody’s Analytics

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**Table 2: House Prices Hinge on Policy**

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>2005</th>
<th>1995</th>
<th>Normal I.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>New South Wales</td>
<td>-2.5</td>
<td>7.2</td>
<td>-10.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Victoria</td>
<td>7.8</td>
<td>8.2</td>
<td>-17.1</td>
<td>15.7</td>
</tr>
<tr>
<td>Queensland</td>
<td>-8.1</td>
<td>17.1</td>
<td>4.7</td>
<td>-1.4</td>
</tr>
<tr>
<td>South Australia</td>
<td>-11.9</td>
<td>17.9</td>
<td>-10.2</td>
<td>5.4</td>
</tr>
<tr>
<td>Western Australia</td>
<td>-8.5</td>
<td>24.5</td>
<td>2.2</td>
<td>-1.8</td>
</tr>
<tr>
<td>Tasmania</td>
<td>-2.7</td>
<td>25.7</td>
<td>-8.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>0.9</td>
<td>0.5</td>
<td>6.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>-5.6</td>
<td>9.8</td>
<td>-4.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Australia</td>
<td>-2.8</td>
<td>11.3</td>
<td>-8.4</td>
<td>4.3</td>
</tr>
</tbody>
</table>

*Highly negative=undervalued; +/-10%=fairly valued; Highly positive=overvalued

Source: Moody’s Analytics

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**Table 3: Scenario Comparison**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Global GDP</th>
<th>Australia unemp rate, %</th>
<th>Narrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline scenario</td>
<td>3.1% in 2014</td>
<td>Peaks at 6%</td>
<td>2.5% to 3% GDP growth. RBA lifts interest rates from late 2014.</td>
</tr>
<tr>
<td>International scenarios</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global slowdown</td>
<td>1.5% in 2014</td>
<td>7.5% peak in 2015</td>
<td>Australia slows but avoids recession. Interest rates stay low.</td>
</tr>
<tr>
<td>Global recession</td>
<td>4.6% peak-to-trough fall</td>
<td>10.7% peak in 2015</td>
<td>Global downturn similar to 2009. Australia suffers a deep recession.</td>
</tr>
<tr>
<td>Policy shocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tighter interest rates</td>
<td>Same as baseline</td>
<td>7% peak in 2014</td>
<td>Cash rate lifted from 2.5% to 4.5% by end of 2014.</td>
</tr>
<tr>
<td>Highest rates on record</td>
<td>Same as baseline</td>
<td>15% peak in 2015</td>
<td>Cash rate spikes to 18.5%. Intended as sensitivity analysis.</td>
</tr>
<tr>
<td>Supply shock</td>
<td>Same as baseline</td>
<td>Same as baseline</td>
<td>Vacancy rate doubles for four quarters</td>
</tr>
</tbody>
</table>

Source: Moody’s Analytics

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\(^{15}\) This is a ceteris paribus measure of valuation, which is different from our tighter interest rates scenario below.
tive to a shift in global GDP and commodity prices. This finding was common across the larger states, while the Australian Capital Territory and the Northern Territory showed a muted reaction. Western Australia was the most sensitive, as it has a large export-facing mining sector that would turn down sharply under a global recession. Victoria was also hit hard, reflecting its larger manufacturing component and overvalued housing market. The result for the Northern Territory, where the state economy is dependent on hard commodity demand, is counterintuitive but is explained by our model specification, which found no historical relationship between commodity prices and house prices.

Interest rates are a notable long- and short-run driver of house prices in our model, confirming that the structural fall in interest rates over the past 20 years has had a substantial impact on house prices. In 2013, approximately 85% of Australian mortgages were taken out under floating interest rates, suggesting that small changes in the RBA’s cash rate can have a substantial impact on the housing market and the broader economy.

The inclusion of negative gearing in the user cost of capital helps to mitigate the effect on prices during a downside shock. As rents fall, rising losses on investment income can be written off against taxable income, helping to cushion the impact on disposable income and therefore house prices. Under the rate shock scenarios, higher interest rates are partly offset by elevated investment losses through negative gearing.

As expected, house prices fall sharply across all states when interest rates are lifted to 18.5%, the highest rate on record; in most of the larger states they drop by 25% to 40% (see Chart 16). Victoria and Western Australia are the most sensitive under this and the tighter interest rate scenario, with New South Wales also above the national average. House prices in most states tend to flatten to around 2016, and in some cases fall slightly, under the tighter interest rate shock. The supply shock causes prices to fall moderately in some states, with New South Wales the most sensitive. Chart 17 illustrates the effect of all five shocks over time.

Prices are also sensitive to changes in the unemployment rate. This broadly reaffirms the consensus around the Australian housing market, which suggests that it has not been properly stress-tested and that higher unemployment would likely trigger lower prices.

Weaker commodity prices have a mixed impact, weighing on house prices in Western Australia, as expected, but with a smaller effect in many other states. This is likely because of the exchange rate channel, whereby higher commodity prices lift the economy but also the Australian dollar, crowding out economic activity in export-facing industries such as manufacturing and tourism. Despite this, we find a relationship between international trade exposure and house price vulnerability to a global recession (see Chart 18).

**State-by-state scenario results**

1. **New South Wales**

New South Wales was the first state to enter a housing boom as prices rose sharply from 1996 and, despite the recent increase in housing activity, prices are close to fair value. The effective tax rate in New South Wales is among the highest in the country, providing greater benefits through negative gearing, which lifts the equilibrium house price. The state’s exposure to external and domestic interest rate shocks is comparable to the national average; its economy is large and diversified and mirrors the Australian economy.
Prices fall furthest and fastest under the record interest rate scenario (see Chart 19). New South Wales house prices are among the most sensitive to interest rates and the unemployment rate, which both spike under this scenario. The negative gearing tax benefit fails to offset the other factors weighing on prices. House prices fall moderately under the global recession, reflecting the state’s links to the world economy through financial services, tourism, and as a favoured destination for foreign investors. Rents fall moderately under the global recession but incomes remain relatively stable, which helps to cushion the downturn.

New South Wales is among the most sensitive to changes in housing supply. Prices fall slowly, eventually dipping 14% below the baseline in 2016 under the supply shock scenario. Moreover, the house price recoveries under all downside scenarios are sharper than in the other states as supply falls in response to the initial economic downturn. This aligns with anecdotal evidence suggesting a chronic housing shortage in Sydney and to a lesser extent with our measure of housing supply in Chart 14. Note that the chart measure assumes that supply and demand were equally balanced in January 2001, which was probably not the case in the state, given that the housing boom started in the mid-1990s.

2. Victoria

As in New South Wales, Victoria house prices began to take off before they did in the rest of the country, rising steadily from 1997 to 2007 (see Chart 20). The three measures of housing valuation remain elevated and above the national average, while Victoria’s negative gearing offset is well below the national average. House prices are overvalued relative to Victoria’s long-run drivers and fall by more than the national average under four of the five shocks, suggesting that the market is vulnerable.

Victoria’s housing is highly sensitive to rising unemployment. This comes through most clearly under the record interest rate shock, with the state’s unemployment rate peaking at 13.8% in mid-2015, which, along with the fall in Australian GDP and incomes and higher borrowing costs, pushes house prices down 35% peak to trough. Victoria also has a large export-facing manufacturing industry, and its income and house prices fall under the two global scenarios. Victoria is among the most sensitive to a drop in global GDP. Prices fall sharply under the global recession scenario, even though Victoria has a smaller direct trade exposure than some other states and shows little effect from falling commodity prices. The only scenario in which Victoria performs well is the supply shock, but this is because it may be the least supply-constrained of all the states—most other states have a housing shortage of varying severity. This aligns with the state’s low rental return and high sensitivity to an adverse demand shock—in other states the housing shortage helps to cushion the downturn somewhat. Victoria stands out as one of the most vulnerable of all the states.

3. Queensland

Queensland’s house prices rose strongly from 2001 until the global financial crisis hit in 2008. With the subsequent flatlining, houses are now modestly undervalued.

House prices in Queensland are less sensitive than the national average to external shocks. Among the larger states, Queensland’s fall the least under the record interest rate scenario, as it is among the least sensitive to higher unemployment and rising interest rates. Prices fall by 14%, close to the national average, under the global recession (see Chart 21). The state’s economy has a large mining component, which pushed up house prices during the boom but leaves
them exposed to a slowdown in the global economy and falling commodity prices. The economy is also dependent on tourism, leaving Queensland vulnerable to weaker global growth.

4. South Australia

Houses in South Australia are the most undervalued of any state relative to long-term drivers and under normalized interest rates, and are the cheapest of any state after Tasmania. Our baseline outlook is for modest price growth.

South Australia’s current undervaluation helps to insulate the market somewhat, and prices perform better than the national average under all scenarios. As with most other states, prices fall furthest under the record high interest rate scenario as unemployment peaks above 14% (see Chart 22). Prices are sensitive to global GDP but less so to commodities, despite a growing mining sector outside of the state capital, Adelaide. The South Australian housing market appears only moderately vulnerable to shocks.

5. Western Australia

Western Australia’s housing market was highly overvalued in 2005, but surging incomes linked to the mining boom, rising rents, the country’s highest negative gearing offset, and falling interest rates have pushed it into undervalued territory. House prices have risen 206% since 2001, but rents have increased 191% (national average is 89%) and incomes 100% (national average is 61%). Despite this, the Western Australia housing market is still vulnerable to a range of shocks (see Chart 23).

Prices fall by 30% under the global recession scenario and by 10% under the global slowdown. Both of these are the largest falls of all the states and not surprising given Western Australia’s high dependence on mining. House prices are sensitive to global GDP and commodity prices, with prices recovering strongly during the global recovery from 2016. Investors should beware of the state’s vulnerability to international shocks, especially a scenario that results in lower commodity prices such as a downturn in the Chinese economy. House prices fall further than any other state under the two interest rate shocks, partly because of the market’s rate-sensitivity but also because house prices respond to shifts in the unemployment rate which rises to 14% under the record interest rate scenario. Prices are not overly sensitive to supply.

6. Tasmania

Tasmania’s housing market went from highly overvalued in 2005 to close to fairly valued today, according to our long-term measure, as incomes have continued to rise and prices have flattened.

House prices in Tasmania are exposed under the two interest rate shocks, and show a moderate response to supply (see Chart 24). Prices also fall sharply under the two international shocks. That said, these results are influenced by the shorter data history, making the results less robust than those for other states.

7. Northern Territory

House prices in the Northern Territory are close to fair value and the least vulnerable to shocks. Prices fall moderately under the record interest rate scenario but barely decline under either of the international shocks (see Chart 25), instead flatlining for a couple of years. Prices are sensitive to commodity prices, as expected, but otherwise uncorrelated with the global economy. House prices continued to rise in 2008 and 2009 as the global economy entered recession but stalled in 2010 and 2011 during the global recovery, making it difficult to link house prices to the global economy. The Northern Territory series begins only in 1994, so the model may not be working as well as for other states.
8. Australian Capital Territory

The Australian Capital Territory housing market remains close to fair value and relatively insulated from international shocks. Prices fall moderately under the record interest rate shock and flatline under the global recession (see Chart 26). House prices show little reaction to changes in commodity prices or global GDP. The unemployment rate in the Australian Capital Territory is less responsive, peaking at 7.6% under the global recession shock because the economy is insulated by the large government sector.

Conclusion

Australian house prices are near fair value but are still vulnerable to both international and domestic shocks. The results differ substantially at the state level. This is not surprising, given the large degree of heterogeneity across state economies and housing markets.

It is important to examine house prices and vulnerabilities at this level. Household investors typically invest in only one state, and institutional investors, lenders, mortgage insurers, and others connected to housing will have varying levels of exposure across states. This suggests that state-specific housing policy could be beneficial, particularly when the market is overheated.
Appendix A: Methodology, Data and Economic Shocks

Methodology

The long-run house price equation takes the following form:

$$ HP_t = \alpha_0 + \alpha_1 \frac{R_t}{UC_t} + \alpha_2 \gamma_t + \alpha_3 $$

where,

- $i$ is a vector of Australian states (New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, Australian Capital Territory, Northern Territory);
- $HP_t$ = log of house price in period $t$ and state $i$;
- $\frac{R_t}{UC_t}$ = log of rents divided by the user cost of capital;
- $\gamma_t$ = log of incomes; and
- $\alpha_m$ = state-specific fixed effect

We estimated the above equation using a pooled regression with fixed effects. This ensures relative consistency across states, but allows for state-specific policy (such as rules governing land released for development) through the fixed effect term. We exploit the fact that house prices can be thought of as the present value of future rental income to incorporate interest rates into the long-run equation through the user cost of capital term. This is important because interest rates have trended structurally lower over the last 30 years. In the short run, house prices are also affected by business cycle drivers, including state unemployment rates, Australian GDP, commodity prices, supply, and the global economy (proxied by U.S. GDP).

To capture these dynamics and to allow for endogeneity between the housing market and the broader economy, we have modeled house prices, rents, incomes and supply as a system similar to a vector error correction framework. However, we also assume that incomes are weakly exogenous of rents and house prices in the long run. That is, nominal incomes are driven by price effects and productivity improvements over the long run—we use nominal Australian GDP—but in the short run, to capture housing’s endogeneity with the broader economy, house prices and rents can influence incomes.

These restrictions require the use of seemingly unrelated regressions to estimate house prices, rents, incomes, and housing supply as a system of equations.

We allowed up to four lag lengths on short-run dynamics. However, in most instances, two lags were sufficient; we favour parsimony in forecasting and to maximize degrees of freedom. The system of equations is not a panel regression, as substantial state-level heterogeneity in the short run renders panel methodology unsuitable.

The short-run drivers are exogenous to the model and are drawn from the Moody’s Analytics baseline and alternative scenarios forecast catalog.

Data

The house price data are drawn chiefly from RP Data’s hedonic house price index, spliced with data from the Real Estate Institute of Australia. In all instances, we use capital city house prices and rents to proxy for the state.

Rental data are from the REIA. We use the weekly rent on a three-bedroom house in each capital city. For incomes, we use Australian Bureau of Statistics wages and salaries data, available at the state level. We constructed a user cost of capital to account for borrowing costs and Australia’s tax system which incentivizes residential investment. The borrowing cost component uses the 10-year government bond yield as a risk-free interest rate representing the typical length of a mortgage, with the spread between the RBA cash rate and the IMF’s lending rate\(^\text{17}\) used to capture competition among lenders. The investor component includes the capital gains tax\(^\text{18}\), which the federal government halved in September 1999, and the tax benefit to investors from negative gearing. The latter is constructed as a time and state-varying function of interest rates, depreciation\(^\text{19}\), and the effective tax rate on income\(^\text{20}\). Vacancy rates from the REIA are used as a short term measure of supply. The RBA index of nonrural commodity prices is our commodity price measure. We also use Australian nominal GDP as a price-sensitive business cycle gauge of the Australian economy. The global economy is proxied by U.S. real GDP.

Calibration and economic shocks

We calculate house prices under a baseline and five alternative scenarios.

The first is a global slowdown in which the major global economies such as Europe and the U.S. slow but do not enter recession. This causes Australian GDP growth to be lower than in the baseline.

The second global recession scenario is an international shock that closely resembles the Moody’s Analytics S4 scenario, which assumes a protracted slump in which global GDP (proxied by U.S. GDP), Australian GDP and commodity prices fall sharply from the first quarter of 2014. The RBA responds by aggressively cutting the policy interest rate, which eventually drives the recovery from mid-2015. The unemployment rate rises in each state, though by differing amounts.

The interest rate shocks are localized scenarios designed to test the sensitivity of house prices to interest rates. The global economy is assumed to be the same as the baseline. In the third simulation, the RBA increases interest rates more aggressively, with the policy rate lifted to its neutral rate by the end of 2014, causing the economy to perform worse than in the baseline.

The fourth scenario is intended as a sensitivity analysis in which interest rates are hiked to their highest on record, 18.5%, a rate last reached in the late 1980s, when inflation was above 8%. It is not necessarily a realistic scenario but helps to disentangle which states are more vulnerable to higher interest rates.

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\(^{17}\) According to the IMF, this is the “rate charged by banks on standard housing loans.”

\(^{18}\) Calculated as a function of the effective tax rate and expectations of future house price appreciation, which is set at 4% across all scenarios.

\(^{19}\) We assume 2.5% annual depreciation.

\(^{20}\) Calculated using the ABS Household Income and Income Distribution series
The final scenario is a positive supply shock, in which the vacancy rate doubles throughout 2014 before reverting to baseline. All other local and international drivers are the same as the baseline. Again, this is not a realistic scenario but helps to isolate house price trends and give some insight into the varying levels of housing shortages across states and how they affect prices.

These downside scenarios are designed to stress-test the Australian housing market under various situations encapsulating likely triggers for a fall in house prices—namely, a rise in unemployment, greater supply of housing, higher interest rates, a slowdown in the domestic and global economies, and a fall in global commodity prices.

The house price forecasts under the alternative scenarios were calibrated to the Moody’s Analytics baseline forecasts. Results are reported in the main text of this report.

## Appendix B: Table of Coefficients

### House price equation coefficients

<table>
<thead>
<tr>
<th>Short-run drivers</th>
<th>NSW</th>
<th>Victoria</th>
<th>Queensland</th>
<th>SA</th>
<th>WA</th>
<th>Tasmania</th>
<th>NT</th>
<th>ACT</th>
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<tbody>
<tr>
<td>Unemp(t)</td>
<td>-1.17</td>
<td>-1.19</td>
<td>-0.38</td>
<td>-1.21</td>
<td>-2.01</td>
<td>-0.63</td>
<td>-0.78</td>
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</tr>
<tr>
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<td>-1.19</td>
<td>-0.38</td>
<td>-1.21</td>
<td>-2.01</td>
<td>-0.63</td>
<td>-0.78</td>
<td>-0.07</td>
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<td>-0.17</td>
<td>-0.08</td>
<td>-0.13</td>
<td>-0.17</td>
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<td>0.02</td>
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<tr>
<td>Commodity(t-1)</td>
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<td>-0.35</td>
<td>-0.13</td>
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<tr>
<td>Commodity(t-2)</td>
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<td>0.17</td>
<td>0.08</td>
<td>0.11</td>
<td>0.29</td>
<td>0.09</td>
<td></td>
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<tr>
<td>Interest_rate(t-1)</td>
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<td>0.18</td>
<td>0.17</td>
<td>0.08</td>
<td>0.11</td>
<td>0.29</td>
<td>0.09</td>
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<tr>
<td>Vacancy_rate (t)</td>
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<td>-0.33</td>
<td>-0.40</td>
<td>-0.26</td>
<td>-0.71</td>
<td>-0.30</td>
<td>-0.40</td>
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<td>USGDP(t)</td>
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<td>0.78</td>
<td>0.46</td>
<td>0.74</td>
<td>1.07</td>
<td>0.69*</td>
<td>0.43</td>
</tr>
</tbody>
</table>

**Long-run drivers - estimated as a fixed effects pool**

| Rent/user_cost(t) | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 |
| Income(t)         | 1.28 | 1.28 | 1.28 | 1.28 | 1.28 | 1.28 | 1.28 | 1.28 |
| Fixed effect      | -3.60 | -3.60 | -3.60 | -2.97 | -3.52 | -2.40 | -2.46 | -2.77 |

Note: *USGDP(t-2)

Enters through the income equation.
About the Authors

Glenn Levine

Glenn Levine is a senior economist in the Sydney office of Moody’s Analytics. He is involved in macroeconomic modelling and research and oversees the Asia-Pacific section of the Dismal Scientist. Glenn is regularly quoted and interviewed by major news media outlets and is the Moody’s Analytics chief spokesman for the Asia-Pacific region. Prior to joining Moody’s Analytics, he worked as an economic consultant and modeller with KPMG and as IMA Asia’s regional economist. Glenn received his honours degree in economics from the University of New South Wales and his MSc in economics from the London School of Economics.

Fred Gibson

Fred Gibson is an associate economist in the Sydney office of Moody’s Analytics. He covers national and metropolitan economic issues across the Asia-Pacific region. He earned honours and master’s degrees in economics from the University of Otago.
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