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Housing prices and rents in Australia 1980-2023: Facts, explanations and outcomes

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Abstract

Nationally, real median house prices approximately doubled between the early 1980s and 2003 and again between 2003 and 2022. And there was a strong uniformity of housing price changes across Australia. Accounting for quality changes, real house prices rose by about 50% between 2003 and 2022. On the other hand, constant quality real housing rents rose by only about 20% from 1980 to end 2022. Our long-run equilibrium house price model shows the impacts on house prices of changes in mortgage rates, real household disposable income and the national housing stock. Our error correction model finds that if an external shock throws the variables out of equilibrium, the price adjusts to the long-run equilibrium with about 11 per cent of the adjustment occurring in each quarter. Housing ownership has fallen substantially for households under 55 due in part to the rising cost of first home deposits, but average mortgage payments have not risen as a proportion of average household income. Rents have been a broadly constant proportion of household disposable income. However, many low-income households pay more than 30% of their disposable income because household incomes are distributed more widely than house rents. There has also been a major fall in the supply of public housing.

Keywords: Housing, house prices, housing rents, ownership, affordability
JEL codes: C50, R30, R31

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1 Introduction

In the early 2000s, the authors of this paper were among the few in Australia actively researching, reporting on, and explaining housing prices in Australia. In 2005, in the *Australian Economic Review*, Abelson and Chung described "The Real Story of Housing Prices in Australia from 1970 to 2003". Also in 2005, in the *Economic Record*, Abelson and Joyeux *et al*. described the various drivers of housing prices in "Explaining House Prices in Australia: 1970 to 2003".

By major contrast, in recent years there has been a veritable explosion of professional, political and public discussion on housing prices (as well as developer and real estate promotion) frequently dominating the daily national and local news. Much of this work is strongly empirically based. We note especially the excellent paper explaining housing prices by Saunders and Tulip (2019) published as a Reserve Bank of Australia Discussion Paper. However, much of this explosion of information focuses on immediate events and often presents a partial explanation.

Our aim in this paper is to provide a full description of housing prices and rents across Australia from 1980 to the first quarter 2023, along with some second quarter data, and an informed explanation of these prices and rents along with major outcomes for households. Where possible, we draw on ABS data. We also note some issues that warrant further analysis.

In this Introduction, we describe the structure of the paper. Section 2 summarises nominal and real house and unit prices in the cities and the rest of the states from 1980 to early 2023. This shows considerable uniformity of housing price changes across the country over the whole period.

Section 3 provides national price indices in real terms for houses, units, and all dwellings. We discuss how changes in housing quality affects reported housing prices. We also provide some comparisons with rising housing prices in other countries.

In Section 4, we report on nominal and real housing rents in Australia from 1980 to early 2023. This includes national and capital city rental data and provides a comparison of housing prices and rents.

Section 5 provides a general explanation of the major demand and supply drivers of real housing prices and rents. This describes the principles of asset pricing which influence the capital values of housing. The major variables include population, disposable household income, mortgage rates, and the private and public housing stock. Other factors, such as borrowing regulations and taxation, are discussed. We also provide summary data for the major drivers.

Section 6 formally models and quantifies the drivers of housing prices. We report the key results from Abelson, Joyeux et al. (2005) and Saunders and Tulip (2019). We then describe our current house price modelling work and results. The findings in the three studies are very consistent.

Section 7 explains the changes in housing rents that have occurred. Mean rents have generally risen with mean household incomes. Year 2023 has seen an unusual spike in rents, with special causes. But again, we also recognise the changing quality of rental housing.

Section 8 describes some major housing outcomes, including home ownership, rent affordability and homelessness.

The concluding section draws together the main findings of the paper.

Appendices provides detailed supporting data on housing prices and indices for houses, rents, the major explanatory variables, and more detail on our 2005 and current modelling of house prices.

2 House and Unit Prices Across Australia: 1980 to 2022

This section shows annual median house and unit prices in the capital cities and the rest of the states, along with the respective real housing price indices from 1980 to 2022. These annual prices are unweighted averages over the four quarters. Therefore, they are not precisely the median price over the year, but they are generally close to it.

These data provide a broad picture of housing prices across Australia over this period. Appendix A provides more detailed information, including sources. The next section provides detailed quarterly data and a description of long, and short-term, national housing price movements, including for the first quarter of 2023 from CoreLogic data.

Table 1 (next page) shows 5-yearly median house prices in the capital cities along with real price indices with 2003 = 100 as this represents the start of the ABS data series taking over from the various earlier data sources pre-2003. Nominal price indices are shown in Appendix A. The real price indices take out general inflation effects, drawing on the national Consumer Price Index (CPI). But they do not allow for changes in housing quality, a significant issue discussed in the next section. The national mean real price index is estimated using 1980 city populations as weights.

There are three key take aways from Table 1.

(i) The real median house price across the cities approximately doubled between the early 1980s and 2003 and again between 2003 and 2022. Thus, real increases in house prices are a long-term phenomenon.

(ii) However, the increases were not constant. Real house prices were relatively flat in the first halves of the 1980s and the 1990s and for most of the 2010s. On the other hand, major real house price rises occurred in the second halves of the 1980s and 1990s, the decade from 2000 to 2010, and between 2020 and 2022. More detail on short-term house price movements is presented in the next section and modelled in Section 6.

(iii) There was strong uniformity of price changes across the cities. Between 1980 and 2003, real median house prices in Sydney, Melbourne, Brisbane, Adelaide and Canberra all slightly more than doubled. Perth and Hobart were standouts with much lower real increases. Then between 2003 and 2022, real median house prices in most cities again approximately doubled, with Perth again at the low end and Sydney prices below the average, while Hobart was well over the double mark and Melbourne slightly above it.

Table 2 shows annual median unit prices and real price indices in the capital cities. Units formed about 11% of the housing stock in 1980 and rose to 16 % by 2022. Here again, three takeaways.

(i) Like house prices, the national real median unit price doubled between the early 1980s and 2003. The real median unit price also rose quite similarly to house prices between 2003 and 2020. It was only between 2020 and 2022 that unit prices rose by significantly less than house prices.

(ii) The pattern of real changes (until 2020) is also consistent with those observed for houses. The first halves of the 1980s, the 1990s and the 2010s were relatively flat real price periods. By contrast, the second halves of the 1980s and 1990s, 2000 to 2010, were major price rise periods. Real unit prices also rose between 2020 and 2022, but less dramatically than house prices.

Table 1 Annual Median House Prices and Real Price Indices in Capital Cities: Selected Years

Median House Prices ($s)									
Year	**Sydney**	**Melbourne**	**Brisbane**	**Adelaide**	**Perth**	**Hobart**	**Darwin**	**Canberra**	
1980	68,850	39,500	35,475	36,000	40,350	36,250		44,675	
1990	194,000	131,000	113,000	97,200	101,125	82,000	101,500	120,750	
2000	287,000	191,000	170,000	135,000	156,250	117,750	186,800	180,825	
2005	494,000	320,500	314,725	274,000	311,250	246,875	292,500	375,050	
2010	603,375	494,075	461,250	405,500	507,000	344,825	534,750	527,675	
2015	863,925	569,575	473,200	424,750	529,625	355,000	580,000	591,875	
2020	964,575	733,750	554,250	493,000	494,375	537,250	488,750	745,125	
2021	1,222,500	931,750	678,250	577,125	544,750	672,750	567,700	930,525	
2022	1,291,150	922,050	777,500	669,525	563,750	740,500	586,750	1,017,700	
Real Median House Price Indices: 2003=100									
Year	**Sydney**	**Melbourne**	**Brisbane**	**Adelaide**	**Perth**	**Hobart**	**Darwin**	**Canberra**	**Mean[a]**
1980	45.4	42.9	42.7	48.0	59.0	63.0		45.6	49.3
1990	58.7	65.3	62.4	59.4	67.8	65.4	66.0	56.5	62.9
2000	69.8	76.5	75.4	66.3	84.2	75.4	97.7	68.0	74.5
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2005	99.3	104.1	116.3	106.5	146.9	146.6	132.9	104.3	109.2
2010	106.2	140.5	149.3	130.9	109.1	179.3	212.7	128.5	138.0
2015	138.8	147.8	139.8	131.6	124.9	168.5	210.5	131.5	146.8
2020	146.5	180.1	154.8	154.1	165.8	241.0	167.7	156.5	161.4
2021	181.9	224.0	185.6	183.4	164.6	295.8	190.9	191.6	195.0
2022	184.2	212.5	203.9	198.3	164.3	312.0	189.1	200.8	197.5

(a) Weighted by city populations.

Sources: ABS Cat. 6432, *Total Value of Dwellings*, Table 2. See Appendix A for more details.

Table 2 Annual Median Unit Prices and Real Price Indices in Capital Cities: Selected Years

Median Unit Prices ($s)									
Year	**Sydney**	**Melbourne**	**Brisbane**	**Adelaide**	**Perth**	**Hobart**	**Darwin**	**Canberra**	
1980	56,500	33,000	37,379	31,997	35,825	na	Na	33,867	
1990	135,715	115,000	91,375	81,300	75,625	71,208	Na	96,979	
2000	256,250	184,000	171,500	99,300	114,275	88,850	146,550	140,250	
2005	383,750	287,000	268,425	220,650	253,375	217,125	200,500	306,325	
2010	473,650	444,750	386,575	334,000	414,250	283,500	420,175	418,350	
2015	698,750	500,200	422,500	344,875	432,375	289,750	467,500	419,975	
2020	734,250	602,000	397,875	409,650	378,750	419,875	286,825	477,075	
2021	786,750	650,000	431,875	429,325	416,250	523,125	364,450	544,975	
2022	762,500	631,250	471,500	471,250	401,250	566,750	394,625	589,750	
Real Median Unit Price Indices: 2003 = 100									
Year	**Sydney**	**Melbourne**	**Brisbane**	**Adelaide**	**Perth**	**Hobart**	**Darwin**	**Canberra**	**Mean[a]**
1980	47.1	36.8	55.5	60.1	66.9			40.0	46.7
1990	51.8	58.8	62.3	70.0	64.8	77.6		52.6	56.8
2000	78.7	75.6	93.9	68.7	78.7	77.8	105.7	61.1	79.1
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2005	101.5	101.6	126.6	131.6	150.3	163.8	124.6	98.9	114.8
2010	109.7	137.8	159.7	174.4	215.2	187.3	228.7	118.2	145.9
2015	147.7	141.5	159.3	164.3	205.0	174.7	232.2	108.3	155.7
2020	146.7	161.0	141.8	184.5	169.8	239.3	134.7	116.3	157.3
2021	154.0	170.3	150.8	189.5	182.8	292.2	167.7	130.2	167.2
2022	143.1	158.5	157.8	199.3	168.9	303.4	174.0	135.0	161.4

(a) Weighted by city populations. Sources: ABS Cat. 6432. See Appendix A for more details.

(iii) There was less geographical uniformity of unit price increases than house price increases. Between 1980 and 2003, median unit prices increased most in Melbourne and Sydney and least in Adelaide and Perth. On the other hand, between 2003 and 2022, median unit prices rose most in Adelaide, Hobart and Darwin and least in Sydney and Canberra.

Table 3 shows annual median housing prices and real price indices in the rest of the states. Here, we don't have nation-wide metrics, but we can compare the outcomes with the national city house and unit price metrics.

Table 3 Annual Median Housing Prices and Real Price Indices in Rest of the States: Selected Years

Median prices ($s)									
Year	**NSW Houses**	**NSW Units**	**Victoria Houses**	**Victoria Units**	**Queensland Houses**	**SA Houses**	**SA Units**	**WA Houses**	**Tasmania Houses**
1985	70,175		50,000	51,500	Na	48,800	52,000	52,325	49,450
1990	107,525		80,000	78,500	88,000	63,100	64,600	77,425	74,600
2000	164,775		105,000	96,600	140,000	91,300	90,300	148,250	101,525
2005	281,250	267,500	211,250	191,575	281,250	191,825	131,450	241,250	182,325
2010	340,000	304,000	281,425	238,700	392,625	277,575	189,250	390,000	259,750
2015	401,750	353,000	299,900	256,500	413,825	264,625	191,750	356,250	257,500
2020	510,725	479,000	416,250	375,425	442,875	291,100	197,000	352,250	351,375
2021	714,700	662,500	588,750	516,875	489,025	333,750	245,000	410,750	441,375
2022	778,750	672,000	624,250	504,050	537,750	370,750	244,250	420,000	516,250
Real Price Indices: 2003 = 100									
Year	**NSW Houses**	**NSW Units**	**Victoria Houses**	**Victoria Units**	**Queensland Houses**	**SA Houses**	**SA Units**	**WA Houses**	**Tasmania Houses**
1985	51.7		56.8	69.0		72.4	82.8	51.7	67.7
1990	54.1		62.1	71.8	69.1	63.9	70.2	52.2	69.7
2000	66.6		65.5	71.0	88.4	74.3	78.9	80.3	76.3
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2005	106.6	104.0	111.4	110.6	133.2	117.1	149.9	141.8	131.4
2010	112.9	103.4	130.0	120.6	162.8	148.3	189.0	200.7	163.9
2015	121.7	109.6	126.4	118.3	156.7	129.1	174.7	167.3	148.3
2020	146.3	140.6	165.9	163.7	158.5	134.2	169.7	156.4	191.3
2021	200.6	190.6	229.9	220.8	171.5	150.8	206.8	178.7	235.4
2022	209.5	185.3	233.6	206.4	180.7	160.5	197.6	175.1	263.9

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-2022 data, ABS Cat. 6432.

For housing prices in the rest of the states, we draw the following main takeaways.

(i) Between 1985 and 2003, the rest of the states' house prices rose slightly less than in the capital cities. But between 2003 and 2022, the real prices of both houses and units tended to double. This followed the pattern for house prices in the capital cities but reflected higher price increases for units.

(ii) Turning to patterns of changes over time, real price increases between 1985 and 2000 were generally modest and, as in the cities, price increases through most of the 2010s were also modest. By contrast, again as in the cities, the periods from 2000 to 2010 and from around 2019 to 2022 saw major real unit price rises. Table A.9 in Appendix A provides more details.

(iii) Comparing price increases in the rest of the states with those in the capital cities, between 2003 and 2022, real house prices rose slightly more in the rest of NSW, Victoria and West Australia, and less in Queensland, South Australia and Tasmania than in the respective capital city. And, over this period, real unit prices in the rest of NSW, Victoria and South Australia approximately doubled, which was more than the unit price increases in the respective capital city.

Concluding observations

There has been a high level of uniformity in house and unit price movements across the capital cities and the rest of the states, excepting Tasmania with their notably higher housing price increases. There are two main potential explanations (not mutually exclusive) for this broad uniformity of price movements. One is that housing prices are driven substantially by national (macroeconomic) factors, notably national interest rates, population and household income, as well as by national housing supply.

The second explanation is the role of locational spatial equilibrium, whereby housing prices adjust so that households are indifferent across space. Households are willing to live in a higher priced city or region where they are adequately compensated by higher incomes and / or preferred climate and environment, or other factors. If house prices move out of this equilibrium, without compensating factors, households will move and spatial equilibrium (and price differentials) will be restored (Glaeser and Gottlieb, 2009). In early research on this topic, Abelson (1991) found that Melbourne house price movements in the 1970s and 1980s tended to relate to Sydney house price movements after a year and that Adelaide house price movements tended to follow Melbourne's after a year or so.

Of course, with good motives, state governments often aim to lower housing prices in their capital city or over the state. But, if a city's housing prices fall, with no change in the relative environmental or economic attractiveness of the city, more people will come and fewer leave, and the initial price equilibrium will be restored. City or regional prices can fall relatively only if the relative attractiveness of the city or region falls.

Given the broad uniformity of house price movements across Australia from 1980 to 2022, our focus in this paper is to provide a national explanation of housing prices. There is, of course, much interesting work to be done to explain any differences in the changes in real housing prices across the cities and the rest of Australia – albeit these differences are often small. But this is beyond the scope of our current work.

3 National Housing Prices: 1980 to Second Quarter 2023

Table 4 provides a summary of four Australian housing real price indices from 1980 to first quarter 2023, along with the real ASX Ords. The housing indices are the "Dallas" index of Australian house prices and the CoreLogic house, unit, and dwelling price indices. Dwellings include houses and units. These four indices are constructed with data from the 8 capital cities combined. To present the broad picture, Table 4 shows the four indices at 5-year intervals from 1980 to 2015. The table then shows quarterly data from the March 2018 quarter. Appendix B provides quarterly outcomes for the Dallas index over the whole period. The real price indices take out the relevant CPI changes.

The "Dallas" house price index is estimated by the Globalization Institute of the Federal Reserve Bank of Dallas which produces an international house price database. This index is based on ABS house price data since 2003. To extend the data back to 1980, Dallas splices this index with growth rates of the Australian Treasury house price index, with an unobserved components time series model, with 2003 = 100. Real values are estimated using the personal consumption expenditure deflator.

The other three indices are based on CoreLogic housing price data. CoreLogic (2018) explains in some detail how its hedonic price estimation strategy aims to allow for changes in the composition of housing and housing quality and thereby to estimate the real changes in dwelling prices for constant quality dwellings over time. The method is best practice in principle. But the reported outcomes cannot be readily tested. As shown below, this hedonic approach produces significantly lower real housing price increases over time than the Dallas index based on the median of all house sale prices.

Table 4 Four Real Housing Price Indices and ASX stock market index: March Quarter 2003 = 100

Year / Quarter	House Prices Dallas Index	House Prices CoreLogic	Unit Prices CoreLogic	Dwelling Prices CoreLogic	Real ASX Ords
1980 March	46.5	71.8	66.1	70.6	56.6
1990 March	64.1	67.0	74.5	69.0	68.5
2000 March	74.3	80.0	85.0	81.4	117.1
2003 March	100.0	100.0	100.0	100.0	100.0
2005 March	113.1	110.0	105.9	108.9	127.1
2010 March	141.1	127.7	122.9	126.3	134.3
2015 March	147.2	135.2	128.4	133.1	143.0
2018 to 2022					
2018 March	168.4	155.5	138.0	150.3	142.7
2018 June	166.1	153.2	136.6	148.2	149.1
2018 September	163.7	149.9	134.5	145.3	137.8
2018 December	160.1	145.3	131.7	141.4	137.7
2019 March	155.9	140.6	128.5	137.1	148.8
2019 June	155.6	136.9	125.8	133.6	158.9
2019 September	160.3	137.9	127.3	134.7	155.3
2019 December	163.7	142.8	131.1	139.4	162.1
2020 March	164.7	147.6	134.1	143.7	127.0
2020 June	164.2	150.3	137.5	146.5	140.1
2020 September	169.2	146.1	133.6	142.4	139.6
2020 December	176.4	146.4	131.6	142.1	155.1
2021 March	185.3	151.9	133.0	146.4	163.6
2021 June	192.9	161.1	137.1	154.2	170.7
2021 September	205.9	170.5	141.2	162.1	168.8
2021 December	215.2	175.5	142.8	166.2	158.5
2022 March	215.3	175.7	140.7	165.6	164.9
2022 June	215.5	171.9	137.5	162.1	150.5
2022 September	200.6	163.0	132.4	154.5	145.4
2022 December	190.8	153.5	126.9	146.4	155.5
2023 March	181.6[a]	148.4	123.5	141.2	149.7
2023 June	na	Na	na	143.6	141.6

Sources: Globalization Institute of the Federal Reserve Bank of Dallas, CoreLogic, ABS CPI.

(a) Author's estimate using ABS data.

The following are some key takeaways.

- The Dallas House Price Index reflects our previous findings in Table 1 that real house prices approximately doubled between 1980 and 2003 and again between 2003 and 2022.[1] But real house prices fell by 15.8% between December quarter 2021 and March quarter 2023.

- There is a significant difference (explained below) between the Dallas and CoreLogic house price indices. With the CoreLogic index, real house prices rose by only half as much: by about 40% between 1980 and 2003 and then by around 50% by end 2022.

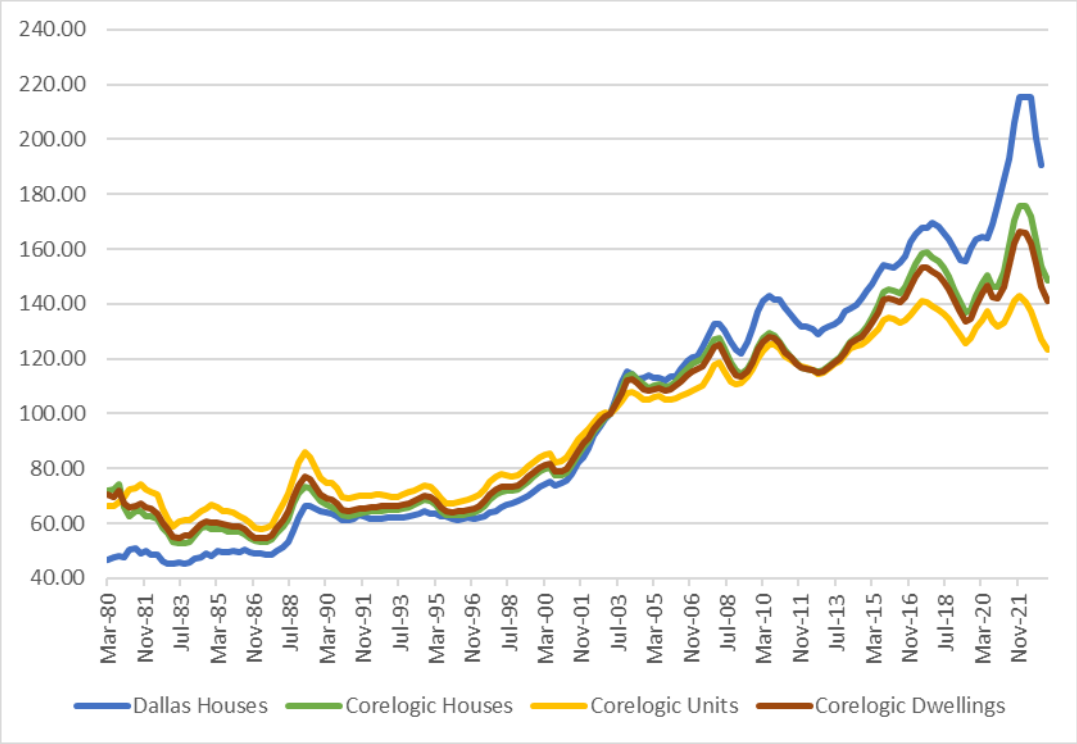
- Under CoreLogic indices, real unit prices rose by a similar amount to real house prices from 1980 and 2003. But between 2003 and 2022, real unit prices rose by about a quarter, which was only about half the increase in house prices.

[1] The 100.0 in Table 4 refers to the March quarter 2003, not to the average for the year as in Table 1.

- For all dwellings in the capital cities, CoreLogic data indicates that average real prices rose by about 40% between 1980 and 2003 and by another 66% by December quarter 2021. But they fell by 15.0% between December quarter 2021 and March quarter 2023. There followed a small real increase of 1.7% in June quarter 2023 (2.5% nominal increase and 0.8% CPI).

The differences in these indices are illustrated in Figure 1.

Figure 1 Four Real Housing Price Indices: Dallas house price index and CoreLogic house, units and dwelling price indices



Sources: Globalization Institute of the Federal Reserve Bank of Dallas, CoreLogic.

As described in Section 2 above, and in more detail in Appendix B, real housing prices move up and down. They were fairly flat from 1980 to mid-1988. After a short sharp up-turn in 1988 and 1989, they were again flat in the first half of the 1990s before increasing slightly in the second half of the 1990s. Real housing prices took off between 2000 and 2003 before flattening for three years to 2006. They took off again between 2006 and 2010, but from 2010 to 2014 they fell and remained flat. Real prices rose from 2014 to 2017, and then fell from 2018 to 2020. They rose dramatically between December quarter 2020 and end 2021, but then fell by 14.4% by first quarter 2023.

Table 4 also shows the ASX real All Ords Index (RORDS; AllOrds index deflated by CPI). This shows the similarity in the long run between movements in real dwelling prices and the RORDS, although the RORDS are more volatile in the short run. Between the early 1980s and early 2000s, the RORDS doubled, as did housing prices. Between the early 2000's and end 2019, RORDS again rose broadly with housing prices. Unlike housing prices, RORDS fell dramatically with the start of Covid in the first quarter of 2020. It has since recovered to almost exactly match the CoreLogic Dwelling price index at end June 2023, but not the Dallas house price index.

Turning to housing quality. The Dallas index does not allow for changes in housing quality. So, in principle, the difference between the Dallas and CoreLogic house price indices reflects changes in housing quality. There is substantial expenditure (and own household work) on alterations and

additions. Also, new houses are generally higher quality today, for example in plumbing, heating, electrical and IT systems, than 30 or 40 years ago. On the other hand, if not maintained, housing may depreciate. And new housing may be constructed in less accessible locations. Here we briefly review expenditure on alterations and additions and the size of new housing. Estimating the various other impacts is beyond the scope of this paper.

Table B.2 in Appendix B shows ABS reported annual expenditures on alterations and additions of over $10,000 from 1980 to 2018 and estimated gross values of the housing stock to 2022. Drawing on these numbers, expenditure on alterations and additions represented around 1% of housing value between 1980 and 2005, but more recently around 0.6%. The earlier year estimates may undervalue the housing stock as they are based on median house prices. On the other hand, the ABS includes only reported expenditures of $10,000 or more on alterations and additions and no household work. Saunders and Tulip (2019, Appendix B, p.6) observe that ABS data on "expenditure on large alterations and additions accounts for only around a quarter of total spending on alterations and additions". This extraordinary difference may explain why the ABS appears to have discontinued publishing these data. Based on these various data and observations, work on alterations and additions likely raises the value of housing by at least 1% per annum. Saunders and Tulip suggest a higher incremental value.[2]

Another quality factor is the size of dwellings. The average floor area in new dwellings increased by 38% from 150.7m² to 207.6m² between the mid-1980s and 2012-13 (ABS 8752.0). New houses increased from 162.4m² to 241.1m² (48.5%), while new other dwellings increased from 99.2m² to 133.9m² (35.0%).[3] However, a more recent ABS report (8752.0 - *Building Activity, Australia*) found that "the national average of floor area of new houses over the 15 years to June 2018 has broadly remained unchanged, ranging from 230m^2 to 245m^2. The average floor space of constructed houses peaked in 2008-09 at 245.9m^2 and was lowest in 2014-15 at 230.6m^2."

These quality issues are critical, but often ignored in discussions of changes in house prices. As a broad observation, housing indexes that do not account for quality changes appear likely to overestimate real housing price changes by around 1% per annum. This is broadly consistent with the difference over time between the Dallas and CoreLogic real house price indices. Ideally a more explicit explanation of the CoreLogic process would show more clearly how, and whether, the CoreLogic process does capture all the major changes in dwelling quality.

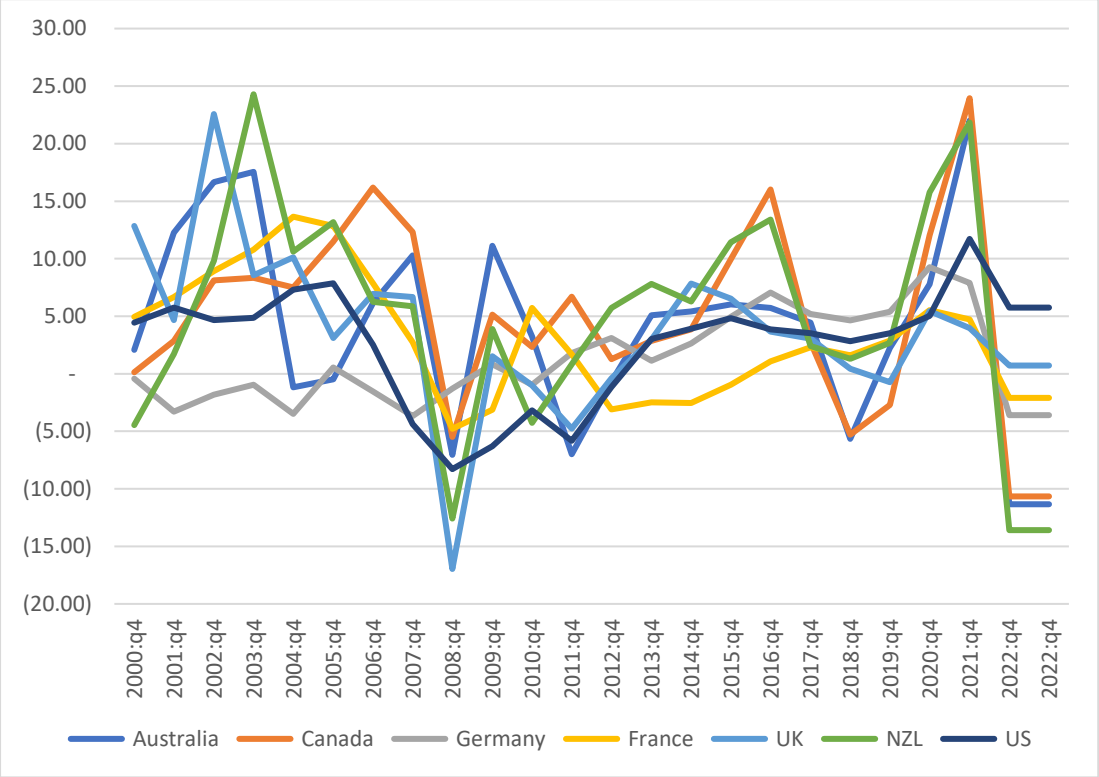
International Comparisons of Housing Prices

Figure 2 shows the year-on-year growth rate of median house prices from 2002 to end 2022 in six countries including Australia. The broad picture is that Australian house prices have moved quite similarly to international house prices. This may in part reflect the worldwide moves in interest rates.

[2] Saunders and Tulip (ibid., p,14): "As discussed in Online Appendix B, we assume that the average quality of new dwellings is proportional to income per capita".

[3] Source: ABS 8752.0 Building Activity, *Average floor area of new residential dwellings*, June quarter 2013.

Figure 2 Year-on-Year Growth Rate of Real House Price Indices



Source: Globalization Institute of the Federal Reserve Bank of Dallas.

4 Housing Rents in Australia: 1980 to Mid-2023

In this section, we report ABS (CPI) indices for national rents for housing from 1980 to 2022. Drawing on CoreLogic data for rent listings, we then show median weekly rents for houses and units in capital cities from 2008 to end 2022. Thirdly we show some data on recent rent price movements. Appendix C provides more detailed ABS data.

Table 5 shows nominal and real rent indices (averages of the four quarters) for selected years from 1980 to 2022 based on the rent component of the CPI, with 2003 = 100 (as for the housing price indices shown above). The CPI reports prices for constant (quality) baskets of goods and services by resident households in Australian metropolitan areas.

Between 1980 to 2003, real rents rose by 7.5%. Between 2003 and 2023, they rose by 11.8%. Thus, overall, they rose by about half a percentage point a year. But, as with house prices, the changes were not constant. Between 2005 and 2015, real rents rose by around 22%. They then fell every year to 2022. Real rents were 9% lower in 2022 than in 2015.

Table 5 Indices for Metropolitan Rent Component of CPI: 2003 = 100

Year	Nominal	Real		Year	Nominal	Real
1980	31.1	93.0		2016	161.7	121.9
1990	74.8	102.9		2017	162.7	120.9
2000	92.9	102.6		2018	163.8	119.9
2003	100.0	100.0		2019	164.4	119.0
2005	104.8	99.8		2020	162.9	117.2
2010	136.9	114.1		2021	162.6	114.6
2015	160.5	122.2		2022	165.4	111.8

Source: ABS Cat. 6401.0, *Consumer Price Index*, Table7.

Table 6 shows **nominal** CPI, and advertised, rents over the past 10 years as reported by Agarwal et al, (2023, *RBA Bulletin*). As they note: "The average rate of increase in rents over the past decade has been relatively weak … Since the start of 2022, the strong growth in advertised rents has started to be reflected in higher rents for all leases, as measured by the CPI. The increase in CPI rents of 4 per cent over 2022 was the strongest in 10 years." They also showed that over the 10 years to end 2022, wages had grown faster than annualised percentage rents growth.

Table 6 Average annualised percentage real rents growth to December 2022

CPI rents	2-years	5-years	10-years
Capital cities	2.1	0.7	1.1
Sydney	0.7	−0.2	1.3
Melbourne	0.5	0.7	1.3
Brisbane	4.5	1.8	1.4
Adelaide	3.7	2.1	1.7
Perth	7.9	1.4	−0.4
Darwin	7.9	0.1	−0.6
Canberra	4.5	3.2	1.5
Hobart	5.1	4.8	3.4
Advertised rents			
Capital cities	9.6	4.0	2.7
Regional	10.3	6.0	3.6
Wages and income			
Wages	2.7	2.2	2.3
Disposable income	3.2	4.9	4.3
CPI	4.7	2.8	2.4

Sources: Agarwal et al., (2023) using ABS data. Advertised rents, CoreLogic.

Tables 7 and 8 show median weekly rents and real indices for houses and units in the cities from 2008 on drawing on CoreLogic data. The annual figures are the average over the four quarters. The 2022 quarterly data are averages over the respective 3 months. The real rent indices are based on the June quarter 2008 = 100. CoreLogic uses a hedonic model, drawing on advertised listings information, across all private dwellings to estimate median quarterly rental valuations.

The key takeaways from Tables 7 and 8 are that:

- Real changes in median rents between 2008 and end-2022 were under 10% in Sydney, Melbourne, Adelaie and Darwin. They were over 20% in the much smaller rental markets in Adelaide, Hobart and Canberra.
- The percentage changes in median rents for houses and units are similar.

The CoreLogic rents tend to be higher than ABS rents for two reasons. First, as noted, the ABS holds housing quality constant. Second, CoreLogic data are based on listings on the open market. Properties with a change of tenant tend to experience larger rent increases than existing tenancies. As ABS (2023) observes, "actual rents paid by new tenants increased by 14 per cent over the year to February 2023, which is 9 percentage points higher than the increase in the monthly CPI indicator rent index (which measures all rents, not just those paid by new tenants)."

Table 7 Median Capital City House Weekly Rents and Real Indices[a]

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
2008	449	309	338	275	338	295	407	412
2010	460	347	361	309	379	318	498	452
2015	525	378	400	344	444	329	612	450
2016	543	398	400	350	408	351	554	457
2017	550	404	405	354	378	372	513	492
2018	542	419	409	365	360	407	499	531
2019	535	425	410	378	365	445	474	551
2020	565	423	414	385	376	457	458	569
2021	623	430	440	410	427	481	525	606
2022(2)	607	448	493	447	477	520	597	673
2022(4)	650	457	532	477	500	550	600	690
Real Indices								
2008	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2010	98.4	107.9	102.6	108.0	107.7	103.6	117.6	105.4
2015	102.6	107.3	103.8	109.8	115.3	97.9	131.9	95.8
2016	105.1	111.9	102.8	110.6	104.9	103.4	118.3	96.4
2017	104.9	112.0	102.6	110.3	95.8	108.0	108.0	102.3
2018	101.9	114.5	102.1	112.0	89.9	116.5	103.5	108.8
2019	99.4	114.7	101.2	114.7	90.1	125.9	97.2	111.6
2020	104.4	113.6	101.6	116.1	92.3	128.5	93.3	114.6
2021	112.7	113.1	105.8	121.1	102.6	132.5	104.8	119.5
2022(2)	103.5	111.0	111.7	124.5	108.1	135.0	112.3	125.1
2022(4)	106.8	109.1	116.2	128.0	109.2	137.6	108.8	123.6

(a) Data for years are averages of the four quarters; data for quarters are averages of three months.

Source: CoreLogic data; real indices estimated by authors.

Table 8 Median Capital City Unit Weekly Rents and Real Indices[a]

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
2008	361	285	298	232	305	251	328	366
2010	400	328	338	265	350	263	415	399
2015	472	365	381	296	411	277	503	380
2016	507	380	387	300	380	290	453	395
2017	522	395	380	301	343	309	408	416
2018	530	408	376	312	330	344	391	441
2019	522	420	380	321	330	379	368	466
2020	500	416	381	333	344	400	353	475
2021	486	395	394	356	380	410	397	495
2022(2)	500	398	420	380	420	438	470	533
2022(4)	532	422	447	400	450	450	490	550
Real Indices: 2nd qtr 2008 = 100								
2008	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2010	106.5	110.6	109.0	109.8	110.3	100.7	121.6	104.7
2015	114.7	112.4	112.2	112.0	118.2	96.8	134.6	91.1
2016	122.0	115.9	112.8	112.4	108.3	100.4	120.0	93.8
2017	123.9	118.7	109.2	111.1	96.3	105.5	106.6	97.4
2018	123.9	120.8	106.5	113.5	91.3	115.7	100.6	101.7
2019	120.6	122.9	106.4	115.4	90.3	126.0	93.6	106.2
2020	114.9	121.1	106.1	119.1	93.6	132.2	89.3	107.7
2021	109.4	112.6	107.4	124.7	101.2	132.7	98.3	109.9
2022(2)	106.1	106.9	107.9	125.4	105.5	133.6	109.7	111.5
2022(4)	108.8	109.3	110.7	127.2	108.9	132.3	110.3	110.9

(a) Data for years are yearly averages; data for quarters are averages of three months.
Source: CoreLogic.

Turning to more recent rents, Table 9 provides a minor rent data update to February 2023 provided by the ABS, based on its large administrative dataset of rental properties.

Table 9 Recent Changes in Average State Rents ($s)

	NSW	VIC	QLD	SA	WA	TAS	NT
Jun-21	470	380	385	335	370	320	440
Dec-21	480	385	395	340	390	340	460
Jun-22	495	399	410	355	410	360	489
Dec-22	520	410	440	375	440	380	500
Jan-23	520	410	440	380	440	390	500
Feb-23	530	420	450	380	450	390	500

Source: ABS, 2023, *New insights into the rental market,* released 24/04/2023.

As the ABS (2023) report observes. “Since 2021, rents have increased across inner-city and regional areas throughout all the states. Rent increases have also become more common and larger on average – particularly for the 2–3 per cent of properties each month that have a change in tenants. This is in contrast with the experience during the COVID-19 pandemic where rents fell in many suburbs close to central business districts but increased in regional areas, driven by a preference shift among many households for more space and net population flows.” However, the ABS data suggest that only relatively minor real rent increases had occurred by February 2023.

Table 10 shows the latest (as we write) nominal and real changes in rents for the capital cities and regions in June 2023 published by CoreLogic. This shows that, over 12 months to June 2023, real rents increased nationally by 3.5%, including an average rise of 5.2% in the cities and a small average fall of 1.0% in the regions.

To put these recent changes in longer perspective, as shown in Table 7, real rents in the capital cities were generally around 8% higher in mid-2022 than in 2008 (with Adelaide and Hobart outliers with higher increases). Thus, as of mid-2023, real rents in cities were generally around 13% higher in mid-2023 than in 2008. This represents slightly under a 1% increase in real rents per annum.

Table 10 Rents in June 2023

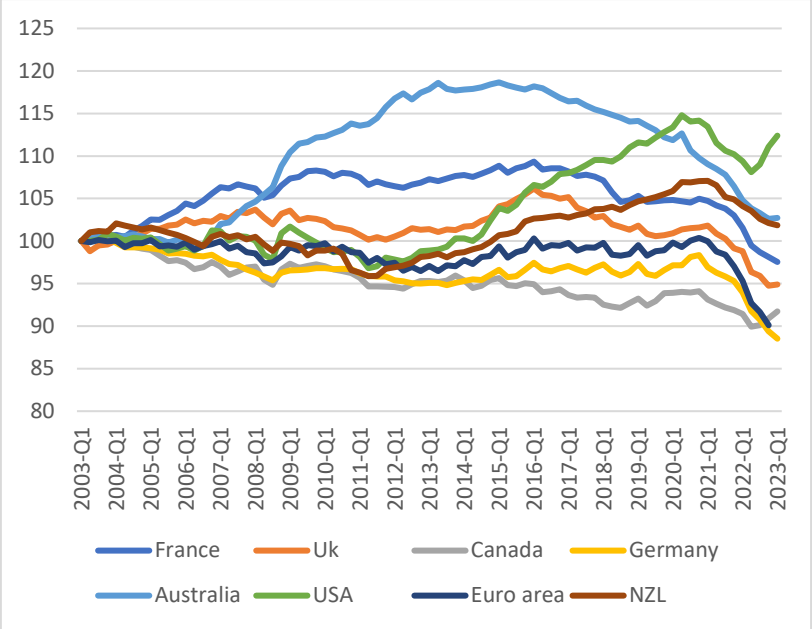
Location	Median rent per week ($)	Nominal changes over 12 months (%)	Real changes over 12 months (%)
Sydney	733	12.9	6.5
Melbourne	551	12.6	6.2
Brisbane	614	10.3	4.1
Adelaide	540	9.6	3.4
Perth	599	13.4	7.0
Hobart	552	1.3	-4.4
Darwin	600	3.5	-2.4
Canberra	669	-2.8	-8.3
Aggregates			
Combined capitals	617	11.5	5.2
Combined regionals	517	4.9	-1.0
National	589	9.7	3.5

Source: CoreLogic, *Quarterly Rental Reviews*, July 2023.

International comparisons of housing rents

Figure 3 shows eight sets of real rent indices from 2002 to the third quarter 2022, including Australia, with nominal rents deflated by CPI. Of course, this period includes the nearly world-wide recession after the 2007-08 financial crisis, which Australia avoided, continues with high immigration to Australia, and finishes with Covid prevalent in many countries. Over this period real rents fell in five of the eight countries (in four of them by less than 10%). Australia was one of the other three countries, but on this reckoning real rents rose by only 3% over the 20 years to 3rd quarter 2022.

Figure 3 International real rent price indices as part of CPI (2003q1=100)



Source: OECD (2023), "Prices: Analytical house price indicators", *Main Economic Indicator* (database), https://doi.org/10.1787/cbcc2905-en (accessed on 16 June 2023).

5 Drivers of Housing Prices and Rents

We turn now to the general principles that determine housing prices and rents and summarise how the major drivers of housing demand and supply have moved over the last 40 years. More details are shown in Appendix D. Our approach to modelling house prices is described in the next section.

Principles driving housing prices and rents

In general, asset prices are a function of net asset income, the cost of capital, and risk. As illustrated in Figure 4, house prices are a function of rents and the user cost of housing for investors, where user costs include mortgage rates plus expenses less expected capital gains.

In simplified terms, house prices (P^H) can be viewed as function of rents and the borrowing rate for housing (MR).

$$P^H = \frac{R}{MR} \quad (1)$$

Rents are, in turn, a function of the demand and supply of housing services, especially population (Pop), household disposable income (HDI) and the housing (stock) supply (HS).

$$R = f\,(Pop, HDI, HS) \quad (2)$$

Therefore,

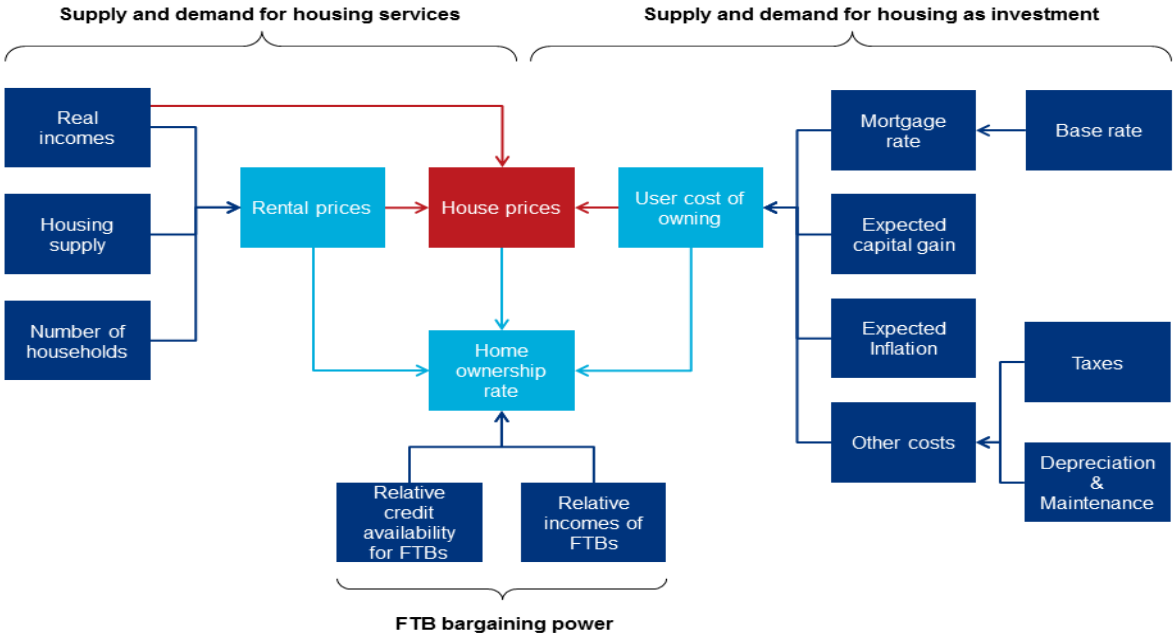
$$P^H = g\,(Pop, HDI, HS, MR) \quad (3)$$

Alternatively, for homeowners

$$P^H = \frac{RHUC}{MR} \quad (4)$$

where $RHUC$ = real housing user costs, including mortgage rates, but also expected real capital gains, housing taxes, home maintenance and depreciation.

Figure 4 Explaining House Prices and Rents



Source: Oxford Economics, 2016.

Significantly, the housing price / rent ratio is generally higher than other asset price / income ratios, including those on stock exchanges, because home ownership also has consumption benefits, including control over one's daily living environment, and is generally regarded as a low-risk asset.[4]

Other factors driving house prices may include regulations on lending for residential properties, tax benefits, and foreign demand for local housing.

We discuss a more complex multi-equation model below where we discuss the Saunders and Tulip (model) and their and our results. Here we introduce the key variables. We then add a few further observations before turning in the next section to the results of various modelling exercises.

Key Variables Data

Table 11 shows some average annual data on key variables: population, real household disposable income per capita, mortgage rates and dwelling stock. Table 12 shows the real indices for these data. Appendix D provides more detailed data on the key variables driving housing prices and rents.

Each key driver of housing prices moved substantially between 1980 and 2000 and again between 2000 and 2022. Population and household incomes increased substantially over these periods and both nominal and real mortgage rates fell substantially over these years (see Figure 5).

Between 2000 and 2021, driven in large part by net immigration, the population grew by 37%. But note that population figures do not include visitors staying in Australia for less than 12 months. And real mean household disposable income per capita rose by 53%. But it then fell by 5.2% over 2022, largely due to inflation rate of 7.4% over the 12 months to January 2023.

[4] In efficient asset pricing, an asset with a smooth earnings profile should have a *PE* equal to 1/(*r*-*g*) where *r* is the required rate of return and g is the expected growth rate of earnings.

Table 11 Major Housing Demand and Supply Variables 1980-2023

Year	Population	Net migration	RHDIPC	MR (nominal)	MR (real)	Total dwellings	Public housing
1980	14,721,250	75,900	6,914	10.19	0.06	5,023,253	228,938
1990	17,090,416	89,400	7,595	16.19	8.84	6,289,317	326,928[a]
2000	19,060,647	111,400	8,789	7.80	3.35	7,656,433	317.171
2010	22,068,180	172,100	11,703	6.73	3.80	8,951,506	333,383
2015	23,862,619	186,800	12,362	4.75	3.25	9,690,030	321,627
2016	24,244,527	243,900	12,332	4.61	3.34	9,856,420	320,041
2017	24,640,055	241,600	12,361	4.50	2.57	10,047,642	319,913
2018	25,018,244	252,200	12,485	4.57	2.65	10,240,167	316,231
2019	25,395,190	247,600	12,591	4.39	2.79	10,427,990	305,191
2020	25,641,989	-5,000	13,198	3.72	2.84	10,594,563	300,403
2021	25,703,639	5,900	13,467	3.54	0.69	10,751,218	299,520
2022	26,121,617		13,182	4.83	-1.75		
2022 (1)	25,890,773	96,000	13,480	3.45	-1.65	10,840,814	
2022 (2)	25,978,935	63,800	13,311	4.20	-1.90	10,879,349	
2022 (3)	26,198,565	106,200	13,199	5.70	-1.60		
2022 (4)	26,418,196		12,775	5.97	-1.83		
2023 (1)	26,637,826						

Sources: See Appendix D. (a) Refers to 1995.

Table 12 Major Housing Indices 1980-2023

Year	Population	Net migration	RHDIPC	Total dwellings
1980	77.2	68.1	78.7	65.6
1990	89.7	80.3	86.4	82.1
2000	100.0	100.0	100.0	100.0
2010	115.8	154.5	133.2	116.9
2015	125.2	167.7	140.6	126.6
2016	127.2	218.9	140.3	128.7
2017	129.3	216.9	140.6	131.2
2018	131.3	226.4	142.1	133.7
2019	133.2	222.3	143.3	136.2
2020	134.5	-4.5	150.2	138.4
2021	134.9	5.3	153.2	140.4
2022	137.0	Over 300.0	150.0	
2022 (1)	135.8		153.4	141.6
2022 (2)	136.3		151.4	142.1
2022 (3)	137.4		149.8	
2022 (4)	138.6		145.4	
2023 (1)	139.8			

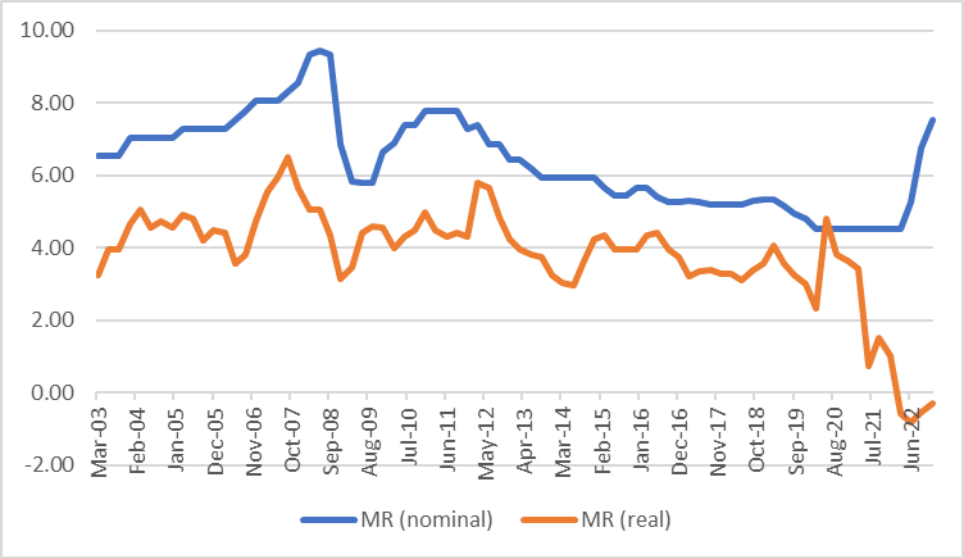
Source: Table 11.

As Ellis (2022) observes, in broad terms, the usual pattern of net population flows is that migrants from overseas are more likely to arrive in Sydney and Melbourne, but this net flow into these cities is usually offset (or more than offset) by the net outflow of residents from these cities to other parts of Australia, especially Queensland. There are, of course, variations around this trend, such as the shifting net flows into, and then out of, Western Australia as mining booms peak and decline.

Nominal mortgage rates were continuously in double figures from early 1980 to 1996, except for a few quarters in 1993 and 1994. In real terms they were mainly between 7% and 8%. In the 2000's, nominal mortgage rates fell from around 7-8 % down to around 4.0% in the 2010's. After allowing for inflation, real mortgage rates were usually between 2.5% and 3.5% in most years from 2000 to 2020, before falling dramatically to under 1% in 2021 and becoming negative in 2022.[5] See Figure 8 below.

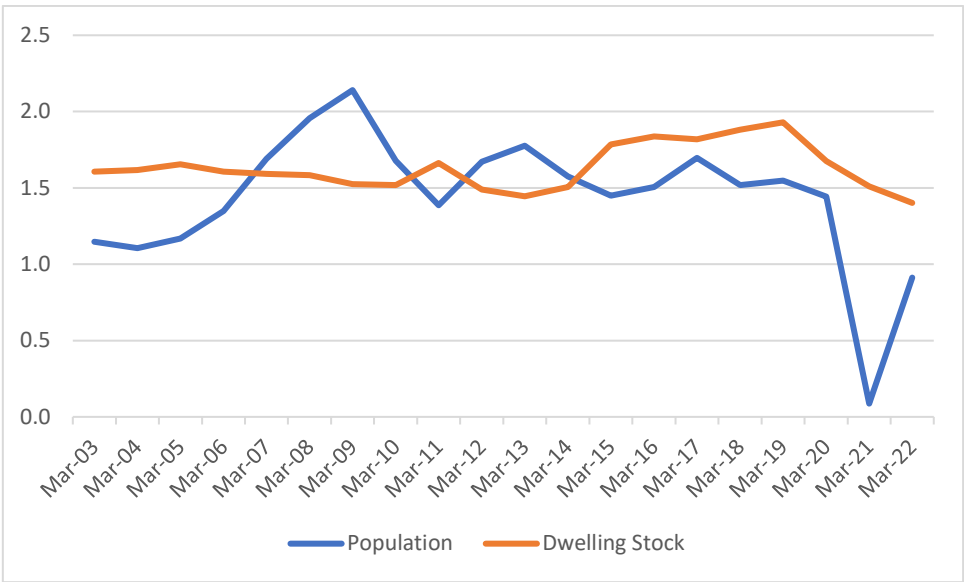
But, as shown in Table 12 and Figure 6, in most years between 2003 and 2022, the national housing stock increased marginally faster than the population (excluding, as noted, short-stay visitors).

Figure 5 Nominal and Real Mortgage Rates 2003-22



Source: Standard variable rate, owner occupier, quarterly yield, RBA F5 *Indicator Lending Rates. Real rate is* nominal rate for the period less inflation, quarterly yield.

Figure 6 Year-on-year Dwelling Stock and Population Growth 2003-22 (March to March changes)



Sources: ABS 3101.0, *National State and Territory Population* and ABS 8701.0 *Estimated dwelling stock*, TABLE 01.

[5] In practice, there is a range of mortgage rates. Discounted rates are usually around 0.5% to 0.6% lower than commonly cited market rates.

However, the number of public housing dwellings (which are included in total housing) **declined** from 327,000 in 1995 to under 300,000 by 2021. And the proportion of the population in public housing fell from 6% in 1995 to 2.9% by 2019 and presumably less to-day. This was offset only to a minor extent by a rise in community housing from around 44,000 in 2001 to 118,000 community homes in 2022 (See Appendix D).

Other factors that may affect housing prices

Many other factors may also influence housing prices. These include public policy changes for mortgage lending or property taxation, indirect impacts from higher household incomes, foreign demand, and what may be called market factors.

Re public policy, regulations may affect the availability of mortgages. In 2014, the Australian Prudential Regulation Authority (APRA) put a 10% growth cap on lending to investors. The regulation led to significant short-term fall in lending to investors from 35% to 15% of the market. But total mortgage growth remained steady. And, in response to rapidly rising credit in residential mortgage products, in 2017 APRA capped interest only loans at 30% of loans. Banks met the limits by raising interest rates on targeted mortgage products and substituting into non-targeted mortgage products. As described by Garvin et al. (2021), these limits were later removed and replaced by longer-term solutions. However, there is little evidence to suggest that the measures excessively constrained aggregate credit supply or had a significant impact on housing construction or competition for lending (and we could find no significant evidence for an impact in our house price modelling).

In principle changes in taxation, for example changes in the capital gains tax exemption for homeowners or on negative gearing for investors, or changes in land taxes could also affect housing prices. But between 1980 and 2022, there were no changes in the capital gains tax exemption for homeowners, in negative gearing for investors, and no major changes in stamp duties or land taxes other than in the ACT. And the change in the capital gains tax (CGT) on investors in 1999 from 100% tax on real capital gains to 50% tax on nominal capital gains was **not** the major tax concession that it is often portrayed to be. Indeed, when the rate of inflation exceeds the real capital gain, the tax change **increases** the CGT.

Indirect impacts of increasing household incomes include significant changes in housing quality (described in Section 3 above), increased demand for housing space, more second homes, and more short-term holiday accommodation. Over the last 17 years, average occupancy has fallen from 2.7 persons to about 2.58 persons per household, an effective increase of demand for about 75,000 dwellings.[6]

A possibly significant issue is higher-income households increasingly purchasing second homes. We are aware of some anecdotal evidence of this occurring, and thus reducing supply to regular market. But we are not aware of data to support this plausible hypothesis.

Turning to foreign purchases, as described in Appendix D, formal foreign real estate purchases (with approval via the Foreign Investment Review Board) rose from around 1,000 a year in 2000 to 7,000 in 2014. Regulations on foreign purchases introduced in 2014 then led to a significant fall back to around 1,000 purchases in 2020, which was then exacerbated by Covid. Thus, this formal foreign demand for housing has not contributed significantly to housing demand. But we must again caution this view by acknowledging the possibility that there are various informal routes to foreign purchase.

Other market factors include the use of housing for short-term lettings, the influence of expected capital gains, and the rate of housing sales (transfers). Over the last 10 years there has been a large

[6] See ABS *Housing Occupancy and Costs* and Ellis (2022). Some of the decline in household occupancy rates could be temporary if it reflected changes in household preferences due to Covid.

increase in short-term lettings via AirBnB and other methods, reflecting increased domestic and foreign tourism. Again, we don't have data on the scale of these short-term lettings, but they have almost certainly increased the demand for housing and reduced the supply to long-term renters.

As discussed above, actual capital gains reduce housing user costs and the demand for housing is almost certainly influenced by expected capital gains.

Similarly, the volume of housing transfers (sales) may influence house prices at any point in time. When transactions are low, because either buyers or sellers are holding off the market for some reason, housing prices are likely to be higher than they would be with more transactions. Thus, the low level of transfers since mid-2022 may have moderated the decline in house prices and maintained prices above the long-run market equilibrium level. But this would be a short-term phenomenon.

Finally, the Covid pandemic years from March 2020 to mid-2022 were an extraordinary period. The proportion of working days from home escalated dramatically. During Covid, the Federal government raised stimulus spending, deficits and debt to unprecedented record high levels, and the RBA set the Cash Rate at an unprecedented record low near zero. Thus, Covid also led to an increased demand for household space. It is hard to capture all these extraordinary events in a model of the housing market.

6 Results from Modelling House Prices

In this section we summarise the results of two previous models of house prices in Australia (Abelson et al., 2005 and Saunders and Tulip, ST, 2019) and then provide our current modelling of housing prices. The core message is that the different models produce similar explanations of house prices across both similar and different timescales. We conclude by noting two other major reviews of housing prices with similar findings and the impacts of housing supply for house prices.

It should be noted that our two studies are based on house prices in the eight capital cities. The ST study appears to be based on a CoreLogic national housing (dwelling) price index, but this is not stated explicitly.

Abelson, Joyeux et al (2005): Modelling Real House Prices from 1970 to 2003

This paper modelled the quarterly real Australian house price index estimated by the Federal Treasury from 1970 to 2003. The formal models and results are summarised in Appendix E.

Between 1970 and 2003, Australian real house prices rose by over 3 per cent per annum. On a quality-adjusted basis, house prices rose by about 2.3 per cent per annum. Over this period, there were four house price booms: 1972-74, 1979-81, 1987-89 and 1996 to 2003. In between these booms, real house prices tended to fall.

In the paper we estimated a long-run equilibrium model of house prices that shows the real economic determinants of house prices and a short-run asymmetric error correction model to represent house price changes in the short run.

Consistent with economic theory, the paper found that, in the long-run, real house prices are determined significantly by real disposable income, unemployment, real interest rates, equity prices, the consumer price index, and the supply of housing. Key results included:

- A high long-run elasticity of real house prices with respect to real household disposable income (RHDI) is 1.7.
- A 1% increase in the CPI index results in an estimated 0.8% increase in real house prices (reflecting a mixture of expected capital gains and tax benefits).

- On the other hand, a fall of 1 percentage point in the real mortgage rate will lead to a rise in house prices of 5.4% on average and an increase of 1 percentage point to a fall in house prices of 5.4%.
- The coefficient of the All Ordinaries was significant at -0.14, pointing to an asset substitution effect from stocks to housing, notably after the 1987 and 2000 stock market down turns.
- The estimated long-run elasticity of real house prices is -0.2 with respect to unemployment (a measure of economic confidence).
- A 1% increase in housing stock per capita leads to an estimated decrease in real house price of 3.6% on average.

In the short run, house prices may deviate from this equilibrium, but they continually readjust to it in a non-linear fashion through an asymmetric error correction term. The asymmetry arises because we expect adjustments to equilibrium will be faster when prices are rising than when they are flat or falling. Our observation is that buyers are keen to get into the housing market when prices are rising for fear that delay will mean paying still higher prices. On the other hand, sellers are often unwilling to reduce prices when markets are flat. Transaction times are typically shorter when real prices are rising than in flatter periods.

Employing a short-run asymmetric error correction model, the paper found that there were significant lags in adjustment to equilibrium. House prices typically take one to two years to adjust to equilibrium values. When real house prices were rising by more than 2% per annum, the housing market adjusted to equilibrium in about four quarters. When real house prices were static or falling, the adjustment process took longer – than about six quarters.

Saunders and Tulip (2019)

Saunders and Tulip (ST, 2019) provides a multi-equation model of house prices and rents, with links between house prices and rents.

ST (p.19) base their modelling on the concept of annual housing user costs (AHUC). AHUC "comprises the sum of interest payments, repairs, rates and other running costs, less expected capital appreciation. In the long run, AHUC tends to be close to the cost of renting a similar dwelling. If the user cost were lower than rents, households would be financially better off owning than renting and might be expected to bid up the price of houses. Conversely, when renting is cheaper, there would be downward pressure on housing prices. This implies the arbitrage condition: Price = RENT / USERCOST where USERCOST is the user cost of housing expressed as a share of the dwelling value. In our estimated equation, housing prices gradually adjust to this long-run target so as to keep the cost of owning close to the cost of renting. In the short run, prices exhibit strong momentum and respond to short-term variable rates." [7]

As ST note, multi-equation housing user cost models differ from reduced-form models in which housing prices are directly determined by fundamentals such as housing construction or population. But many of their results are similar to ours, and to those of others.

Some key ST findings are[8]:

(i) Housing prices are driven largely by interest rates, rents and momentum.
(ii) Much of the strength in housing prices and construction over the past few years can be explained by the fall in interest rates.

[7] An important assumption of the modelling (ST. p.14) is that the average quality of new dwellings is proportional to income per capita.

[8] These are inevitably a selection of findings from a much larger set of findings.

(iii) Dwelling investment is also driven in large part by interest rates through the channel of housing prices.
(iv) Population growth reduces rental vacancies, boost rents and housing prices, and increases construction. This helps to explain developments following the immigration surge of the mid-2000s.
(v) Housing prices and construction are mutually determined, so examining bivariate relationships in isolation can be misleading.

ST (2019, Abstract) "We find that low interest rates … explain much of the rapid growth in housing prices and construction over the past few years. Another demand factor, high immigration, also helps explain the tight housing market and rapid growth in rents in the late 2000s."

Specifically, ST find (p.21) that "at a user cost of 6 per cent, … a sustained percentage point drop in interest rates would, in the long run, boost housing prices by 17 per cent, holding rents and other components of the user cost equal. This semi-elasticity (the proportionate increase in housing prices for a given percentage point increase in interest rates) is larger than the time series estimates of Abelson et al. (2005), perhaps because they control for many other variables affected by interest rates (e.g. share prices and income), so only capture part of the effect of interest rates. Our estimate is similar to Gitelman and Otto's (2012, p 183) estimate of 20 per cent for Sydney housing prices using disaggregated census data, and Himmelberg, Mayer and Sinai's (2005, p 78) estimated range of 19 to 33 per cent for the United States in a calibrated model."

Another key finding (p.28) is that "As a rule of thumb, every 1 per cent increase in the number of dwellings (when driven by an increase in supply) lowers the cost of housing by 2½ per cent." Note that this refers to the stock of dwellings, not to annual completions.

ST also found that expected increases in capital (housing) values lower user costs and so increase house prices. They find that prices have risen much more than rents because annual housing user costs (AHUC) have fallen. And rental yields have fallen from 8% in 1980s to under 4% by 2018.

Also, (p.22), changes in borrowing limits appear to affect housing prices in the short run. For example, tightening in lending limits seems to be important in the decline in house prices in 2018. However, the paper did not find borrowing limits had longer-run effects on house prices.

Abelson and Joyeux: A Long-run and Short-run Model of House Prices 2003-2023

Here we describe our model of the quarterly real Australian house price index from 2003Q1 to 2022Q4 provided by the Federal Reserve Bank of Dallas. As in Abelson. Joyeux et al. (2005) we model house prices in the long, and short, run. In the long run we assume that real house prices adapt to economic fundamentals. In the short run, house prices continually readjust to their long-run relationship through an asymmetric error correction term. The asymmetry over the period arises because we expect that adjustments to equilibrium will be slower during the COVID-19 epidemic period (2020q1 to 2021q4). Our observation is that, during the covid period, buyers initially expected house prices to fall and so postponed housing investments even though interest rates were very low.[9]

The long-run equilibrium model is:

$$log(P_t) = \gamma_1+\gamma_2 MR_t+\gamma_3 log(HDI_t)+\gamma_4 log(UE_t)+\gamma_5 log(HS_t)+u_t \quad (5)$$

[9] This implies that the variables included in our model are cointegrated moving together tracing a long-run path from which they are disturbed by temporary shocks but to which they continually readjust. Tests for unit roots and cointegration are available upon request.

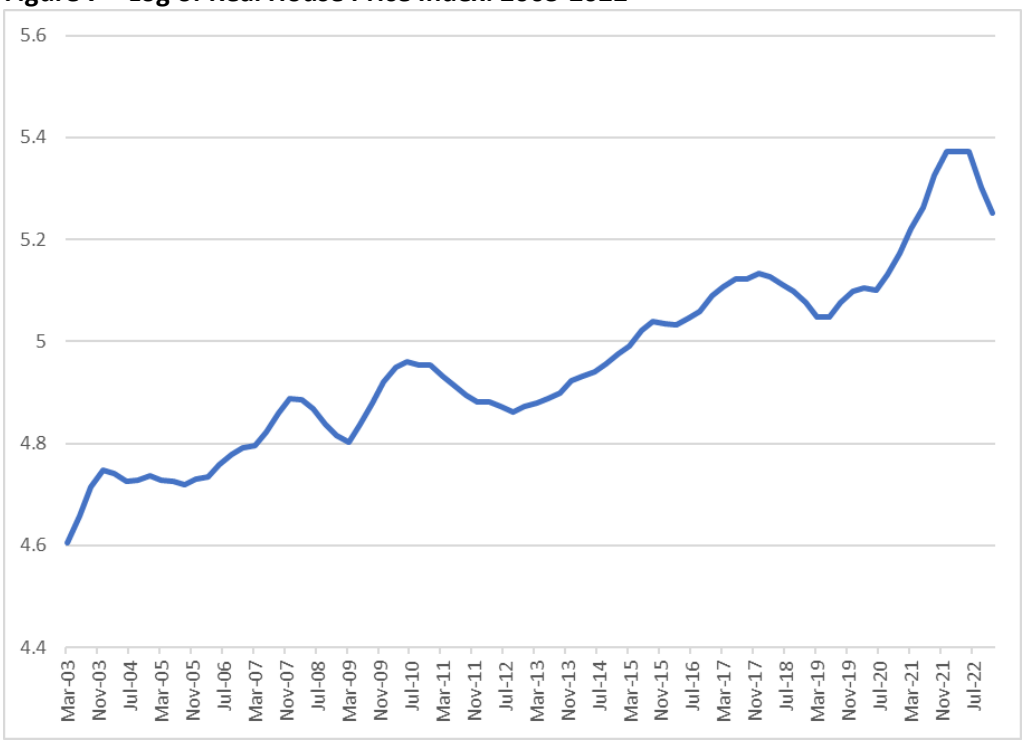
where P_t is real house prices, MR_t is the real mortgage interest rate (estimated by adjusting the standard variable mortgage rate from the Reserve Bank website for quarterly inflation), HDI_t is real household disposable income per capita (seasonally adjusted, ABS), UE_t is the unemployment rate (seasonally adjusted, ABS), HS_t is houses stock per capita (calculated using depreciation rate and actual stock data from census every five years), and u_t is a stationary error term. The unemployment rate is included as indicator of the economic environment and is expected to affect housing prices negatively.

Many other variables could be included such as population, credit per capita, expected capital gains and a variable measuring quality change. We do not include specifically population as an explanatory variable since we include the log of real household disposable income per capita and log of housing stock per capita which are highly multicollinear with log of population. We attempted to include real total credit to private non-financial sector per capita, but including both real disposable income per capita and credit led to insignificant coefficients for both variables and did not improve the fit due to multicollinearity issues between these two variables. As in ST, we assume that expectations of capital gains are exogenous and approximately equal to their historical mean. We also assume that quality change is a constant increase exogenous variable which would be a trend in the long run relationship but is not supported by the data.

Figure 7 shows the log of the real house price index. Figure 8 shows the trends in the major independent variables over the study period. Note that the large spike in the real interest rate occurs in June 2020 when inflation was negative. The graphs of population and real rents are shown although they are not included in our model.

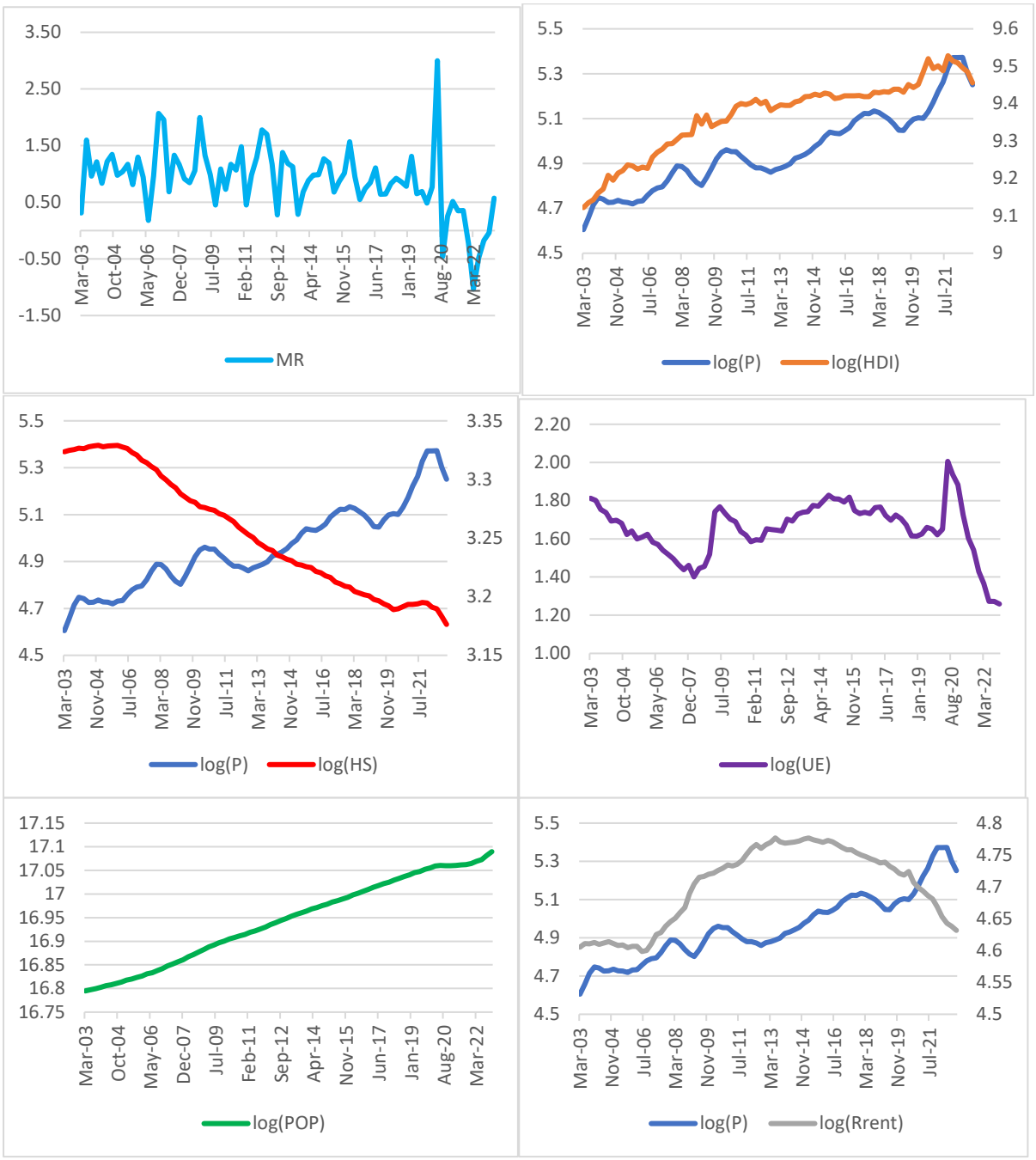
Further details of the data are described in Appendix D. We report below the results for the full sample of observations, 2003q1 to 2022q4. Results for the sample from 2003q1 to 2019q4 are reported in Appendix F.

Figure 7 Log of Real House Price Index: 2003-2022



Source: Globalization Institute of the Federal Reserve Bank of Dallas.

Figure 8 Fundamentals



Sources: *MR:* Standard variable rate, owner occupier, quarterly yield, RBA F5 *Indicator Lending Rates*, adjusted for inflation*; P:* Globalization Institute of the Federal Reserve Bank of Dallas; *HDI:* ABS 5206.0, *Australian National Accounts*, Table 20, *Household Income Account; HS:* houses stock per capita (calculated using depreciation rate and actual stock data from census every five years); *UE:* ABS 6202.0 *Labour Force, Australia Table 1; Pop:* ABS 3101.0, *National State and Territory Population; Rrent:* real rent is the rent index adjusted by the CPI, rent index is part of CPI, ABS 6401.0, Consumer Price Index, Australia, Table 7.

We estimate the long-run relationship using the fully modified OLS (FMOLS) method proposed by Phillips (1995). The FMOLS estimation results are presented in Table 13. Except for the coefficient of the real interest rate, those estimates are the *long-run elasticities of the real house price with respect to the individual variables*. All signs of the coefficients accord to expectations. The coefficients are highly significant.

Table 13 FMOLS long run coefficients[a]: Dependent variable log(P_t)

Variable	2003q1-2022q4 Estimated Coefficient (SE)
Constant	-2.2602 (1.5683)
MR	-0.0355** (0.0162)
log(*HDI*)	0.5056** (0.2240)
log(*HS*)	-2.2877** (0.4621)
Log(*UE*)	-0.3528** (0.0640)
R^2 adjusted	0.9032

[a] ** and * indicate 5 per cent and 10 per cent significance level respectively.
Long-run covariance estimate (Prewhitening with lags = 1, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

The long-run elasticity of real house prices with respect to real household disposable income is significant at the 5 per cent significance level. Real house prices increase by 0.51 per cent on average following an increase of 1 per cent in real disposable income.

On the other hand, a fall of 1 percentage point in the real mortgage rate causes house prices to rise by 3.6 per cent on average. As discussed in Appendix F, this was largely due to the movements of interest rates and house prices in 2020-22 (Covid years).

The coefficient of unemployment is very significant and negative, suggesting that this is an indicator of economic conditions.

The coefficient of the housing stock variable (houses stock) is significant at the 1 per cent level. A one per cent increase in housing stock per capita leads to an estimated (long-run) decrease in real house price of 2.3 per cent on average.

To estimate the short run parameters, we estimate an asymmetric error correction equation model.

Let $x_t = (R_t, log(HDI_t), log(UE_t), log(HS_t))'$ and define the vector $z_t = (log(P_t), R_t, log(HDI_t), log(UE_t), log(HS_t))$, the model is:

$$\Delta \log(P_t) = b_0 + \alpha_1 I_{t-1}(\log(P_{t-1}) - \hat{\theta} x_{t-1}) + \alpha_2 (1 - I_{t-1})(\log(P_{t-1}) - \hat{\theta} x_{t-1}) + \sum_{j=1}^{k} b_j \Delta z_{t-j} + \varepsilon_t \qquad (6)$$

where $\hat{\theta}$ is the estimated FMOLS cointegrating vector and I_t is the Heaviside indicator function which defines "COVID" observations.

$I_t = 1$ if t is between 2020q1 and 2021q4

$I_t = 0$ otherwise.

The significance tests on the differenced explanatory variables give us information on the strength of the short-term effects. The coefficients on the lagged error correction terms represent the proportion by which the long-term disequilibrium in the log of real house prices is being corrected in each period. In our model we suggest that those speeds of adjustment are different in COVID and non-COVID years. Estimation results for Equation (6) are presented in Table 14. $k = 2$ is selected using the AIC.

Table 14 Asymmetric error correction model of real house prices[a]

Variable	2003q1-2022q4 Estimated Coefficient (SE)
α_1	0.0297 (0.0897)
α_2	-0.1177* (0.0464)
R^2 adjusted	0.5971
Serial correlation	
B-G-1 $\chi^2(1)$	0.9978
B-G-2 $\chi^2(2)$	1.1465
B-G-4 $\chi^2(4)$	4.9005
ARCH(1) $\chi^2(1)$	0.724

[a] ** and * indicate 1 per cent and 5 per cent significance level respectively. B-G-1, B-G-2 and B-G-4 stand for the Box-Godfrey autocorrelation tests for first, second and fourth order autocorrelation respectively. According to the diagnostic tests there is no problem of autocorrelation or ARCH(1) effect.

The speed of adjustment α_1 is positive and insignificant even at the 5% level, α_2 is negative and significant at the 5 per cent level, indicating adjustment to equilibrium outside of the COVID years but not during COVID years. Excluding the COVID periods, if an external shock throws the variables out of equilibrium and assuming no further shocks, the price adjusts to its long-run equilibrium with about 11 per cent of the adjustment taking place in each quarter. Such an adjustment speed is reasonably fast. Given the large recent increases in interest rates, using the 11 per cent quarterly adjustment rate, housing prices will take 2-3 years to adjust to the new downward equilibrium. This typically happens as housing prices flatten while other prices rise.

Three Further Observations

First, our results are consistent with other studies of house prices. In analysis of 20 studies across 12 countries, Girouard et al. (2006) found the following elasticities:

- Real house prices to real disposable household income = 1.9 (for 20 studies).
- Real house prices to real interest rates = -3.1 (for 18 studies).
- Real house prices to housing stock = -3.1 (for 10 studies).

Oxford Economics (2016) found:

- A house price elasticity of -1.8 in relation to UK housing stock.
- Another six refereed studies with price elasticities for housing stock between -1.1 and – 2.2. The paper concluded that an increase in housing stock would have little impact on house prices in the UK.

Second, our results refer to capital city house prices. The ST study included all dwellings. Generally, average city prices for houses and units have moved quite closely even though relatively more units have been built. This indicates their substitutability. Unit supply affects house prices and (detached) housing supply affects unit prices. So, our take is that similar results would apply to unit prices or total dwelling prices.

Our third observation relates to the role of the housing stock. As noted above, ST estimated the elasticity of housing prices to housing supply is -2.5. In our current work, we estimate the long-run elasticity to be close to this at -2.3. What are the price implications for increasing housing stock?

Currently there are nearly 11.0m residential dwellings in Australia. And there is an average net increase of around 180,000 new dwellings a year. Suppose that 25% more new dwellings (225,000) were produced in a year, broadly as per the Commonwealth Governments' current plan. This extra 45,000 dwellings would increase the housing stock by 0.4%. This may have a short-term effect on house prices. But, as noted above, housing prices adjust to their long-run equilibrium with about 11 per cent of the adjustment taking place in each quarter. With a long-term stock elasticity of say -2.5, this extra housing would reduce real house prices by 1.0% in about two and a half years. Achieving this each year over 5 years would reduce real house prices by 4.0% approximately.

7 Explaining Housing Rents

As described in Section 4, there is a fair amount of agreement about the changes in real rents that have occurred in the long run. ABS household surveys of actual rents indicate that mean real rents for constant quality housing rose by about 10% between 1980 and 2000 and by another 10% between 2000 and 2022. CoreLogic data for listings indicated that nationally real rents for both houses and units in the cities rose on average by around 10% between 2008 and 2022, although there were significant differences between cities. The small difference between the ABS and CoreLogic may be explained by rents for listings rising more than rents for ongoing tenants and possibly by CoreLogic rent data being less adjusted for changes in housing quality. However, the differences for rent changes since mid-2022 may be harder to resolve.

We provide below some observations on the likely drivers of changes in real rents along with some observations on the ST modelling of rents.[10]

As discussed in Section 5, the three main drivers of rents are: population, household incomes, and housing supply (stock). Since housing supply has increased by marginally more than population over the last 20 years (and the previous 20 years), at a high level they would appear to offset each other. Thus, household incomes seem likely to be a main explanator of rents, which is what ST (2019) found.

ST (*ibid*.) modelling of real rent changes, based on ABS rental price data, found that real rents are a function of the growth in household income and the rental vacancy rate. This result is consistent with the ABS data (see Section 8 below), which show that, from 1994-95 to 2019-20, mean rents were consistently around 18% of mean household income.

Re vacancies, ST found that when the vacancy rate is 2.4 per cent, real rents grow at 0.9 per cent a year, which they describe as consistent with the housing stock increasing in line with population. A percentage point increase (reduction) in the vacancy rate reduces (increases) the annual growth of real rents by an estimated 2 percentage points initially and by 1.4 percentage points in the long run. This reflects a high level of momentum, with coefficients on the lagged changes in real rents summing to 0.7.

To provide some perspective, national rental vacancy rates have been broadly as shown in Table 12.

Table 12 National Rental Vacancy Rates (VRs): % of Rentals

Years	2005-08	2009	2010-13	2014-18	2019-20	2021	2022	2023
VRs (%)	About 1.5	2.0–2.5	1.5–2.0	2.0–2.5	2.5+	About 2.0	2.0 →1.0	About 1.0

Source: SQM Research[11]

[10] At this time, we have not tried to formally model changes in rents.

[11] https://sqmresearch.com.au/graph_vacancy.php?national=1&t=1#terms

However, estimates of rental vacancies vary. Real Estate (2023)[12] estimated higher vacancy rates in 2023. "In March 2023, the country's rental vacancy rate stood at 1.5%, marking a decrease from 1.6% in the preceding quarter and 1.8% in March 2022…There continues to be a large difference between house and unit vacancy rates, with the house vacancy rate at 1.2% in March 2023 and the unit vacancy rate at 2.2%."

A more general problem is that vacancies are not an exogenous variable. To forecast vacancies, we need to know the drivers. ST note that the vacancy rate deviates from this benchmark due to changes in population growth, household size, and housing completions. But it is not clear how the underlying factors are driving vacancies and hence rents.

As mentioned above, other possible factors affecting rents include the number of short-term visitors who are not included in population figures, increasing short-term letting sites (e.g. AirBnB) which reduce the effective supply of standard rental stock, and high-wealth households increasingly owning second (or more) homes for private use.

The net effect is that we know little about the real drivers of rental vacancy rates, or indeed of rents. As Ellis (2022., p.15) observed, "it's natural to focus on the opening of the borders and resumption of population growth as potential drivers of higher rents. But it turns out that similar surges in advertised rents are evident in the United States and the United Kingdom. Actual rents paid have been rising there, and in these and some other countries, such as Canada, CPI rental inflation is now running at the fastest pace in many years." Our conclusion is that there is more research to be done on this topic.

8 Housing Outcomes: For Homeowners and Renters

In this section we discuss key outcomes: home ownership accessibility and affordability, rental costs for median and low-income households, and briefly homelessness.[13]

Home Ownership: Accessibility and Affordability

Table 16 shows national home ownership rates by selected age groups from 1986 to 2021. The more detailed 2021 age groups and data are based on the 2021 Census.[14]

Table 16 National home-ownership rates (%) by age group: 1986 to 2019-20

Age	1986	1996	2006	2011	2017-18	2018-19	Age	2021
15-24	26	22	24	25	14	10	15-24	na
25-34	58	52	51	47	37	41	25-30	30
							30-34	50
35-44	74	70	69	64	61	57	35-40	59
							40-44	65
45-54	79	79	78	73	72	72	45-49	69
							50-54	72
55-64	82	83	82	79	78	79	55-64	77
65+	80	82	82	79	84	82	65+	82
All ages	70	69	70	67	66	67	**All ages**	67

Sources: Hall, 2017; ABS, 4149.0, *Housing Occupancy and Costs, 2019-20, Table 2.1*. AIHW *Housing Data Dashboard*, 2021 data

[12] https://www.realestate.com.au/insights/proptrack-rental-report-march-2023-quarter.

[13] The AIHW Housing Data Dashboard has up-to-date data on most important housing outcomes.

[14] The recent data for the 35-44 age group appears inconsistent and difficult to explain.

From 1986 to 2021, homeowners fell from 70% to 67% of the population. This overall rate was held up by the proportion of people over 65 (with over 80% ownership rates) rising from 11% in 1981 to 16% in 2021. On the other hand, home ownership rates have fallen substantially for all age groups under 54 and especially for the three lowest age groups (15-24, 25-34 and 35-44). These falls were relatively modest between 1986 and 2006. They became much larger between 2006 and 2021.

This raises the question – why? To what extent is the fall in ownership for those under 45 driven by increasing costs of home ownership for first time buyers (declining "accessibility"), social factors, changing demographics, or government policies?

Home ownership costs for first home buyers have two main components: debt servicing payments and the initial housing deposit. Debt service is a function of the size of the mortgage and mortgage rate. But the mortgage and the mortgage rates are deeply (negatively) linked as the rise in house prices substantially reflects lower borrowing rates.

Abelson (2018) found that, from 1990 to 2017, annual debt servicing costs for first home buyers had stayed broadly constant as a proportion of household income, with lower interest payments fully offsetting the higher loan repayments. The RBA (2021, Graph 5) found more substantially that the cost of mortgage payments (measured as the percentage of median gross household income needed to service a variable rate mortgage with an 80 per cent loan-to-value ratio for a median priced dwelling) fell substantially in all 8 capital cities. And, as RBA (ibid. Graph 6) shows, households have contributed significant amounts to offsets and redrawals over and above scheduled principal and interest payments. The RBA (p.5) concludes that "The decline in interest rates over the past few years has **lowered** the cost of servicing a typical new mortgage as a share of median income. On this metric, housing affordability has improved considerably".

However, this does not account for the deposit required for the balance of the capital which is typically around 20% of the property price. Yes, some home buyers can borrow up to 90% at historically low real interest rates. And some are assisted by recently introduced government grants to first homeowners[15] or by the "bank of mum and dad," which is much more fully endowed to-day than it was 20 or 30 years ago. But for those without access to these funding sources, the first home deposit requires significantly more saving in 2023 than in 1980 or 2000. The RBA (2021, Graph 8) shows that, for a 24-35 year household saving 20% of their median gross income, the average time needed to save a 20% deposit for the median priced dwelling in each capital city had then risen by 3 years.

Nevertheless, the RBA (2021, pp.7-8) concludes: "Despite these developments, there has been a large rise in the share of new housing loan commitments from first-home buyers over recent years (Graphs 9 and 10), suggesting that housing accessibility has improved. The indicators discussed above suggest that purchasing housing has remained accessible for many households. Individual experiences will differ, however, because incomes vary across households and housing prices differ both within and across geographic areas."

Turning to social (lifestyle) factors, several factors (age of marriage, access to education, and entry into the workforce) have influenced homeownership rates for persons under 35. In 1976, the median age of first marriage was (incredibly) 24 years for men and 21 years for women. By 2019, the median age had risen to 32 years and 30.5 years respectively. In the 1970s, only 5% of the Australian population had post-school education, implying that around 95 per cent of potential workers joined the workforce before they were age 20. By 2016, around 35% of the Australian population were in

[15] Government programs to support first home buyers include the First Homeowner Grant, the First Home Loan Deposit Scheme, and Family Home Guarantee. Deposit guarantee schemes can assist with the deposit hurdle, though the repayment burden over the life of the loan will be higher.

post-school education, so that only around 65% were earning significantly before the age of 20. All these social factors very likely delayed home ownership.

Another factor in housing ownership is immigration. Overseas born residents have risen from around 20% of the population in 1981 to 30% in 2022 and many are under 45 years of age. Migrants tend to become homeowners later than those born in Australia. As recorded by ABS (34170DO001_2021*, Permanent migrants in Australia),* 53% of the permanent migrants arriving between 2000 and 2012 owned homes (well below the national figure). Of the 385,000 permanent residents arriving between 2013 and 2018, only 12% owned housing. In addition, an increasing percentage of migrants in Australia are on temporary visas (mainly for education and work) who are almost all renters.

Turning to government policies, public support for first homeowners varies over time. For example, before September 2012, the NSW Government First Homeowner Grant was $15,000 for any home up to $650,000. Now it is only $10,000 for new homes up to $750,000. On the other hand, in NSW, first homeowners now receive relief from stamp duties on low priced housing.

Given these multiple factors, it is difficult without more examination to know how much to attribute the substantial decline in home ownership for people under 45 to rising house prices, notably finding the first home deposit. As the RBA (2021, p.4) observes, "multiple factors have contributed to the decline in homeownership, and they are difficult to disentangle. Changing demographics and shifts in household preferences (including marrying later and higher divorce rates) are likely to have contributed. Using standard statistical decomposition techniques, these factors are estimated to have subtracted around 2–3 percentage points from the rate of home ownership for those households with heads who were born between 1972 and 1991. Other factors, which would include, among other things the effects of public policies, are estimated to have subtracted around 2–4 percentage points from the home ownership rate over the past decade." However, this would still leave rising house prices, especially first home deposits, as a potentially significant factor. More research on housing accessibility seems to be needed.

Rental Outcomes: Median and Income Households

Analysis of rental outcomes is complicated by the changes in real rents that have been occurring with real rents generally falling between 2015 and 2021 and then rising from late 2022.

As the RBA (2021, pp.10-11) noted, "one clear trend in advertised rents … has been flat or declining advertised rents in Sydney and Melbourne over recent years. Meanwhile, rents outside of these cities have mostly drifted higher. Demand in regional areas has been reported to have led to acute pressures on rental markets in popular coastal areas, affecting people who may not be well positioned for personal or employment reasons to move to large cities. In regional areas, increased demand has come at a time where the supply to the rental market has declined, either due to formerly leased rental stock being repurposed for very short-term holiday accommodation or increased purchases of second homes by city residents, which could also be contributing to affordability issues."

Table 17 shows mean private and public housing rents and household income per week from 1994-95 to 2019-20. Over these years, mean rents were a broadly constant proportion of mean gross household income at around 18%. And, as we have noted, housing quality rises over time.

Table 17 Mean Housing Rents and Household Income per Week: 1994-95 to 2019-20

Year	Mean Rent Private Housing	Nominal Rent Index	Mean gross hh income per week	Nominal Mean hh income index	Mean Rent % of mean hh income	Mean Rent Public Housing (PH)	Mean PH Rent % of 1/3 mean income
1994-95	256	89	1422	85	18.0	113	26.5
1995-96	260	90	1402	83	18.5	108	25.7
1996-97	265	92	1440	86	18.4	113	26.2
1997-98	272	94	1484	88	18.3	107	24.0
1999-2000	277	96	1566	93	17.7	118	25.1
2001-02	272	94	1527	91	17.8	115	25.1
2002-03	281	97	1574	94	17.9	120	25.4
2003-04	289	100	1681	100	17.2	123	24.4
2005-06	307	106	1830	109	16.8	139	25.3
2007-08	344	119	2123	126	16.2	135	21.2
2009-10	373	129	2060	122	18.1	146	23.6
2011-12	402	139	2137	127	18.8	158	24.6
2013-14	414	143	2273	135	18.2	163	23.9
2015-16	407	141	2253	134	18.1	178	26.3
2017-18	411	142	2310	137	17.8	163	23.5
2019-20	413	143	2329	139	17.8	150	21.5

Source: ABS, 2022, *Housing Occupancy and Costs*, Australia, 2019-20, Table C.2.

Table 18 shows the percentages of equivalised disposable household income spent on rents in 2019-20. This shows the lowest income group spending over 40% of their disposable income on rents. This indicates that the distribution of household income is significantly greater than the distribution of rents, which is an underlying social problem.

Table 18 Equivalised Disposable Household Income (EDHI) % Spent on Rents (2019-20)

Quintile	Fifth (high EDHI)	Fourth	Third	Second	First (low EDHI)	All
% of EDHI	12.0	17.5	21.5	26.1	42.6	19.9

Source: ABS, *Housing Occupancy and Costs, Australia, 2019–20.*

Rental stress is conventionally described as spending more than 30% of gross income on housing costs. However, rent assistance covers around a quarter of the rent that recipients pay. Agarwal *et al*. (2023) estimate that, accounting for rent assistance to lower income households in the first and second quintiles, these households spent on average 28% of their disposable income on rent in the 2019/20 financial year. But many low-income households are living in the rental stress category (over 30% of EDHI).

Agarwal et al. (2023, Graph 11) estimate that, between 2000 and 2019, rent-to-income ratios were unchanged for private renters in the upper quintiles of the income distribution while worsening slightly for households in the first and second quintiles. But, after adjusting for increased rent assistance, they have been broadly unchanged. Rent assistance covers around one quarter of the rent recipients pay. There were around 1.7 million recipients of Commonwealth Rental Assistance in June 2020, up from 1.3 million in June 2019.

Between 2003-04 and 2021-22, the average cost of rent and other dwelling services for the lowest disposable income quintile rose by 87% and the average gross disposable income rose by 112%.[16] And Agarwal *et al.* (2023, Graph 13) show, over this period, income and income support for low-income renters increased at around the same rate as advertised rents. They conclude that "This provides some evidence that the increase in housing costs has been broadly offset by strong income growth, thereby limiting the deterioration in housing affordability for at least some renters." But this is the story up to mid-2022 including the strong growth in social assistance benefits during the pandemic. Rents increased in real terms by 4% in 2022 (the highest increase in 10 years) and rose again in 2023. For some renters, housing affordability has worsened since the start of 2022, but it is difficult to measure the extent.

In summary, over the past decade, rents have grown modestly, and this growth has been largely matched by the growth in wages and household disposable income (including rental support) across income groups in the economy. However, many low-income households remain in rental stress and the growth in rents in FY 2022-23 will have reduced rental affordability and increased financial stress for some renter households. More detailed data would be valuable for policy development.

Homelessness

A more extreme metric of welfare is homelessness. The ABS defines this to include persons living in improvised dwellings tents or sleeping out, supported accommodation for the homeless, staying temporarily with other households, living in boarding-houses, and living in severely crowded dwellings. The largest group is the last category (around 40% of the homeless).

Census data shows that the rate of homelessness has been broadly constant since 2001: per 10,000 population, 51 in 2001, 45 (2006), 48 (2011), 50 (2016) and 48 in 2021.[17] On census night in 2021, 122,494 people were experiencing homelessness. Twenty-three per cent were 12 to 24 years old.

Homelessness often raises mental health issues which create difficulties for conventional renting relationships and may require special mental health support services, which are not simply relieved by additional standard housing stock.

Conclusions

Allowing for the various drivers of home ownership, our review finds that housing accessibility has become marginally more difficult for first homeowners due to the rise in the first home deposit, not because of rising mortgage repayments. However, repayments have risen substantially (or are about to do so) for many recent home purchasers who purchased at market high prices due to the 12 rises in interest rates since 2021 that the Governor of the RBA told us would not happen before 2024.

Rental payments as a proportion of income are higher for lower income households because the distribution of income is significantly greater than the distribution of housing rents. Most low-income households in the first quintile are paying over 30% of their income in gross rent, albeit in many cases assisted significantly by rent support so that aggregate net payment for low-income households is below 30%. This proportion did not change much up in the decade leading up to 2022, but it may have increased in 2023 with the substantial re-opening of the economy.

The RBA (2021, p.21) cites a study by Troy et al. (2019) that estimates that there is a shortage of 440,000 homes that are affordable for the homeless and people in the lowest 20 per cent of household

[16] 5204055011 ABS *National Accounts Distribution of Household Income Consumption and Wealth* 2003-04 to 2021-22.

[17] Source: AIHW*, Homelessness and homelessness services.*

incomes. The report (*ibid.* p.1) concludes that affordability has declined the most for lower income households who are renting or looking to buy a home.

The RBA report notes further (p.23) that the combination of negative social housing changes and low-income growth have contributed to a meaningful deterioration in housing affordability for more vulnerable households. As described in Section 5 above, there has been a major fall nationally in the supply of social housing. And the RBA notes (p.24) that expected waiting time for social housing in New South Wales is usually around 5 to 10 years or more. Thus, renting affordability is driven by many factors, including the distribution of household income, the lack of public housing, the use of housing by short-term renters, and high-income households with more than one home.

9 Conclusions

Real increases in housing prices have been a long-term experience. Real median house prices across the cities and regions approximately doubled between the early 1980s and 2003 and again between 2003 and 2022. And there was strong uniformity of price changes across cities and regions. This suggests that housing prices across the country are related (the spatial equilibrium concept) and driven to a large extent by national factors, notably national interest rates, population and household income, as well as by national housing supply.

Three other general observations are significant. First, observed price changes include changes in the quality of housing which has likely risen by at least 1% per annum. CoreLogic indices, which attempt to model constant quality housing prices, show average real prices of dwellings (houses and units) in the capital cities rose by about 40% between 1980 and 2003 and 50% between 2003 and end of 2022.

Second, in the medium term, though not each year, quality adjusted housing prices have increased very similarly with other asset prices, (i.e. the ASX real ordinaries share price index). This implies an important role for asset / income pricing. Third, over the last 20 years, Australian house prices have risen broadly similarly to house prices in other developed economies.

Real rents are also a complex narrative. ABS (CPI) data for existing renters indicate lower rent increases than CoreLogic data for new listings.

ABS rent data for constant quality housing indicate that real rents rose by 20% between 1980 and 2022 (averaging half a percentage point a year). But the rate of change varies. Between 2005 and 2015, real rents rose by around 22%. But they then fell every year to 2022 and **were 9% lower** on average in 2022 than in 2015. And, over the 10 years to end 2022, wages had grown faster than annualised percentage rents growth.

However, Corelogic figures show that over the 12 months to June 2023, national average real rents rose by 3.5%, including by 5.2% in the combined capital cities and by -1.0% in the combined regions.

Key explanatory variables driving rents are population, household disposable income and public rental support, and housing supply. The same factors, along with mortgage rates are key drivers of (asset) house prices.

In most years between 2003 and mid-2022, the housing stock increased by marginally more than the population and over the whole period it rose by 4.3% more than the population. However, the population in public housing halved from 6% in 1995 to under 3% in 2022. This fall was offset to only a minor extent by a rise in community housing.

Also, between 2003 and mid-2022, real household disposable income per capita rose by over 50%, although it declined by 5% in the second half of 2022.

After allowing for inflation, real mortgage rates were usually between 2.5% and 3.5% in most years from 2000 to 2020, before falling dramatically to under 1% in 2021 and becoming negative in 2022.

Of course, several other factors may influence house prices and rents. These include public policy changes for mortgage lending or property taxation, foreign demand, use of housing for short-term lettings, expected capital gains, purchases of second hones, and the rate of housing sales (transfers) in any period.

In this paper we reported the results of three models of housing prices: Abelson and Joyeux et al. (2005) modelling of house prices from 1970 to 2003 and our new modelling from 2003 to 2022, and Saunders and Tulip (2019) on all dwelling prices from 1980 to 2018. The core results are similar and statistically significant across the three studies.

In our studies, for 1970 to 2003 and 2003 to 2022, the estimated long-run elasticity of real house prices with respect to real household disposable income was +1.7 and +0.5 respectively. The estimated long-run elasticity for the housing stock was -3.6 and -2.3 respectively. And a one percentage change in real mortgage rates moved house prices in the opposite direction by 5.5% and 3.6% respectively.

If an external shock throws the variables out of equilibrium, the price adjusts to its long-run equilibrium with about 11 per cent of the adjustment taking place in each quarter. Thus, when real prices are falling, or rising, the full impact may not be realised for 2 years. Given the large recent increases in interest rates, housing prices may take 2-3 years to adjust to the new downward equilibrium. This typically happens as housing prices flatten while other prices rise.

Saunders and Tulip (ibid.) estimated the elasticity of real house prices with respect to housing stock to be -2.5, very consistently with our results. But they found that a one percentage fall in real mortgage rates raised house prices in the long run by an extraordinary 17%. They do not provide a house price - income elasticity. These results are well aligned with two other cited international studies of house prices.

Of course, other factors influence house prices and / or the rate of change. For example, in both our studies we found that the unemployment rate is significant and negative, suggesting that this is an indicator of economic conditions. And Saunders and Tulip found that expected changes in house values and changes in mortgage regulations influenced house prices.

But the fundamental finding is the very high, and critical, impact of changes in real mortgage rates. This is, of course, consistent with the core principles of asset pricing.

By contrast, increasing net annual completions by 25% would increase the national dwelling stock of about 11.0 m dwellings by around 0.4% and reduce house prices by only 1.0%. Allowing for the adjustment process, achieving this over 5 years would reduce house prices by approximately 4.0%. As the RBA (2021, p. 17) noted, “In any one year, newly built housing only shifts the stock of housing incrementally.”

The three main drivers of rents are: population, household incomes, and housing supply (stock). Since housing stock has increased by marginally more than population over the last 40 years, they broadly offset each other. Thus, household incomes are likely the main explanator of rents, which is what ST (2019) found. ST (*ibid.)* found that real rents are a function of the growth in household income and the rental vacancy rate. However, they did not provide an explanation for vacancy rates.

Other possible factors affecting rents include the number of short-term visitors, increasing short-term letting, and high-wealth households owning second (or more) homes for private use. It seems that we need more research into the real drivers of rental vacancy rates and indeed what drives rents.

Turning to household outcomes, between 1986 to 2021 house ownership fell only marginally for the total population from 70% to 67% because of the increasing proportions of people over 55. However, ownership fell heavily for all age groups under 55, especially post 2011.

These falls in ownership have several causes. They include the rising cost of first home deposits relative to income, changing demographics (more immigration), later entries into the workforce, and later marriages. With falling real mortgage rates over most of this period, average mortgage payments did not rise as a proportion of average household income and were not a significant factor in ownership rates, although lower-income households would have been left out.

Regarding rents, mean rents have been around 18% of mean household disposable income for the last 25 years. But the story is different for low-income households. In 2019-20 gross rents for households in the lowest quintile averaged 43% of equivalised household disposable income, well above the 30% standard affordability benchmark. This higher proportion arises *because the distribution of income is significantly greater than the distribution of housing rents.* After accounting for rent assistance to lower income households, these households spent an average 28% of their disposable income on rent in the 2019/20 financial year. This proportion has likely increased with the recent increase in rents. But in any event, large numbers of low income households are likely paying over 30% of their disposable income in net rents.

Also, homelessness remains a major problem. The rate of homelessness has been broadly constant over the last 20 years at around 50 per 10,000 population. On Census night in 2021, 122,484 people were experiencing homelessness.

Housing is a fundamental element in individual and community welfare. This paper has focused principally on what explains average housing prices and rents and how this affects actual and potential homeowners and renters. To develop effective and fair housing policy for all in the community, more information is needed on low-income households who are rent-stressed or unable to raise a first-home deposit and how they can be supported most effectively - along with a comprehensive social policy to provide them with effective support. More housing will reduce housing prices by a small amount but be far from providing all the solutions to housing that our society needs.

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Appendix A: House and Unit Prices Across Australia

Appendix A shows detailed data for housing prices across Australia from 1980 to 2022.

For each year, the price shown is the average over the four quarters (in effect giving equal weight to the median price in each quarter). Therefore, it is not actually the annual median price over the year, but it is generally close to it.

Table A.1 (over page) shows average annual median house prices in the eight capital cities.

Table A.2 shows the average annual median unit prices in the eight capital cities.

Table A.3 shows annual median house prices in the rest of the six states from the mid-1980s to 2022 along with median unit prices in the rest of Victoria and South Australia.

There are two principal sources for the data in these tables. Abelson and Chung (2005) provide housing price data from 1980 to 2003. This paper drew on three main data sources: government land title offices, the Real Estate Institute of Australia, and the Commonwealth Bank.

The housing price data for 2003 to 2022 are sourced from ABS Cat. 6432, *Total Value of Dwellings*, Table 2.

Tables A.4 and A.5 below show estimated nominal and real price indices for housing prices in the cities.

As shown in Table A.1, there are minor differences between our two data sources for 2003 house prices (not all in the same direction). To derive nominal housing price indices in Table A.4, we adopt the ABS 2003 numbers as 100.0. We then use the percentage changes in the 1980 to 2003 numbers from Abelson and Chung (2005) to estimate the city nominal annual indices from 1980 to 2003.

The real price city indices are obtained by deflating the nominal indices using the national CPI.

Tables A.6 and A.7 show the nominal and real price indices for unit prices in the cities.

Tables A.8 and A.9 provide these indices for dwelling prices in the rest of the states.

However, the ABS values for 2003 cited in Tables A.2 and A.3 are averaged only over the 3rd and 4th quarters of the year (since earlier figures are not available). This was a year when housing prices were rising by over around 14% (on average) in nominal terms. Accordingly, in this case the nominal indices of 100 in 2003 shown in Tables A.6 and A.8 are based on the housing prices reported in Abelson and Chung (2005).

The average (mean) city real price indices for houses and units shown in Tables A.5 and A.7 are weighted averages of the city index numbers, with the weights reflecting the populations in the cities at the start of the period.

Importantly, these real price indices do not allow for changes in housing quality. This issue is discussed in Section 3 and Appendix C of this paper.

Table A.1 Median House Prices in Capital Cities (1980-2022)

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
1980	68,850	39,500	35,475	36,000	40,350	36,250	na	44,675
1981	78,900	44,000	45,325	39,100	43,825	37,100	na	57,750
1982	79,425	46,750	55,125	42,850	48,225	40,325	na	59,025
1983	81,425	52,500	55,525	47,950	49,000	42,500	na	68,150
1984	85,900	65,000	58,950	61,250	48,175	44,750	na	84,250
1985	88,350	75,200	61,550	72,200	52,050	55,500	na	90,625
1986	98,325	82,000	63,000	73,500	58,000	56,725	87,500	91,175
1987	120,025	89,500	63,500	74,500	61,225	63,450	81,075	90,125
1988	141,000	109,000	71,000	80,400	78,000	67,950	86,000	101,250
1989	170,850	132,000	96,000	90,400	102,500	77,325	90,750	115,000
1990	194,000	131,000	113,000	97,200	101,125	82,000	101,500	120,750
1991	182,000	127,000	120,000	103,900	99,500	89,650	111,550	136,500
1992	183,300	125,000	129,000	108,300	102,500	95,825	126,125	155,250
1993	188,000	126,000	136,500	111,200	112,750	104,250	150,500	159,375
1994	192,375	130,000	143,000	113,500	123,125	110,500	157,875	160,850
1995	196,750	129,000	147,000	111,500	126,788	106,750	165,375	155,550
1996	211,125	131,000	148,000	110,000	126,625	108,000	164,250	152,375
1997	233,250	142,000	150,000	113,500	134,125	108,750	176,500	152,750
1998	248,750	155,000	159,500	118,600	141,000	107,250	173,500	155,500
1999	272,500	175,000	161,000	127,000	147,500	112,225	179,375	161,500
2000	287,000	191,000	170,000	135,000	156,250	117,750	186,800	180,825
2001	322,500	225,000	178,700	150,000	168,375	120,575	188,000	206,250
2002	387,500	258,000	205,000	180,000	189,250	137,150	202,250	234,150
2003	454,250	276,000	249,000	225,000	205,000	172,500	211,333	293,667
2003	473,625	293,125	257,600	228,100	231,750	160,325	209,625	342,375
2004	509,000	308,875	305,675	259,625	264,000	223,075	248,075	368,625
2005	494,000	320,500	314,725	274,000	311,250	246,875	292,500	375,050
2006	486,750	345,250	333,375	289,000	426,250	269,500	357,750	404,575
2007	511,575	371,750	383,000	328,250	473,750	291,625	400,750	450,750
2008	490,500	388,750	414,750	360,000	447,500	301,500	429,325	460,250
2009	508,250	418,625	426,250	371,325	468,000	316,650	482,500	469,875
2010	603,375	494,075	461,250	405,500	507,000	344,825	534,750	527,675
2011	566,750	492,375	438,750	392,500	483,750	335,125	505,500	513,250
2012	608,125	487,750	435,000	387,000	498,375	329,200	542,375	501,000
2013	670,000	516,750	449,750	399,250	530,250	336,250	554,750	505,825
2014	738,500	522,600	456,250	411,750	529,125	350,375	575,875	556,925
2015	863,925	569,575	473,200	424,750	529,625	355,000	580,000	591,875
2016	907,625	614,500	498,375	442,000	518,250	371,750	540,000	616,200
2017	989,750	704,875	522,000	455,575	507,750	401,375	510,950	670,500
2018	954,525	734,000	534,500	469,825	498,500	453,025	504,000	702,125
2019	913,000	712,500	540,250	478,125	485,750	489,625	478,500	706,500
2020	964,575	733,750	554,250	493,000	494,375	537,250	488,750	745,125
2021	1,222,500	931,750	678,250	577,125	544,750	672,750	567,700	930,525
2022	1,291,150	922,050	777,500	669,525	563,750	740,500	586,750	1,017,700

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-22 data, ABS Cat. 6432, Table 2. na = not available.

Relative Indices with Sydney = 100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
1980	100	57	52	52	59	53	na	65
2003	100	62	54	48	49	34	44	72
2022	100	71	60	52	44	57	45	79

Table A.2 Median Unit Prices in Capital Cities (1980-2022)

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
1980	56,500	33,000	37,379	31,997	35,825	na	na	33,867
1981	67,300	36,500	48,308	34,334	36,004	na	na	43,963
1982	70,200	38,500	48,471	38,887	38,958	na	na	42,833
1983	66,000	42,500	54,396	45,213	40,729	na	na	50,358
1984	67,800	52,500	58,738	56,238	37,467	40,200	na	59,833
1985	70,500	60,000	55,446	61,600	40,033	47,750	na	72,604
1986	72,300	66,750	60,508	65,400	44,042	62,100	na	84,333
1987	86,200	72,250	61,146	64,200	48,263	59,908	na	76,668
1988	118,400	85,000	68,875	67,000	57,417	60,896	na	84,667
1989	138,525	104,500	85,604	72,900	75,917	73,833	na	91,313
1990	135,715	115,000	91,375	81,300	75,625	71,208	na	96,979
1991	139,285	108,500	93,875	86,000	75,500	72,775	na	104,083
1992	140,280	110,000	98,896	89,600	76,267	76,817	na	128,125
1993	142,760	110,000	101,688	91,400	79,492	80,771	na	130,583
1994	156,075	115,000	103,583	96,000	86,200	84,542	na	129,083
1995	173,625	115,000	107,358	94,100	87,096	88,292	na	125,542
1996	186,250	115,000	127,583	89,000	87,525	84,404	na	122,083
1997	214,250	127,000	128,125	89,300	92,813	77,375	131,667	122,333
1998	228,375	140,000	145,333	91,100	98,473	79,017	127,167	128,500
1999	243,375	170,075	139,000	94,100	107,075	85,500	155,550	131,125
2000	256,250	184,000	171,500	99,300	114,275	88,850	146,550	140,250
2001	291,250	215,388	165,475	112,200	123,575	88,525	149,750	156,875
2002	329,500	240,075	173,775	138,300	142,150	95,625	154,750	197,750
2003	360,000	269,000	201,833	159,700	160,467	126,200	153,167	253,533
2003[a]	379,000	280,500	231,300	186,750	196,500	170,000	132,750	295,000
2004	382,500	277,375	257,250	208,375	216,750	194,950	156,650	291,000
2005	383,750	287,000	268,425	220,650	253,375	217,125	200,500	306,325
2006	384,525	309,025	291,250	236,500	334,250	228,750	246,625	316,125
2007	396,250	342,500	331,750	271,250	375,250	247,500	300,000	352,500
2008	387,625	358,750	356,750	300,225	365,575	246,750	323,325	361,875
2009	412,750	385,125	366,450	311,700	383,750	267,500	376,750	382,000
2010	473,650	444,750	386,575	334,000	414,250	283,500	420,175	418,350
2011	476,000	441,250	377,875	328,700	401,250	283,250	406,875	417,500
2012	505,500	431,250	382,375	320,500	404,000	278,200	418,875	414,575
2013	541,250	447,250	395,500	327,250	434,000	280,700	458,950	414,500
2014	617,875	480,750	414,750	339,625	446,000	276,000	477,775	413,000
2015	698,750	500,200	422,500	344,875	432,375	289,750	467,500	419,975
2016	717,875	498,225	414,500	360,500	418,750	299,575	407,675	429,625
2017	740,250	549,225	397,125	378,375	408,750	316,250	366,250	438,725
2018	731,750	574,500	386,250	375,250	398,750	356,875	335,250	440,100
2019	710,250	571,250	393,575	388,750	381,625	389,375	301,000	457,550
2020	734,250	602,000	397,875	409,650	378,750	419,875	286,825	477,075
2021	786,750	650,000	431,875	429,325	416,250	523,125	364,450	544,975
2022	762,500	631,250	471,500	471,250	401,250	566,750	394,625	589,750

(a) Average of 3rd and 4th quarters.

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-2022 data, ABS Cat. 6432, Table 2.

Relative Indices with Sydney = 100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra
1980	100	58	66	57	63	Na	na	60
2003	100	74	61	49	52	45	35	78
2022	100	83	62	62	53	74	52	77

Table A.3 Median Housing Prices in Rest of the States (1985-2022)

Year	NSW Houses	NSW Units	Victoria Houses	Victoria Units	Queensland Houses	SA Houses	SA Units	WA Houses	Tasmania Houses
1985	70,175		50,000	51,500	Na	48,800	52,000	52,325	49,450
1986	67,500		55,500	57,000	55,000	52,200	60,700	52,800	57,025
1987	71,550		60,000	59,950	57,500	51,900	65,000	58,200	57,450
1988	81,975		67,000	65,000	65,000	56,900	59,800	63,025	61,700
1989	96,375		77,000	74,000	80,000	58,700	60,300	74,175	67,075
1990	107,525		80,000	78,500	88,000	63,100	64,600	77,425	74,600
1991	115,825		80,000	80,000	94,900	66,400	72,500	82,500	76,925
1992	120,025		82,000	80,800	101,500	68,000	72,000	84,100	82,475
1993	119,175		83,500	80,000	112,000	72,800	73,900	89,925	85,950
1994	126,275		86,000	82,350	120,000	77,700	78,700	100,050	91,950
1995	131,625		85,000	83,000	127,000	81,300	75,700	112,850	96,450
1996	136,225		85,500	82,000	127,000	81,800	81,900	123,425	97,675
1997	143,375		88,000	80,000	128,000	84,000	83,300	134,725	105,450
1998	154,675		91,000	83,000	134,000	85,600	83,700	139,250	106,600
1999	170,150		100,000	88,500	135,000	90,200	84,700	148,975	106,475
2000	164,775		105,000	96,600	140,000	91,300	90,300	148,250	101,525
2001	169,900		121,000	105,000	138,000	99,300	89,100	149,650	99,525
2002	209,725		144,000	122,250	151,000	117,800	107,400	174,400	109,225
2003	273,200		177,120	150,368	175,000	135,800	126,500	203,967	147,067
2003[a]	251,150	245,000	180,500	165,000	201,000	156,000	83,500	162,000	132,150
2004	272,000	264,750	196,250	175,000	239,500	173,150	91,800	185,200	159,625
2005	281,250	267,500	211,250	191,575	281,250	191,825	131,450	241,250	182,325
2006	288,750	277,375	224,000	195,200	317,475	208,750	144,325	326,000	196,500
2007	302,500	279,250	234,625	204,000	367,000	229,825	160,525	374,975	220,000
2008	300,125	280,150	238,375	208,000	372,500	245,000	185,200	366,500	232,375
2009	312,500	287,375	249,875	220,200	379,450	255,000	178,875	376,250	243,075
2010	340,000	304,000	281,425	238,700	392,625	277,575	189,250	390,000	259,750
2011	338,000	295,825	291,250	244,650	383,950	268,750	188,125	378,200	253,475
2012	346,500	300,875	291,000	241,250	378,750	263,750	171,250	377,500	249,575
2013	358,125	310,000	296,625	239,975	389,200	255,950	180,450	380,125	251,125
2014	369,650	329,750	288,500	247,500	393,750	261,250	184,650	373,750	249,825
2015	401,750	353,000	299,900	256,500	413,825	264,625	191,750	356,250	257,500
2016	428,875	373,750	311,700	266,700	431,000	272,500	197,375	340,825	261,625
2017	461,625	409,750	334,500	273,575	446,000	276,475	180,500	335,500	274,125
2018	474,950	417,750	358,750	296,200	439,250	282,750	192,125	322,375	299,500
2019	476,750	424,500	376,250	306,825	440,750	284,750	188,000	324,450	320,000
2020	510,725	479,000	416,250	375,425	442,875	291,100	197,000	352,250	351,375
2021	714,700	662,500	588,750	516,875	489,025	333,750	245,000	410,750	441,375
2022	778,750	672,000	624,250	504,050	537,750	370,750	244,250	420,000	516,250

(a) Average of 3rd and 4th quarters.

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-2022 data, ABS Cat. 6432, *Total Value of Dwellings*, Table 2.

Table A.4 Median House Prices in Capital Cities, 1980-2022: Nominal price indices: 2003=100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	CPI
1980	15.2	14.3	14.2	16.0	19.7	21.0	na	15.2	33.4
1981	17.4	15.9	18.2	17.4	21.4	21.5	na	19.7	36.6
1982	17.5	16.9	22.1	19.0	23.5	23.4	na	20.1	40.7
1983	17.9	19.0	22.3	21.3	23.9	24.6	na	23.2	44.8
1984	18.9	23.6	23.7	27.2	23.5	25.9	na	28.7	46.5
1985	19.4	27.2	24.7	32.1	25.4	32.2	na	30.9	49.7
1986	21.6	29.7	25.3	32.7	28.3	32.9	41.4	31.0	54.2
1987	26.4	32.4	25.5	33.1	29.9	36.8	38.4	30.7	58.8
1988	31.0	39.5	28.5	35.7	38.0	39.4	40.7	34.5	63.0
1989	37.6	47.8	38.6	40.2	50.0	44.8	42.9	39.2	67.8
1990	42.7	47.5	45.4	43.2	49.3	47.5	48.0	41.1	72.7
1991	40.1	46.0	48.2	46.2	48.5	52.0	52.8	46.5	75.1
1992	40.4	45.3	51.8	48.1	50.0	55.6	59.7	52.9	75.8
1993	41.4	45.7	54.8	49.4	55.0	60.4	71.2	54.3	77.2
1994	42.4	47.1	57.4	50.4	60.1	64.1	74.7	54.8	78.6
1995	43.3	46.7	59.0	49.6	61.8	61.9	78.3	53.0	82.3
1996	46.5	47.5	59.4	48.9	61.8	62.6	77.7	51.9	84.4
1997	51.3	51.4	60.2	50.4	65.4	63.0	83.5	52.0	84.6
1998	54.8	56.2	64.1	52.7	68.8	62.2	82.1	53.0	85.4
1999	60.0	63.4	64.7	56.4	72.0	65.1	84.9	55.0	86.6
2000	63.2	69.2	68.3	60.0	76.2	68.3	88.4	61.6	90.5
2001	71.0	81.5	71.8	66.7	82.1	69.9	89.0	70.2	94.5
2002	85.3	93.5	82.3	80.0	92.3	79.5	95.7	79.7	97.3
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	107.5	105.4	118.7	106.9	130.9	139.1	118.3	107.7	102.3
2005	104.3	109.3	122.2	111.8	154.3	154.0	139.5	109.5	105.0
2006	102.8	117.8	129.4	123.5	114.9	168.1	170.7	118.2	108.6
2007	108.0	126.8	148.7	142.0	119.7	181.9	191.2	131.7	110.9
2008	103.6	132.6	161.0	141.9	124.3	188.1	204.8	134.4	115.3
2009	107.3	142.8	165.5	158.5	127.1	197.5	230.2	137.2	117.0
2010	127.4	168.6	179.1	157.0	130.9	215.1	255.1	154.1	120.0
2011	119.7	168.0	170.3	151.4	135.2	209.0	241.1	149.9	123.3
2012	128.4	166.4	168.9	155.5	139.9	205.3	258.7	146.3	125.0
2013	141.5	176.3	174.6	160.8	146.8	209.7	264.6	147.7	127.5
2014	155.9	178.3	177.1	166.1	154.3	218.5	274.7	162.7	129.9
2015	182.4	194.3	183.7	172.9	164.2	221.4	276.7	172.9	131.4
2016	191.6	209.6	193.5	177.1	178.4	231.9	257.6	180.0	132.7
2017	209.0	240.5	202.6	184.0	195.2	250.4	243.7	195.8	134.6
2018	201.5	250.4	207.5	187.7	211.3	282.6	240.4	205.1	136.6
2019	192.8	243.1	209.7	191.4	224.3	305.4	228.3	206.4	138.2
2020	203.7	250.3	215.2	214.2	230.5	335.1	233.2	217.6	139.0
2021	258.1	317.9	263.3	260.2	233.6	419.6	270.8	271.8	141.9
2022	272.6	314.6	301.8	293.5	243.3	461.9	279.9	297.2	148.0

Sources: Table A.1 and ABS CPI data.

Table A.5 Median House Prices in Capital Cities, 1980-2022: Real price indices: 2003=100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	Average[a]
1980	45.4	42.9	42.7	48.0	59.0	63.0	na	45.6	49.3
1981	47.5	43.6	49.8	47.5	58.5	58.8	na	53.8	52.4
1982	43.0	41.6	54.4	46.8	57.8	57.5	na	49.4	49.6
1983	40.0	42.5	49.8	47.6	53.4	55.0	na	51.8	47.6
1984	40.6	50.6	50.9	58.5	50.5	55.8	na	61.7	49.6
1985	39.2	54.9	49.8	64.6	51.1	64.8	na	62.1	51.0
1986	40.0	54.8	46.7	60.3	52.2	60.7	76.4	57.3	50.5
1987	45.0	55.2	43.4	56.3	50.8	62.6	65.3	52.2	48.9
1988	49.2	62.7	45.2	56.7	60.4	62.5	64.6	54.7	55.7
1989	55.5	70.6	56.9	59.3	73.8	66.1	63.3	57.8	65.6
1990	58.7	65.3	62.4	59.4	67.8	65.4	66.0	56.5	62.9
1991	53.4	61.3	64.2	61.5	64.7	69.2	70.3	61.9	61.6
1992	53.2	59.7	68.3	63.5	66.0	73.3	78.7	69.7	61.4
1993	53.6	59.1	71.0	64.0	71.3	78.3	92.3	70.3	61.5
1994	53.9	59.9	73.0	64.1	76.4	81.5	95.0	69.6	63.0
1995	52.6	56.8	71.7	60.2	75.2	75.2	95.1	64.4	62.4
1996	55.0	56.2	70.4	57.9	73.2	74.1	92.0	61.4	61.6
1997	60.7	60.8	71.2	59.6	77.3	74.5	98.7	61.4	63.0
1998	64.1	65.8	75.0	61.7	80.6	72.8	96.2	62.0	66.8
1999	69.3	73.2	74.6	65.2	83.1	75.1	98.0	63.5	71.0
2000	69.8	76.5	75.4	66.3	84.2	75.4	97.7	68.0	74.5
2001	75.2	86.3	76.0	70.6	86.9	74.0	94.2	74.3	79.9
2002	87.7	96.1	84.6	82.2	94.9	81.7	98.4	81.9	92.2
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	105.0	103.0	116.0	104.5	127.9	136.0	115.7	105.2	108.0
2005	99.3	104.1	116.3	106.5	146.9	146.6	132.9	104.3	109.2
2006	94.7	108.5	119.2	113.8	105.8	154.8	157.2	108.8	114.8
2007	97.4	114.4	134.1	128.1	107.9	164.0	172.4	118.7	123.0
2008	89.9	115.1	139.7	123.1	107.8	163.2	177.7	116.6	120.6
2009	91.7	122.0	141.4	135.5	108.6	168.8	196.7	117.3	124.4
2010	106.2	140.5	149.3	130.9	109.1	179.3	212.7	128.5	138.0
2011	97.1	136.3	138.2	122.8	109.7	169.6	195.7	121.6	129.6
2012	102.7	133.1	135.1	124.4	111.9	164.3	207.0	117.1	129.7
2013	111.0	138.3	137.0	126.2	115.2	164.6	207.6	115.9	134.9
2014	120.0	137.2	136.3	127.9	118.7	168.2	211.4	125.2	137.3
2015	138.8	147.8	139.8	131.6	124.9	168.5	210.5	131.5	146.8
2016	144.4	158.0	145.8	133.5	134.5	174.7	194.1	135.6	152.2
2017	155.2	178.6	150.5	136.7	145.0	186.0	181.1	145.5	162.1
2018	147.6	183.4	152.0	137.5	154.7	206.9	176.1	150.2	161.5
2019	139.5	175.9	151.8	138.5	162.4	221.1	165.2	149.4	156.6
2020	146.5	180.1	154.8	154.1	165.8	241.0	167.7	156.5	161.4
2021	181.9	224.0	185.6	183.4	164.6	295.8	190.9	191.6	195.0
2022	184.2	212.5	203.9	198.3	164.3	312.0	189.1	200.8	197.5

(a) Based on weights for city populations.

Source: Table A.4.

Table A.6 Median Unit Prices in Capital Cities, 1980-2022: Nominal price indices: 2003=100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	CPI
1980	15.7	12.3	18.5	20.0	22.3	na	na	13.4	33.4
1981	18.7	13.6	23.9	21.5	22.4	na	na	17.3	36.6
1982	19.5	14.3	24.0	24.4	24.3	na	na	16.9	40.7
1983	18.3	15.8	27.0	28.3	25.4	na	na	19.9	44.8
1984	18.8	19.5	29.1	35.2	23.3	31.9	na	23.6	46.5
1985	19.6	22.3	27.5	38.6	24.9	37.8	na	28.6	49.7
1986	20.1	24.8	30.0	41.0	27.4	49.2	na	33.3	54.2
1987	23.9	26.9	30.3	40.2	30.1	47.5	na	30.2	58.8
1988	32.9	31.6	34.1	42.0	35.8	48.3	na	33.4	63.0
1989	38.5	38.8	42.4	45.6	47.3	58.5	na	36.0	67.8
1990	37.7	42.8	45.3	50.9	47.1	56.4	na	38.3	72.7
1991	38.7	40.3	46.5	53.9	47.1	57.7	na	41.1	75.1
1992	39.0	40.9	49.0	56.1	47.5	60.9	na	50.5	75.8
1993	39.7	40.9	50.4	57.2	49.5	64.0	na	51.5	77.2
1994	43.4	42.8	51.3	60.1	53.7	67.0	na	50.9	78.6
1995	48.2	42.8	53.2	58.9	54.3	70.0	na	48.3	82.3
1996	51.7	42.8	63.2	55.7	54.5	66.9	na	48.2	84.4
1997	59.5	47.2	63.5	55.9	57.8	61.3	86.0	48.3	84.6
1998	63.4	52.0	72.0	57.0	61.4	62.6	83.0	50.7	85.4
1999	67.6	63.2	68.9	58.9	66.7	67.7	101.6	51.7	86.6
2000	71.2	68.4	85.0	62.2	71.2	70.4	95.7	55.3	90.5
2001	80.9	80.1	82.0	70.3	77.0	70.1	97.8	61.9	94.5
2002	91.5	89.2	86.1	86.6	88.6	75.8	101.0	78.0	97.3
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	106.3	103.1	127.5	130.5	135.1	154.5	102.3	98.6	102.3
2005	106.6	106.7	133.0	138.2	157.9	172.0	130.9	103.8	105.0
2006	106.8	114.9	144.3	148.1	208.3	181.3	161.0	107.2	108.6
2007	110.1	127.3	164.4	169.8	233.8	196.1	195.9	119.5	110.9
2008	107.7	133.4	176.8	188.0	227.8	195.5	211.1	122.7	115.3
2009	114.7	143.2	181.6	195.2	239.1	212.0	246.0	129.5	117.0
2010	131.6	165.3	191.5	209.1	258.2	224.6	274.3	141.8	120.0
2011	132.2	164.0	187.2	205.8	250.1	224.4	265.6	141.5	123.3
2012	140.4	160.3	189.5	200.7	251.8	220.4	273.5	140.5	125.0
2013	150.3	166.3	196.0	204.9	270.5	222.4	299.6	140.5	127.5
2014	171.6	178.7	205.5	212.7	277.9	218.7	311.9	140.0	129.9
2015	194.1	185.9	209.3	216.0	269.4	229.6	305.2	142.4	131.4
2016	199.4	185.2	205.4	225.7	261.0	237.4	266.2	145.6	132.7
2017	205.6	204.2	196.8	236.9	254.7	250.6	239.1	148.7	134.6
2018	203.3	213.6	191.4	235.0	248.5	282.8	218.9	149.2	136.6
2019	197.3	212.4	195.0	243.4	237.8	308.5	196.5	155.1	138.2
2020	204.0	223.8	197.1	256.5	236.0	332.7	187.3	161.7	139.0
2021	218.5	241.6	214.0	268.8	259.4	414.5	237.9	184.7	141.9
2022	211.8	234.7	233.6	295.1	250.1	449.1	257.6	199.9	148.0

Sources: Table A.2 plus ABS CPI data.

Table A.7 Median Unit Prices in Capital Cities, 1980-2022: Real price indices: 2003=100

Year	Sydney	Melbourne	Brisbane	Adelaide	Perth	Hobart	Darwin	Canberra	Average[a]
1980	47.1	36.8	55.5	60.1	66.9	na	na	40.0	46.7
1981	51.1	37.1	65.5	58.8	61.4	na	na	47.4	49.5
1982	47.9	35.2	59.0	59.9	59.7	na	na	41.5	45.5
1983	41.0	35.3	60.2	63.3	56.7	na	na	44.4	43.0
1984	40.5	42.0	62.6	75.7	50.2	68.5	na	50.7	45.7
1985	39.4	44.9	55.3	77.7	50.2	76.2	na	57.7	45.3
1986	37.1	45.8	55.3	75.6	50.7	90.8	na	61.4	44.8
1987	40.7	45.7	51.6	68.4	51.2	80.8	na	51.5	44.9
1988	52.2	50.1	54.1	66.6	56.8	76.6	na	53.0	53.2
1989	56.8	57.3	62.6	67.3	69.8	86.3	na	53.1	59.3
1990	51.8	58.8	62.3	70.0	64.8	77.6	na	52.6	56.8
1991	51.5	53.7	62.0	71.7	62.7	76.8	na	54.7	55.2
1992	51.4	53.9	64.6	74.0	62.7	80.3	na	66.7	55.0
1993	51.4	53.0	65.3	74.2	64.2	82.9	na	66.7	56.0
1994	55.1	54.4	65.3	76.4	68.3	85.2	na	64.7	57.4
1995	58.6	52.0	64.6	71.6	66.0	85.0	na	58.7	55.5
1996	61.3	50.6	74.9	66.0	64.6	79.2	na	57.0	58.9
1997	70.3	55.8	75.0	66.1	68.3	72.4	101.5	57.0	64.0
1998	74.3	61.0	84.3	66.8	71.9	73.3	97.2	59.4	70.3
1999	78.0	73.0	79.5	68.0	77.0	78.2	117.2	59.7	75.4
2000	78.7	75.6	93.9	68.7	78.7	77.8	105.7	61.1	79.1
2001	85.6	84.8	86.8	74.4	81.5	74.3	103.5	65.5	85.6
2002	94.1	91.7	88.5	89.0	91.0	77.9	103.8	80.2	94.6
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	109.0
2004	103.8	100.8	124.6	127.5	132.0	151.0	100.0	96.4	112.0
2005	101.5	101.6	126.6	131.6	150.3	163.8	124.6	98.9	114.8
2006	98.4	105.8	132.9	136.4	191.8	166.9	148.3	98.7	121.3
2007	99.3	114.8	148.2	153.2	210.9	176.8	176.6	107.7	130.9
2008	93.4	115.7	153.4	163.1	197.7	169.7	183.2	106.4	129.5
2009	98.0	122.3	155.1	166.8	204.4	181.1	210.2	110.7	134.8
2010	109.7	137.8	159.7	174.4	215.2	187.3	228.7	118.2	145.9
2011	107.3	133.1	151.9	167.0	202.9	182.1	215.5	114.8	140.3
2012	112.3	128.3	151.6	160.6	201.4	176.4	218.8	112.4	139.4
2013	118.0	130.5	153.7	160.8	212.2	174.5	235.1	110.2	143.3
2014	132.1	137.6	158.2	163.7	213.9	168.3	240.1	107.8	150.6
2015	147.7	141.5	159.3	164.3	205.0	174.7	232.2	108.3	155.7
2016	150.3	139.6	154.8	170.1	196.7	178.9	200.6	109.7	154.7
2017	152.7	151.7	146.2	176.0	189.2	186.1	177.6	110.5	157.5
2018	148.9	156.4	140.1	172.1	182.0	207.1	160.3	109.3	155.9
2019	142.8	153.7	141.2	176.2	172.1	223.3	142.2	112.3	153.0
2020	146.7	161.0	141.8	184.5	169.8	239.3	134.7	116.3	157.3
2021	154.0	170.3	150.8	189.5	182.8	292.2	167.7	130.2	167.2
2022	143.1	158.5	157.8	199.3	168.9	303.4	174.0	135.0	161.4

(a) Based on weights for city populations.
Source: Table A.6.

Table A.8 Median Housing Prices, Rest of States (1985-2022): Nominal price indices: 2003=100

Year	NSW Houses	NSW Units	Victoria Houses	Victoria Units	Queensland Houses	SA Houses	SA Units	WA Houses	Tasmania Houses	CPI
1985	25.7		28.2	34.2		35.9	41.1	25.7	33.6	49.7
1986	24.7		31.3	37.9	31.4	38.4	48.0	25.9	38.8	54.2
1987	26.2		33.9	39.9	32.9	38.2	51.4	28.5	39.1	58.8
1988	30.0		37.8	43.2	37.1	41.9	47.3	30.9	42.0	63.0
1989	35.3		43.5	49.2	45.7	43.2	47.7	36.4	45.6	67.79
1990	39.4		45.2	52.2	50.3	46.5	51.1	38.0	50.7	72.72
1991	42.4		45.2	53.2	54.2	48.9	57.3	40.4	52.3	75.07
1992	43.9		46.3	53.7	58.0	50.1	56.9	41.2	56.1	75.81
1993	43.6		47.1	53.2	64.0	53.6	58.4	44.1	58.4	77.18
1994	46.2		48.6	54.8	68.6	57.2	62.2	49.1	62.5	78.64
1995	48.2		48.0	55.2	72.6	59.9	59.8	55.3	65.6	82.29
1996	49.9		48.3	54.5	72.6	60.2	64.7	60.5	66.4	84.44
1997	52.5		49.7	53.2	73.1	61.9	65.8	66.1	71.7	84.65
1998	56.6		51.4	55.2	76.6	63.0	66.2	68.3	72.5	85.37
1999	62.3		56.5	58.9	77.1	66.4	67.0	73.0	72.4	86.63
2000	60.3		59.3	64.2	80.0	67.2	71.4	72.7	69.0	90.50
2001	62.2		68.3	69.8	78.9	73.1	70.4	73.4	67.7	94.47
2002	76.8		81.3	81.3	86.3	86.7	84.9	85.5	74.3	97.30
2003	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	108.3	108.1	108.7	106.1	119.2	111.0	109.9	114.3	120.8	102.3
2005	112.0	109.2	117.0	116.1	139.9	123.0	157.4	148.9	138.0	105.0
2006	115.0	113.2	124.1	118.3	157.9	133.8	172.8	201.2	148.7	108.6
2007	120.4	114.0	130.0	123.6	182.6	147.3	192.2	231.5	166.5	110.9
2008	119.5	114.3	132.1	126.1	185.3	157.1	221.8	226.2	175.8	115.3
2009	124.4	117.3	138.4	133.5	188.8	163.5	214.2	232.3	183.9	117.0
2010	135.4	124.1	155.9	144.7	195.3	177.9	226.6	240.7	196.6	120.0
2011	134.6	120.7	161.4	148.3	191.0	172.3	225.3	233.5	191.8	123.3
2012	138.0	122.8	161.2	146.2	188.4	169.1	205.1	233.0	188.9	125.0
2013	142.6	126.5	164.3	145.4	193.6	164.1	216.1	234.6	190.0	127.5
2014	147.2	134.6	159.8	150.0	195.9	167.5	221.1	230.7	189.0	129.9
2015	160.0	144.1	166.1	155.5	205.9	169.6	229.6	219.9	194.9	131.4
2016	170.8	152.6	172.7	161.6	214.4	174.7	236.4	210.4	198.0	132.7
2017	183.8	167.2	185.3	165.8	221.9	177.2	216.2	207.1	207.4	134.6
2018	189.1	170.5	198.8	179.5	218.5	181.3	230.1	199.0	226.6	136.6
2019	189.8	173.3	208.4	186.0	219.3	182.5	225.1	200.3	242.1	138.2
2020	203.4	195.5	230.6	227.5	220.3	186.6	235.9	217.4	265.9	139.0
2021	284.6	270.4	326.2	313.3	243.3	213.9	293.4	253.5	334.0	141.9
2022	310.1	274.3	345.8	305.5	267.5	237.7	292.5	259.3	390.7	148.0

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-2022 data, ABS Cat. 6432, *Total Value of Dwellings*, Table 2.

Table A.9 Median Housing Prices, Rest of States (1985-2022): Real price indices: 2003=100

Year	NSW Houses	NSW Units	Victoria Houses	Victoria Units	Queensland Houses	SA Houses	SA Units	WA Houses	Tasmania Houses
1985	51.7		56.8	69.0		72.4	82.8	51.7	67.7
1986	45.6		57.8	70.0	58.0	71.0	88.6	47.8	71.6
1987	44.6		57.6	67.8	55.9	65.0	87.4	48.6	66.5
1988	47.6		60.0	68.6	58.9	66.5	75.0	49.0	66.6
1989	52.0		64.1	72.6	67.4	63.8	70.3	53.6	67.3
1990	54.1		62.1	71.8	69.1	63.9	70.2	52.2	69.7
1991	56.5		60.2	70.9	72.2	65.1	76.3	53.9	69.7
1992	58.0		61.1	70.9	76.5	66.1	75.1	54.4	74.0
1993	56.5		61.1	68.9	82.9	69.5	75.7	57.1	75.7
1994	58.8		61.7	69.6	87.2	72.7	79.1	62.4	79.5
1995	58.5		58.3	67.1	88.2	72.7	72.7	67.2	79.7
1996	59.0		57.2	64.6	85.9	71.3	76.7	71.7	78.6
1997	62.0		58.7	62.8	86.4	73.1	77.8	78.0	84.7
1998	66.3		60.2	64.6	89.7	73.8	77.5	80.0	84.9
1999	71.9		65.2	67.9	89.0	76.7	77.3	84.3	83.6
2000	66.6		65.5	71.0	88.4	74.3	78.9	80.3	76.3
2001	65.8		72.3	73.9	83.5	77.4	74.6	77.7	71.6
2002	78.9		83.5	83.5	88.7	89.1	87.2	87.9	76.3
2003[a]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2004	105.8	105.6	106.3	103.7	116.4	108.5	107.4	111.7	118.0
2005	106.6	104.0	111.4	110.6	133.2	117.1	149.9	141.8	131.4
2006	105.9	104.3	114.3	109.0	145.5	123.2	159.2	185.3	137.0
2007	108.6	102.8	117.2	111.5	164.6	132.8	173.4	208.7	150.1
2008	103.7	99.2	114.6	109.4	160.8	136.3	192.4	196.3	152.6
2009	106.3	100.2	118.3	114.0	161.3	139.7	183.1	198.5	157.2
2010	112.9	103.4	130.0	120.6	162.8	148.3	189.0	200.7	163.9
2011	109.2	98.0	130.9	120.3	155.0	139.8	182.8	189.4	155.6
2012	110.4	98.2	129.0	117.0	150.7	135.3	164.1	186.4	151.1
2013	111.9	99.3	128.9	114.1	151.9	128.7	169.6	184.1	149.1
2014	113.3	103.6	123.0	115.5	150.8	128.9	170.2	177.6	145.5
2015	121.7	109.6	126.4	118.3	156.7	129.1	174.7	167.3	148.3
2016	128.7	115.0	130.1	121.8	161.6	131.6	178.1	158.5	149.2
2017	136.5	124.2	137.7	123.2	164.8	131.6	160.6	153.8	154.1
2018	138.5	124.9	145.6	131.5	160.0	132.7	168.5	145.7	166.0
2019	137.4	125.4	150.9	134.6	158.7	132.1	163.0	145.0	175.3
2020	146.3	140.6	165.9	163.7	158.5	134.2	169.7	156.4	191.3
2021	200.6	190.6	229.9	220.8	171.5	150.8	206.8	178.7	235.4
2022	209.5	185.3	233.6	206.4	180.7	160.5	197.6	175.1	263.9

(a) Treasury index based on average 2003 = 100.

Sources: 1980-2003 data, Abelson and Chung, 2005; 2003-2022 data, ABS Cat. 6432, *Total Value of Dwellings*, Table 2.

Appendix B: Real National Housing Price Indices for Cities

Table B.1 shows the Dallas quarterly real national house price index for the capital cities from 1980 to end quarter 2022. This index is estimated by the Globalization Institute of the Federal Reserve Bank of Dallas which produces an international house price database. This index is based on Australian Treasury house price data from 1980 to 2003 and on ABS data post 2003.

Dallas computes the real values using the personal consumption expenditure deflator, whereas the deflator used in Appendix A above is the CPI. In Table B.1, 100 represents prices in the first quarter of 1983, when prices were rising rapidly, rather than an annual average for 1983 as in the tables in Appendix A**.** This means that, post 2003, the real index numbers in Table B.1 are slightly higher than those in the corresponding Table A.5.

We do not have national price indices for dwellings outside the capital cities. But observing the real price indices for the cities and the rest of the states shown in Appendix A, changes in dwelling prices in the rest of the states have broadly reflected the changes in the capital cities.

Table B.2 shows expenditure on alterations and additions (A&A, valued at $10,000 or more) as a percentage of the estimated national value of housing in current dollar values. The results are sensitive to the accuracy of the data on A&A and the total value of housing. ABS data for A&A includes only reported expenditures of $10,000 or more. And the estimates stop in 2019-20. On the other hand, the ABS produces estimates of the total value of housing only from 2012 to the present.

Author estimates of the value of the housing stock for the earlier years are based on average house values. There is a significant jump in value with the ABS estimates in 2012. A possible reason for the difference is the inclusion of the high-prices private housing in the ABS housing stock valuations.

The data in Table B.2 suggests that expenditure on reported expenditures over $10,000 on alterations and additions between 1980 and 2005 was around 1% of total housing value. In the last decade, reported expenditure on alterations and additions over $10,000 has been closer to 0.6% of the estimated total housing value.[18] Section 3 in the paper discusses these issues in more detail.

[18] These findings are based on data from ABS 5206.0, *Australian National Accounts: National Income, Expenditure and Product,* Table 3. ABS 8752.0, *Building Activity, Australia, Table 75*, suggests much higher expenditure on alterations and additions including conversions.

Table B.1 Capital Cities: Dallas Real National House Price Index: March 2003 = 100

Mar-80	46.5	Mar-90	64.1	Mar-00	74.2	Mar-10	141.1	Mar-20	164.7
Jun-80	47.8	Jun-90	63.4	Jun-00	75.2	Jun-10	142.8	Jun-20	164.2
Sep-80	48.2	Sep-90	62.5	Sep-00	73.6	Sep-10	141.6	Sep-20	169.2
Dec-80	47.7	Dec-90	61.3	Dec-00	74.9	Dec-10	141.6	Dec-20	176.4
Mar-81	50.3	Mar-91	61.2	Mar-01	75.9	Mar-11	138.7	Mar-21	185.3
Jun-81	50.9	Jun-91	61.7	Jun-01	77.9	Jun-11	136.2	Jun-21	192.9
Sep-81	49.1	Sep-91	63.1	Sep-01	82.1	Sep-11	133.5	Sep-21	205.9
Dec-81	49.9	Dec-91	62.4	Dec-01	84.1	Dec-11	131.7	Dec-21	215.2
Mar-82	48.4	Mar-92	61.8	Mar-02	87.6	Mar-12	131.7	Mar-22	215.3
Jun-82	48.5	Jun-92	61.9	Jun-02	92.2	Jun-12	130.6	Jun-22	215.5
Sep-82	46.3	Sep-92	61.8	Sep-02	95.5	Sep-12	129.1	Sep-22	200.6
Dec-82	45.2	Dec-92	61.9	Dec-02	98.1	Dec-12	130.8	Dec-22	190.8
Mar-83	45.2	Mar-93	62.2	Mar-03	100.0	Mar-13	131.6	Mar-23	NA
Jun-83	45.9	Jun-93	62.1	Jun-03	105.3	Jun-13	132.7		
Sep-83	45.3	Sep-93	62.3	Sep-03	111.6	Sep-13	134.1		
Dec-83	45.7	Dec-93	62.5	Dec-03	115.3	Dec-13	137.4		
Mar-84	47.0	Mar-94	62.8	Mar-04	114.6	Mar-14	138.5		
Jun-84	47.7	Jun-94	63.4	Jun-04	112.8	Jun-14	139.9		
Sep-84	49.3	Sep-94	64.3	Sep-04	113.0	Sep-14	141.9		
Dec-84	48.3	Dec-94	63.5	Dec-04	114.0	Dec-14	144.9		
Mar-85	50.2	Mar-95	63.7	Mar-05	113.1	Mar-15	147.2		
Jun-85	49.4	Jun-95	62.5	Jun-05	112.8	Jun-15	151.5		
Sep-85	49.4	Sep-95	62.4	Sep-05	112.1	Sep-15	154.4		
Dec-85	49.8	Dec-95	61.8	Dec-05	113.4	Dec-15	153.6		
Mar-86	49.6	Mar-96	61.3	Mar-06	113.7	Mar-16	153.4		
Jun-86	50.6	Jun-96	61.7	Jun-06	116.5	Jun-16	155.2		
Sep-86	49.7	Sep-96	62.1	Sep-06	118.9	Sep-16	157.6		
Dec-86	49.1	Dec-96	61.7	Dec-06	120.4	Dec-16	162.4		
Mar-87	48.8	Mar-97	62.1	Mar-07	121.0	Mar-17	165.3		
Jun-87	48.5	Jun-97	62.7	Jun-07	124.3	Jun-17	167.8		
Sep-87	48.6	Sep-97	63.9	Sep-07	128.9	Sep-17	167.7		
Dec-87	50.1	Dec-97	64.7	Dec-07	132.8	Dec-17	169.6		
Mar-88	51.5	Mar-98	66.0	Mar-08	132.5	Mar-18	168.4		
Jun-88	53.2	Jun-98	67.0	Jun-08	130.2	Jun-18	166.1		
Sep-88	57.5	Sep-98	67.2	Sep-08	126.3	Sep-18	163.7		
Dec-88	62.3	Dec-98	68.2	Dec-08	123.4	Dec-18	160.1		
Mar-89	66.6	Mar-99	69.3	Mar-09	121.8	Mar-19	155.9		
Jun-89	66.2	Jun-99	70.2	Jun-09	126.1	Jun-19	155.6		
Sep-89	65.5	Sep-99	71.6	Sep-09	131.4	Sep-19	160.3		
Dec-89	64.6	Dec-99	73.4	Dec-09	137.1	Dec-19	163.7		

Source: Globalization Institute of the Federal Reserve Bank of Dallas.

Table B.2 Quality Changes: Alterations and Additions as Percentage of Value of Housing Stock

Year	Dwelling stock (June) (no. '000.) [a]	Average value June ($) [b]	Estimated value of housing stock June ($bn) [c]	Exp. on alterations and additions (FY) ($bn) [d]	A & A Expenditure % of housing stock value [e]
1980	5,007	43,739	219	2.4	1.1
1981	5,124	49,766	255	3.0	1.2
1982	5,261	53,222	280	3.4	1.2
1983	5,375	56,372	303	3.3	1.1
1984	5,497	62,943	346	3.6	1.0
1985	5,637	69,363	391	4.2	1.1
1986	5,776	73,753	426	4.8	1.1
1987	5,886	80,530	474	4.9	1.0
1988	5,991	100,818	604	5.3	0.9
1989	6,128	119,778	734	6.3	0.9
1990	6,274	122,251	767	7.4	1.0
1991	6,394	121,207	775	7.5	1.0
1992	6,524	123,697	807	7.5	0.9
1993	6,678	127,583	852	8.3	1.0
1994	6,844	131,502	900	9.2	1.0
1995	7,012	131,774	924	10.3	1.1
1996	7,146	134,761	963	10.2	1.1
1997	7.254	143,783	1,043	10.2	1.0
1998	7,272	155,391	1,130	11.7	1.0
1999	7,500	165,733	1,243	12.7	1.0
2000	7,641	176,417	1,348	15.2	1.1
2001	7,760	197,809	1,535	14.3	0.9
2002	7,872	231,199	1,820	18.8	1.0
2003	8,000	257,750	2,062	21.8	1.1
2004	8,132	284,736	2,315	24.6	1.1
2005	8,266	295,498	2,443	24.8	1.0
2006	8,393	321,303	2,697	24.0	0.9
2007	8,531	351,544	2,999	25.0	0.8
2008	8,662	358,360	3,104	26.7	0.9
2009	8,797	375,101	3,300	26.1	0.8
2010	8,932	426,779	3,812	28.2	0.7
2011	9,079	411,823	3,739	30.2	0.8
2012	9,097		4,457	27.8	0.6
2013	9,227		4,688	28.3	0.6
2014	9,367		5,128	31.6	0.6
2015	9,562		5,738	34.0	0.6
2016	9,823		6,055	35.4	0.6
2017	10,022		6,771	35.9	0.5
2018	10,266		6,921	38.3	0.6
2019	10,406		6,720		
2020	10,575		7,251		
2021	10,732		8,808		
2022	10,879		10,405		

Sources: (a) Dwelling stock, 1980-2011, estimated using depreciation rate and actual stock data from census every five years. Data 2012-22, ABS 5204.0. (b) 1980-2002, Abelson and Chung (2005); 2003-2011 Dallas index + CPI. (c) 1980-2011, dwelling stock * estimated average value. 2012- 2022, ABS 5204.0. (d) FY means 1980 = 1979-80. 1980-2003 figures from Abelson and Chung (2005). 2004-2020 data from ABS 5206.0, *Australian National Accounts: National Income, Expenditure and Product,* Table 3. (e) Estimated from columns 3 and 4.

Appendix C: Housing Rents in Australia

Table C.1 shows annual real national housing rent indices, *based on the average of the four quarters*, from 1980 to 2022 drawn from the quarterly rent component of the ABS national consumer price index (CPI).

As standard ABS practice in estimating the CPI, these rental prices are based on constant quality housing and do not allow for changes in housing quality.

Table C.1 National Rents: Nominal and Real Rent Indices: 2003 = 100

Year	Nominal rent index	CPI	Real rent index	Year	Nominal rent index	CPI	Real rent index
1980	31.1	33.4	93.0	**2001**	95.8	94.5	101.3
1981	33.6	36.6	91.7	**2002**	98.1	97.3	100.9
1982	37.5	40.7	92.2	**2003**	100.0	100.0	100.0
1983	40.9	44.8	91.2	**2004**	102.5	102.3	100.2
1984	43.9	46.5	94.3	**2005**	104.8	105.0	99.8
1985	47.6	49.7	95.8	**2006**	108.2	108.6	99.6
1986	52.5	54.2	96.8	**2007**	114.1	110.9	102.9
1987	57.9	58.8	98.5	**2008**	123.0	115.3	106.7
1988	64.5	63.0	102.4	**2009**	131.2	117.0	112.1
1989	70.6	67.8	104.2	**2010**	136.9	120.0	114.1
1990	74.8	72.7	102.9	**2011**	143.2	123.3	116.1
1991	77.3	75.1	102.9	**2012**	149.1	125.0	119.3
1992	78.0	75.8	102.9	**2013**	154.0	127.5	120.8
1993	78.4	77.2	101.5	**2014**	157.9	129.9	121.6
1994	78.9	78.6	100.4	**2015**	160.5	131.4	122.2
1995	80.3	82.3	97.6	**2016**	161.7	132.7	121.9
1996	82.7	84.4	98.0	**2017**	162.7	134.6	120.9
1997	85.2	84.6	100.7	**2018**	163.8	136.6	119.9
1998	87.8	85.4	102.8	**2019**	164.4	138.2	119.0
1999	90.1	86.6	104.0	**2020**	162.9	139.0	117.2
2000	92.9	90.5	102.6	**2021**	162.6	141.9	114.6
				2022	165.4	148.0	111.8

Source: ABS CPI Data.

Appendix D: Key Housing Related Variables

In this Appendix, we provide data on the key demand and supply variables driving house prices along with some related data on key issues.

Table D.1 shows the major demand variables: population, real household disposable income per capita (RHDIPC) and housing mortgage rates (MR). ABS population numbers include temporary residents but not short-term visitors. Temporary resident numbers are shown below in Table D.3.

There are often several MRs depending on lender competition and buyer credit standing. The data in Table D.1 are sourced from the RBA. The annual figures are averaged over the 4 quarters. The discounts are estimated only from the June quarter 2004. Some advertised borrowing rates are lower still than these discounted MRs. So, these numbers are guides to the changes that have occurred. For the purposes of modelling of house prices, RBA quarterly rates are used.

Table D.1 Major Housing Demand Variables 1980-2023

Year	Population[a]	Pop'n (Index)	RHDIPC[b] ($'000)	RHDIPC (index)	MR (nominal)[c]	MR (real)[d]
1980	14,692,200	77.2	6,914	78.7	10.19	0.06
1985	15,788,312	83.0	7,190	81.8	12.50	5.78
1990	17,065,128	89.7	7,595	86.4	16.19	8.84
1995	18,004,882	94.6	7,797	88.7	10.50	5.90
2000	19,028,802	100.0	8,789	100.0	7.80	3.35
2005	20,176,844	106.0	10,187	115.9	6.75	4.05
2010	22,031,750	115.8	11,703	133.2	6.73	3.80
2011	22,390,938	117.4	12,122	137.9	6.93	3.63
2012	22,784,088	119.5	12,019	136.8	6.15	4.40
2013	23,172,285	121.5	12,065	137.3	5.29	2.84
2014	23,521,278	123.4	12,306	140.0	5.08	2.61
2015	23,862,619	125.2	12,362	140.6	4.75	3.25
2016	24,244,527	127.1	12,332	140.3	4.61	3.34
2017	24,640,055	129.2	12,361	140.6	4.50	2.57
2018	25,018,244	131.2	12,485	142.1	4.57	2.65
2019	25,395,190	133.2	12,591	143.3	4.39	2.79
2020	25,641,989	134.8	13,198	150.2	3.72	2.84
2021	25,703,639	135.0	13,467	153.2	3.54	0.69
2022	25,978,935	136.5	13,182	150.0	4.83	-1.75
2022 (1)	25,890,773	136.1	13,480	153.4	3.45	-1.65
2022 (2)	25,978,935	136.5	13,311	151.4	4.20	-1.90
2022 (3)	26,124,814	137.3	13,162	149.8	5.70	-1.60
2022 (4)	26,418,196	138.6	12,775	145.4	5.97	-1.83
2023 (1)	26,637,826	139.8			6.43	-0.57

Sources: (a) Population – June quarter. ABS 3101.0, *National State and Territory Population*. (b) ABS 5206.0, *Australian National Accounts*, Table 20, Household Income Account. (c) RBA Statistical Table F5. (d) The nominal rate for the period less inflation.

Table D.2 shows the national dwelling stock along with a dwelling stock index (2000 = 100) and population per dwelling units from 1980 to 2022, with annual changes shown from 2010.

Annual net additions (new completions less removals) to the dwelling stock varied from a low of 1.4% in 2012 to a high of 1.9% in 2017 and 2018. Removals are typically around 25,000 a year. The total includes public housing, which as shown below, has declined in numbers significantly since 2004. The

decline in the population per dwelling over time indicates that the dwelling stock has risen by slightly more than population both pre- and post-2000. But, of course, 2021 and 2022 saw low population increases.

Up to 2016, dwelling stock numbers are calculated using ABS dwelling completions (8752.0 Building Activity, Australia, Table 37) and the depreciation rate calculated by the authors using actual stock data from census every five years. From second quarter 2016 to second quarter 2022, data are from ABS 8701.0, *Estimated dwelling stock* Table 01. 1.

Table D.2 National Housing Stock 1980-2023

Year	Dwellings (no)[a]	Dwellings index	Population / dwellings	Net Additions to stock (no)	Net additions / dwellings (%)
1980	5,023,253	65.6	2.93		
1985	5,657,213	73.9	2.80		
1990	6,289,317	82.1	2.72		
1995	7,030,646	91.8	2.57		
2000	7,656,433	100.0	2.49		
2005	8,283,991	108.2	2.44		
2010	8,951,506	116.9	2.47		
2011	9,098,121	118.8	2.46	146,615	1.6
2012	9,229,880	120.6	2.47	131,759	1.4
2013	9,364,271	122.3	2.47	134,391	1.5
2014	9,514,378	124.3	2.47	150,107	1.6
2015	9,690,030	126.6	2.46	175,652	1.8
2016	9,856,420	128.7	2.46	166,390	1.7
2017	10,047,642	131.2	2.45	191,222	1.9
2018	10,240,167	133.7	2.44	192,525	1.9
2019	10,427,990	136.2	2.44	187,823	1.8
2020	10,594,563	138.4	2.42	166,573	1.6
2021	10,751,218	140.4	2.39	156,655	1.5
2022	Na				
2022 (1)	10,840,814	141.6	2.39	37,036	
2022 (2)	10,879,349	142.1	2.39	45,522	

Source: (a) ABS, 8701.0, *Estimated Dwelling Stock.* The year numbers are the average for year. This is slightly different to the estimated June figures in Appendix B.

Table D.3 provides further insights into the historical composition of dwellings and occupation rates provided in the five yearly census. Houses include semi-detached dwellings and town houses. Other dwellings include caravans and other informal living. The dwelling numbers are slightly different to those in Tables D.2 and D.3. The ABS, 8701.0, *Estimated Dwelling Stock,* classifies buildings according to their functional use. The Census classifies buildings according to their dwelling structure.

A key takeaway from these data is that apartments (units) have risen from 12% of total dwelling stock in 1991 to nearly 16% in June 2022. This would have a marginal downward impact on the average price of the total dwelling stock. As previously noted, occupancy rates have fallen over this same period by around 10% from 2.8 persons per dwelling to 2.5 per dwelling. This is a higher number than persons per dwelling as some dwellings are not occupied.

Table D.3 Dwelling Types and Occupancies 1981 to 2021 (June)

	1981	1991	2001	2011	2016	2021
Total dwellings						
Houses		5,455,270	6,525,677		8,414,627	9,002,499
Apartments		784,883	1,048,800		1,391,051	1,692,565
Other			212,921		64,425	157,153
Total		6,240,153	7,787,398	8,687,922[a]	9,870,103	10,852,517
Occupied dwellings (no)						
Apart (%) exc. Other		12.0	13.5		14.1	15.8
Houses	3,859,293	4,983,000	5,959,485	6,630,553	7,096,804	7,879,442
Apartments	676,465	685,900	923,139	1,056,236	1,087,434	1,319,095
Other[b]		242,300	189,578	66,662	64,425	54,711
Total	4,668,909	5,935,000	7,072,202	7,753,451	8,248,663	9,253,248
Persons / Dwelling		2.8	2.6	2.6	2.6	2.5
Unoccupied Private Dwellings (no)						
Total			687,945	934,471	1,039,874	1,043,776
Unoccupied Dwellings (%)						
Total			9.2	10.7	11.2	10.1

Sources: Census data.

(a) 2011 excludes "visitor only dwellings, other not classifiable dwellings and non-private dwellings.

(b) Includes not stated.

Finally, we observe that unoccupied dwellings were 9.2% of all dwellings in 2001, before rising to 11.2% of all dwellings in 2018 and then falling slightly to 10.1% of all dwellings in 2021. Of course, some vacancies on Census nights may be temporary vacancies while the usual residents are travelling, and they may not be long-term vacancies.

Table D.4 (next page) shows other data including net migration, housing transfers and the proportion of households in public housing. Data are provided at five-year intervals from 1980 to 2010, followed by annual data to 2021 and quarterly data from March 2022 where they are available.

Migration statistics include temporary visa holders (with a high proportion being students) permanent visa holders, Australian citizens, NZ citizens and a very small number of unknowns.

Of the immigrants, about 2/3 were usually temporary visa holders, with a large proportion being students. On the other hand, about a half of the out-migrants were also temporary visa holders.

Immigrants are counted as residents (and included in the population numbers) if they live, or plan to live, in Australia for 12 months or more over a 16-month period. As of June 2022, there were 1,926,337 people with temporary visas in Australia.

In the 2010's, around 500,000 persons per annum were in-migrants and 265,000 out-migrants. Thus, pre-pandemic migrant net intake gain was around 235,000 per year. The Covid pandemic caused a net loss of 85,000 in 2020-21. Australia's net overseas migration is expected to be 400,000 in 2022-23 and 315,000 in 2023-24. Thus, net immigration has risen from around a half of the population increase in the 2000's to around three-quarters in the 2020's.

Table D.4 Other Relevant Housing Price Data

Year	Net migration ('000)[a]	Net migrants as % of population growth	Housing transfers (no.)b	Transfers % of stock[c]	Public housing (no)[d]	Households in public housing (%)
1980					228,938[c]	
1985	89.4	40.0				
1990	97.2	41.7				
1995	106.8	47.2			326,928[c]	6.0
2000	111.4	50.2			317,171[c]	5.8
2005	137.0	51.6	480,607	5.81	343,301	4.7
2010	172.1	56.1	434,865	5.18	333,383	3.9
2011	206.2	59.0	397,086	4.65	331,371	
2012	240.2	59.2	403,675	4.66	330,906	3.9
2013	208.4	56.4	469,584	5.34	328,340	3.6
2014	182.4	53.2	511,653	5.73	323,803	
2015	186.8	54.2	521,214	5.74	321,627	
2016	243.9	60.8	471,267	5.12	320,041	3.5
2017	241.6	64.3	478,410	5.12	319,913	
2018	252.2	64.8	432,340	4.56	316,231	3.1
2019	247.6	65.8	434,412	4.49	305,191	2.9
2020	-5.0	-4.5	469,593	4.78	300,403	
2021	5.9	4.4	633,622	6.32	299,520	
2022			500,707	4.90		
2022 (1)	96.0	78.3	140,372	1.37		
2022 (2)	63.8	67.9	135,579	1.32		
2022 (3)	106.2	82.5	123,914	1.20		
2022 (4)			100,842	0.97		

Sources: (a) Net overseas migration - Australia – historical. ABS 3101.0, *National, state and territory population*, Table 1.
(b) ABS 6432.0, *Total Value of Dwellings*, Table 2.
(c) Housing Assistance in Australia (AIHW) 29 June 2022 https://www.aihw.gov.au/reports/housing-assistance/housing-assistance-in-australia/contents/social-housing-dwellings#Dwellings_man and Housing Assistance in Australia (AIHW) 2008, 2010, 2011, and 2013.
(d) 1980, 1995 and 2000 show the Census data for public housing in 1981, 1996, 2001 respectively.

Table D.4 also shows annual property transfers (sales) as a proportion of dwellings. These are typically around 5% of the dwelling stock indicating that owners on average own their properties for around 20 years. Arguably, dwelling prices will tend to be below their (demand and supply) equilibrium price when there are a large number of sales and above the equilibrium price when there are few sellers.

As shown in Table D.4, there has been a significant fall in the amount of public housing since 2005. Much of this decline has been in NSW where public housing fell from 121, 634 dwellings in 2005 to 96,728 in 2021. And the proportion of households living in public housing in Australia fell from 6% in the 1990s to under 3% by 2019.

This decline has been mitigated partially, but far from completely, by the growth in community run homes. The 2001 Census reported 44,301 community homes. To-day the Community Housing Industry

Association website reports that, in 2022, its members were managing over 118,000 community homes nationally with subsidised rents.

Turning finally to foreign demand for residential dwellings in Australia. Between 2001 and 2014, official foreign purchases of rose from about 1,500 to 6,000 dwellings (Gauder et.al., 2014).[19] However, in 2015, new regulations were introduced under the *Foreign Acquisitions and Takeovers Regulation* 2015 (Cth) and the *Foreign Acquisitions and Takeovers Fees Imposition Act* 2015 (Cth) which significantly reduced foreign purchases.

In 2017-18, the Foreign Investment Review Board approved $12.5 billion of foreign investment in residential real estate, equating to around four percent of total residential real estate sales. This represented a 58% decline compared to 2016-17. The share of sales to foreign buyers in both the new and established residential property markets reached a seven-year low in 2018 Q3, with eight percent and four percent market share respectively.

Also, foreign interests sell residential property. FIRB / ABS reports that, in 2020-21, 5,310 residential real estate purchase transactions had a level of foreign ownership, with a total value of $4.2 billion. On the other hand, there were 3,103 residential sales by foreign persons in this year, with a total value of $2.7 billion. Therefore, the net purchases amounted to 2,207 dwellings with a net value of $1.5bn. Of course, 2020-21 was a major covid year and not typical. Foreign real estate investment appears to be on the rise again with $7.6bn spent in 2021-2022 compared to $5.7bn in 2020-2021 (RealEstate.com, 2023). But, overall, it appears that formal foreign investment, as distinct from net immigration, is not a major mover of the Australia housing market. However, there is likely strong informal foreign investment in Sydney and Melbourne.

[19] Gauder, M., Houssard. C, and D. Orsmond, 2014, "Foreign Investment in Residential Real Estate", *RBA Bulletin*, June Quarter.

Appendix E: Models of House Prices in Abelson, Joyeux et al, 2005

Appendix E provides the full results of our long-run equilibrium model of real house prices in Australia from 1970 to 2003 and our asymmetric error correction short-run model of house prices, as reported in Abelson, Joyeux et al. (2005). Separate models were run for 1970 to 2003 and 1975 to 2003 as there was concern about the reliability of the data from 1970 to 1975.

The long-run model is:

$$log(P_t)=\gamma_1+\gamma_2 log(Allords_t)+\gamma_3 MR_t+\gamma_4 log(HDI_t)+\gamma_5 log(ER_t)+\gamma_6 log(UE_t)+\gamma_7 log(CPI_t)+\gamma_8 log(HS_t)+u_t \quad \text{(E.1)}$$

where P_t is real house prices, MR_t is the real mortgage interest rate (quarterly yield), $Allords_t$ is the real All Ordinaries index, HDI_t is real household disposable income per capita, ER_t is the trade weighted exchange rate, CPI_t is the consumer price index, UE_t is the unemployment rate, HS_t is the housing stock per capita, and u_t is a stationary error term. The real All Ordinaries index is included to capture a possible substitution effect with the stock market. The exchange rate is included as this could influence overseas demand for Australian real estate. The consumer price index is included to capture the after-tax investment advantages of housing in conditions of rising prices. The unemployment rate is included as a barometer of economic conditions and is expected to influence the price of houses negatively.

Table E.1 shows the results.

Table E.1 Stock-Watson DOLS long run coefficients[a] : Dependent variable log(P_t)

Variable	1970q2-2003q1 Estimated Coefficient (SE)	1975q1-2003q1 Estimated Coefficients (SE)
Constant	-5.0415* (2.6898)	-5.5212 (3.3698)
log(Allords)	-0.0804 (0.0528)	-0.1421** (0.0690)
R	-0.0424 (0.0263)	-0.0542* (0.0318)
log(HDI)	1.4051** (0.3547)	1.7097** (0.3619)
log(ER)	0.0254 (0.1132)	-0.0034 (0.1051)
log(UE)	-0.2558** (0.0528)	-0.1895** (0.0582)
log(CPI)	0.7172** (0.1738)	0.7632** (0.2113)
log(HS)	-3.3364** (1.5639)	-3.5980* (1.8836)
R^2 adjusted	0.9616	0.9565

[a] ** and * indicate 5 per cent and 10 per cent significance level respectively.
Standard errors are the Newey-West standard errors computed with 3 lags.

To estimate the short run parameters, the asymmetric error correction price equation is:

$$\Delta \log(P_t) = b_0 + \alpha_1 I_{t-1}(\log(P_{t-1}) - \hat{\theta} x_{t-1}) + \alpha_2 (1 - I_{t-1})(\log(P_{t-1}) - \hat{\theta} x_{t-1}) + \sum_{j=1}^{k} b_j \Delta z_{t-j} + \varepsilon_t \quad \text{(E.2)}$$

where $\hat{\theta}$ is the estimated DOLS cointegrating vector and I_t is the Heaviside indicator function which defines "boom" observations as observations for which the real price growth over the past year has been over 2 per cent. This represented the average annual value of improvements plus selling costs.

$I_t = 1$ if $log(P_t)-log(P_{t-4}) > 0.02$

$I_t = 0$ otherwise

The only exceptions are observations 2000q3, 2003q4 and 2001q1 which would be classified as "non-boom" observations due to the introduction of the GST in 2000q3. To redress this distortion, those observations were classified as "boom" observations.

The existence of cointegration between some variables implies that those variables move together through time, tracing a long-run path from which they are disturbed by temporary shocks but to which they continually readjust. The coefficients on the lagged error correction terms represent the proportion by which the long-term disequilibrium in the log of real house prices is being corrected in each period. In our model we posit that those speeds of adjustment are different in boom and non-boom years. The results are presented in Table E.2

Table E.2 Asymmetric error correction model of real house prices[a]

Variable	**1970q2-2003q1 Estimated Coefficient (SE)**	**1975q1-2003q1 Estimated Coefficient (SE)**
α_1	-0.1446**	-0.2100**
	(0.0492)	(0.0503)
α_2	-0.1402*	-0.1396*
	(0.0573)	(0.0575)
R^2 adjusted	0.2958	0.3971
Serial correlation		
B-P-L1 $\chi^2(1)$	0.0069	0.0467
B-P-L2 $\chi^2(2)$	0.1043	0.0806
B-P-L4 $\chi^2(4)$	0.2666	1.7815
Heteroscedasticity $\chi^2(1)$	2.063	0.179
ARCH(1) $\chi^2(1)$	0.629	0.416

[a] ** and * indicate 1 per cent and 5 per cent significance level respectively. B-P-L1, B-P-L2 and B-P-L4 stand for the Box-Pierce-Ljung autocorrelation tests for first, second and fourth order autocorrelation respectively.

The heteroscedasticity test is based on a regression of the squared residuals on a constant and the squared fitted values. According to the diagnostic tests there is no problem of heteroscedasticity, autocorrelation, or ARCH(1) effects for both periods.

For both samples the speeds of adjustment α_1 and α_2 are significant at the 1 per cent and 5 per cent levels respectively (although using the Dickey-Fuller critical values only α_1 is significant at the 5% level). They are both negative indicating adjustment to equilibrium. The speeds of adjustment are not significantly different during boom and outside boom times. Excluding the early 1970's, if an external shock throws the variables out of equilibrium during 'boom' time, and assuming no further shocks, the price adjusts to its long-run equilibrium with about 21 per cent of the adjustment taking place in each quarter. Such an adjustment speed is reasonably fast. Outside 'boom' time the price adjusts to its long-run equilibrium with about 14 per cent of the adjustment taking place per quarter.

Appendix F The Impacts of Covid on the Estimated Results

This Appendix briefly reviews the impacts of Covid 2020-22 on the econometric modelling results with special reference to the impacts of real mortgage rates on the results.

As shown in Table 11 above, between 2003 and 2019, nominal mortgage rates fell from an average annual figure of nearly 7.9% to 4.5%. But, over this period, real mortgage rates fell minimally from 3.4% to 2.8%. And annual changes in real mortgage rate were usually small. On the other hand, real mortgage rates fell dramatically from 2.8% in 2020 to -1.75% in 2022.

We report in Table F.1 the results for the FMOLS model (the model employed in the main text) for the sample of observations from 2003q1 to 2019q4, taking out the Covid period.

Table F.1 FMOLS long run coefficients[a]: Dependent variable log(P_t)

Variable	**2003q1-2019q4** **Estimated Coefficient (SE)**
Constant	-2.2026 (2.3596)
MR	-0.0128 (0.0313)
log(*HDI*)	0.5025 (0.3363)
log(*HS*)	-2.3166** (0.7231)
Log(*UE*)	-0.4129** (0.1336)
R^2 adjusted	0.8524

[a] ** and * indicate 5 per cent and 10 per cent significance level respectively.
Long-run covariance estimate (Pre-whitening with lags = 1, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

As shown, the real mortgage rate is not significant in the 2003 to 2019 period because of the small changes in the real mortgage rate over this period, which mainly reflected minor changes in the inflation rate. As shown in Section 6 above, including the major changes in the real mortgage rate in the Covid period brought out the importance of the real mortgage rate. It also makes it possible to estimate its coefficient more precisely (lower standard error).

To test this result, we also report below the results using Dynamic OLS (DOLS) to estimate the long run coefficients over both the longer and shorter sample period (only 68 observations). DOLS has better small sample properties than FMOLS which requires a first step OLS estimator which is biased.

Table F.2 shows the DOLS long run coefficients for the period 2003q1 to 2022q4. This produces a very significant model (R^2 = 0.95) and a statistically, very significant, result for MR, suggesting that the impact of the real MR on house prices was **twice as high** as was found with the FMOLS model.

However, Table F.3 based on the shorter period from 2003q1 to 2019q4 confirms the results of the FMOLS model that real mortgage rates did not have a significant impact on real house prices over these years because of the small variation in the real MR over this period.

Table F.2 DOLS long run coefficients[a]: Dependent variable log(P_t)

Variable	**2003q1-2022q4 Estimated Coefficient (SE)**
Constant	-2.7799 (1.7375)
MR	-0.0743** (0.0372)
log(*HDI*)	0.58571** (0.2520)
log(*HS*)	-2.0481** (0.5518)
Log(*UE*)	-0.2766** (0.1115)
R^2 adjusted	0.9517

[a] ** and * indicate 5 per cent and 10 per cent significance level respectively. Long-run covariance estimate (Prewhitening with lags = 1, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Table F.3 DOLS long run coefficients[a]: Dependent variable log(P_t)

Variable	**2003q1-2019q4 Estimated Coefficient (SE)**
Constant	-2.8880 (2.4940)
MR	-0.0542 (0.0618)
log(*HDI*)	0.5989* (0.3363)
log(*HS*)	-1.9189** (0.6619)
Log(*UE*)	-0.1956** (0.1369)
R^2 adjusted	0.9167

[a] ** and * indicate 5 per cent and 10 per cent significance level respectively.
Long-run covariance estimate (Prewhitening with lags = 1, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)