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The housing crisis in Sydney and Melbourne – new strategies to fix it

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The housing crisis in Sydney and Melbourne – new strategies to fix it

David McCloskey and Bob Birrell

Executive summary

When Labor came to power in May 2022, housing prices in Sydney and Melbourne were already higher than in almost all other developed world cities. Since May 2022, the crisis has deepened as dwelling and rental prices have continued to rise, along with interest rates, thus generating a serious rental crisis and a slide in the affordability of detached houses, especially in Sydney and Melbourne.

Though much less of a focus for Governments than the rental crisis, the first home owner affordability crisis is nonetheless of huge significance. For younger households wanting family friendly housing and to get a foot on the property ownership ladder their inability to do so is a catastrophe.

As Table 2 indicates, by 2021 the share of households in Sydney headed by a 30-39 year old who were renting had reached 53 percent, and 37 percent for 40-49 year old household heads. (Note that census data also refers to household heads as reference persons.)

Melbourne was trending in a similar direction, though from a lower base. The situation has worsened since 2021 as housing prices have continued to rise.

The result is that, for many of these households, home ownership is a receding dream. It is being replaced by continuing rental. Given how important home ownership is in retirement years, it implies a spectre of financial insecurity in this phase of life.

Federal and State governments have committed massive funds, especially to fix the rental crisis. Yet despite this commitment, building permit approvals for medium and high-density dwellings in Sydney and Melbourne were lower in 2023 than a decade ago (Table 1). They continued to fall in 2024.

How could this be?

The dominant explanation, held by Governments, planners and most expert commentators is that current zoning laws and building approval procedures are restricting development. If they were loosened, so it is argued, much more medium density housing will result in middle suburban areas. Similarly, if constraints on high rise apartment buildings are eased, many more of these projects will start.

According to this dominant perspective, both resident and new migrant demand can be satisfied, notwithstanding the huge increase in the migrant influx in 2022 and 2023. Net overseas migration to Australia was 433,150 in 2022 and 547,267 in 2023. This compares with near 250,000 each year prior to the 2019-2020 Pandemic (which was itself a steep increase from the long-term average from 1950 to 2005 of 88,700)¹. Some 67.5 of this net influx reside in NSW and Victoria (which comprise 57 per cent of Australia's population), the great majority locating in Sydney and Melbourne.

However, irrespective of zoning laws and building approvals, the densifying strategy is not working. We show that in the current setting developers cannot make a profit from providing affordable rental accommodation, either from medium density projects in the middle suburbs (the 'missing middle') or from high-rise inner-city apartment projects. In the case of the 'missing middle', developers can't build such units or town houses because of escalating site costs, mainly due to the high price of the land on which they have to be built.

Site costs continued to escalate because of competition for detached housing not just from aspiring first home owners. The escalation is also from a large cohort of financially strong upgraders who are switching houses in pursuit of the tax-free capital gains flowing from the price escalation of higher end houses. Investors, too, are adding to the demand. In addition, there is a lagged demand for the purchase of detached housing from earlier arrived migrants. This latter source is very important, but has not been recognized in the housing literature.

This competition is occurring at a time when just over half the detached housing stock in Sydney and Melbourne is held by household heads aged 50+ (Table 15). A remarkably small share of these households is exiting or downsizing, thus gumming up the supply of established houses.

In the case of high rise apartments, developers cannot make a profit unless they target the high end of the apartment market.

What to do?

The key goal must be to restore the housing market to equilibrium. The factors contributing to the current crisis have been building up over many years. Therefore, resolving the crisis will take time, and will need investments and policies. These will transform the housing industry from small scale operators to larger companies that can operate with scale and improve productivity, and leverage advanced manufacturing techniques to allow more pre-fabrication.

Solving the crisis will also need an adjustment to the current reliance on interest rates in managing inflation pressures.

We also need to lift the level of thinking on our understanding of how people choose and use housing, in particular, understanding the typical flows that occur through different types of housing stock at different life stages. When a housing market is in equilibrium this can help planners to identify 'stuck' market sectors and to shape policies to improve normal flow.

In the short term, the only realistic strategy likely to soften the rental crisis is a slowdown in the immigration influx. This is because recently arrived migrants are the main source of new rental demand in both Sydney and Melbourne (Table 6).

Some industry and government sources argue that any such curb would be counter-productive because migrant tradies are needed to build the extra dwellings. We show (pp 21-22) that this belief is wrong. Few migrant tradies are currently being visaed. This will not change because Australia's construction trade qualification system will not allow it. The focus must be on domestic training.

Slowing immigration, at least in the short term, will not solve the first home owner crisis. Relatively few recently arrived migrants have the resources to compete in the detached housing markets of Sydney and Melbourne. However, they can and do compete successfully a decade or so after arrival. We show that those arriving before 2016 are currently the biggest source of demand in these markets (Tables 9-11) and they dominate the ranks of buyers in the fringe suburbs of Melbourne (pp. 18-19).

Even if migration stops, the impact of this lagged demand will be felt for years. The huge wedge of migrants locating over the years 2022, 2023 (and probably 2024) will give an unprecedented push to this demand.

The only realistic medium-term option that can significantly provide for this need is to open up the respective city fringes for detached housing. This can be delivered at a fraction of the cost of medium and high-density housing in the middle and inner suburbs of Sydney and Melbourne. It is not being

utilized because of deliberate policy decisions by the Victorian and New South Wales Government to restrict outer suburban expansion.

Though fringe developers, needless to say, agree with this stance, they face almost uniform opposition from State Governments, housing experts and commentators. One exception is Alan Kohler who, in his recent Quarterly Essay, reached the same conclusion as we do, if by a slightly different route.²

Therefore the strategies to fix the housing crisis need to cover all the levers that can be applied – opening the fringe, new industry policy, reducing migration levels, improved workforce training, changes to monetary policy, new transport links, innovation in construction techniques and adoption of advanced manufacturing methods – all these factors have a role to play in restoring our housing system to equilibrium.

Introduction and overview

It is hard to find a household or family unaffected by the housing crisis in Australia. The issues of affordability and availability of housing have been widely canvassed with a range of policy options being advocated to improve the situation. Most of the discussion on policy options are based on the premise that planning controls and 'red tape' are the fundamental issues that need to be addressed.

There is the fixation on reducing planning control. But this fixation is not allowing taller buildings and higher density of development as a 'solution' to the housing crisis because it does not consider the economics of such developments (if developers cannot make a profit in building them, they will not build them), nor is there the buyer demand for such developments.

Clearly, this 'solution' is not working. Despite State action to speed up building permit issuance and pressure on Councils to rezone locations for more medium and high density housing, the actual number of permits for such dwellings in Sydney and Melbourne fell in 2023 to well below the levels of the late 2010s (see Table 1). This decline has continued.

Table 1: Housin	Table 1: Housing approvals 2012-2023 Greater Sydney and Greater Melbourne						
	House	Other dwelling	House approvals	Other dwelling			
Year	approvals	approvals	Greater Melbourne	approvals Greater			
	Greater Sydney	Greater Sydney		Melbourne			
2012	9,240	19,233	18,764	22,834			
2013	11,331	25,123	18,578	21,666			
2014	14,057	27,235	22,394	27,637			
2015	16,918	38,634	24,495	33,372			
2016	17,800	40,772	26,559	31,598			
2017	18,613	37,016	27,025	32,435			
2018	18,533	28,926	27,957	26,862			
2019	14,818	21,338	23,935	21,992			
2020	15,863	20,016	26,655	22,423			
2021	17,802	25,671	30,911	22,508			
2022	15,305	21,436	24,485	24,342			
2023	12,810	17,445	23,213	17,561			

Table 1 Annual building approvals for houses and other dwellings for Greater Sydney and Greater Melbourne 2002-2023 Source: 8731.0Building Approvals, Australia – Number of dwelling units approved by Greater Capital City Statistical Area- ABS Feb 2024

With so much being written and discussed on this issue, it is time to draw breath to spend time understanding the structure of housing demand. This includes the flow of people across different housing stock through their life-stages and the constraints on adding supply to meet this demand. This understanding is a requirement if actions to improve affordability and availability are to succeed.

We take a systems approach to analysing the housing market, one that incorporates stock and flow analysis. This enables us to identify the long-term factors that affect the interlinked components of the housing market: renters, investors, first home buyers, upgrade buyers and downsizers. In this approach there is equilibrium when there is an approximate balance between supply and demand for types of dwelling structure across the geographic markets. This is most likely to occur when the primary driver of population growth is fertility. Large scale migration is providing a 'shock' to the system.

Australia experienced this type of shock to housing market equilibrium following WWII with the return of servicemen and large-scale migration from Europe. In contrast to conditions existing today, the surge in population was met by large scale project home development on the (then) fringes of the cities with very little regulation or precinct planning in place.

Minimal infrastructure was demanded of developers by State Governments, with many roads remaining unsealed for decades. Sewerage infrastructure only shifted from septic tank systems to being fully sewered following the urban infrastructure programs financed by the Whitlam Government in the mid 1970's. At this time capital flows were managed by Government and the interest rate on mortgages was also determined by the government of the day. With relatively low land costs on the city fringe and active encouragement for people to buy their own home, home ownership peaked at 73% of households in 1966.

High levels of migration do provide a 'shock' to the housing market. In the short term we see this today in the increased demand for rental housing in the capital cities of Melbourne and Sydney, cities which are the destination locations of more than half of the migrants arriving in Australia in recent years.

What has not been previously identified is the longer-term impact of high levels of migration. This is particularly true of younger migrants who have arrived to study in Australia and then progressed on to permanent settlement. We demonstrate that, for home purchasing, the high levels of migration experienced in Australia up to the COVID epidemic have locked in significant housing demand for at least the next 10 years.

Indeed, if migration stopped today, while this would have an immediate effect on rental markets, this change would have minimal impact on home ownership demand for at least the next 5-15 years. The lag effect of migration on home ownership demand is quantified in our paper.

Given this situation, what are the options to increase supply of the type of housing that first home buyers are seeking?

Until recently most housing flows have been generated from young people leaving the family home for independent living. Often this is in rental housing as part of a group household or as a lone person. The next life-stage of partnering has involved living together in a range of housing types – high rise flats, medium density housing including townhouses or detached houses, either as renters or first home buyers.

When children are on the horizon there has been a flight from flats and apartments into either town houses or detached houses, accommodation with enough bedrooms to meet the needs of a growing family. Our analysis shows that the escalation of detached housing prices has impeded this transition, leading to a sharp increase in the proportion of young households in Sydney and Melbourne in their 20's, 30's, and 40s, who are renting a flat or apartment.

In the next stage of the housing cycle there is often movement from a first home to upgrade. This upgrade can be both in the quality of the housing and the residential amenity of the location. The locations desired by upgraders include established suburbs with good access to schools, efficient transport links and natural amenity (trees and parks) and cultural amenity (dining, entertainment, shopping and the arts).

The scale of this upgrader cohort is increasing. The number of households headed by 30-50 year olds who have some equity in their current homes (the pool of potential upgrade buyers) has increased by 8% in Sydney and 17% in Melbourne between 2011 and 2021, with no corresponding increase in housing stock.

However, there is a limited number of dwellings with sufficient bedrooms available for purchase by home upgraders. This is because just over half of the detached dwellings in high amenity areas are

owned by people aged 50 years or more, including many 'empty nesters' who have chosen to stay in the home in which they bought up their children.

These areas of high amenity are the very locations targeted by State Governments to increase density. While this is a desirable goal to allow more households people to live in areas with good amenity, the number of detached houses in these areas is either stable or declining.

For this sector of the housing market, additional supply is severely constrained from all the factors mentioned above, while demand has escalated. As upgraders usually have both equity in a current dwelling and also a loan servicing capacity through mid-career employment, they are better equipped to compete for the available stock. Younger households are the losers, thus the rise in the proportions renting, especially in Sydney.

This resulting competition and thus continued increase in house prices has led to an escalation of site costs in middle suburbs. This increase is such that along with increasing costs of building materials and construction labour, developers cannot supply medium density housing at a profit. This why the 'missing middle' solution is not working. At the same time, upgraders looking to buy into higher amenity areas have higher capacity to bid on established dwellings, fuelling further growth in house prices.

Meanwhile, first home buyers without equity are limited by loan serviceability to homes with a build cost of \$458,000 or less. Indeed, 87% of all detached dwellings approved for construction in Greater Sydney in 2021 had a value of \$458,000 or less (Table 10). The only feasible detached house or large apartment option for them is in locations in the outer suburbs or new fringe developments.

There are related constraints on new affordable high-density apartments. The development costs (including those of a unionised construction workforce) mean that these are only profitable if directed at the high price end of the apartment market.

How do we tackle these issues and increase affordability and availability of housing? The first thing to recognise is that this crisis has been years in the making, and resolution to restore equilibrium in the housing market will take time.

The second thing to recognise is that blunt instruments (like mandated densities) can be ineffective and cause unanticipated market distortions.

The third thing that needs to be remembered is that the crisis is real and is having significant impact on people now and on their future welfare. This should be a call to arms to act now by applying a range of measures that, combined, can deliver a more sustainable housing market.

We should recognise the risks of not acting, or acting ineffectually. These risks include loss of social cohesion and growing stratification of the community with deep pockets of entrenched deprivation and increased homelessness.

Moving towards equilibrium should see home prices continue to rise (nominal growth) but at a level below inflation. If this is sustained over a number of years the pressure on housing affordability will reduce. Achieving this goal is only possible by tackling the issues on multiple fronts, as summarized in our recommendations at the end of this study.

The framework of analysis

In our paper we look beyond aggregate supply and demand to understand patterns of tenure (owning outright, purchasing and renting) and choice of type of housing (flats/apartments, medium density dwellings and detached houses) by life-stage. Based on these patterns we then examine how these patterns vary across Sydney and Melbourne and how they have changed over time.

On the demand side we look at rental demand by age of head of household, first home buyer activity by age of buyers, type of dwelling being purchased, cost of dwellings and the components of demand for those entering home ownership for the first time. This analysis includes a quantification of the proportion of demand that is created by households generated by migrants to Australia.

We also analyse the patterns of tenure and movement through different housing types by family status of the household and age of the head of household.

On the supply side we examined the cost of construction of different types of dwelling and the transfer³ costs for established dwellings.

These frameworks allow an analysis of what a 'normal' market or a housing market in equilibrium looks like and to help identify factors associated with disequilibrium. Understanding the typical flows through existing housing stock gives a better insight into the size and type of housing that needs to be added to the stock to meet buyer accommodation needs, budgets and preferences.

For each life-stage (transition to independent living from the parental home, partnering, having children, empty nester and living alone) we have examined the factors driving demand as well as issues limiting supply to meet the demand.

We have broadly classed these into the following housing tenure/purchase groups:

- Rental (across all age groups)
- First home buyers
- Upgraders
- Downsizers

Rental demand

The rental market has two broad subgroups. The first is predominantly made up of younger households where people have either transitioned from living in the parental home into independent living, or are migrants who have recently arrived from overseas. The second is made up from households of all age groups where the occupants typically do not have the assets or level of income that will allow them to raise the deposit to buy a home, or to meet the serviceability and security requirements of lenders to take out a mortgage.

With the reducing affordability of housing in Melbourne and Sydney the age at which people have transitioned from rental to first home purchase has been increasing. As Table 2 shows, the impact in Sydney is dramatic. The share of households whose head is aged 30-39 who are renting has increased from 44 percent in 2011 to 52 percent in 2021 while the share of households whose head is aged 40-49 year has increased from 31 percent to 37 percent. The trend in Melbourne is similar though from a lower base.

Table 2: Tenure patterns 2011 and 2021 by age of head of household for Greater Sydney, Greater Melbourne and the remainder of Australia								
		Greater S	Greater Sydney		Greater Melbourne		Remainder Australia	
Age of household head	Tenure Type	2011	2021	2011	2021	2011	2021	
20-29 years	Owned	6%	5%	6%	5%	5%	5%	
	Buying	29%	19%	30%	24%	33%	31%	
	Rent	65%	76%	64%	70%	62%	64%	
30-39 years	Owned	7%	5%	8%	6%	7%	6%	
	Buying	48%	42%	54%	51%	53%	52%	
	Rent	44%	52%	38%	43%	40%	42%	
40-49 years	Owned	16%	11%	19%	13%	16%	13%	
	Buying	53%	52%	57%	57%	54%	56%	
	Rent	31%	37%	25%	30%	30%	31%	
50-59 years	Owned	33%	26%	37%	30%	35%	28%	
	Buying	43%	45%	45%	48%	43%	47%	
	Rent	24%	29%	18%	23%	22%	25%	
60+ years	Owned	70%	64%	75%	70%	72%	68%	
	Buying	13%	16%	12%	16%	12%	15%	
	Rent	17%	20%	12%	14%	16%	17%	
Total	Owned	32%	29%	34%	31%	34%	34%	
	Buying	36%	34%	38%	38%	36%	36%	
	Rent	32%	37%	27%	31%	30%	30%	

Table 2: Tenure by age of head of household Source: ABS Table Builder 2021 Census dataset

The recently released 2021 longitudinal Census results backs up this conclusion. It allows an analysis of the age distribution of people moving from rental accommodation to purchasing a home. The chart below shows the age distribution of parents in couple families with children in Sydney who moved from rental accommodation to purchasing a home with a mortgage in 2011 to 2016 and from 2016 to 2021.



Chart 1 Age distribution of couples buying first home 2011-16 and 2016-2021 Source: ABS Table Builder

The later age of entry into home ownership (shown in Chart 1) means that many home buyers are likely to have mortgages beyond retirement age and will need to keep working into their early 70's to meet repayments. From the perspective of the rental market there is a longer dwell period for tenants, meaning that stock is occupied for longer with less turnover, reducing rental options for those coming into the market from overseas as migrants or for young people transitioning to independent living.

These trends show up in changing tenure patterns of the housing stock in Sydney and Melbourne between 2011 and 2021 (Table 3). The dwelling stock by 2021 reflects both demolitions and construction of dwellings. While there were 89,873 detached dwellings added to Sydney's housing stock between 2011 and 2021, the number of rental households in detached dwellings increased by 44,770.

If patterns of tenure were unchanged, we would expect 20% of the additional houses to be rented (17,975). Instead, rentals increased by 44,770 in detached houses.

There were an additional 285,195 dwellings occupied in Greater Sydney from 2011-2021 and an additional 176,997 rental households in this period. Comparing the growth in rental households to the growth in dwelling stock in Greater Sydney in this period, rental household growth was 62% of dwelling stock growth.

This indicates a shift from home ownership to rental, as seen in the older age profile of first home buyers in 2021 compared to those in 2011 (shown in Table 2), and a significant increase in rental of detached houses to accommodate young families.

Sydney and Greater Melbourne							
	Greater Sydney			Greater Melbourne			
Dwelling structure	Change in rental household	Change in dwelling	Rental change as % of	Change in rental household	Change in dwelling	Rental change as % of	
	count 2011-	count	dwelling	count 2011-	count	dwelling	
	2021	2011-	count	2021	2011-	count	
		2021	change		2021	change	
Separate house	44,770	89,873	50%	66,544	178,631	37%	
Semi-detached, row or terrace house,	- 1,003	- 4,906	20%	24,255	57,963	42%	
townhouse etc with 1 storey							
Semi-detached, row or terrace house,	18,739	43,590	43%	29,738	69,393	43%	
townhouse etc with 2 or more storeys							
Flat, unit or apartment in a 1 or 2 storey	613	- 4,802	-13%	- 22,934	- 43,159	53%	
block							
Flat, unit or apartment in a 3 storey block	14,947	13,683	109%	5,143	11,407	45%	
Flat, unit or apartment in a 4 or more	98,931	147,757	67%	55,857	88,862	63%	
storey block							
All dwelling structures	176,997	285,195	62%	158,603	363.097	44%	

Table 3: Change in count of dwelling stock and dwellings rented by dwelling structure 2011-2021 in Greater

Table 3: Changes in dwelling stock and rental counts 2011-2021: Source: ABS Table Builder Census of Population and Housing Place of Enumeration 2021

Rental demand from migration

The impact of migration on demand for rental stock can be seen in Table 4.

Table 4: Number of new property rentals between 2016 and 2021 per 100 population in migrant andAustralian born cohorts					
	Greater Sydney	Greater Melbourne			
1st 5 years in Australia (arrive 2016-2021)	24.54	22.35			
5-10 years in Australia (arrive 2011-2015)	18.68	14.75			
10-15 years in Australia (arrive 2006-2010)	13.87	10.38			
15-20 years in Australia (arrive 2001-2005)	11.59	9.64			
Arrived > 20 years ago (before 2001)	6.96	5.36			
Australian born	8.07	7.88			

Table 4: Rate of property rentals migrants and Australian born population in Greater Sydney and Greater Melbourne Source: ABS Table Builder: Census of Population & Housing Place of Enumeration 2021

Estimates of rental demand are often made using data on the average number of people per households, percentage renting and estimated future population counts. In our study we have used actual Census data based on reference persons⁴ in rental households. For each rental household we have identified whether the head of household (aka reference person) was born in Australia or overseas and, if born overseas, when they arrived in Australia. Next we have information on whether they were at the same address or moved to their current address in the last 5 years. From this we were able to establish the rate at which rental demand has been generated and to express this as a rate per 100 people in a cohort.

Thus, Table 4 shows that between 2016-2021 for every 100 migrants who arrived in Sydney there were 24.54 new rental households, while for every additional 100 Australian born people in Sydney there were 8.07 new rental households. Compared to the population growing through natural increase, rental demand from migrants in their first five years in Australia is 3 times higher on a per capita basis.

The quantification of rental demand linked to the net overseas migration per annum to each State allows a forecast of the future demand that is driven from migration to Australia. Importantly, the quantification has been based on empirical data, rather than 'averaging' or estimation.

Supply of rental housing

State and Federal governments have responded to the very low stock of dwellings available for rental in Melbourne and Sydney by focusing on initiatives to 'remove red tape' and 'reduce planning constraints'.

The belief is that with high land prices and significant infrastructure costs involved in developing greenfield sites, the best option is to increase supply by converting current low density housing stock into medium or high density stock.

Further, it is assumed that with an increased yield of dwellings per site, the cost per dwelling should reduce.

From the perspective of a developer building new stock there are 3 key conditions that need to be met for them to take on the risk of new construction.

- First, the planning rules need to permit the type and density of development they are considering for a site.
- Second, they must have mechanisms to manage risk of cost increases in labour and materials during the construction phase of work.
- Third, there must be a sufficiently deep market of potential buyers who would consider purchase/rental in the development at the price the developers would need to charge to enable a commercial return.

Our analysis demonstrates that the push for relaxing planning rules and guidelines will not increase the supply of affordable dwellings.

Paradoxically, conditions imposed by lenders for large scale developments to reduce their exposure to risk (such as requiring 50-80% of the development stock to be pre-sold before development commences) can increase the risk of collapse of the developers and construction companies. If the majority of the development is pre-sold, the return to the developer is locked in with fixed price sale contracts, exposing them to cost increases in labour and materials during construction.

With this setting we turn to a closer look at constraints on the addition of rental housing in Sydney and Melbourne, starting with proposals to increase density in middle suburbs (the 'missing middle') then proposals for much increased higher density apartments in inner city areas or around transport hubs.

Supply in middle ring suburbs – medium density – the 'missing middle'

The crisis in affordability for younger households in Sydney and Melbourne has, at last, prompted a flurry of government proposals. One focus has been on increasing density in middle suburbs. The assumption is that there will be a big increase in affordable housing if zoning laws are freed up and if the time taken for developers to win a building approval for medium density is reduced.

The Federal Treasury is the latest to argue this case. It does so at length in the 2024-25 Budget Papers. It states that this would occur if additional housing was located in 'well located areas' where 'households can reside closer to jobs in areas with higher quality amenities and infrastructure'.⁵ The Treasury argues that this can be achieved with planning and zoning changes. It is not happening, and will not happen, because of the escalating site costs in middle suburbia. These costs preclude the production of affordable town houses or flats.

The NSW Government Productivity Commission which has been an influential advocate for higher density development. It is notable that the Commission partially justifies its focus on high rise apartments by its claim that medium density infill is much less affordable than will be the apartments flowing from its recommendations.

The NSW Productivity Commission states that 'It is much more expensive to produce housing for a given number of people with medium-density townhouses than with apartment buildings. That reflects townhouses' relatively less efficient land use.⁶ Yet, as the Productivity Commission notes, the 'missing middle' option is still being pushed by planners and commentators despite its flaws.⁷

This argument has been documented many times. The best source is the 2020 Sydney University Feasibility Guide for Town Planners. It shows in copious detail that the cost of the 'missing middle' sites, plus the build costs for the proposed units, have meant that, except for very high-end flats or town houses, they cannot (and are not) being built, because there is no prospect of a profit.

The guide shows that in high value detached housing areas, the value of the existing building is likely to be greater to the developer or investor than it would be even after putting several units on the site.⁸ Recent empirical evidence supporting this conclusion is provided in the following table with the build and transfer costs of medium density housing in Sydney suburbs such as Ryde and Eastern Suburbs. [Table 5 – unclear whether it just refers to dwellings that are not detached houses.]

Table 5: Other dwell	Table 5: Other dwelling approval counts, average cost, established other dwelling transfer prices						
and counts in SA4 ⁹	and counts in SA4 [®] areas of Sydney 2021						
SA4 Areas of	Median price	Private sector	Avg	Median price	Number of		
Greater Sydney	of established	approvals dwellings	build	of attached	attached		
	house	excluding houses	cost for	dwelling	dwelling		
	transfers (\$)	(no.)	other	transfers (\$)	transfers (no.)		
South West	775,000	1,318	274,659	525,000	1,706		
Blacktown	820,000	3,342	264,213	570,000	2,457		
Baulkham Hills and	1,330,000	1,403	323,592	850,000	1,248		
Hawkesbury							
Outer South West	717,000	722	235,457	480,000	795		
Outer West and Blue	750,000	630	239,683	525,000	1,806		
Mountains							
Inner South West	1,240,000	2,261	335,692	650,000	5,366		
Parramatta	1,090,000	4,300	348,372	630,000	5,380		
North Sydney and	2,500,000	1,133	406,884	950,000	5,477		
Hornsby							
Northern Beaches	2,310,500	479	488,518	1,055,000	2,631		
Ryde	1,950,000	2,209	363,966	805,000	2,825		
Sutherland	1,420,000	1,170	442,735	795,000	2,844		
Inner West	2,000,000	1,336	402,695	800,000	3,976		
Eastern Suburbs	3,120,000	450	540,000	1,220,000	4,077		
City and Inner South	1,685,000.0	2,808	520,655	890,000	6,596		

Table 5:Other dwelling approvals, transfers and build costs in 2021 Greater Sydney Source: ABS Data Explorer Regional Statistics

If a developer is to proceed with a new medium density project he/she will first have to procure a site – almost always including one or more detached houses.

A prospective four unit development which replaced a detached house would start with a site cost of at least \$500,000 (based on a median transfer price for a detached house of \$1.9 million). The build cost for a 150 square metre unit or town house would be at least \$900,000 (\$6,000 per square metre). That's already \$1.4 million. To this we must add finance, marketing and profit.

As the transfer price data in Table 5 indicates, the average transfer price of an 'other' dwelling (which includes units and apartments) was near \$2 million in Ryde and the Eastern suburbs. There is clearly not a market for affordable medium density dwellings in these suburbs that developers can supply at a profit.

Similarly, the only flats and town houses being built in the inner and middle suburbs of Melbourne are at the high end of the market, way out of the range of households seeking affordable accommodation.

Table 6: Other dwelling approval counts, average cost, established other dwelling transfer prices and counts in SA4 areas of Melbourne 2021							
SA4 Areas of	Median price	Private sector	Avg	Median price	No.		
Greater	established	approvals dwellings	build	established	established		
Melbourne	house transfers	excluding houses	cost for	other	other		
	(\$)	(no.)	other	transfers (\$)	transfers		
Melbourne – West	630,000	3,526	285,309	530,000	3,898		
North West	660,000	1,027	290,166	549,000	1,993		
South East	687,000	1,911	304,553	588,400	5,475		
North East	750,000	1,827	262,726	630,000	3,385		
Outer East	860,000	1,157	315,471	643,000	3,154		
Mornington	835,000	474	367,089	565,000	2,102		
Peninsula							
Inner East	1,705,000	2,301	469,361	735,000	3,945		
Inner South	1,646,000	2,839	463,191	739,000	5,370		
Melbourne – Inner	1 500 000	4 091	440 968	610 000	13 980		

Table 6: Detached dwelling and other dwelling approvals, transfers and build costs in 2021 Greater Melbourne Source: ABS Data Explorer Regional Statistics

The supply of high-rise rental apartments

The recent approval drought for inner city high-rise apartments is embarrassing for governments and advocates alike. They assume that aspiring home owners will embrace inner city living and that developers will be enthusiastic suppliers. They believe that all that is required is a speed-up in the zoning and planning permit process and the rights of developers to add additional stories to high-rise projects.

As evidence has mounted that these expectations are incorrect the response has been that developers are slow to act because of shortages in the supply of skilled labour and associated rises in the costs of labour and building materials (as well as interest rates). It is also noted that the building industry has been hobbled following the collapse of multiple builders caught with fixed price contracts yet escalating build costs.

All these costs are relevant. Our consultations with developers indicated that it now costs up to \$12,000 a square metre to build an apartment block in Sydney. A 3 bedroom apartment of 120 square metres has to sell at \$1.4 million or more for the developer to make a satisfactory return on the development.

The bottom line is that development costs are now such that most big and small prospective developers can only make a profit on higher-end product. This is out of the range of most of the households the planners like to think would be interested in renting a high-rise apartment. In making this judgement developers compare their costs against the prices of comparable product on the market in the location.

There has been a belated recognition of the importance of this factor in understanding the recent drop in high rise dwelling construction. The ABC's Business Editor, Michael Yanda, has recently penned an insightful piece on the subject. ¹⁰

We have been able to utilize an ABS data source which details the actual transfer price for houses and other dwellings by type across the various regions of Sydney.

The City and Inner South region of Sydney illustrate the point. Most of dwellings being built in this region are apartments (Table 5 above), so we are safe in assuming that the build costs and transfer data refer primarily to apartments (not low rise units).

The median price of all such dwellings transferred in the City and Inner South region in 2021 was \$890,000. The average build cost for these dwellings in this region in 2021 was \$520,000. To this we must add site costs (\$100-200,000 per apartment), holding and selling costs, plus profit.

Given that the prevailing transfer price in the City and Inner South Region by 2021 was \$890,000 the apartments produced had to be small in order to keep build costs in check and thus deliver a profit. Build costs have escalated since. So have site costs as the price of the sites grows with Sydney's overall rise in dwelling prices.

Build to rent

Build to rent is a relatively new asset class in the housing market in Australia. A key attraction in build to rent is for tenants to have more security of tenure and to be able to act more like homeowners in managing furnishings and fittings to suit their needs.

With long term tenancies build to rent provides more opportunities for connected communities and interaction with neighbours.

It is likely to take some years, perhaps decades, before this type of supply contributes meaningfully to the rental housing market. This is because it takes time to establish a community of long term renters. Paradoxically, some initiatives coupled with current build to rent schemes may slow down the development of long term connected rental communities.

This is because tenancies have been offered without requiring bonds, and while this provides welcome support for renters who may have difficulty in obtaining a rental property from a private real estate agent, tenants that have difficulty in paying a bond are more likely to be transitory, resulting in higher turnover of tenancy.

This means that for young families who cannot afford to buy a home, the build to rent market is unlikely to provide the accommodation and amenity they would like to have in the short term and therefore additional and other measures will need to be adopted to meet the housing rental crisis.

Key take outs on the rental market

- Rental demand from migration in the migrants' first 5 years in Australia has 3 times the impact on demand as does the rental demand from the Australian-born population growth.
- The age of entry into homeownership is rising, meaning more people will have mortgages in their sixties and seventies.
- A growing number of people are being locked out of home ownership.
- Fixed price contracts and pre-sales of apartments to investors increase risk for developers and reduce their incentive to build.
- High site costs and high construction costs make affordable high-density developments uneconomic in desirable city locations.

First home buyer market

The urgency of the rental market crisis has overshadowed the circumstances of households seeking to buy their first home. Yet, for those affected, it is of huge importance. This importance derives partly from the preference for detached housing as households contemplate raising a family in a stable community and partly from the importance of home ownership in Australia for long term financial security.

Those who reach retirement years without the rent free advantage of home ownership and the capital gains built up from housing price rises face prolonged income insecurity if they have to rely on the age pension.

But as we have seen, getting a foot on the property ladder in Sydney and Melbourne has become a receding dream. The reasons are poorly understood by commentators.

Demand from migration

To determine the contribution to demand for home purchases from migration we have analysed the homes purchased in Greater Sydney and Greater Melbourne by Australian born residents and by migrants by year of arrival in Australia.

If the age profile of migration to Australia in recent years continues, it will generate significantly more demand for home purchasing per capita than the demand per capita from Australian born people. This is because the age profile of migrants is highly skewed towards people in their 20's. Within 5-10 years of arrival they are approaching the age typical for family formation and first home purchase.

In Table 7 below it can be seen that 22% of arrivals in Australia during 2006-10 were in the 35-39 year age band in 2021, compared to 6% of the Australian born population.

Table 7: Percent of population in Greater Sydney by selected age bands by time period of arrival in Australia						
Selected age bands	30-34 years	35-39 years	40-44 years			
Australian born	7%	6%	5%			
Arrived pre 2006	4%	6%	8%			
Arrived 2006-2010	15%	22%	17%			
Arrived 2011-2015	21%	19%	11%			
Arrived 2016-2021	18%	11%	6%			
Total	8%	8%	7%			

Table 7: Population age profile by time of arrival in Australia Source: ABS Table Builder 2021 Census

This pattern is replicated in Greater Melbourne

Table 8: Percent of population in Greater Melbourne by selected age bands by time period of arrival in Australia					
Selected age bands	30-34 years	35-39 years	40-44 years		
Australian born	7%	6%	6%		
Arrived pre 2006	4%	7%	8%		
Arrived 2006-2010	15%	23%	16%		
Arrived 2011-2015	20%	17%	10%		
Arrived 2016-2021	17%	10%	6%		
Total	8%	8%	7%		

Table 8: Population age profile in Greater Melbourne by time of arrival in Australia Source: ABS Table Builder 2021 Census

So, what is the impact of migration on housing demand? Table 9 below has been generated through analysis of Net Overseas Migration (NOM) at a state level for NSW and Victoria from 2001 onwards. It matches the number of rentals or purchases that took place in Greater Sydney and Greater Melbourne by migration (by year of arrival) and by the Australian born between 2016 and 2021.

and Australian born cohorts					
	Greater Sydr	iey	Greater Melt	ourne	
	Rent	Buying	Rent	Buying	
1st 5 years in Australia (arrive 2016-2021)	24.54	4.52	22.35	6.64	
5-10 years in Australia (arrive 2011-2015)	18.68	9.82	14.75	12.22	
10-15 years in Australia (arrive 2006-2010)	13.87	12.65	10.38	15.56	
15-20 years in Australia (arrive 2001-2005)	11.59	10.78	9.64	12.51	
Arrived > 20 years ago (before 2001)	6.96	6.96	5.36	7.63	
Australian born	8.07	6.05	7.88	7.36	

Table 9: Number of new rentals or property purchases between 2016 and 2021 per 100 population in migrant

Table 9: Number of new rental or property purchases 2016-2021 per 100 population in Australian born and migrant groups Source: ABS Tablebuilder Census of Population and Housing Place of Enumeration 2021

From this analysis we can see for home purchases that migration has the biggest impact 10-15 years after arrival in Australia. If this same rate applies to future migration cohorts then for 10,000 migrants arriving in Sydney in 2024 their contribution to demand to purchase a home would be:

- 452 homes between 2024-2029
- 982 homes between 2030-2034
- 1265 homes between 2035-2039 •
- 1078 homes between 2040-2044

In contrast, for each of the time periods detailed above, the Australian born population would contribute demand for 605 homes in each of these time periods. We call this impact on demand the 'lag effect', with high levels of migration taking 15-20 years to 'wash out of the system' and return demand closer to equilibrium.

The politicians and planners assessing housing need are well aware that the high influx of migrants to Sydney and Melbourne is a major factor in the demand for rental stock. This could hardly be otherwise since the recent NOM data are compelling. The planners know that most recent migrants rent and thus assume that their supply priority must be rental stock.

However, they do not acknowledge that that this competition extends to detached housing, though largely through the lagged effect of earlier arriving migrant cohorts.

The migrant competition for the purchase of a detached house in Sydney was small from the recent arrivals - they made up just three percent. Most of the migrant competition came from earlier arriving migrants. We don't know whether these purchasers were new to the detached market or movers who already owned a detached house.

Many of those who arrived prior to 2006 would probably have been in the latter camp. But for the 10 per cent who arrived in Australia between 2006-10 and the nine percent who arrived between 2011 and 2016, it is likely that they were new purchasers. Given the cost of detached housing in Sydney it would have taken several years before most of those aspiring to purchase a detached houses managed to accumulate the required financial resources.

A large share of migrant arrivals in the 2000s and 2010s were temporary student visa holders. Since many of these subsequently obtained university credentials and professional employment, it should not surprise that, though with a lag, they have proved capable of competing in the detached housing markets of Sydney and Melbourne.

Where can first home buyers find a niche in the big cities?

Both Australian born and migrant first home buyers are typically budget constrained. Without equity in an existing home they are limited by the serviceability and security requirements of lenders which are tied to household income and expenditure. The budget constraints limit the locations in which first home buyers can buy an established dwelling or construct a new dwelling.

There is only a limited stock of detached housing in Sydney and Melbourne. The median price of established house transfers in Sydney and Melbourne show that there are only a few areas within the budget of first home buyers.

Table 10: Greater Sy	Table 10: Greater Sydney approvals, transfers and build costs for houses in 2021						
SA4 Areas of	Private sector	Avg build cost for	Median price of	Number of			
Greater Sydney	house approvals	separate house (\$)	established house	established house			
	(no.)		transfers (\$)	transfers (no.)			
South West	3,775	309,934	775,000	6,476			
Blacktown	3,500	290,000	820,000	6,333			
Baulkham Hills and	2,280	450,000	1,330,000	4,748			
Hawkesbury							
Outer South West	2,096	347,328	717,000	5,033			
Outer West and Blue	1,032	415,698	750,000	5,332			
Mountains							
Inner South West	1,024	458,008	1,240,000	5,014			
Parramatta	863	409,038	1,090,000	3,752			
North Sydney and	497	1,732,394	2,500,000	4,174			
Hornsby							
Northern Beaches	438	1,319,635	2,310,500	3,016			
Ryde	343	720,117	1,950,000	1,723			
Sutherland	314	863,057	1,420,000	2,732			
Inner West	307	1,182,410	2,000,000	2,459			
Eastern Suburbs	139	3,438,849	3,120,000	2,197			
City and Inner South	105	1,676,190	1,685,000	1,959			

Table 10: Greater Sydney detached dwelling approvals, average build cost and count and value of established house transfers in 2021 Source: ABS Data Explorer Regional Statistics

Table 10 shows that in Sydney, 87% of detached houses that were approved for construction in 2021 had a value of \$458,008 or less.

Table 11 shows that in Melbourne 88% of detached dwellings that were approved for construction had a value of \$362,442 or less.

If the land on which these new dwellings are being constructed has a cost of between \$300,000 - \$400,000 then the total cost of house and land would be between \$660,000 - \$760,000. These costs are likely to be near the ceiling of affordability for borrowers to meet lending criteria.

Table 11: Greater Melbourne approvals, transfers and build costs for houses in 2021							
SA4 Areas of	Private sector	Avg build cost for	Median price	No. established			
Greater Melbourne	house approvals	separate house	established house	house transfers			
	(no.)		transfers (\$)				
Melbourne – West	12,287	303,329	630,000	11,112			
North West	4,330	327,945	660,000	5,655			
South East	6,130	346,819	687,000	10,814			
North East	3,882	362,442	750,000	5,980			
Outer East	1,143	599,300	860,000	5,683			
Mornington Peninsula	915	838,251	835,000	6,059			
Inner East	655	1,235,115	1,705,000	3,562			
Inner South	586	1,445,392	1,646,000	3,962			
Melbourne – Inner	333	2,726,727	1,500,000	3,228			

Table 11: Greater Melbourne detached dwelling approvals, average build cost and count and value of established house transfers in 2021 Source: ABS Data Explorer Regional Statistics

For most, at least until a decade or so ago, the outer suburban locations offered an option where house prices were far lower than in middle suburbs. The same was true for new housing in fringe estates. However, the latter option, in particular, has been curtailed.

By the 1990s the NSW Government had implemented tight restrictions on fringe expansion and had imposed very expensive infrastructure charges on land developers. Victoria has followed with a lag, beginning in 2002 with Melbourne 2030 and intensified with Plan Melbourne in 2017.

These were policy driven measures. There are vast tracts of land potentially available in Sydney. ¹¹] In Melbourne large areas are left which are zoned for housing development. But, as in Sydney, the actual scale of lot development has been truncated by precinct planning rules.

New estates in neighbourhood sized precincts must meet exacting infrastructure and community and environmental standards. The planning preparations for these outcomes take years to complete – effectively enforcing a slowdown on land releases.

Nevertheless, the search for affordable housing has drawn households with limited purchasing power to the outer suburbs where they can buy a house for much less than in the inner or middle areas. This was shown above in Table 10 for Sydney and Table 11 for Melbourne.

But developers have had to shrink the size of block to miniscule sizes so that they can supply product at a price point that prospective purchasers can afford. The median size of lots sold in 2022 was just 352 square metres in Melbourne. True, these outers areas are often starved for services. However, the reality is that the only relatively affordable new housing in Melbourne is being provided in outer suburbs, where site costs and build costs are lower.

You might think that there would be a reluctance from first home buyers to trek out to housing estates 50 kilometres or so from the respective CBDs. But this is not the case. Competition is high since, for first home buyers, these estates offer the only affordable option.

In the case of Melbourne where fringe development is proceeding, albeit at a relatively slow pace, the main source of buyers is migrants.

Migrant competition on the fringe

This competition is acute in Melbourne, particularly in the western and northern parts of the city where most of the land zoned for fringe development is located.

Map 1 below shows the proportion of buyers of detached houses between 2016 and 2021 where the reference person in the household was born overseas. There are many areas on the map where the proportion of overseas born detached house buyers is 70% or more of all buyers of detached houses.

In Tarneit, for example, which is a rapidly growing suburb in the west of Melbourne, almost all of the growth in young household population aged 25-44 by 2021 was foreign-born. There were a total of 52,681 persons in this age cohort living in Tarneit by 2021. Only 10,368 were Australian-born. The rest were foreign born, some 21,641 of whom, or double the number of local born, were born in India.¹²



Map 1 Percent of purchasers of detached houses between 2016 and 2021 who were born overseas, based on birthplace of reference person in household. Sources Census of Population and Housing Source:2021 Table Builder Mapping from Tactician Corporation.

Upgraders

Demand

The longitudinal Census (2011-2016-2021) allowed an estimate of the size of the upgrader market in Greater Sydney and Greater Melbourne over the 10 years from 2011-2021. The upgrader market is typically defined as families moving to either a better location, better accommodation or both. Consequently we have looked at movement patterns of the partnered population between 2011 and 2021 in Greater Sydney and Greater Melbourne, focussing on those people who had equity in their home in 2011 and also had equity in their home in 2021.

In the 10 years from 2011- 2021 in Greater Sydney there were 603,494 people in a partner relationship who owned or were purchasing a detached home who remained in the same home over the 10-year period. In the same period there were 137,126 homeowners/buyers of a detached house in a partner relationship who moved and purchased another detached house. This group is likely to represent upgraders – no change in relationships in household (e.g. from couple to lone parent or lone person) and who started with equity in 2011, and purchasing another detached house between 2011 and 2021.

There is a smaller group of 25,480 who may represent 'flippers', households that have remained unchanged in their composition (partnered) but have been engaged in the purchase of multiple detached houses over the 10 years. The longitudinal census data indicates that they have moved address at least twice in the 10 years and that they started with equity in a detached dwelling in 2011, had equity in another detached dwelling in 2016 and then had equity in a different detached dwelling in 2021.

The longitudinal data indicates that 17.9% of family households who owned or were buying a detached home moved to purchase a different detached home in the 10 year period, while 3.3% of the family households were 'flippers', changing their family (capital gains tax exempt) home multiple times.

The picture Is similar in Greater Melbourne where there were 665,652 people in a partner relationship living in a detached home, owned or being purchased by them in 2011, who remained at the same address in 2021. During 2011-2021 there were 181,566 people in partner relationships who moved to purchase another detached dwelling, approximately 20% of the people in partner relationships living in a detached house being purchased or owned in 2011. The 'flipper' component was higher, 40,112 (5%) of owners of detached dwellings who had changed their family home multiple times in the 10 year period.

The longitudinal data only identifies people who were present in Australia in 2011 and later. Because the records are linked at the individual level, it is possible to identify the rates of flow (into/out of relationships, change of tenure, change of dwelling structure). Using this data we have established that the annual upgrader market for family households is around 1.79% of all couple family households already living in a detached home that they are buying or own outright in Sydney, and 2% of all couple family households living in a detached home that is being bought or is owned outright in Melbourne.

Looking at this cohort the count of people in a relationship, living in a detached house with the occupants having equity in the house has changed from 2011 to 2021 as follows:

Table 12: Count of person and 2021	ns in a relationship living i	n detached house with equ	ity in the dwelling 2011
	2011	2021	% change

Greater Sydney1,113,3201,228,77410.37Greater Melbourne1,192,6741,373,72515.18Table 12: Upgrader potential market size 2011 and 2021 Greater Sydney and Greater Melbourne. Source ABS Table Builder

Table 12: Upgrader potential market size 2011 and 2021 Greater Sydney and Greater Melbourne. Source ABS Table Builder 2021 Census

Supply

There are two options open to upgraders. The first is to improve the quality of the property in the existing location, involving demolition of an existing building and construction of a new dwelling. The second is to relocate to a location with higher residential amenity. In the period from 2011 to 2021 most of the mid to high amenity regions in Sydney have seen a decline in total stock of detached dwellings. The maps below show where detached house stocks in Sydney and Melbourne have declined.



Map 2 Regions with decline in count of detached houses 2011-2021 in Greater Sydney Source ABS Data Explorer Regional Statistics Mapping provided by Tactician Corporation





Map 3 Regions with decline in count of detached houses 2011-2021 in Greater Melbourne Source ABS Data Explorer Regional Statistics Mapping provided by Tactician Corporation

Tables 13 and 14 below show by region of Sydney and Melbourne the extent to which the stock of detached dwellings has increased or decreased from the base count in 2011.

Table 13: Change in stock of detached dwellings by SA3 area in Greater Sydney 2011-2021				
SA3 Region Name	Detached dwelling stock 2021	Percent change from 2011 stock level		
Decline	in detached dwelling stock 2	011-2021		
Sydney Inner City	2.377	-36.1%		
Marrickville - Sydenham - Petersham	6.583	-11.8%		
Leichhardt	7,002	-10.3%		
Eastern Suburbs - North	9.722	-9.3%		
Strathfield - Burwood - Ashfield	20,593	-9.0%		
North Sydney - Mosman	7,817	-8.8%		
Eastern Suburbs - South	14,127	-6.8%		
Manly	6,149	-2.9%		
Kogarah - Rockdale	21,750	-2.4%		
Parramatta	20,313	-2.1%		
Sutherland - Menai - Heathcote	27,621	-1.3%		
Chatswood - Lane Cove	18,494	-1.2%		
Hurstville	24,295	-0.3%		
Less than 5% in	crease in detached dwelling	stock 2011-2021		
Canada Bay	12,961	0.0%		
Ku-ring-gai	29,254	0.2%		
Ryde - Hunters Hill	24,224	0.5%		
Canterbury	23,033	0.9%		
Carlingford	14,587	1.8%		
Pennant Hills - Epping	11,479	1.9%		
Hornsby	19,311	2.0%		
Botany	5,913	2.2%		
Cronulla - Miranda - Caringbah	23,701	2.3%		
Auburn	11,938	2.8%		
Bankstown	36,469	3.8%		
Warringah	32,634	4.1%		
Merrylands - Guildford	32,387	4.8%		
5% or more i	ncrease in detached dwelling st	ock 2011-2021		
Dural - Wisemans Ferry	8,002	5.7%		
Hawkesbury	8,321	6.6%		
Blue Mountains	28,931	7.1%		
Blacktown	37,240	7.5%		
St Marys	16,110	7.7%		
Fairfield	43,407	8.0%		
Gosford	52,804	9.1%		
Pittwater	16,538	9.2%		
Richmond - Windsor	10,844	11.2%		
Baulkham Hills	39,063	11.7%		
Mount Druitt	29,389	13.2%		
Wyong	54,677	14.2%		
Campbelltown (NSW)	47,045	19.1%		
Liverpool	27,880	22.2%		
Penrith	43,808	26.3%		
Wollondilly	14,471	26.5%		
Camden	22,201	42.9%		
Bringelly - Green Valley	38,202	85.6%		
Blacktown - North	36,631	87.2%		
Rouse Hill - McGraths Hill	15.045	92.1%		

Table 13: Declines in detached dwelling stock 2011-2021 Greater Sydney Source ABS Data Explorer Regional Statistics

A similar picture emerges for Greater Melbourne.

Table 14: Change in detached dwelling stock by SA3 area in Greater Melbourne 2011-2021				
SA3 Region Name	Detached dwelling stock 2021	Percent change from 2011 stock level		
Decline	e in detached dwelling stock 2011-2	021		
Port Phillip	38,202	-35.8%		
Yarra	5,407	-24.3%		
Melbourne City	1,638	-23.2%		
Stonnington - West	5,406	-22.5%		
Essendon	12,255	-6.1%		
Stonnington - East	7,785	-5.2%		
Boroondara	35,493	-4.8%		
Darebin - South	11,300	-4.4%		
Whitehorse - West	24 766	-4.4%		
Kingston	27.081	-2.6%		
Glen Fira	29,001	_2.5%		
Brunswick - Coburg	17 875	-2.0%		
Darebin - North	23 325	-1.8%		
Manningham West	23,523	-1.0 %		
Marihurpong	17 261	-0.3 /0		
Monash	17,201	-0.7 /0		
l ess than 5%	40,710	-0.7 /0		
Whitehorse - East	17 159	0.3%		
Hobsons Bay	23 409	0.8%		
Keilor	17.675	0.9%		
Moreland - North	19.287	1.2%		
Brimbank	51,862	2.3%		
Banyule	37,042	2.3%		
Bayside	24,346	2.8%		
5% or more increase in detached dwelling stock 2011-2021				
Knox	48,993	6.0%		
Manningham - East	8,235	7.4%		
Nillumbik - Kinglake	21,519	7.6%		
Frankston	43,966	8.9%		
Casey - North	40,921	9.3%		
Yarra Ranges	53,816	12.4%		
Dandenong Marsia atau Dania aula	48,018	16.2%		
Mornington Peninsula	58,876	22.6%		
	11,092 5 075	25.1%		
Sumuly Maroondah	010,C VVC 95	20.1% 26.0%		
Whittlesea - Wallan	30,244 7/ 850	20.9% 50.0%		
Melton - Bacchus Marsh	74,000 58 557	50.0% 55.3%		
Tullamarine - Broadmeadows	56.068	56.6%		
Cardinia	37 710	58.2%		
Wyndham	84 322	65.5%		
Casey - South	65 148	70.9%		

Table 14: Declines in detached dwelling stock 2011-2021 Greater Melbourne Source ABS Data Explorer Regional Statistics

From this analysis of Greater Melbourne and Greater Sydney we can see that the total supply of detached dwellings in most mid to high amenity areas in these cities has shrunk, or has had very low growth (and any growth that has occurred has been below the growth of the upgrader market in this period).

Downsizers

The supply side of detached housing for upgraders (and aspiring first home buyers) is further constrained by limited flows out of detached homes after the homes become empty nests or lone person households. For current owner occupants of these detached dwellings there is little incentive to downsize.

Table 15: Share of detached houses occupied by age of head of household				
Region	Age of head of household	Count	Percent	
Greater Sydney	20-29 years	54,105	5%	
	30-39 years	164,468	16%	
	40-49 years	220,213	22%	
	50-59 years	217,487	21%	
	60+ years	363,021	36%	
Greater Melbourne	20-29 years	79,835	7%	
	30-39 years	229,058	19%	
	40-49 years	255,775	21%	
	50-59 years	243,589	20%	
	60+ years	398,086	33%	
Rest of Australia	20-29 years	368,970	8%	
	30-39 years	754,222	17%	
	40-49 years	835,843	19%	
	50-59 years	864,908	19%	
	60+ years	1,644,413	37%	

Table 15: Share of detached dwellings occupied by age of head of household Source: Census of Population and Housing, 2021, Table Builder

Table 15 shows that, as of 2021, households headed by persons aged 50+ occupied 57 per cent of the detached housing stock in Sydney and 53 per cent in Melbourne. This share is also high, at 56 per cent in the Rest of Australia. This high share reflects the size of the baby boomer cohort in Australia, that is those born in the post-war era from 1946 to 1980. This cohort is now aged from their late 50s to early 70s.

These Australians have largely been successful in obtaining detached housing right across Australia, including Sydney and Melbourne. For reasons we now explore, few are moving or are likely to do so, at least over the next decade. Given that they hold such a huge share of the available detached housing stock this means that those aspiring for such dwellings face a highly constricted market and inevitably higher prices while demand is high.

There are several reasons for this situation.

First, the huge increases in property prices for detached dwellings is increasing the wealth of the current occupants, making little financial sense to downsize or relocate. Second, there can be limited local choices to relocate to, with current occupants wanting to keep local community contacts, shopping patterns and living patterns. Third, there are still significant transaction costs involved in moving.

As would be expected the flow of downsizers is relatively small.

We have analysed the longitudinal Census for the period between 2016 and 2021 to identify the flow of people in owned detached dwellings to either flats, apartments or townhouses.

To estimate the rates of downsizing at a household level we first calculated the stock of dwellings that are owned or being purchased (houses, semi-detached, flats and apartments) occupied by people aged 60+ (based on the age of the household reference person) from the 2021 Census.

Next we estimated the move counts at a household level by generating tables by counts of people per household (1,2 and 3+). The counts for 2 person household were divided by 2 and the counts for the 3 person households were divided by 3 and the data then summed at the 2021 SA4 level by movement pattern.

The results of this analysis confirm that the flow of occupiers from detached dwellings of households aged 60 plus is low. Indeed, the proportion of purchase activity for buyers aged 60 years or more is higher for detached home to detached home or to upsize from an apartment or townhouse. In fact it is greater than the rate of downsizing.

In Sydney the downsizing activity from detached houses with owners aged 60 plus from detached houses equates to 3.6% of the stock of detached homes occupied by such owners. This can be compared to activity equal to 5.6% of the stock of detached homes occupied by owners over 60 who have moved from one detached house to another or have upsized from a town house or apartment into a detached house. The comparable figures for Melbourne are 3.3% and 7%.

Table 16: Profile of stock held by owners 60+ years and movement patterns 2016-2021 in Greater						
Sydney and Greater Melbourne by SA4 area						
SA4 AREA NAME	Stock detached dwellings with owners 60+ years	Moved to another detached dwelling	Upsize to detached dwelling 2016- 2021	Down- size from detached dwelling 2016- 2021	% Down- sizing from detached dwelling	% transferring to another detached dwelling or upsizing to detached
Oude on Double on Ulle and Usuda share	00 700	4 540	000	400	0.40/	dwelling
Sydney - Baulkham Hills and Hawkesbury	20,792	1,518	283	428	2.1%	8.7%
Sydney – Blacktown	20,886	946	265	196	0.9%	5.8%
Sydney - City and Inner South	4,846	41	31	496	10.2%	1.5%
Sydney - Eastern Suburbs	8,933	204	131	569	6.4%	3.8%
Sydney - Inner South West	36,308	969	329	865	2.4%	3.6%
Sydney - Inner West	15,244	579	29	934	6.1%	4.0%
Sydney - North Sydney and Hornsby	26,713	968	327	1,557	5.8%	4.8%
Sydney - Northern Beaches	18,899	860	350	1,495	7.9%	6.4%
Sydney - Outer South West	19,607	1,301	299	261	1.3%	8.2%
Sydney - Outer West and Blue Mountains	28,621	1,957	212	603	2.1%	7.6%
Sydney – Parramatta	23,259	701	88	442	1.9%	3.4%
Sydney – Ryde	13,061	546	126	618	4.7%	5.1%
Sydney - South West	26,595	1,592	174	242	0.9%	6.6%
Sydney – Sutherland	18,691	862	161	1,333	7.1%	5.5%
SYDNEY TOTAL	282,455	13,044	2,805	10,038	3.6%	5.6%
Melbourne – Inner	18,970	721	183	1,796	9.5%	4.8%
Melbourne - Inner East	31,307	1,273	275	1,541	4.9%	4.9%
Melbourne - Inner South	31,011	1,454	391	2,136	6.9%	6.0%
Melbourne - North East	44,948	2,426	312	991	2.2%	6.1%
Melbourne - North West	31,520	1,547	259	658	2.1%	5.7%
Melbourne - Outer East	52,449	3,396	193	924	1.8%	6.8%
Melbourne - South East	59,136	3,722	367	1,350	2.3%	6.9%
Melbourne – West	48,817	2,831	362	1,227	2.5%	6.5%
Mornington Peninsula	33,938	4,166	746	1,014	3.0%	14.5%
MELBOURNE TOTAL	352,096	21,535	3,089	11,637	3.3%	7.0%

 Table 16: Tenure and movement patterns of households aged 60+ in Greater Melbourne and Greater Sydney 2016-2021

 Source: ABS Table Builder Census of Population and Housing Place of Enumeration 2021

It is likely that the increased competition for limited stock in the upgrader market is the primary driver of the enormous growth in the transfer price of established dwellings. As an asset price bubble develops for high amenity detached houses this in turn lifts the transfer price for the second and third choice areas for upgraders. Upgrader buyers now have more equity in their current home and can therefore bid more for their desired upgrade home, leading to further price growth and an asset bubble.

The owner occupier housing market now becomes bifurcated into buyers with equity in an existing home and uncompetitive buyers with limited savings and borrowing capacity capped by their income.

Melbourne has a similar profile, with a decline in stock of detached dwellings across the core and inner suburbs, particularly in the high amenity eastern suburbs.

Construction workforce

We argue that a slow-down in the inflow of migrants has to be a part of the solution to the housing crisis. The Federal Labor Government has declared that it will lower the intake. The Coalition opposition has since announced that it will make bigger cuts. The response has been a cascade of criticism from building employers and housing groups that such cuts will reduce the supply of the skilled construction workforce needed to build extra dwellings.

For instance, the AFR headlined 'veteran developer', Tim Satterley's assertion that without additional skilled construction workers, developers will not be able to increase their rate of housing construction.¹³

These claims are not correct. Very few construction tradies are being visaed under the employer sponsored or skilled permanent entry visa programmes.

For example, employers can sponsor such skills under the Employer Nomination Scheme which allows employers to sponsor skilled construction workers for permanent entry visas. However, over the May 1, to August 31 months of 2023, just 76 of these visas were granted to plumbers and 195 to electricians.¹⁴

Skilled construction workers are also eligible for the points-tested permanent-entry skilled visa programs. But again, very few are utilising this entry point. Again, over the same period from May 2022 to 31 August 2023 (while Labor was in office), there were only 139 of such visas issued to plumbers, 658 to carpenters and 391 to electricians.¹⁵

The Department of Home Affairs (DHA) has provided additional unpublished data on the skill select system which shapes the choice of those who received a skilled permanent entry visa under all the various points-tested categories (including regional visas). It includes both onshore and offshore applicants.

Under the skill select system prospective migrants seeking a permanent entry skill visa must first submit an application providing details of their occupation, work experience, English language capacity and other factors. These are the indicators that DHA takes account of in determining whether a skill visa will be issued. DHA then issues an invitation to apply for the skilled visa in question to those applicants with occupations it puts a high priority on and those who it thinks will score the required points needed for a visa.

This data is essential for any assessment of how deep the reservoir of potential skilled construction workers interested in a skilled permanent entry visa is. What it shows is that interest is negligible. Moreover, of the few prospective migrants with skilled construction trade qualifications who are interested enough to put in an expression of interest, only a tiny minority have been issued with an invitation to apply for a skilled visa.

The following outcomes are for the four months from August to November 2023. By this time the Labor Government was well aware of the seriousness of the housing crisis and the need for additional skilled construction workers. Yet the numbers expressing interest were negligible as were the numbers of those invited to apply for a skilled permanent entry visa.

For electricians, 296 principal applicants submitted an expression of interest, and just 29 were issued with an invitation to apply. For plumbers 145 submitted an expression of interest and 22 were invited to apply. For carpenters the parallel numbers were 617 expressions of interest and 59 invitations to apply. For bricklayers, it was 86 expressions of interest and 13 invitations to apply.

The skilled points tested visas are attracting much greater interest from registered nurses, accountants and programmers. There were 9780 expressions of interest over the four months received from accountants of whom 419 were invited to apply. The parallel figures for registered nurses were 5071 expressions of interest and 399 invitations to apply. For programmers there were 11,916 expressions of interest and 1481 invitations to apply.

There may be many migrants who have worked in construction and would like to receive a permanent entry skilled visa. However, to receive such a visa (and to work as a skilled construction tradie) they need qualifications equivalent to those of an Australian resident who has completed an apprenticeship in the trade. There are plenty of Europeans eligible but few Asians.

Perhaps overseas students could augment the skilled workforce by entering the ranks of building apprentices? This is something that the overseas student industry would like to see happen. However this is currently not possible.

The reason is not lack of citizenship. Rather, Australia's Apprenticeship authorities stipulate that to be eligible a candidate must find an employer willing to sign up to a Training Contract that includes on the job training and paid time off for TAFE training. They have concluded that the rules on allowable work hours for education visas do not meet these apprenticeship requirements.

An official responsible for decisions on apprentice eligibility indicated that:

- We don't recommend apprenticeship and traineeship pathways for candidates on a (temporary) visa.
- We recommend waiting for Permanent Residency and then starting the process.

In these circumstances migration is not providing and cannot provide a significant boost to the skilled construction trade workforce.

Any solution will have to go to the root of the problem, which is that there is not enough domestic training in these skills.

Cottage industry, fragmented with low capital base

As an industry residential home construction is very much a cottage industry. Across all of Australia approximately 53% of those employed in home construction are self-employed in a business that has no other workers. Another 45% work in businesses that have between 1-19 employees.

Thus approximately 98% of the workers constructing residential homes are working for themselves or in a small business.

Table 17 below shows the current 'micro-business' structure of residential home construction and businesses servicing this industry.

Table 17: Size of businesses in the private sector workforce involved in construction			
Industry of Employment	Nil employees	1-19 employees	20 or more employees
House Construction	53.0%	44.9%	2.1%
Carpentry Services	69.4%	29.9%	0.7%
Electrical Services	48.0%	48.7%	3.3%
Plumbing Services	49.7%	47.7%	2.7%
Painting and Decorating Services	68.2%	31.2%	0.6%
Other Residential Building Construction	55.5%	42.6%	1.9%
Tiling and Carpeting Services	69.8%	29.7%	0.5%
Concreting Services	51.2%	46.4%	2.4%
Building Construction, nfd	60.9%	36.7%	2.5%
Site Preparation Services	57.9%	38.3%	3.7%
Plastering and Ceiling Services	64.7%	34.2%	1.1%
Bricklaying Services	58.3%	40.8%	0.9%
Roofing Services	50.1%	47.6%	2.3%
Air Conditioning and Heating Services	41.0%	54.0%	5.0%
Glazing Services	51.1%	46.8%	2.1%
Land Development and Subdivision	52.0%	38.5%	9.5%

Table 17: Percentage of private sector businesses by number of employees in selected construction industries. Source ABSTable Builder Census of Population and Housing 2021

While there are productivity benefits from motivated individual workers, the limited capital from small business operations means that they have little free working capital to expand operations. Therefore they take on work sequentially, rather than having the resources to operate multiple projects concurrently. This acts as a brake on the speed of home completions and impacts the supply of new dwellings.

It is possible that significant productivity gains can be achieved by introducing more manufacturing processes in the construction cycle. Rather than having skilled sole operators working independently at individual sites, we might shift to increased customisable pre-fabrication of complete building components.

As individual operators will not have the financial resources to undertake this transition, this is an area in which Government can invest for industry transformation. This will require investment to establish the feasibility, viability and desirability of new prefabrication and construction methods.

Determining the feasibility, viability and desirability of new technology solutions is the typical approach adopted by equity funders, with funding rounds being tied to success in meeting these criteria:

- Feasibility an assessment of whether it is technically possible to create new technologies for construction has typically been the province of organisations such as the CSIRO and universities.
- Viability assessment whether we can develop and use the technologies at a commercially viable price has typically been left to industry partners in collaborative research centres (CRCs).
- Desirability getting insight into the features and benefits the buyer wants has typically been done downstream, after the prototypes have been completed and basic research done.

The current approach to industry innovation with fragmented methods for determining feasibility, viability and desirability will not work. There are many challenges in changing an industry from being almost entirely composed of micro-businesses to one that has firms of sufficient size to be able to compete on the global market.

Given the importance of the housing industry to our economy, it is critical that governments explore the requirements for an efficient industry to improve affordability.

Fiscal and monetary policy

The Reserve Bank has the responsibility for monetary policy in Australia and it has embarked on a number of increases in interest rates in an attempt to reduce inflationary pressure in Australia and avoid the spectre of runaway inflation.

The use of interest rates to dampen inflationary pressures is a very blunt instrument that both causes collateral damage to the economy when rates are high, and also places much of the burden on home owners with a mortgage.

The recent increases in interest rates have led to higher mortgage repayments and have further reduced the affordability of housing.

The very high cost of housing in Australia also comes with risks for our financial sector as our main banks are almost totally reliant on mortgage interest income for their profitability. Any sharp decline in home prices would likely result in unbearable pressure on the banks and economic chaos.

Ideally, to reduce the risks to the financial system and to improve affordability of housing we would see nominal increases in house prices over a period of years (which would avoid shock to the financial sector), with these nominal rises being below the rate of increase in the CPI (consumer price index).

Rather than rely on interest rate management alone, it is possible to manage demand in the economy (and pressure on inflation) through other instruments.

For example, it would be possible to legislate for a body that is independent of the government of the day (such as the Reserve Bank) to establish a variable GST (goods and services tax) managed by the Reserve Bank. Here the Reserve Bank would have the authority to change the GST rate within a defined range.

A variable GST rate (not managed by the government of the day) could reduce the need for interest rate hikes and spreads the cost of management of inflationary pressures across the whole community, rather than just home purchasers.

Adding to the flexibility of demand management with a variable GST could be introduced in conjunction with support for low-income earners when GST rates are set higher than the baseline.

Lower interest rates would not only improve affordability and reduce mortgage stress, they would also have a positive impact on the supply side, reducing the cost of capital for construction companies and lowering the holding costs while construction is underway.

Recommendations

At the outset of this report we highlighted the likelihood of the housing crisis both worsening and also lasting longer when policy makers take a narrow lens to the problem. It will also worsen when recommendations are made based on an incomplete and inadequate understanding of the housing market.

To build a sound evidence base for proposed policy initiatives the first step is to build an understanding of the current situation. This requires thinking about housing as a system with interconnected parts, and to develop nuanced thinking. For example, buyers are not a single group – the options available to buyers, the preferred type of housing and location vary across first home buyers, upgraders, re-locaters and downsizers.

The second step is to work out, at a system level, what we want our future to look like. The system in focus here needs to be the overall dynamics of the housing market, not specific arbitrary benchmarks. We suggest a goal for the future of the housing market in Australia is a system that is close to equilibrium, with home prices rising each year, but below inflation. This would slowly improve housing affordability and avoid the economic calamity that would arise from a severe collapse in home prices.

The third step is to put forward hypotheses as to how we can move towards our broad goal. We believe that initiatives must address issues of both demand (across all market segments) and supply (including workforce, productivity improvements and capacity), as well as macro-economic policy settings and regulatory settings.

We have prepared a number of recommendations to tackle the crisis gripping Melbourne and Sydney, which can help restore housing affordability and equilibrium to the housing market.

Recommendation 1 – Stop adding fuel to the fire.

Throughout this paper we have highlighted the long term nature of the problems of housing affordability, including the fact that the majority of housing demand over the next 10-15 years is already locked in through the lag effect of migration.

Actions are required now to give the housing system a chance to return to equilibrium in the future. This means that net overseas migration (NOM) must be reduced very significantly. While it will take around 10 years for the impact of recent levels of high migration to wash through the system, significantly lower levels of NOM will reduce short term pressure on rental markets and allow the housing market to reach equilibrium in the longer term.

Recommendation 2 – Recognise the impact of the migration lag effect and fast track urban fringe development.

The scale of the housing crisis is such that 'the least worst' option to improve supply of affordable house and land options is to allow increased urban development on the city fringe.

It is important to recognise that a significant component of the response to the housing shortages that followed the return of servicemen after WW2 and high levels of European migration was relatively unrestricted development on the city fringe.

There is a need for State governments to commit to increased investment in infrastructure in the fringe The goal should be that 50% or more of new builds will take place on the fringe, until we approach equilibrium in the housing market.

Fringe development is not ideal, however not doing this now will make the housing crisis worse for many years longer.

This will require ditching the dominant 'up not out' policies of the NSW and Victorian Governments. It must include opening up the precinct planning system so that new developments can proceed much quicker than is presently the case. Also, there will have to be a commitment to increased government investment in infrastructure in the fringe.

Recommendation 3 – Increase the capacity of the non unionised builders to construct multiple medium density developments simultaneously

Recognising the small builder is typically the most productive provider of housing (producing housing at substantially lower cost than large builders with unionised workforces), they need to be supported with improved access to capital to fund multiple jobs simultaneously to accelerate the number of dwelling units that can be completed each year.

Recommendation 4 – Explore the opportunities to increase productivity in the sector through investment in advanced manufacturing that can prefabricate modules, reducing the need for skilled labour on building sites.

Government R&D funding and programs can focus on technology to reduce time, cost and material wastage in construction. This funding can not only improve housing outcomes but also develop expertise that can be sold around the world.

Recommendation 5 – Reduce the transaction costs and increase local downsize options for empty nesters to make the choice to downsize from a detached dwelling to a townhouse or other medium density development across middle ring suburbs.

Importantly, this means a decentralised approach for encouraging town house and low-rise flats and apartments, rather than clustering them into specific precincts that suit planners but not the prospective buyers.

Recommendation 6 – Improve transport links between the capital cities and major regional cities so that upgraders have an extended choice of areas in which to purchase, reducing asset inflation pressures on high amenity detached dwelling stock.

Recommendation 7 – Reduce reliance on the blunt instrument of interest rate management to control inflation.

Give the Reserve Bank the power to vary the GST rate within a pre-set range. This will allow both interest rates and GST to be used as tools to manage the levels of economic activity and spread the impact of these controls across the community, rather than hitting home buyers only. With less distortion of the capital market the costs for developers in building new homes is reduced.

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References

⁴ A <u>'reference person'</u> is usually Person 1 on the Census form. Where this isn't Person 1, a more appropriate person on the form is chosen during coding. This is based on age, marital status, and relationship considerations. A reference person must be a usual resident of the dwelling aged 15 years and over, and present on Census Night. For example, an adult is chosen rather than a child, or in the event of multiple family households, additional reference people are chosen.

In multiple family households, there is a reference person for each family. The reference person for the primary family is usually defined as the household reference person. The identification of a family reference person allows each family within a dwelling to be treated as a separate entity for tabulation purposes.

For group households, the first person on the form who meets the criteria will become the reference person. For visitor only households and households with no person present aged 15 years and over, the household is considered 'non-classifiable' and no reference person is assigned.

⁵ Treasury, 2024-25 Budget Papers, Budget Paper No. 1, Statement 4: Meeting Australia's Housing Challenge. p. 142

⁶ NSW Productivity Commission, *Building more homes where people want to live,* May 2023, p.30

⁷ Ibid,

⁸ Murray, C, Feasibility Guide for Town Planners, Sydney University, 2020, p.18

⁹ The ABS <u>Statistical Area</u> [SA] Structure is used to release and analyse a broad range of social, demographic and economic statistics. It is a nested hierarchy of geographies, and each level directly aggregates to the next level.

Statistical Areas Level 1 (SA1s) are designed to maximise the geographic detail available for Census of Population and Housing data while maintaining confidentiality. Most SA1s have a population of between 200 to 800 people.

Statistical Areas Level 2 (SA2s) are medium-sized general purpose areas built to represent communities that interact together socially and economically. Most SA2s have a population range of 3,000 to 25,000 people. Statistical Areas Level 3 (SA3s) are designed for the output of regional data and most have populations between 30,000 and 130,000 people.

Statistical Areas Level 4 (SA4s) are designed for the output of a variety of regional data, and represent labour markets and the functional area of Australian capital cities. Most SA4s have a population of over 100,000 people.

States and Territories (S/T) are a cartographic representation of legally designated state and territory boundaries.

¹⁰ Michael Janda, 'Housing density has surged across Australia's cities, yet home prices keep hitting fresh records', ABC post, 28 April 2024

¹¹ Greater Sydney Commission, A Metropolis in Three Cities, 2018

¹² ABS Census, 2021, Community Profiles, Tarneit

¹³ Campbell Kwan, et al., 'Don't cut off skilled workers urge developers'. AFR, 18-19 May 2024

- ¹⁴ Answer to Senate Question no. 2566
- 15 Ibid

¹ Calculated from Table 3 in J. Phillipa and J. Simon Davies, <u>Migration: A Quick Guide to the Statistics</u>, Parliament of Australia, January 2017

² Alan Kohler, The Great Divide, *Quarterly Essay* No. 92

³ In this paper the term <u>'transfer'</u> stands for the record of sale of established houses and attached dwellings, taken from the residential property sales dataset supplied to the ABS by CoreLogic. Transactions between related parties, such as family members, or in divorce settlements are removed from the dataset by the ABS and therefore do not contribute to calculations.