Macro drivers of Australian housing affordability, 1985–2010: An autoregressive distributed lag approach

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Abstract

This paper models the macro drivers of Australian housing affordability using aggregate quarterly data over the period September 1985 to June 2010 and an autoregressive distributed lag (ARDL) approach. We employ two alternative measures of relative housing affordability: the Housing Industry Association’s Housing Affordability Index and the housing price–earnings multiplier. Six sets of variables are then used to proxy the economic, demographic, financial, social and other factors that influence housing affordability, including conditions relating to housing finance, housing construction activity and costs, economic growth, population, alternative investments and taxation. In the long run, the results indicate that the primary drivers of affordability are housing finance, dwelling approvals and financial assets. Interestingly, economic and population growth only have an influence on affordability in the short run, while taxation related to housing has only a limited impact on affordability in the long run. The findings also indicate the high-speed adjustment following a shock to the short-run equilibrium of deteriorating housing affordability in Australia.

JEL codes C22, R21, R31, G21

Keywords Housing affordability, affordability drivers, housing policy

I. Introduction

Housing affordability has represented a continuing policy challenge in Australia since at least the 1970s. Starting with inquiries into housing costs by the Priority Review Staff (1975) and the Committee of Inquiry into Housing Costs (1978), it has subsequently manifested itself in the National Housing Strategy (1991), Affordable Housing National Research Consortium (2001) and the Prime Minister’s Home Ownership Task Force (Bor and Moloney 2003; Caplin et al. 2003; Gans and King 2003). More recently, it includes a Productivity Commission (2004) report on first-home ownership, the creation of a framework for national action on affordable housing by a joint meeting of the Housing, Local Government, and Planning Ministers (2005), and a Senate Select Committee on Housing Affordability in Australia (SCHAA) (2008).

These national government initiatives, of course, exclude the many separate efforts taken by state and local governments and industry, consumer, and welfare groups in Australia to focus attention on housing affordability. These include an ongoing National Affordable Housing Summit, various industry reports [see, for instance, Urban Development Institute of Australia (2007)], and successive publications from the Australian Housing and Urban Research Institute (AHURI) [Chapman (2006),

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Reasons for this interest in Australian housing affordability are not hard to find after drawing upon international comparisons. By all accounts, not only are Australian houses now among the world’s largest [an average 186m$^2$ for new homes, compared with 76m$^2$ in the UK and 200m$^2$ in the US (SCHAA 2008)], but also the most expensive. In evidence, between 1997 and 2010, Australian house prices increased nationally by 220%, compared with 181% in Britain, 129% in Ireland, 70% in the US, 141% in France, 70% in Canada, 157% in Spain, –37% in Japan, 18% in Singapore, and 108% in New Zealand (Anonymous 2010). More ominously, calculations of the long-run price-to-rent ratio by The Economist magazine (Anonymous 2010) indicate Australia also has the world’s most overvalued (63.2%) housing market, well ahead of the US (10.6%), Canada (23.9%), Britain (32.0%), and New Zealand (20.2%). In yet other international evidence, housing in Australia is also the most unaffordable, with 96% of its urban and regional submarkets ranked severely unaffordable, compared with 63% in New Zealand, 58% in the UK, and just 18% and 6% in Canada and the US, respectively (Cox and Pavletich 2010).

The relative deterioration in Australian housing affordability is equally alarming in domestic terms. Consider the quarterly housing price–earnings multiple constructed using Australian Bureau of Statistics (ABS) data from September 1985 to June 2010 shown in Table 1. During this period, median house prices increased substantially, from $65,900 in the September quarter of 1986 to $534,800 in the June quarter of 2010, an eightfold increase representing an annual growth rate of some 8.9%. However, during the same period, average annual full-time earnings increased from only $20,191 to $65,114, a slightly better than threefold increase at an annual average growth rate of 4.8%. As a result, the housing price–earnings multiple increased from just 3.3 in September 1985 to 8.2 in June 2010, suggesting a substantial generational worsening of housing affordability. The persistent increase observed during the period 1985–2010 in the housing price–earnings multiple is consistent with other studies in this area and over time. For example, Merrett (2000) concludes that from the 1880s to the 1930s, the price–earnings multiple in Australia was about 5, while Yates (2007a) suggests a multiple of 3–4 in the late 1950s, increasing fourfold between 1960 and 2006. Similar sorts of figures are given by the Committee of Inquiry into Housing Costs (1978) in the 1970s, while the
Productivity Commission (2004) estimated that the multiple had increased from 6 in the mid-1990s to about 9 at the time of its report.

In absolute terms, the record is no better. The Housing Industry Association (HIA) Housing Affordability Index plotted in Figure 1 records the ratio of average household disposable income to the ‘qualifying’ income required for a ‘typical’ first home loan. Qualifying income here is the assumption that the repayments on a 25-year loan, for 80% of the price of a ‘typical’ property purchased by a first homebuyer, are equal to 30% of household income (when the index value equals 100, housing costs account for the industry maximum 30% of disposable income). In September 1985, the index stood at 191.0, well below the maximum share of disposable income.

Figure 1 Housing Affordability Index (HAI) and inverse housing price-earnings (HPE) multiple, Sep 1985-Jun 2010

However, in the intervening period, the index has trended down by about 0.8 points per quarter and housing affordability as a result has worsened, such that by June 2010, the index was at 108.3, slightly above the record low of 107.1 in March 2008, and now close to the point where housing costs will exceed 30% of disposable income. All the same, even this sophisticated measure likely understates the actual level of housing affordability in that concern lies only in the direct costs of housing purchase. It therefore ignores the ongoing costs of ownership, including property rates, depreciation and maintenance, and the indirect costs of acquisition (including stamp duty, real estate agency fees and charges, furniture removal, transport, etc.).
The lack of affordable housing in Australia has many worrying implications. Apart from meeting the basic need for shelter, affordable housing also provides a foundation for family and social stability, and contributes to improved health, educational, social and economic outcomes (Gabriel et al. 2006, Productivity Commission 2004). Homeowners also may have a relatively stronger incentive for civic involvement, their typically longer residential tenure suggests minimal disruption to social networks and children’s education, and the enhancement of self-esteem through homeownership can potentially reduce the incidence of socially disruptive behaviour and promote physical wellbeing (SCHAA 2008). Yet other work points out the benefits of homeownership for access to disability and aged services and the reduction in welfare dependency. Somewhat more prosaically, homeownership also serves as a tax effective, low risk, stable return, and long-term investment for household portfolios.

Of course, the many inquiries, reports, and commentaries concerning the deterioration of housing affordability in Australia have not only addressed its measurement but also its purported drivers, including strong economic growth and changing population dynamics, cheap and readily-accessible housing finance, changes in government policy, and a generally favourable tax environment. There is also discussion of the several government responses, including direct and indirect assistance in the form of concessions on stamp duty, grants and more recently subsidised home-saving accounts and funds to promote reforms in planning and building approvals. However, it is surprising to find that none of this is of a quantitative nature, with very few details on the specific contribution of the myriad drivers to housing affordability or any assessment of their interaction in a multifactor framework.

Accordingly, the primary purpose of this paper is to estimate and interpret a model of housing affordability and its determinants in Australia over the past quarter century. This will permit a more exact understanding of the drivers of housing affordability and place the policy efforts of the very many interested stakeholders on a more solid empirical footing. The remainder of the paper comprises five sections. Section II discusses the main drivers of housing affordability. Section III presents the data and variable specification and Section IV the estimation method and model. Section V provides the results. The paper ends with some concluding remarks in Section VI.

II. Macro drivers of housing affordability

As shown in Figure 2, the primary components of all measures of housing affordability are housing prices, household incomes and/or interest rates. Each of these as a price in its own right has its own demand and supply factors, with some being ‘cyclical’, with their effects felt primarily in the short
term, and others ‘structural’, and therefore influencing prices over the medium to longer term. Moreover, each of the components of housing affordability affects the remaining components. For example, interest rates and household incomes influence housing affordability both directly, through their impact on housing affordability measures that typically include adjustments for income and interest rates, and indirectly through their affect on housing demand and thence housing prices.

**Figure 2 Selected drivers of housing affordability**

![Diagram of housing affordability drivers](image)

**Source:** Yates and Milligan (2007)

Fundamentally, we can trace some of the reasons for the decline in housing affordability in the past quarter century to Australia’s earliest colonial beginnings. From the start, and almost incongruously given the close association of Australians with ‘the bush’, Australia has always had one of the world’s most urbanised populations. Moreover, the populations in the several Australian colonies (states following Federation in 1901), were concentrated in just a single capital, and so even in comparison with other settler colonies like the US, Canada and New Zealand, Australia has relatively few major urban concentrations. For instance, 57% of the population now call one of Australia’s five-largest cities home, compared with 18% in the US and 27% in the UK (Callaghan 2010).

Other long held inherited factors determining housing demand include the strong cultural preference of Australians for detached dwellings on large suburban blocks and the high rate of owner-occupation [comparable to the US and UK at about 70% but as there significantly higher than elsewhere in the OECD (SCHAA 2008)]. The implications of these factors are that a few increasingly congested capital city markets spread over very large geographic areas with severe infrastructure and planning requirements dominate the question of housing affordability in Australia.
Outside these factors and in terms of the quarter century that is the focus of this paper, strong housing demand and limited and slow to react housing supply are the most obvious and cited reason for the increase in housing prices and the deterioration in housing affordability. Underlying this market behaviour are several drivers repeatedly cited in the various government and nongovernment inquiries and reports. On the demand side, these include the cost of housing finance, economic growth and population dynamics, and changes in government policy and tax incentives.

First, the Productivity Commission (2004), the SCHAA (2008) and the OECD (2011) all conclude that cheaper and more accessible housing finance is a central part of the story. With the move to a low-inflation environment, interest rates fell over much of the 1990s and remained at relatively low levels throughout the 2000s. At the same time, increased competition among housing lenders (including the rise of mortgage originators and brokers) has made it easier for many borrowers to obtain loans, and has contributed to lower interest costs by reducing lending margins. This has also flowed through to investor housing, where expectations of rising housing prices and a favourable tax environment has seen a doubling of the proportions of taxpayers with an investment property and the proportion of new housing loan commitments for investment purposes in just the last decade. Problematically, while changes in interest rate regimes are conventionally only a cyclical influence on housing affordability, the SCHAA (2008, p. 54) argues that as housing prices are ‘sticky’, vendors are reluctant to accept low bids even with rising interest rates and that affordability will only be restored by the gradual increase in incomes.

Second, economic growth and population dynamics have also had a role to play (Productivity Commission 2004; SCHAA 2008). In terms of economic growth, strong productivity gains in the 1990s from deregulation and microeconomic reform and the sustained ‘resources boom’ of the 2000s has increased household income and wealth and part of this has been diverted into increasing the overall quality of owner-occupied housing and the demand for investor housing. The influence of the mining boom itself on house prices is especially noticeable in regional areas of the major mining states (Western Australia and Queensland but also New South Wales and South Australia). As for population growth, the Australian population of 22.342 million is now growing at its fastest rate since the 1960s (currently 1.7% per year with 43% from natural increase and 57% from net overseas migration). This is also partly fuelled by the mining boom (with higher rates of population growth in the mining states), with immigration an important contributor to the growth in underlying demand, especially in Sydney and Melbourne, and interstate migration a major contributor in Queensland, particularly in the rapidly growing southeast. Accompanying this has been the long but still increasing
trend to smaller, often single-occupancy households, and the pressures this also places on housing demand.

The final demand driver for housing prices is the changes in government policy and the favourable tax environment for both owner-occupied and investor housing that has prevailed and increased for much of the last twenty-five years. In terms of owner-occupied housing, owners are exempt from capital gains tax (CGT) and land tax while the means-tested public pension excludes the family home. For investor housing, investors benefit from concessional capital gains tax treatment and generous negative gearing (since October 1987) and allowances for depreciation. Overall, SCHAA (2008: 62) suggests that the tax treatment of both owner-occupied and investor housing in Australia is relatively favourable when compared with other OECD economies. For its part, the Productivity Commission (2008: 75) considers that “...aspects of the personal taxation regime—including negative gearing rules, ‘capital works’ deductions, the 1999 change to capital gains tax, and high marginal income tax rates—have combined to magnify the attractiveness of investing in residential property during the recent upswing in house prices, thereby adding to price pressures”.

Apart from government policy as it relates to taxation, there is also direct government assistance to households to purchase their own home. Of these, the First Home Owner Scheme, notionally introduced to compensate first-home buyers for the introduction of the goods and services tax (GST) in 2000, is the most noteworthy. For its part, the Productivity Commission (2004) argues that this scheme has not being well targeted, with among other things the cap on price eligibility set too high such that as with other forms of demand-orientated direct assistance, it has placed pressure on house prices. The details of the housing assistance schemes available vary by state.

Using NSW as an example, first-home benefits of up to $24,990 are currently available, comprising a $7,000 First Home Owner Grant and a duty exemption of up to $17,990 under the First Home Plus Scheme, with a house price cap for eligibility set at $835,000. This involves a substantial amount of cost subsidisation to first homebuyers, with the scheme providing the more than thirty thousand purchasers with direct assistance of $636 million in 2010 alone (NSW Office of State Revenue 2011). Most recently, in 2008 the federal government established First Home Saver Accounts to assist first-home buyers (Australian Government Treasury 2011). Under this arrangement, the government contributes 17% on the first $5,000 (indexed) of individual contributions made each year. In these accounts, investment earnings (or interest) that accrue in the accounts is taxed at a concessional 15 percent while withdrawals are tax free when used to purchase an owner-occupied home.

While the supply side has not been a principal cause for the increase in housing costs in Australia over the past twenty-five years, a common argument is that the inflexibility of the supply side...
response has also aggravated outcomes. In evidence, the OECD (2011) concludes that while the price elasticity of housing supply in Australia is about average for the OECD, it is relatively low when compared with countries with a similar population density, such as the US and Canada. This means that increases in the demand for housing involves significant increases in housing prices and that the nature of housing development and construction means that it may take some time for short and medium-term supply–demand imbalances to be resolved. Once again, part of the problem in Australia is that inherent geographical and demographic conditions, including physical limitations on land for development and the degree of urbanisation, restrict housing supply in certain areas and open up differences in regional housing affordability.

However, government policy also affects the supply of housing as it relates to both land and housing planning, regulation and taxation. One complication in the Australian situation is, of course, the presence of a three-tier system of government where all tiers of government are heavily involved with the housing sector. State and territory governments, for instance, have extensive responsibilities related to land release and zoning, establishment of charges for (and in some cases provision of) housing-related infrastructure, and implementation and enforcement of building and environmental regulations. Likewise, local government functions typically include the supervision of land development, the administration of planning requirements, and the supply of some infrastructure. Finally, while most of the taxation related to housing is at the state and local level (including stamp duty and land taxes for the former and property rates for the latter), the GST, CGT and allowances for income deductibility at the federal levels also have a role to play.

On this, and further to the discussion of tax policy as a demand driver, the Productivity Commission (2004: 83) concluded that “…although international comparisons of taxation arrangements can be difficult, Australia’s reliance on specific property taxation seems high compared with many other countries. Such taxation accounted for about 9 per cent of total taxation revenue for Australia in 2001, compared with a range from below 2 per cent to 12 per cent in a selection of overseas countries”. Together, these various taxes and charges can add significantly to both the cost of acquiring and holding housing, and hence reduce the level of affordability. These also influence the overall transaction costs of acquiring and disposing of housing, with the OECD (2011) providing evidence that transaction costs (on both buyers and sellers) in Australia account for about 14% of the property value (fourth highest in the OECD after Belgium, France and Greece).

Putting taxation aside, the capacity of state and local governments to influence housing markets through zoning and development plans and thereby contribute to housing price pressures through new dwelling commencements and redevelopment in existing areas. This is particularly important
because of the presence of an argued structural gap between the demand and supply of housing (Stuchbury 2010) and the oft-heard argument by industry that slow and restrictive building and development approvals and onerous infrastructure charges are one of the main reasons for the increase in housing costs (Carter 1990). However, the actual position of Australia in terms of the planning and regulation of housing and development is unclear. This ambiguity is perhaps best reflected in the Productivity Commission’s (2004: 123) argument that “…because recent price increases have been due mainly to the surge in demand in established areas, improvements to land release policies or planning approval processes could not have greatly alleviated them”. Confusingly, in the same report, “…urban consolidation policies that introduce constraints on fringe development, including through ‘urban growth boundaries’, are likely to increase the scarcity value of land” (Productivity Commission 2004: 123).

Overall, the Productivity Commission (2004) concluded that planning processes have not contributed in any significant way to the housing affordability problem (Beer et al. 2007). Nevertheless, there remains general agreement inside both Australia and the OECD (2011) that the housing supply in Australia could be more responsive by designing and enforcing efficient land-use regulations, providing infrastructure and other services along with housing, and using well-designed taxes to encourage the appropriate use of land for residential purposes.

There is some recognition of this problem in the recent creation of the Commonwealth government’s $512 million Housing Affordability Fund (FAHCSIA 2008), expressions of interest (by state and local governments) in which closed in January 2010. The stated aims of this fund are “…to make housing more affordable by encouraging best practice in…residential development assessments, speeding up development assessment processes to reduce the holding costs for developers…and reducing the burden of infrastructure charges on developers, in order to generate savings for purchasers of new, moderately priced homes”. However, while this scheme is yet unimplemented, there are already some concerns over its ability to alter the supply of housing, with the suggestion that subsidies targeted directly at low-income first homebuyer households may be a more efficient and simpler way to improve housing affordability, with less distortion and more allowance for household choice (Abelson 2009).

III. Data and variable specification

Drawing on the above discussion, we hypothesise that housing affordability is a function of a set of economic, demographic, financial and other factors as follows. To start with, we proxy housing affordability as the dependent variable using two alternative quarterly measures over the period
September 1985 to June 2010: (i) the Housing Affordability Index (HAI), provided by the Housing Industry Association (2011), and (ii) the inverse of the housing price–earnings multiple (HPE), constructed using ABS data on median housing prices and annual full-time earnings. The main distinction between these measures is that HPE represents only the cost of housing relative to income while HAI is an absolute measure that also incorporates the costs of housing finance given assumptions on leverage and maturity. Nonetheless, an increase (decrease) in both measures as constructed represents an improvement (worsening) of housing affordability, i.e. housing becomes more (less) affordable.
<table>
<thead>
<tr>
<th>Variable category</th>
<th>Code</th>
<th>Description</th>
<th>Expected sign</th>
<th>Expected sign</th>
<th>Data source</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing affordability</td>
<td>HAI</td>
<td>Housing Affordability Index (n)</td>
<td>n/a</td>
<td>n/a</td>
<td>HIA</td>
<td>107.06</td>
<td>231.62</td>
<td>167.78</td>
<td>35.34</td>
<td>0.21</td>
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<td></td>
<td>HPE</td>
<td>Inverse of housing price–earnings multiple (n)</td>
<td>n/a</td>
<td>n/a</td>
<td>ABS</td>
<td>121.75</td>
<td>331.92</td>
<td>218.75</td>
<td>57.96</td>
<td>0.26</td>
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<tr>
<td>Housing finance</td>
<td>SVM</td>
<td>Standard variable mortgage rate - banks (%)</td>
<td>?</td>
<td>+</td>
<td>RBA</td>
<td>5.80</td>
<td>17.00</td>
<td>9.69</td>
<td>3.42</td>
<td>0.35</td>
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<tr>
<td></td>
<td>DTA</td>
<td>Housing debt to housing assets (leverage) (%)</td>
<td>+</td>
<td>+</td>
<td>RBA</td>
<td>10.28</td>
<td>31.10</td>
<td>18.90</td>
<td>6.20</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>RTD</td>
<td>Housing interest payments to disposable income (debt)</td>
<td>–</td>
<td>–</td>
<td>RBA</td>
<td>4.02</td>
<td>11.19</td>
<td>6.05</td>
<td>1.86</td>
<td>0.31</td>
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<td>LIN</td>
<td>Lending commitments (share of investor housing) (p)</td>
<td>–</td>
<td>–</td>
<td>ABS</td>
<td>0.05</td>
<td>0.63</td>
<td>0.20</td>
<td>0.15</td>
<td>0.75</td>
</tr>
<tr>
<td>Housing construction activity and costs</td>
<td>PPH</td>
<td>Producer price index, housing construction (n)</td>
<td>–</td>
<td>–</td>
<td>ABS</td>
<td>72.10</td>
<td>165.20</td>
<td>119.40</td>
<td>23.62</td>
<td>0.20</td>
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<td>DHP</td>
<td>New private sector dwelling units approved, 000s (n)</td>
<td>+</td>
<td>+</td>
<td>ABS</td>
<td>18.22</td>
<td>36.62</td>
<td>26.56</td>
<td>3.94</td>
<td>0.15</td>
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<tr>
<td></td>
<td>DHG</td>
<td>New public sector dwelling units approved, 000s (n)</td>
<td>+</td>
<td>+</td>
<td>ABS</td>
<td>0.26</td>
<td>1.97</td>
<td>0.73</td>
<td>0.39</td>
<td>0.53</td>
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<tr>
<td>Economic growth</td>
<td>GDP</td>
<td>Gross domestic product, thousands ($)</td>
<td>–</td>
<td>+ /–</td>
<td>ABS</td>
<td>145.15</td>
<td>325.43</td>
<td>224.31</td>
<td>55.50</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>MIN</td>
<td>Index of mining production (n)</td>
<td>–</td>
<td>–</td>
<td>ABS</td>
<td>36.40</td>
<td>109.60</td>
<td>72.79</td>
<td>18.82</td>
<td>0.26</td>
</tr>
<tr>
<td>Demographic s</td>
<td>POP</td>
<td>Estimated resident population, mil. (n)</td>
<td>–</td>
<td>–</td>
<td>ABS</td>
<td>15.84</td>
<td>22.34</td>
<td>18.77</td>
<td>1.77</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>PAR</td>
<td>Labour participation rate (%)</td>
<td>+</td>
<td>+</td>
<td>ABS</td>
<td>61.12</td>
<td>65.66</td>
<td>63.48</td>
<td>1.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Alternative investments</td>
<td>ASX</td>
<td>ASX All Ordinaries Index (n)</td>
<td>+ /–</td>
<td>+ /–</td>
<td>ASX</td>
<td>955.00</td>
<td>6492.4</td>
<td>2832.2</td>
<td>1356.10</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>BND</td>
<td>Yield on 10-year Govt. bonds (%)</td>
<td>+ /–</td>
<td>+ /–</td>
<td>RBA</td>
<td>4.22</td>
<td>14.85</td>
<td>8.12</td>
<td>3.08</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>INB</td>
<td>Yield on indexed bonds (%)</td>
<td>+ /–</td>
<td>+ /–</td>
<td>RBA</td>
<td>2.15</td>
<td>5.94</td>
<td>3.96</td>
<td>1.09</td>
<td>0.28</td>
</tr>
<tr>
<td>Taxation</td>
<td>TAX</td>
<td>Marginal personal tax rate at average earnings (%)</td>
<td>–</td>
<td>–</td>
<td>ATO</td>
<td>0.30</td>
<td>0.46</td>
<td>0.35</td>
<td>0.05</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>GST</td>
<td>Introduction of GST (and FHOG) (from Sep-2000 = 1; otherwise 0)</td>
<td>?</td>
<td>?</td>
<td>ATO</td>
<td>0.00</td>
<td>1.00</td>
<td>0.40</td>
<td>0.49</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>NEG</td>
<td>Negative gearing reintroduced (from Sep-1987 = 1; otherwise 0)</td>
<td>–</td>
<td>–</td>
<td>ATO</td>
<td>0.00</td>
<td>1.00</td>
<td>0.92</td>
<td>0.27</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>CGT</td>
<td>Changes to CGT (from Sep-1999 = 1; otherwise 0)</td>
<td>–</td>
<td>–</td>
<td>ATO</td>
<td>0.00</td>
<td>1.00</td>
<td>0.44</td>
<td>0.50</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Table 1 provides selected descriptive statistics for HAI and HPE. As shown, while both measures have varied throughout the sample period, HPE is generally more volatile with a coefficient of variation of 26% compared to 21% for HAI. As a rule, for most mortgage-holding households, we expect that HPE offers a better medium-to-long term perspective on housing affordability (relative to household incomes), while the HAI index places relatively greater emphasis on short-term changes in affordability (relative to interest rates) for highly-geared (80% loan-to-valuation ratio) first-home and investor (25-year maturity) buyers. However, while this at first suggests the HAI should be the more volatile measure (given incomes as the denominator in HPE increase at a stable rate), the record indicates that interest rates have for the most part moderated the impact on housing affordability of the increase in housing costs. For example, while in the late 1980s and early 1990s high interest rates substantially worsened the impact of rising housing prices, from the mid 1990s right through to the mid 2000s, overall affordability benefited from relatively low interest rates, with housing prices rising at much the same rate as earlier. This is consistent with the findings of other work that the worsening housing affordability found in Australia is a generally tale of housing costs not housing finance costs.

Six sets of variables are used to proxy the economic, demographic, financial, social and other factors that influence housing affordability. All regressor data is also of quarterly frequency over the period September 1985 to June 2010. The first set relates to the market for housing finance and its influence on housing affordability. The first variable, the standard variable bank mortgage rate (SVM), represents the price of housing finance. As HAI already includes mortgage interest rates in its construction, we would expect the estimated coefficient to be insignificant when HAI is specified as the regressand. However, with HPE, higher (lower) interest rates will result in a decrease (increase) in demand for housing, house prices will fall (increase) and affordability as measured by HPE should improve. A positive coefficient is hypothesised. The second variable, housing debt to housing assets (DTA), is a measure of leverage. In general, deregulation of the Australian financial system has meant that aggregate leverage has increased such that more households can access suitable levels of housing finance to purchase homes. We again expect a positive coefficient: that is, affordability should improve.

The third variable, housing interest payments to disposable income (RTD), is an indicator of debt servicing. All other things being equal, a higher level of debt servicing implies a worsening in housing affordability through increasing financial stress in mortgage-holding households. Potentially, this could also be followed by a decrease in the demand for housing, falling housing prices and improved affordability. Nonetheless, we expect a negative coefficient overall. Finally, lending commitments
(proxied by the share of investor housing) \((LIN)\) reflects the availability of housing finance for investment purposes as against those of owner occupiers. It is sometimes argued that one negative side effect of financial deregulation has been an easing of the availability of finance to investors and that this has increased prices in strong housing markets and so worsened housing affordability. A negative coefficient is hypothesised for both regressands.

The second set of explanatory variables relate to housing construction activity and costs. The first of these is the producer price index for housing construction \((PPH)\). All other things being equal, higher costs of supply should contract the supply of housing and increase house prices, thereby worsening affordability, and so would expect a negative coefficient when affordability is regressed against the price of housing. The next two variables also reflect the supply of housing via the approval of new dwellings, made available through both the private \((DHP)\) and public sector \((DHG)\). As a rule, increases in housing supply should again lower house prices and improve affordability: positive coefficients are hypothesised.

The third set of variables concerns economic growth. As discussed, it is often argued that Australia’s strong economic growth has increased household income and wealth and part of this has been diverted into increasing the demand for more and higher quality housing, resulting in increasing housing prices and a deterioration in affordability. Gross domestic product \((GDP)\) proxies for this effect for which we hypothesise a negative coefficient. However, with \(HPE\) the increase in incomes associated with strong economic growth should also increase incomes relative to housing prices, thereby improving housing affordability, for which a positive coefficient could also be hypothesised. The sign will then depend on the relative strength of these competing effects.

The second economic growth variable employs an index of mining production \((MIN)\) to proxy for the impact on the demand for housing of the resources boom of the 2000s. Certainly, the impact of the mining boom is visibly most acute in small mining towns, where the smaller housing stock accentuates the impact of the increase in housing demand for miner accommodation on house prices (see, for instance, Moranbah in Queensland and Karratha in Western Australia). However, there is also a wider impact when miners invest in housing in desirable nearby coastal locations (for example, Mackay and Rockhampton in relation to the Bowen Basin in Queensland) or further afield, and then become part of a significant fly-in fly-out long-shift workforce accommodated in temporary work camps. A negative coefficient is hypothesised.

The fourth set of variables relate to demographics. As discussed, the rapidly growing Australian population \((POP)\) is argued to exert a considerable influence on the rate of household formation and the demand for housing, thereby increasing house prices and worsening affordability (a negative
The labour participation rate (PAR) is also likely to have an influence with a higher participation rate increasing household incomes and pushing prices up and affordability down. We again hypothesise a negative coefficient.

The fifth set of explanatory variables address general financial market conditions. In this regard, we specify two variables, the ASX All Ordinaries Index (ASX) and the yield on 10-year government bonds (BND), as indicators of the financial returns available on alternative investments to real assets in the form of residential housing. In both cases, this would infer a positive coefficient as relatively higher yields on these investments would reduce the demand for housing investment, thereby causing house prices to fall and affordability to improve. However, it is also possible that in much the same manner that earned income from higher GDP increases the demand for housing, returns from financial assets could also be diverted into real assets such as residential housing. This would imply a positive coefficient.

Similarly, in the same set of variables we include the yield on indexed bonds (INB) as a proxy for the expected rate of inflation. In general, higher expected inflation brings forward consumption decisions and this should increase the demand for housing and with it housing prices (worsening affordability). However, when we consider housing finance as a component of the demand for housing, the increase in expected inflation (and interest rates) also causes some households to substitute away from housing toward current and future non-housing consumption. Accordingly, we hypothesise no particular a priori sign on the estimated coefficients for these financial variables.

The final set of explanatory variables concern the taxation environment as it relates to residential housing. Three of these, the (relatively high) marginal personal tax rate at average earnings (TAX), the reintroduction of negative gearing (NEG) and the 1999 changes to capital gains tax (CGT) have been argued by the Productivity Commission (2004) to have magnified the attractiveness of investing in residential property during the recent upswing in house prices, thereby adding to price pressures and worsening affordability. We hypothesise negative coefficients when these variables serve as regressors for housing affordability. The fourth variable, identifying the introduction of the goods and services tax (GST) and concomitantly higher construction costs, would be normally associated with a contraction in housing supply and worsening affordability. However, we consider that the impact of the GST is offset by the introduction at the same time of the first-home owners grant (FHOG) as compensation, as was the policy intent. No particular sign is thus hypothesised.

IV. Estimation method
The method we employ to investigate the short- and long-run relationships between the housing affordability measures as regresands and the housing finance, housing construction and activity, economic growth, demographic, alternative investment and taxation variables as regressors is the bounds test and autoregressive distributed lag (ARDL) cointegration procedure developed by Pesaran et al. (2001) with recent empirical applications (but not in housing) in De Vita and Abbott (2004), Narayan (2005), Narayan and Smyth (2005), Fosu and Magnus (2006), Pahlavani and Rahimi (2009) and Sakyi (2011). This has three main advantages over earlier cointegration techniques when applied to aggregate data such as in our study. First, it is relatively simple compared with the Johansen and Juselius (1990) multivariate cointegration technique as ARDL permits the cointegration relationship to be estimated using ordinary least squares (OLS) once the lag order of the model has been identified.

Second, the chosen approach is applicable irrespective of whether the regressors are purely stationary without any trend—and thus integrated of order zero or I(0) —or with a unit root (a random walk) —and therefore integrated of order one or I(1) —or mutually cointegrated. Nevertheless, it will produce spurious results for I(2) or higher series so differencing is still required to reduce these to I(1). Finally, the technique is more efficient for the small sample size found with our data set, a situation where both the Engle and Granger (1987) and Johansen (1988; 1991) cointegration methods are considered unreliable.

The ARDL including bounds test comprises three steps. The first step is to estimate a standard log-log specification of the cointegrating long-run relationship for an I(1) dependent variable as a function of a vector of I(d) regressors of order 0 < d < 1. We specify the housing affordability Equation (1) as:

\[
\Delta \ln Y_i = \alpha_0 + \alpha_1 \ln Y_{i-1} + \sum_{j=2}^{m+1} \alpha_j \ln X_{i-1} + \sum_{j=2}^{m+1} \sum_{k=1}^{n} \alpha_{jk} \Delta \ln Y_{i-j} + \sum_{k=1}^{p} \alpha_k D_{ik} + \epsilon_i
\]

where \(Y\) is HAI or HPE, \(\alpha_0\) is drift, \(\alpha_1\) is an autoregressive parameter, \(\alpha\) are long-run multipliers for the explanatory variables (SVM, DTA, RTD, LIN, PPH, DHP, DHG, GDP, MIN, POP, PAR, ASX, BND, INB) where \(i = 2, 3, \ldots, m+1\) where \(m\) is the number of explanatory variables, \(\Delta\) are first-differenced terms to ensure the residuals, \(\epsilon\), are white noise identically and independently distributed (i.i.d), \(\alpha_{m+1}\) and \(\alpha_{jk}\) are first-differenced parameters where \(p\) is the number of lags, \(\alpha_{k}\) are dummy variable parameters where \(n\) is the number of dummy variables, \(D\) are dummy variables (TAX, GST, NEG, CGT) and all other variables are as previously defined.

Equation (1) is estimated by OLS in order to test for the existence of a long-run relationship among the lagged levels of the explanatory variables by conducting a joint F-test to determine the significance of the coefficients of these slope variables. The null hypothesis of no cointegration
among the variables in Equation (1) is tested using $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 \ldots = \alpha_{m+1} = 0$ against the alternative $H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \ldots \neq \alpha_{m+1} \neq 0$. Two sets of critical values reported in Pesaran et al. (2001) provide critical values bounds of the test for cointegration, when the explanatory variables are assumed $I(d)$ where $0 < d < 1$. The lower critical value of the bounds test assumes the regressors are $I(0)$ and the upper value assumes the regressors are $I(1)$. If the $F$-statistic is above the critical upper limit, then the null hypothesis of no cointegrating long-run relationship can be rejected, irrespective of the orders of integration of the individual time series. Conversely, if the $F$-statistic is below the lower critical value, then the null hypothesis of no cointegrating long-run relationship cannot be rejected. If the $F$-statistic falls between these critical values, the test is inconclusive.

In the second step, once cointegration has been established the conditional ARDL ($I, p$ lags for each explanatory variable) long-run model for the log of $Y$ is estimated in Equation (2) as:

$$\ln Y_t = \beta_0 + \beta_1 \ln Y_{t-1} + \sum_{i=1}^{m} \sum_{j=0}^{p} \beta_{ij} \ln X_{t-i} + \sum_{k=1}^{n} \beta_k D_{t-k} + \epsilon_t$$  \hspace{1cm} (2)

This involves selecting the orders of the ARDL ($I, p$ lags for each explanatory variable) model using the Akaike information criteria (AIC). The third and final step involves the estimation of the short-run dynamic parameters using the error correction model (ECM) associated with the long-run estimates. The ECM is defined in Equation (3) as follows:

$$\Delta \ln Y_t = \gamma_0 + \gamma_1 \Delta \ln Y_{t-1} + \sum_{i=1}^{m} \sum_{j=0}^{q} \gamma_{ij} \Delta \ln X_{t-i} + \gamma_2 \text{ECR}_{t-4} + \epsilon_t$$ \hspace{1cm} (3)

where $\gamma_{ij} = 1, 2, 3, \ldots, m, j = 1, 2, \ldots, q$ are the short-run dynamic coefficients of the convergence of the model to equilibrium and $\text{ECR}$ is the speed of adjustment. Note that as the dummy variables are all by nature very long run (fixed for long periods), they are omitted.

**V. Empirical Results**

The ARDL bounds test for cointegration does not depend on pre-testing the order of integration. Nonetheless, a unit root test is conducted on all variables as the ARDL procedure requires that all variables are $I(0)$ or $I(1)$. We employ a relatively more efficient autoregressive univariate Dickey–Fuller generalised least squares (DF-GLS) unit root test (Elliot et al. 1996). This is a modification of the augmented Dickey–Fuller (ADF) unit root $t$-test with the application of generalised least squares (GLS) which de-trends the series before applying the ADF test. In general, the DF-GLS test outperforms the ADF test in relation to sample size and power. The DF-GLS test includes a constant and trend for the log level series and a constant with no trend for the difference of the log level
series. The DF-GLS unit root test results are presented in Table 2 and they suggest that all variables are either I(0) or I(1). It is interesting to note the relatively long optimal lags (in brackets) in the level series for HPE (2), DHP (5), POP (5) and INB (2).

Table 2 Optimal lag and unit root test results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Levels series</th>
<th>Optimal lag</th>
<th>Statistic</th>
<th>Differenced series</th>
<th>Optimal lag</th>
<th>Statistic</th>
<th>I(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAI</td>
<td>0</td>
<td>-1.3685</td>
<td>1</td>
<td>-3.7837</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPE</td>
<td>2</td>
<td>-2.7097</td>
<td>1</td>
<td>-5.2291</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SVM</td>
<td>1</td>
<td>-2.4804</td>
<td>0</td>
<td>-5.0367</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTA</td>
<td>1</td>
<td>-2.2553</td>
<td>0</td>
<td>-4.8150</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTD</td>
<td>1</td>
<td>-2.2420</td>
<td>0</td>
<td>-4.3462</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIN</td>
<td>0</td>
<td>-5.7655</td>
<td>-</td>
<td>-14.152</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPH</td>
<td>1</td>
<td>-1.4015</td>
<td>0</td>
<td>-3.2644</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHP</td>
<td>5</td>
<td>-3.6879</td>
<td>-</td>
<td>-14.152</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHG</td>
<td>1</td>
<td>-2.8278</td>
<td>0</td>
<td>-14.152</td>
<td>I(1)</td>
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<td></td>
</tr>
<tr>
<td>GDP</td>
<td>0</td>
<td>-1.5711</td>
<td>0</td>
<td>-7.4145</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN</td>
<td>0</td>
<td>-2.1465</td>
<td>0</td>
<td>-10.637</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POP</td>
<td>5</td>
<td>-2.5692</td>
<td>4</td>
<td>-1.7693</td>
<td>I(1)</td>
<td></td>
<td></td>
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<tr>
<td>PAR</td>
<td>0</td>
<td>-1.8184</td>
<td>0</td>
<td>-8.0095</td>
<td>I(1)</td>
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<td></td>
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<tr>
<td>ASX</td>
<td>1</td>
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<td>0</td>
<td>-10.0100</td>
<td>I(1)</td>
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<td></td>
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<tr>
<td>BND</td>
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<td>0</td>
<td>-7.0827</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>INB</td>
<td>2</td>
<td>-3.5547</td>
<td>1</td>
<td>-4.4242</td>
<td>I(1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In order to conduct the bounds test for cointegration, the first step taken in the ARDL procedure is to test for the log-run relationship in Equation (1). A maximum lag order of one is employed given the large number of explanatory variables and the short sample period. This is potentially a limitation of the study in that one of the alternative dependent variables (HPE) and three of the explanatory variables (DHP, POP and INB) exhibit lags of longer than a quarter in their levels, as discussed above. Equation (1) is estimated using OLS regression. The joint F-test is conducted on the lagged log-level variables while the differenced variables have no direct influence on the bounds cointegration test (Pesaran and Pesaran, 1997). The F-statistic tests the joint null hypothesis that the coefficients of the lagged log-levels are equal to zero which implies that no cointegrating long-run relationship exists. The calculated F-statistics for HAI and HPE are respectively 2.6872 and 2.7790 which are higher than the simulated upper bound critical value of 1.151 for \( k = 15 \) and \( n = 80 \) with unrestricted intercept and trend at the 10% level of significance. This suggests that the null hypothesis of no cointegration is rejected, indicating that a long-run cointegrating relationship exists between the dependent and the explanatory variables in both models. That is, the variables tend to move together, or at least not too far apart, over time.

Given a long-run cointegrating relationship is established in both models, the second step of the ARDL procedure is to estimate the long-run model for the log of HAI and HPE in line with Equation
This equation is estimated using the ARDL (1, 0, 0, ..., 0) specification according to the AIC criterion of optimal lag selection. The results for HAI and HPE are presented in Table 2 with the long-run estimated coefficients, standard errors and p-values for HAI in columns 2–4 and those for HPE in columns 8–10. Consider the results for HAI. Other than lagged HAI (which indicates a 29.3% probability of a one-quarter deterioration in housing affordability being followed by another) six explanatory variables exert a significant (10% or lower) effect on housing affordability in the long run: DTA, RTD, DHP, DHG, ASX and INB. Interestingly, none of the variables reflecting economic growth, demographics or taxation have an influence on housing affordability as measured in the long run. Of the former, the financial factors have the greatest combined impact on housing affordability as measured by HAI, with a 1% increase in debt servicing (RTD) leading to an 0.83 percent decrease in HIA (a worsening of housing affordability) an a 1% increase in leverage (DTA) (as an indicator of financial flexibility) increasing HAI (improving housing affordability) by 0.68 percent.
Table 3 Estimated long- and short-run models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Long run</th>
<th>Dependent variable: HAI</th>
<th>Short run</th>
<th>Dependent variable: HPE</th>
<th>Long run</th>
<th>Dependent variable: HPE</th>
<th>Short run</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONS.</td>
<td>8.9122</td>
<td>10.6454</td>
<td>0.4050</td>
<td>−0.0375</td>
<td>0.0176</td>
<td>0.0361</td>
<td>12.8887</td>
<td>7.9078</td>
</tr>
<tr>
<td>HIA</td>
<td>0.2928</td>
<td>0.0802</td>
<td>0.0005</td>
<td>−0.1183</td>
<td>0.0828</td>
<td>0.1568</td>
<td>0.4541</td>
<td>0.704</td>
</tr>
<tr>
<td>SVM</td>
<td>0.0531</td>
<td>0.1221</td>
<td>0.6649</td>
<td>−0.3032</td>
<td>0.1063</td>
<td>0.0055</td>
<td>0.4261</td>
<td>0.964</td>
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<tr>
<td>DTA</td>
<td>0.6754</td>
<td>0.1339</td>
<td>&lt;0.0001</td>
<td>−0.1272</td>
<td>0.1303</td>
<td>&lt;0.0001</td>
<td>−0.6483</td>
<td>0.1131</td>
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<tr>
<td>RTD</td>
<td>−0.8284</td>
<td>0.1693</td>
<td>&lt;0.0001</td>
<td>0.0177</td>
<td>0.0166</td>
<td>0.2906</td>
<td>0.0222</td>
<td>0.0187</td>
</tr>
<tr>
<td>LIN</td>
<td>0.0291</td>
<td>0.0243</td>
<td>0.2350</td>
<td>0.0017</td>
<td>0.0460</td>
<td>0.0137</td>
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<td>0.1849</td>
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<td>−0.3811</td>
<td>0.5137</td>
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<tr>
<td>DHP</td>
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<td>0.0436</td>
<td>0.0059</td>
<td>−0.0029</td>
<td>0.0368</td>
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<td>−0.1066</td>
<td>0.0339</td>
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<td>DHG</td>
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<td>0.0170</td>
<td>0.0073</td>
<td>−0.0348</td>
<td>0.0113</td>
<td>0.0029</td>
<td>−0.0246</td>
<td>0.0129</td>
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<td>GDP</td>
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<td>0.6023</td>
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<td>0.3417</td>
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<td>MIN</td>
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<td>0.3784</td>
<td>1.1888</td>
<td>0.7511</td>
<td>0.9717</td>
<td>1.1502</td>
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<td>ASX</td>
<td>−0.0723</td>
<td>0.0387</td>
<td>0.0653</td>
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<td>0.0413</td>
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<td>BND</td>
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<td>0.4929</td>
<td>−0.0700</td>
<td>0.0605</td>
<td>0.2502</td>
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<td>INB</td>
<td>−0.1703</td>
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<td>0.0112</td>
<td>−0.0283</td>
<td>0.0550</td>
<td>0.6087</td>
<td>−0.1366</td>
<td>0.0475</td>
</tr>
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<td>TAX</td>
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<td>0.9353</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>0.1578</td>
<td>0.2670</td>
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<td>GST</td>
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<td>0.0541</td>
<td>0.2499</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>0.0932</td>
<td>0.0418</td>
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<td>NEG</td>
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<td>0.0442</td>
<td>0.8732</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>0.0342</td>
<td>0.5530</td>
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<tr>
<td>CGT</td>
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<td>0.0317</td>
<td>0.4358</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>0.0244</td>
<td>0.4777</td>
</tr>
<tr>
<td>ECR</td>
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<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>0.0174</td>
<td>0.244</td>
</tr>
<tr>
<td>R-</td>
<td>0.9740</td>
<td>−</td>
<td>−</td>
<td>0.7604</td>
<td>−</td>
<td>−</td>
<td>0.9906</td>
<td>−</td>
</tr>
<tr>
<td>F-</td>
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<td>&lt;0.0001</td>
<td>16.0700</td>
<td>&lt;0.0001</td>
<td>439.7802</td>
<td>&lt;0.0001</td>
<td>7.0674</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
The effects of the remaining variables are of a lesser magnitude. Oddly, increases in both the numbers of private (DHP) and public sector (DHG) dwelling units approved by 1% are associated with respective decreases of 0.12 and 0.05 percent in HAI. That is, the new dwelling approval process in the long run is not offsetting the immediate deterioration in housing affordability. One possibility is that the inferred increase in the stock of housing given by approvals is coming onto the market of an insufficient magnitude to offset the overall increase in housing prices at any point of time, suggesting persistent undersupply in the housing market. Another possibility is significant lags in the reaction to the market signals being sent to housing developers and those building their own home. This is already well evidenced by the long optimal lag of five quarters for DHP discussed above. In terms of alternative investments, a 1% increase in ASX is associated with a worsening in housing affordability of 0.07%. This suggests a wealth effect where higher equity returns are diverted in part to the housing market. The yield on indexed bonds (INB) as a reflection of inflation expectations also has a negative effect on housing affordability, with a 1% increase in yields translating to a 0.17% worsening in housing affordability.

These results are generally consistent with the long-run model where HPE is specified as the dependent variable. Recall that this measure of affordability ignores financing costs. One noticeable difference is that a worsening of housing affordability in one quarter is 45.41% more likely if the previous quarter experienced a reduction in affordability. Another difference is that the standard variable mortgage rate (SVM) also affects the housing price–earnings multiple, with a 1% increase in the standard variable mortgage rate improving affordability by 0.42%, likely by reducing housing demand and thence housing prices. The final differences are that ASX no longer (negatively) affects housing affordability, but GST does and does so positively (i.e. improving housing affordability) with the introduction of GST improving affordability by 9.32%.

Overall, both long-run models in Table 3 are comparable in overall explanatory power, with the model where HPE is the dependent variable explaining some 99.06% of the variation in housing affordability compared with 97.40% for the model where HAI is specified as the dependent variable. In both cases, the null hypothesis that the slope coefficients are jointly insignificant is rejected at the .01 level. Lastly, the constant in each model can be used as an indicator of the long-run equilibrium level of Australian housing affordability with (log) values of 8.91 and 12.89 for HAI and HPE, respectively. This indicates equilibrium values for the Housing Industry Association’s Housing Affordability Index of about 109 (slightly above the historical minimum of 107 and the cut-off of 100 where housing repayments exceed 30% of disposable income) and a housing price–earnings multiple of 7 (below the recent historical maximum set in June 2010 of 8.2).
The third and final step of the ARDL procedure is to estimate the short-run dynamic coefficients associated with the ECM from the long-run relationship as specified in Equation (3). The results are presented in Table 2 in columns 5–7 where HAI is specified as the dependent variable and columns 11–13 where HPE serves as the dependent variable. We first consider the overall fit and dynamics of both models. First, the long-run models are clearly better able to explain the variation in housing affordability than the short-run models, with the HAI model explaining 76.04% of the variation in housing affordability in the short run (compared to 97.4% in the long run) while HPE explains just 58.3% in the short run (compared to 99.1% in the long run. This is consistent with our earlier assertion that housing affordability is very much a long run phenomenon and that interest rates (as reflected in HAI) have a relatively more substantial short run effect. Second, the estimated error correction coefficients (ECR) of –0.35 for the HAI model and –0.50 for the HPE model are significant at the 5% level of significance. These indicate the high speed of adjustment to equilibrium after a shock: that is, approximately 35.38 and 50.18% of the deviation in the explanatory variables from a previous quarter’s shock converge back to the long-run equilibrium in the current quarter. Lastly, there is an expected worsening in housing affordability each quarter of 0.0341–0.0375% (about 1.4% per annum), regardless of the impact of the macro drivers of housing affordability, as indicated by the significant values of the constants.

We now turn to the differences in the long and short run by first considering the HAI model. To start with, it is interesting to see that SVM exerts a significant (and negative) effect on HAI in the short run, even though HAI notionally includes the impact on housing affordability of mortgage interest rates. It may be useful to recall here that the HAI assumes a loan-to-valuation ratio of 80% and it may be that this does not fully capture the short run worsening in housing affordability associated with an increase in SVM. The other interesting finding is that in the short run, neither DHP, ASX or INB affect HAI as in the long run, but that population (POP) does. Somewhat paradoxically, a 1% increase in population actually improves housing affordability by 8.7% in the short run, even though it has no major impact in the long run. This suggests that the key conditions associated with population growth in terms of relative housing affordability (housing prices, incomes and interest rates) are being more than met in the short run, with no discernible effect in the long run.

Of course, we should recall that population includes long lags not modelled in this analysis, and that the beneficial effect of population on housing affordability seen here in the next-to-most recent quarter only arises after a progressive worsening of affordability in previous quarters. The other interesting finding is that deficiency and/or lags in dwelling approvals found in the long run have no effect in terms of private sector approvals (DHP) in the short run, but still do for public sector dwelling approvals (DHG). This suggests the deficiencies and/or lags in public sector dwelling approvals aggravate housing affordability in both the long and short run.
The estimated results for the short run model using HPE as the measure of housing affordability are also similar with their long run counterpart and with the findings of the HAI short run model. Two other key findings are of note. First, economic growth clearly has a negative effect on HPE, with a 1% increase in growth reducing housing affordability by 1.34%. Second, BND now has a small effect on housing affordability in the short run, with a 1% increased in government bond yields worsening affordability by 0.09%. However, in both cases, the affects of both variables on worsening housing affordability in the short run are negated in the long run.

VI. Conclusion

This paper models housing affordability in Australia over the past twenty-five years. The main drivers of affordability identified in the policy literature during this period include strong economic growth and changing population dynamics, ready access to cheap housing finance, changes in government policy, and a generally favourable tax environment. However, while much of the policy documentation comments on the drivers of housing affordability, there is astoundingly little hard quantitative evidence on exactly how these drivers impact on affordability over both the short and long run nor how they interact with each other. This has meant the policy literature has invariably directed attention to the most obvious cyclical factors rather than the more difficult to identify structural concerns.

In the paper, we employ the ARDL approach, two alternative measures of housing affordability, and six sets of variables to proxy the economic, demographic, financial, social, and other factors that influence long- and short-run housing affordability using quarterly data over the period September 1985 to June 2010. In one sense, the results are both expected and surprising. Against the backdrop of a progressive generational deterioration in housing affordability, the principal expected long-run drivers appear to be more flexible housing finance market conditions, which generally serve to improve affordability, and the returns on alternative financial assets and the level of private and public new dwelling approvals, which generally worsen housing affordability.

Of these, the impact of the low rate of new dwelling approvals (public and private sector in the long run and public sector in the short run) points to a persistent structural gap in the demand and supply of housing and the argument that the Australian housing supply needs to be made more responsive by designing and enforcing efficient land-use regulations, providing infrastructure and other services along with housing, and using well-designed taxes to encourage and facilitate the use of land for residential purposes. Potentially, it also suggests the need for a nation-building program of private and public housing to make major inroads into the lack of housing supply.
Nonetheless, the results are also surprising in that some factors argued to underpin worsening housing affordability are either not significant or have only a temporary impact. For example, economic growth only has a negative effect on housing affordability in the short run while taxation potentially related to housing affordability, including personal income tax rates, negative gearing, capital gains tax and the goods and services tax, has no discernible impact on housing affordability, even in the long run, at least when using aggregate data. One qualifier in this regard is that the taxation conditions as they relate to housing in this study have either changed relatively little or remained largely of the same form throughout this relatively short sample period. One final surprise is that the resources boom often blamed for the worsening of housing affordability, at least in the 2000s, has no impact at the aggregate national level, even though there is patent evidence of its impact in small isolated mining towns.

References


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