

**Housing affordability options for first home owner-occupiers in Australia:
A simulation analysis**

Ross S. Guest
Griffith University

Address for correspondence

Ross S. Guest
Professor of Economics
Graduate School of Management
Griffith University
PMB 50
Gold Coast Mail Centre
Queensland, 9726

**Housing affordability options for first home owner-occupiers in Australia:
A simulation analysis**

ABSTRACT

This paper presents a simulation analysis of several policies, or policy proposals, for improving housing affordability for first home owner-occupiers in Australia: the First Home Owner Grant, housing equity partnerships and deposit loans. The focus is on the impact of these measures for housing demand, the private saving rate and house prices. The simulations apply a housing tenure choice model in which a representative adult household makes a lifetime plan concerning when to buy and sell a house, and the amount of housing and non-housing consumption over its adult lifetime. An insight from the lifecycle framework is that policies to improve housing affordability can have a lifecycle timing effect that tends to offset the boost in housing demand and house prices that would otherwise occur.

JEL: D1, E2, R2

Keywords: housing demand, saving, consumption

1. Introduction

The issue of housing affordability is receiving increasing policy attention in Australia. The Prime Ministerial Task Force on Home Ownership commissioned a report by the Menzies Research Centre that was released in June 2003. One recommendation in the Report was the establishment of arrangements that would allow households to form housing equity partnerships with financial institutions (Caplin and Joye, 2002). Proposals from other sources have included matched savings accounts for low income households which could be used to finance a home purchase (Allen Consulting Group, 2003), and the introduction of HECS-style loans for first home buyers (Quiggin, AFR, 19.6.03, expanding on a similar idea by Gans and King, AFR, 6.8.03). The existing policy to improve housing affordability for first home owners is the \$7000 First Home Owner Grant (FHOG), which has come under increasing criticism. The scheme has been rorted by some people who have bought houses in their children's name in order to claim the grant (The Age, 15.10.03). Also, the effectiveness of the FHOG has also been questioned on the grounds that it tends to increase the price of houses which negates the improvement in housing affordability (Freebairn, 1999).

The aim of this paper is to provide a simulation analysis of the effect of several of these policies on aggregate housing demand, private saving and house prices. A consideration of the impact on private saving is motivated by the often-expressed concern that Australian households do not save enough. Household saving in 2002, for example, was approximately zero and private saving was around 10% of private income. The impact on house prices is important because rising house prices had, by the September quarter of 2003, driven the housing affordability to record lows according to the Housing Industry Association's index of housing affordability (HIA, 2003).

The simulation model applied here is a housing tenure choice model in which the decisions by a household about when to buy and sell a house, the size of the purchase,

consumption and saving are made jointly in a lifecycle framework. A lifecycle approach is appropriate because the desire to pay off a home provides an incentive to save. The Mercantile Mutual-Melbourne Institute Household Savings Survey (Loundes, 2001) reports “paying off home” as the most common and significant form of household saving in Australia.

2. Previous research on models of housing demand and tenure choice

A number of studies have analysed the optimal purchase of housing services by households in the context of a lifecycle model of consumption. The focus of these studies has been on the effect of one or more of the following: liquidity and/or wealth constraints (Artle and Variaya, 1978; Slemrod, 1988; Miles, 1992); tax policy (Hayashi et al., 1988; Slemrod, 1988); and mortgage instruments and inflation (Alm and Follain, 1982). The effect of the liquidity or wealth constraints at the time of purchase plays a critical role in the optimal planning of housing, saving and consumption decisions. A binding liquidity constraint on the purchase of a house acts to increase saving and reduce consumption early in the lifecycle and increase consumption later in the cycle, compared with the lifecycle consumption profile of a household that rents throughout the lifecycle. The incentive to distort consumption in order to buy a house is due to the tax incentives for owner-occupied housing. Hence there is a trade-off between the utility cost of distorting the lifecycle consumption plan to meet the housing down payment and the utility gain available through the tax incentives and other less tangible benefits of owner-occupied housing.

Some of the above authors - Alm and Follain, Slemrod, and Slemrod et al. - note the computational difficulties in modelling tenure choice. In particular, in order to find the optimal tenure pattern over the lifecycle it is necessary to calculate the utility maximising consumption choice for all possible rent-own combinations over periods of the lifecycle. This implies significant increases in computational difficulties with increases in the number of periods in

the lifecycle. Slemrod (1988), for example, considers only one lifetime tenure pattern, Alm and Follain (1982) consider four possible lifetime tenure patterns, and Hayashi et al. consider ten possible tenure patterns. However, in the time since these studies increases in processing speed of standard PCs have reduced computational costs of considering a larger number of possible lifetime tenure patterns.

An alternative empirical approach to investigating housing demand and tenure choice is by econometric estimation using time series and/or cross section data. With respect to tenure choice, some studies have found that older homeowners do not reduce their housing consumption at all until retirement, and thereafter by very little implying a low incidence and degree of trading down in retirement (VanderHart, 1998; Skaburskis; 1999; Ermisch and Jenkins, 1999). With respect to borrowing constraints and housing affordability, an Australian study by Bourassa (1995) shows that borrowing constraints are a significant determinant of the probability of home ownership. His conclusion is that government programmes to encourage first-home buyers should focus on reducing deposit requirements.

3. The model

The model of tenure choice applied in this paper is a slightly modified form of the model of Hayashi, Ito and Slemrod (1988) which is in turn based that in Slemrod (1982).¹ This model is augmented in the next section by a housing supply specification in order to determine the implications for house prices.

The tenure choice model is characterised by a representative single-person household that plans its optimal tenure choice – rent or own – over its lifetime. The lifecycle consists of thirteen periods, each period representing five years of a person's adult lifetime which starts at

¹ The main differences between the model here and that in Hayashi et al. (1988) model are: (i) the lifetime here is represented by 13 periods of 5 years whereas Hayashi et al. used 6 periods of 10 years – Hayashi et al recommended a model with more periods but did not pursue this due to computational cost; (ii) parameters are

age 20 and finishes at age 85. The household chooses the consumption of a composite commodity and housing services for each period over the lifetime, given perfect foresight about its future income and age of death.

Housing services may be obtained either by purchasing a house or by renting housing. It is assumed that housing purchases and sales take place at the end of a period; which implies that the household must wait at least until the end of the first period (at age 25) to buy a house. It is also assumed that the household must sell the house at the end of the second last period (at age 80) and move into rented accommodation. Therefore the household has a choice of owning a house for any duration between periods two and thirteen but can buy only once. That is, there are no opportunities for trading up or down to a new house, nor are there opportunities to improve the house through renovations; and, finally, the house does not depreciate.

The household chooses the own/rent lifetime pattern that maximises lifetime utility subject to the lifetime budget constraint and the down payment constraint. The household's choice variables are: consumption of the non-housing good in all periods, consumption of rented housing services in periods when the household rents, consumption of owner-occupied housing services which remain constant for the period of ownership, and the timing of the purchase and sale subject to the constraints given above. The consumption of housing services is assumed to be proportional to the size of the house, so that a decision to consumer more housing services implies occupying a bigger house.

Formally, the household's problem is to maximise with respect to $t(b)$, $t(s)$, $\{c(t)$, $t=1,\dots,13\}$, $\{h(t)$, $t=1,\dots,13\}$, H ,

$$\sum_{t=1}^{t(b)} U(c(t), h(t)) + \sum_{t=t(b+1)}^{t(s)} Z(c(t), H(t)) + \sum_{t=t(s+1)}^{13} U(c(t), h(t)) + F(B) \quad (1)$$

subject to

chosen, where possible, to reflect realities of the Australian housing market and tax system (for example, unlike in the U.S., mortgage interest is not tax deductible in Australia).

$$A(0) = 0$$

$$A(t) = (1 + R(1 - \tau)) A(t-1) + y(t) - c(t) - P_r(t)P_h(t)h(t) + INH(t) \geq 0 \quad t = 1, \dots, t(b-1); s+1, \dots, 13$$

$$A(t) = (1 + R(1 - \tau)) A(t-1) + y(t) - c(t) - P_r(t)P_h(t)h(t) - dP_h(t)H + INH(t) \geq 0 \quad t = t(b)$$

$$A(t) = (1 + R(1 - \tau)) A(t-1) + y(t) - c(t) - V(1-d)P_h(t)H + INH(t) \geq J(t) - P_h(t)H \quad t = t(b)+1, \dots, t(s)-1$$

$$A(t) = (1 + R(1 - \tau)) A(t-1) + y(t) - c(t) - V(1-d)P_h(t)H + P_h(t)H - J(t) + INH(t) \geq 0 \quad t = t(s)$$

where

$t(b)$ and $t(s)$ are the periods at the end of which the house is bought and sold, respectively;

$A(t)$ is the end-of-the-period financial asset value;

$y(t)$ and $c(t)$ are labour income (net of taxes and transfers) and consumption in period t , respectively;

$h(t)$ is the size of a rental unit (which could vary every period);

H is the size of an owner-occupied unit (which remains constant once purchased) and the units of H are defined such that the price of H is normalised to one. The flow of housing services is assumed to be proportional to the size of H and h ;

B is the bequest, which is held fixed for all simulations unless otherwise stated, by appropriate choice of parameter (see Appendix);

$INH(t)$ is the inheritance which is assumed to be received in a lump sum at age 55 on the assumption that heirs are 30 years younger than their parents;²

V represents the equal payments of interest and principal such that the mortgage is paid off at maturity of the mortgage;

$P_r(t)$ is the price of a rental unit relative to the price of a house;

R is the interest rate (before tax);

$P_h(t)$ is the price of a house and is normalised to one at $t=1$ by defining the unit of H accordingly;

$J(t)$ is the amount of outstanding mortgage debt;

τ and d represent the constant tax rate on return from saving and the required down-payment ratio, respectively.

Further detail including functional forms and parameter values are given in the Appendix.

When a house is purchased with a down payment, d , of the house value, the down-payment expenditure is deducted from income of the period of house purchase. The mortgage debt $(1-d)$ becomes $(1+R)(1-d)$ at the beginning of the next period. An equal payment of V for m periods amortises the mortgage debt. When a house is sold, the value of the house, less remaining mortgage, is used for consumption after the period of the sale.

The inequality restrictions on $A(t)$ imply that the sum of financial and real wealth cannot be negative. In other words households cannot hold net financial liabilities in excess of the equity in their homes which is equal to $J(t)-P_h H$.³

The lifetime plan at age 20 is made on the basis of perfect foresight regarding future income, parameter values and death at age 85. The plan consists of values for non-housing consumption, c , housing services, h , in each five-year period, and the size, H , of owner-occupied housing and the timing of its purchase and sale, $t(b)$ and $t(s)$ respectively. Aggregate variables at time t are a cross section of the per-household variables summed over i generations. For example, aggregate income at time t is the sum of $y_{i,t}, i=1, \dots, 13$. The first year of interest for calculating aggregate variables is 2002. The plan for the cohort aged 80-85 years in 2002 was made in 1937 when that cohort were 20 years of age. Hence five-year plans must

² Given population growth, n_k , the inheritance, INH , per person is less than the bequest, B , per person. Hence,

$$INH_t = \frac{B}{\prod_{k=1}^t (1+n_k)}$$

where n_k is the growth rate of population in period k .

³ It has become more common for households to borrow against housing equity through financial products such as home equity loans and mortgages with redraw facilities. A reverse mortgage is a similar product in that a bank advances a loan against security on a property; the difference is that both accrued interest and principal are repaid in one lump sum on either the sale of the property or death of the borrower.

be calculated from 1937. Following Hayashi et al. (1988), if P_h is constant (which it is when the supply elasticity is infinite), $P_r=R$ due to the implicit arbitrage condition between financial asset investment and rental property investment.

The exogenous variables in the model are: labour income per worker, $(Y/L)(i,t)$ which is assumed to grow at 1.5 percent per annum representing labour productivity growth; the labour force participation rate, $(L/N)(i,t)$ for age i in year t ; and population shares, $N(i,t)$, $t=1937, 1942, \dots, 2067$. The population estimates up to the year 2002 are calculated from ABS Catalogue 320109.1 and the projections beyond 2002 are calculated from ABS Catalogue 3222.0; the population shares are normalised to a mean of 1. Household labour income in period t , $y(t) = (Y/L)_i \cdot (L/N)_i \cdot N_i(t)$. The age-specific labour income levels, $(Y/L)_i$, are the mean weekly earnings of full-time employees from ABS Catalogue 6310.0; and the age-specific labour force participation rates, $(L/N)_i$, are in person units, from ABS Catalogue 6291.0. Both of these variables are held constant from 2002 onwards.

The aggregate, cross-section, values of endogenous variables of interest – consumption, saving and owner-occupied housing purchases are defined for period t as follows, where i refers to generation i alive in period t :

$$\text{Housing consumption:} \quad \sum_{i=1}^{13} (P_r(t) \cdot h(i,t) + R \cdot J(i-1, t-1)) N(i,t) \quad (2)$$

$$\text{Non-housing consumption:} \quad \sum_{i=1}^{13} c(i,t) N(i,t) \quad (3)$$

Private saving:⁴

$$\sum_{i=1}^{13} (y(i,t) + R \cdot A(i-1, t-1) - c(i,t) - P_r(t) \cdot h(i,t) + R \cdot J(i-1, t-1)) N(i,t) \quad (4)$$

$$\text{where } y(t), \text{ private income, is} \quad \sum_{i=1}^{13} (y(i,t) + R \cdot A(i-1, t-1)) N(i,t) \quad (5)$$

⁴ There is no distinction in the model between private and household saving because the amount that households choose to save through corporate entities is not modelled.

$$\text{Housing demand}^5: \quad \sum_{i=1}^{13} H(i,t)N(i,t) \quad (6)$$

3.1 A finite supply elasticity

The main criticism typically levelled against policies to improve housing affordability, such as the FHOG, is that they will simply result in higher house prices with little improvement in housing affordability (see Freebairn, 1999, with respect to the FHOG). This obviously depends on the housing supply elasticity. In this section we introduce a finite supply elasticity by apply the stock-flow model in Mankiw and Weil (1989) which is in turn a variation of that in Poterba (1984).

Housing supply, $H_S(t)$, is the flow of housing investment and is described by the following equation:⁶

$$H_S(t) = b(t)P_h^\psi(t); \quad \text{where } b(t), \psi > 0 \quad (7)$$

Equation (7) says that gross investment in housing is an increasing function of both the price of housing and a shift variable, $b(t)$, which grows at the rate of growth of aggregate labour income; the latter is the sum of the exogenous rate of growth of labour productivity and the growth of employment.

Households are assumed to equate the implicit rental rate on owner-occupied housing, $P_r(t)$, with the user cost of capital, R , minus the expected capital gain, formed adaptively from the current period realised capital gain:

$$P_r(t) = R - \left[\frac{P_h(t) - P_h(t-1)}{P_h(t)} \right] \quad (8)$$

⁵ The term “housing demand” refers to the purchases of owner-occupied housing which, in period t , is the sum of housing purchases, H , planned to take place in period t by cohorts aged 20 years and over in period t .

⁶ Unlike the Mankiw and Weil (1989) model, there is no depreciation, so gross investment equals net investment.

where Δ is the realised one-period capital gain at time t .⁷ $P_h(t)$ is determined by equating aggregate housing demand (6) with aggregate housing supply (7).

A range of values of the housing supply elasticity parameter, ψ , have been adopted in the literature. Here we adopt an elasticity of 2.0 which is at the low end of plausible long run elasticities. By comparing this case with the base case in which supply is assumed to be perfectly elastic, yields the plausible range of house price responses.

Some qualifications are in order before turning to the results of the simulations. The asset demand for land is not modelled; only the consumption demand for housing services is modelled. This is likely to bias downwards the level of housing purchases compared with actual housing purchases which include the demand for land as an asset separate from buildings.⁸ Another limitation is the absence of uncertainty which implies that the saving and housing plans that households make at age 20 for the next 65 years of their lives are exactly realised – there are no errors of judgement or revisions of plans. Also the assumption of single person households means that the number of households in each age group is simply the number of persons in that age group. Other assumptions described above such as the absence of opportunities to trade up or down and no home improvements or depreciation are further abstractions in order to make the model tractable.

4. Results

First, results are reported for the base case in which the supply elasticity is infinite. The income and (non-housing) consumption profile are illustrated in Figure 1 for a lifecycle plan

⁷ Mankiw and Weil (1989) compare a forward-looking model with a naive expectations model in which market participants do not expect any effect of demographic change on house prices. They conclude that the forward looking model “cannot come close to fitting the data” and that the naive expectations model does better in that sense. We did comparisons of simulations using (8) with a naive expectations model by setting the capital gain in (8) to zero. The difference in results was small enough to be considered immaterial.

⁸ The expected real appreciation of land reduces the imputed rental price of housing services which equals the real cost of capital minus the expected real appreciation of the house and land combined (minus any depreciation of buildings which is also assumed to be zero in this model).

made by a household aged 20 in the year 2002. People over the age of 70 are assumed to earn no labour income and the income for people aged from 20 to 70 exhibits a hump-shaped profile, with workers in middle age earning higher labour incomes than both younger and older workers. The consumption profile, on the other hand, is relatively flat reflecting the optimal smoothing of consumption subject to the constraints imposed by the need to save for a housing deposit and the non-negativity restriction on wealth. The liquidity constraint is clearly binding in the period in which the house is purchased. The figure also illustrates that the period of high saving is in middle age and the period of dis-saving is from aged 60-65 onwards.

We now consider how well the simulation results for the base case fit the observed characteristics of the Australian households with respect to their housing and saving decisions.

In the base case the optimal age at which to purchase a house is at age 30 which is at the end of the second five year period of the household's lifetime planning period. This fits the observation that the most common age group in which households buy a house is the 25-34 age group (ABS, Australian Social Trends, 2003). The optimal private saving rate in 2002 is 20.3 percent and peaks at 20.5 percent in 2007. The actual gross private saving to private income ratio in Australia in 2002 was 11 percent although the national saving rate was 19 percent (ABS, Cat. 5206.027). Hence the model over-predicts the actual private saving rate unless households are Barro-like savers and reduce their private saving in response to positive public sector saving.⁹

The mortgage interest to household income ratio in the model is 7.2 percent in 2002 compared with an actual ratio of 6.5 percent (MacFarlane, 2003). The optimal housing demand to private income ratio is 17.5 percent. The actual expenditure on homes by "recent home buyers" from 1997 to 1999 (ABS Cat. 4182.0) averages to 13.4 percent of total private

⁹ By equating private saving with household saving in the model we are recognising that households save partly through private firms.

income.¹⁰ This is only an approximation to expenditure by first homebuyers because it includes purchases of homes by investors for rental.

The optimal household debt to income ratio, at 33.1 percent, is well below the actual level which has risen from about 60 percent to 120 percent (MacFarlane, 2003), yet the housing equity share of household wealth of 59%, predicted by the model, is close to the actual figure of between 60 and 70 percent (Caplin and Joye, 2002).¹¹ The difference between optimal and actual debt could be explained by the high actual level of non-housing debt by households.

Simulations of the three measures to improve housing affordability, to which we now turn, are long run simulations. It is assumed that each policy has been in place long enough to have been embodied in the lifecycle plans of all cohorts currently alive. The short run response, in which some households have been able to take account of the policy in their lifetime plans but others haven't, is not simulated.

4.1 Lifecycle timing effect

The lifecycle timing effect refers to the effect on aggregate housing purchases when households alter the optimal timing of their house purchase, either shifting it forward or backward in their lifecycle. This effect is itself the net outcome of several factors. Consider the effect of all households buying a house earlier in their lifecycles. Buying earlier tends to reduce the size of the purchase because younger households have accumulated less saving for the deposit and they have lower incomes from which to service the mortgage. Against this, however, there is a cohort effect - younger cohorts of home buyers have higher lifetime earnings than do older cohorts due to labour productivity growth. This effect implies that if, in

¹⁰ The actual new dwelling expenditure, which excludes demand for existing dwellings, is approximately 7.5 percent of private income in 2002 (ABS Cats. 5206.03, 5206.027).

¹¹ A figure of 57 percent was estimated by the Australian Treasury as the ratio of dwelling assets to total private sector net worth (Littrel, 1999).

any given period, the existing stock of housing has been purchased by younger cohorts it would tend to be larger than if it had been purchased by older cohorts. Also, buying at a younger age means owning for longer, other things equal. This implies a longer time period during which the households receives the benefit from the tax-free status of the implicit rental income from owner-occupancy; hence their lifetime resources are greater which increases the optimal size of their house purchase. In summary, the first of these three effects tends to decrease the size of the house purchase while the other two effects tend to increase it.

It turns out that each of the housing affordability policies considered here results in a bringing forward of the optimal house purchase from age 30 to age 25. The timing effect is calculated as the difference between housing purchases when households purchase houses at age 30 and at age 25, respectively, assuming in each case that the housing affordability policy is in place.

In addition to the lifecycle timing effect, housing policies can have income, substitution and wealth effects. The existing FHOG, for example, has all three of these effects. Being a subsidy, it has a wealth effect in that it boosts household's lifetime resources. It also reduces the relative price of owner-occupied housing services relative to both rental housing services and non-housing services. The change in relative prices has an income effect and a substitution effect. Each of these three effects leads to higher housing purchases. The sum of these effects, which we will call "other effects", is calculated as the difference between housing purchases with and without the policy in question, holding constant the point in the lifecycle at which the house is purchased. Criticism that housing affordability policies – the FHOG in particular - simply bid up the price of houses, seems to ignore the possibility that the timing effect can be negative and can offset, to an unknown extent, the other effects. The simulations reported below suggest that the timing effect can be important.

It is emphasised that these are long run simulations. That is, it is assumed that the housing affordability policy has been in place for an entire adult lifetime which implies that it has been embodied in the lifecycle plans of all cohorts currently alive. The short run response, in which some households have been able to take account of the policy in their plans but others haven't, is not simulated. In the short run, the lifecycle timing effect would not operate because those households who already own a house at the time the policy is introduced cannot turn back time and choose to buy at age 25. Hence in the short run there would be two cohorts who find it optimal to purchase a house at the same time – the 20-25 year old cohort and the 25-30 year old cohort. This would unambiguously boost housing demand in the short run which would last for one five-year period in this model.

The timing and other effects can be expressed algebraically as follows, where HP refers to total housing purchases, *ex ante* and *ex post* refer to before and after the housing affordability policy, and the subscript gives the age at which households buy a house. The timing effect is equal to $HP_{age\ 25}^{expost} - HP_{age\ 30}^{expost}$. To get the latter term, $HP_{age\ 30}^{expost}$, a separate suboptimal simulation must be run, whereas the first term is simply total optimal housing purchases following the introduction of the policy. The sum of the other effects is given by $HP_{age\ 30}^{expost} - HP_{age\ 30}^{exante}$. The net effect of the policy on housing purchases is simply the sum of the timing and other effects which equals $HP_{age\ 25}^{expost} - HP_{age\ 30}^{exante}$.

4.2 The First Home Buyer's Grant (FHOG)

The FHOG was introduced in mid-2000 to cover the estimated impact of the GST on the construction costs of a new home, as these costs are passed on to first homebuyers under the GST. The amount was set at \$7000, although it was temporarily increased to \$14000. Many observers (for example, Freebairn, 1999) have argued that the FHOG will increase the demand for housing and therefore inflate house prices.

The FHOG is simulated by reducing the expenditure required to purchase a house by x percent of the income of the household at age 30-35. We set $x=15.5$ percent in the base case. This implies that if household income is \$45000 at age 30-35 then the FHOG is \$7000 and the housing deposit and mortgage are reduced accordingly.

The results are given in Table 1 for long run supply elasticities of infinity and 2.0. The lifecycle timing effect is negative and largely offsets the other positive effects; the result being a net increase in housing demand in the long run of 1.4 percent and 0.6 percent for the infinite and finite supply elasticities respectively. The increase in house prices that occurs when the supply elasticity is finite reduces the net effect on housing purchases, a general result which applies to all the policy simulations.

The saving rate falls by 3.7 percent for both infinite and finite supply elasticities. The FHOG provides additional lifetime wealth and partly alleviates the liquidity constraint, allowing the household to enjoy higher lifetime utility with lower saving, for a given a bequest size.

4.3 Housing equity partnerships

The simulation model is applied to analyse the equity partnership proposal put forward by Caplin and Joye (2002). Equity partnerships are simulated by assuming that a financial institution, as equity partner, contributes a proportion, z , of the purchase price of the property and the household contributes $1-z$. This reduces the deposit and mortgage required by the household by the proportion z . When the house is sold the equity partner receives a share of the equity in the house which represents a deferred return on capital; and the household or the household's heirs receive any remaining equity.

The value of z is determined such that the effect on the lifetime utility of the household is the same as that for the FHOG simulation. The same principle is used to determine the value

of the parameter for the deposit loan simulation to be discussed below. This allows a comparison of the three housing affordability policies. The resulting value of z is 0.62, meaning that the equity partner finances 62% of the value of the house when it is purchased.

Three scenarios with respect to equity partnerships are considered. In the first scenario, when the house is sold the equity partner receives a lump sum equal to an accumulated annual return of 4 percent which is the assumed annual interest rate used in the model. A difficulty here is that, because it is optimal to own the house for such a long time (55 years) this return accumulates to a sum equal to about 8 times the equity share originally contributed by the equity partner. This implies that the equity partner receives more than the household's equity in the house, the difference being an amount which the household must save, in addition to saving for the bequest. The result is a large increase in the saving rate (see Table 1). With respect to housing purchases, although the size of the timing effect is comparable to that of the FHOG simulation, the sum of the other effects is much larger. This implies that households purchase a much larger house.

The second scenario recognises that it is not likely that households (or their heirs) will accept a policy in which they have to hand over to an equity partner a capital sum more than the equity that they own in the house at the time of its sale. Perhaps some form of government subsidy may effectively limit the lump sum payable to the value of the housing equity. Hence the second scenario reduces the lump sum so that it equals the equity in the house at the time of sale. The effect of this is to substantially reduce the amount that the household must save; however, saving remains higher than it is without the housing equity partnership (see Table 1). This is because the household must still save for the bequest which must take the form of financial assets rather than housing equity. Perhaps this too is unrealistic, in the sense that households who are required to hand over their housing equity to their equity partner are unlikely to provide the same level of bequest to their heirs as households who can pass on

housing equity. In recognition of this, the third scenario extends the second scenario by setting the bequest equal to zero. The result is an even smaller, although still positive, boost to the saving rate as a result of the equity partnership.

Housing equity partnerships, therefore, result in a somewhat higher saving rate. This is because, as Table 1 indicates, households buy a much larger house, to the point where they must reduce their consumption in order to meet their repayments of principal and possibly a bequest.

The timing effect, however, is not as large relative to the wealth effect in the case of equity partnerships as it is in the case of the FHOG. The reason is that equity partnerships largely remove the liquidity constraint that young households face when buying a house – more so than does the FHOG. To see this, recall from above that the timing effect is calculated assuming that the affordability policy is in place, that is, it is an *expost* calculation. It is a comparison of housing purchases when households buy at age 25 compared with buying at age 30, given that the housing affordability policy is in place. With an equity partnership, the lower income and accumulated saving that the household has at age 25 does not bind the household as much.

These results provide mixed support for the claims by Caplin and Joye (2002) about the effects of equity partnerships. By bringing forward the optimal purchase of a house, the partnership scheme does, as Caplin and Joye predict, “accelerate the average household’s transition from the rental to the home ownership market”. However Caplin and Joye argue that households will be able to afford to provide more for themselves of services such as health and aged-care and that this could relieve some pressure for public provision of these services. The simulation results do not provide firm support for this claim. Households substitute owner-occupied housing services for non-housing services, which include health and aged care, and

hence their reliance on the government for these services is likely to be greater (although government provision of such services is not modelled here).

4.4 Deposit loans

Various suggestions have been put for HECS-style loans provided by the government to improve housing affordability. Gans and King, for example (AFR, 6.8.03), propose a housing lifeline loan to homeowners who are under short-term financial stress in meeting their mortgage payments. The loan would be repayable through the tax system on an income contingent basis. An extension of this idea, suggested by Quiggin (AFR, 19.6.03), is to provide this type of loan to finance housing deposits. It is the latter idea that is simulated here.

The deposit loan is equal to a proportion of the required housing deposit. In the simulation the proportion is set at 95 percent because this results in the same level of household utility as in the FHOG simulation. The loan is a HECS-style loan in the sense that it is repaid as an additional tax on labour income at the flat rate of 5 percent. The real interest rate on the loan is assumed to be zero (as there is no inflation in the model the nominal interest rate is a real interest rate). The minimum income threshold at which the tax applies is assumed to be less than the average labour income which all households receive in the model. Hence all households pay the tax.

The deposit loan almost completely alleviates the liquidity constraint. The lifecycle timing effect in this case is positive rather than negative. This means that bringing forward the house purchase results in a larger house purchase rather than a smaller one as in the other policy simulations. The reason is that the 95 percent deposit loan is large enough to reduce the influence of the liquidity constraint such that it is outweighed by the factors that create a positive timing effect; these were described above.

The saving rate is lower by 2.6 percent. Like the FHOG, a deposit loan represents additional lifetime wealth due to the concessional repayment terms, and it alleviates the liquidity constraint. This allows higher lifetime utility with lower saving.

5. Conclusion

An insight emerging from the simulation analysis applied here is that policies to improve housing affordability can have a lifecycle timing effect that offsets the boost to housing demand due to other effects, consisting of wealth, income and substitution effects. The degree to which the lifecycle timing effect offsets the other effects depends on the nature of the policy, as demonstrated by the simulations presented here.

For the FHOG simulation, the timing effect is negative and almost completely offsets the wealth effect; hence the net effect on housing demand and house prices is negligible. In the simulation of housing equity partnerships, the timing effect is also negative but not as strong as for the FHOG and therefore housing demand and house prices are higher but not as high as they would have been if households did not bring forward the timing of their house purchase. The HECS-style deposit loan simulation is different in that the timing effect is positive for the parameters chosen here.

It is appropriate to repeat some caveats that apply to these conclusions. First, these are long run results. In the short run there is no timing effect and therefore housing demand and house prices rise unambiguously in response to improvements in housing affordability. Second, the model cannot predict housing bubbles for several reasons: the model applies only to owner-occupied housing, the asset demand for land is not modelled, and there is no uncertainty in the model. Third, households cannot trade up or down over their lifetimes, which limits opportunities to substitute between owner-occupied and rented housing services.

Despite these limitations, the lifecycle framework applied here is the appropriate way to analyse long run housing and saving decisions because these are fundamentally joint decisions made in a lifecycle context. The lifecycle framework allows the possibility that households will respond to improvements in housing affordability by shifting their purchase decision over their lifecycle which will affect aggregate housing demand and house prices.

APPENDIX

This Appendix describes some technical aspects of the simulation model, including a discussion of parameter values and sensitivity tests. The following functional forms are adopted:

$$U() = \beta^{t-1} \left[(c(t))^{\alpha_c} (h(t))^{\alpha_h} \right] \quad (\text{A1})$$

$$Z() = \beta^{t-1} \left[(c(t))^{\alpha_c} (\gamma H)^{\alpha_h} \right] \quad (\text{A2})$$

$$F(B) = \beta^{12} \omega B^{\alpha_h} \quad (\text{A3})$$

where γ represents the pride-of-ownership coefficient, and $\alpha_c + \alpha_h < 1$ which implies decreasing marginal utility with respect to total consumption.

The values of α_c and α_h are determined as follows. Intratemporal optimisation implies that expenditure on rent and non-housing consumption are linearly related. This is derived as follows:

$$\frac{\partial U / \partial c(t)}{\partial U / \partial h(t)} = \frac{\alpha_c h(t)}{\alpha_h c(t)} = \frac{1}{P_r} \quad (\text{A4})$$

Therefore,

$$P_r h = \frac{\alpha_h c}{\alpha_c} \quad (\text{A5})$$

Hence optimal expenditure on rent, $P_r h$, is a linear function of optimal non-housing consumption expenditure. The values of α_c and α_h are determined in order to give a realistic value of the ratio of optimal rent expenditure to non-housing consumption expenditure which is set at 25%. Hence $P_r h = 0.25c$ and therefore

$$\alpha_h = 0.25\alpha_c \quad (\text{A6})$$

Further, assuming that the elasticity of marginal utility with respect to c is 0.5,¹² then

$$\alpha_c + \alpha_h = 0.5 \quad (A7)$$

Equations (A6) and (A7) imply that $\alpha_c=0.4$ and $\alpha_h=0.1$. These are approximately equal to the values adopted by Slemrod (1982) which are $\alpha_c=0.417$ and $\alpha_h=0.083$. Hayashi et al. (1988) on the other hand assume that $\alpha_h=0.15$ and $\alpha_c=1$, which do not seem as plausible for Australia.

The rate of time preference is $1/(1+\beta)$ which, in conjunction with the rate of interest, affects the rate at which consumption grows over time. The Euler equation that describes the optimal consumption path implies that, between any two periods in which a house is owned, consumption growth is given by:¹³

$$\frac{c(t)}{c(t-1)} = \left[(1 + R^a) \beta \right]^{1/(1-\alpha_c)} \quad (A8)$$

The value of the annual rate of time preference is determined from (A8) so that optimal consumption is constant over the period when the house is owned. The resulting value is 2 percent per annum; Hayashi et al. (1988) adopt 3 percent.

The value for ω is chosen arbitrarily with the goal of achieving a target value of the bequest, B , using the first order condition in the final period (where $t=13$). In the base case the target value of the bequest to equal to 1.5 times average lifetime labour income. This implies, in the base, case, a bequest approximately equal to the size of the house owned by the household.

The parameter values are summarised as follows:

Table A.1	
Parameter	Value
Annual growth rate of labour income per capita, g	0.015

¹² This elasticity can be found by substituting (A5) into (A1).

¹³ Equation (A8) applies only for any two periods in which a house is owned. The corresponding equation is slightly different for periods in which housing is rented or for periods in which the household switches from renting to owning or vice versa. However, our simulations (and those of Hayashi et al .) show that households will choose to own for most of their adult lives. This justifies our focus on the period of home-ownership for the purpose of choosing the constant value of β .

Annual interest rate	0.04
Annual rate of time preference ($=\beta^{0.2}-1$)	0.02
Required deposit ratio ¹⁴ , d	20%
Size of bequest, B , as a multiple of average lifetime labour income	1.5
Elasticity of marginal utility with respect to housing consumption, α_h	0.1
Elasticity of marginal utility with respect to non-housing consumption, α_c	0.4
Tax rate on income from financial assets, τ	0.3
Pride of ownership coefficient ¹⁵ , γ	1.1
Maturity of the mortgage ¹⁶ , m	4 (20 yrs)

Sensitivity analysis

A sensitivity analysis was conducted by varying, one at a time, each of the following parameters in the model: the deposit on the housing purchase, the maturity of the mortgage, the size of the bequest, the “pride of ownership” coefficient, the elasticities of marginal utility of c and h , and the tax rate on saving and financial assets. The discussion here refers to the sensitivity of the baseline outcomes for the tenure pattern, the saving rate and aggregate housing purchases in 2002 that were reported at the beginning of Section 4 in the text.

The optimal timing of the sale of the house is unaffected by the choice of parameters. That is, it optimal in every case to retain owner-occupier status for as long as possible after the purchase. The timing of the housing purchase was found to differ from that in the base case for some alternative parameter values but by no more than one five year period. This suggests that the tenure pattern is quite robust to alternative parameter values.

Altering the required deposit has the expected effects on saving and housing demand; that is, a lower deposit increases housing demand and reduces the saving rate and a higher deposit has the opposite effects.

¹⁴ The typical deposit ratio for Australia is between 10 and 20 percent (ABS Cat. 4182.0). Hayashi et al. used 25 percent.

¹⁵ Hayashi et al.(1988) used 1.4

¹⁶ Hayashi et al. (1988) assume that mortgages are for 30 years, but households in Australia typically pay off their mortgages in about 20 years (based on author’s calculations using data on monthly repayments obtained from the Housing Industry Association of Australia and data on average borrowing size from ABS Cat. 5609.0).

Sensitivity to the bequest is not as great as might be expected. The size of the bequest has two offsetting effects on saving, as pointed out by Hayashi et al. (1988, p.230). A higher bequest implies a higher inheritance of the next generation. Therefore the need to raise saving to accumulate the bequest is reduced by the boost to wealth from a higher inheritance. The outcome is that a doubling of the bequest actually raises housing demand by about 10 percent and raises the saving rate by about 1 percent; a zero bequest commensurately lowers housing demand and the saving rate.

A larger “pride of ownership” parameter brings forward the housing purchase by one period (5 years) which reduces housing demand and the saving rate. The interpretation of this result is that because ownership is more highly valued it is optimal to purchase the house earlier, but the liquidity constraint means that the size of the purchase must be somewhat smaller.

Recall from Section 3 that the relative size of the parameters α_c and α_h imply a certain ratio of rent expenditure to other expenditure in household budgets, which was set at 25%. Varying this ratio to either 15 percent or 40 percent has a very small effect housing demand and private saving - less than 1 percent of income in 2002 – which remains the case throughout the projection period. Finally, lowering the tax rate on the return from accumulating financial assets from 30 percent to 20 percent results in a reduction in the private saving rate by 0.8 percent and a reduction in the demand for housing by 0.6 percent, in 2002.

These sensitivity tests are limited in that they consider perturbations in parameters and assumptions one at a time. A stochastic simulation analysis would be able to account for interaction of various perturbations of parameters and assign probabilities to the outcomes for housing demand and the saving rate.

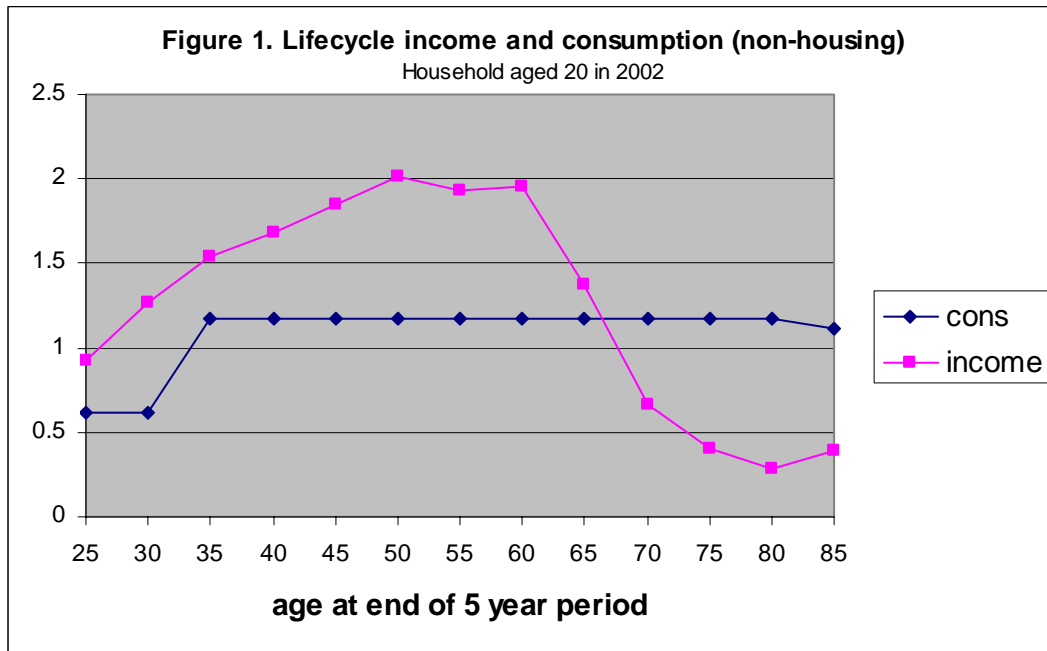


Table 1. Effects of housing affordability policies

<i>Supply elasticity</i>	% change in house purchases			% change in house prices			% point change in private saving rate
	timing effect	other effects	net effect	timing effect	other effects	net effect	
First Home Owner Grant							
infinite	-2.5	3.9	1.4	zero	zero	zero	-3.7
2	-1.9	2.4	0.6	-0.9	1.2	0.3	-3.7
Housing Equity Partnerships							
infinite	-2.9	26.7	23.8	zero	zero	zero	11.3
2	-1.6	16.8	15.1	-0.9	8.2	7.3	11.3
In the remaining housing equity simulations, the capital return to the bank cannot exceed the value of the house							
infinite	-8.8	32.0	23.2	zero	zero	zero	3.2
2	-5.5	20.0	14.5	-2.4	9.5	7.1	3.3
In addition to the above assumption, the bequest is zero in the remaining housing equity simulations							
infinite	-6.6	88.8	82.2	zero	zero	zero	1.9
2	-3.5	51.8	48.3	-1.4	23.2	21.8	2.0
HECS-style deposit loans							
infinite	17.0	9.1	26.0	zero	zero	zero	-2.6
2	10.5	5.6	16.1	5.0	2.8	7.8	-2.6

Notes:
 These are long run effects i.e. they assume that the policy has been in place for one entire adult lifetime.
 The timing effect is the difference between housing purchases when buying at age 30 and at age 25. The sum of the "other effects" is the difference between housing purchases, at age 30, with and without the housing policy.

References

- Alm, J. and Follain, J.R. (1982) Alternative Mortgage Instruments: Their Effects on Consumer Housing Choices in an Inflationary Environment. *Public Finance Quarterly* 10, 2, 134-157.
- Allen Consulting Group (2003) Asset Based Policies. Matched Savings Accounts: Exploring Options. Report to the Chifley Research Centre. www.chifley.org.au
- Artle, R. and Variaya, P. (1978) Life Cycle Consumption and Homeownership. *Journal of Economic Theory* 18, 38-58.
- Australian Bureau of Statistics (ABS) (2003) Australian Social Trends. ABS, Canberra.
- Bourassa, S.C. (1995a) The Impacts of Borrowing Constraints on Home-ownership in Australia. *Urban Studies* 32, 7, 1163-1173.
- Caplin, A. and Joye, C. (2002) A Primer on a Proposal for Global Housing Finance Reform. Menzies Research Centre. www.mrcld.org.au
- Ermisch, J. and Jenkins, S. (1999) Retirement and Housing Adjustment in Later Life: Evidence from the British Household Panel Survey. *Labour Economics* 6, 311-333.
- Freebairn, J. (1999) Tax Reform Proposals and Housing. *Economic Papers* 18,3, 73-84.
- Gans, G. and King, S. (2003), Housing Lifelines Would Rescue Many. *Australian Financial Review*, 6 August.
- Hayashi, F., Ito, T. and Slemrod, J. (1988) Housing Finance Imperfections, Taxation, and Private Saving: A Comparative Simulation Analysis of the United States and Japan. *Journal of the Japanese and International Economies* 2, 215-238.
- Housing Industry Association (2003) Prices Surge Takes Housing Affordability to New Record Low. Media Release, 27 November. <http://www.buildingonline.com.au/>

- Littrell, C. (1999) Australian Investment Income Taxation: The Worst of All Worlds, *Economic Papers* 18, 2, 49-60.
- Loundes, J. (2001) Household Saving Behaviour in Australia. *Economic Papers* 20, 1, 67-84
- MacFarlane, I. (2003) Do Australian Households Borrow Too Much? Reserve Bank of Australia Bulletin April, 7-16.
- Mankiw, N.G. and Weil, D.N. (1992) The Baby Boom, the Baby Bust, and the Housing Market. *Regional Science and Urban Economics* 21, 573-579.
- Poterba, J.M. (1984) Tax Subsidies to Owner-Occupied Housing: An Asset Market Approach. *Quarterly Journal of Economics* 2, 143-203.
- Quiggin, J. (2003) Insurance for House Prices. *Australian Financial Review*, 19 June.
- Skaburskis, A. (1999) Modelling the Choice of Tenure and Building Type. *Urban Studies* 13, 2199-2215
- Slemrod, J. (1982) Down-Payment Constraints: Tax Policy Effects in a Growing Economy with Rental and Owner-Occupied Housing. *Public Finance Quarterly*, 10,2, 193-217.
- The Age (2003) Victoria Broke Grant Rules: Costello, 15 October.
- VanderHart, P.G. (1998) The Housing Decisions of Older Households: A Dynamic Analysis 7, 21, 21-48.