Positioning Paper

A microsimulation model of the Australian housing market with applications to Commonwealth and State policy initiatives

authored by

Gavin Wood, Paul Flatau and Richard Watson

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ABBREVIATIONS

ABS – Australian Bureau of Statistics
ACCC – Australian Competition and Consumer Commission
ATO – Australian Taxation Office
CGC – Commonwealth Grants Commission
CURF – Confidentialised Unit Record File
FTB – Family Tax Benefit
GST – Goods and Services Tax
RIS – Rental Investors Survey
SIHC – Survey of Income and Housing Costs
UCC – User cost of capital

TERMINOLOGY

*Agency cost*s – the costs of managing a rental property including the screening and selection of tenants and the ongoing management of the rental tenancy contract.

Bid-rental rate – the maximum rent a consumer is willing to pay a landlord. It will be equal to the economic costs of owner-occupation when these costs are converted into a stream of charges over time.

Effective marginal tax rate – the share of income from housing capital that is paid in Federal, State and Local Government taxes. This includes annualised capital gains tax liabilities.

Implicit marginal tax rate – the tax rate on an additional dollar of income earned by the individual. This will often differ from average tax rates and statutory income tax rates as changes to variables such as rebates, pension and benefit payments, deductions and tax levies are incorporated into this measure.

Income unit – the decision-making unit for the purposes of housing consumption and investment decisions. In general, this will be either a single person or a couple. Analogous to the ABS definition used in statistical surveys.

Opportunity cost of equity capital – the after tax return on equity capital if it were to be invested in an alternative asset with similar risk characteristics to the housing investment.

Reservation Rental Rate – The minimum ratio of rent to property value at which a landlord would be willing to let a property. It is equal to the ratio of economic costs to property value incurred by the landlord.

User Cost of Capital – The ratio of economic costs to capital value (asset value).

EXECUTIVE SUMMARY

- This project *A Microsimulation Model of the Australian Housing Market with Applications to Commonwealth and State Policy Initiatives* has the aim of constructing a microsimulation model that is capable of measuring the impact that Commonwealth and State government fiscal measures and housing programs have on the prices that households pay for housing (and the subsidies they receive) and the costs providers of housing face. The microsimulation modelling techniques also permit detailed government budget estimates of fiscal instruments.
- The project is best viewed as an investment that will create an asset, which can be used in future years to inform policy development at both Commonwealth and State tiers of government. The microsimulation model informs the development and evaluation of housing assistance programs and provides an economic assessment tool that can be used to evaluate the way in which government housing assistance interventions impact on entry and exit incentives across housing tenures; the role of housing and tax measures in affecting the supply of affordable housing, the impact of home ownership support schemes and rent assistance on housing tenure outcomes, and the ways in which different forms of housing assistance meet the needs of different socio-demographic groups.
- The microsimulation model is 'driven' by two fundamental equations.
    - The first describes the economic costs (or user costs) of a landlord.
    - The second describes the maximum rent a housing 'consumer' is prepared to pay a landlord before choosing to purchase housing.
- The microsimulation model represents a unique attempt to integrate the demand and supply sides of the housing market in cross section microsimulation exercises.
- The *economic costs* of a provider of rental housing are to be distinguished from accounting costs, where the latter only encompass outlays incurred by the landlord. Economic costs have three important characteristics:
    - They include costs outlays such as operating cost (maintenance, rates etc) and the sacrifice (opportunity cost) a landlord makes because she has equity tied up in a rental investment that could earn a return elsewhere;
    - They are defined on an after-tax basis;
    - They include the net costs of holding the asset that are reduced if the asset appreciates in value. (After-tax capital gains are then taken into account in the definition of economic costs.)
- If a real estate investment is to be economically worthwhile to the landlord, the gross rent it yields must be at least sufficient to meet the economic costs of a provider of rental housing. The gross rent that just meets all economic costs is referred to as the *reservation rent*, and when expressed as a proportion (or percentage) of capital value (asset price), it is termed the *reservation rental rate*. We interpret this rent, as the minimum a landlord is willing to accept because rents below this level fail to provide landlords with a return that matches the alternative of saving in a deposit account.
- The maximum rent a housing 'consumer' is prepared to pay a landlord before choosing to purchase housing is critical because it will be used to judge whether a mutually advantageous landlord-tenant match arises with respect to any given property in the private rental sector, and a prospective occupant. If the maximum rent a potential occupant is prepared to pay exceeds the minimum rent a landlord is prepared to accept a potential match obtains. The *bid rental rate* expression states that the maximum rent a 'consumer' is prepared to pay a landlord equals the economic cost (or user cost) of becoming a homeowner.
- The two-equation microsimulation model we have specified is operationalised in the following way. The Australian Bureau of Statistics (ABS) 1996-97 *Survey of Income and Housing Costs* (SIHC) Confidentialised Unit Record File (CURF) is used to estimate the bid rental rate of each income unit. We interpret this measure as the

maximum rental rate each income unit is prepared to pay if they rent. Using the ABS 1997 *Rental Investors Survey*, we measure the reservation rental rate of landlords with respect to each property owned and leased.

- For each property we can measure the proportion of income units who would find it cheaper to rent the property than become (or remain) homeowners. For these income units, the property offers a mutually advantageous tenant-landlord match. It is then possible to identify those segments of the private rental housing stock that offer 'value for money' to different subgroups of housing 'consumers'. We can also ascertain whether these segments are affordable to a particular subgroup.
- Measurement of the two-equation microsimulation model utilising the 1996-97 *SIHC* and 1997 *RIS* is a complex process. It involves a number of steps including:
    - The derivation of *implicit marginal tax rates* (the marginal tax rate on an additional dollar of income earned by the individual if that individual was to change their allocation of resources across housing tenures and ownership of residential rental housing).
        - Implicit marginal tax rates should be distinguished from the statutory marginal tax rate as account is taken of withdrawal of income support payments on receipt of additional income. Moreover, actual tax paid will also reflect the inclusion of deductions, rebates, the Medicare levy and other components of the tax system.
    - The derivation of *expected net rent* for the investor that allows for the lumpiness of maintenance expenditures and the irregular nature of vacancies. Expected net rent is annual gross rent weighted by the expected vacancy rate and incorporates agency costs (including letting and property management fees), expected annual maintenance costs; annual land tax; annual property taxes including utilities such as water and sewerage; insurance premiums; body corporate fees; and mortgage interest payments.
    - The derivation of other elements of economic costs not included in the net rent component such as brokerage fees and stamp duties, and depreciation.
- To illustrate the reach and effectiveness of the microsimulation modelling technique adopted in this project, we include preliminary research findings in the positioning paper in respect of the impact of federal tax policies on the incentive to invest in low-cost private residential accommodation.
- Over recent years, concerns have been raised over the availability of low-cost rental housing in the Australian private residential rental market. These concerns are well founded. Using census data for the period 1986 to 1996, Yates and Wulff (2000) show that while there has been a significant increase in the number of low-income renters in the private residential housing market, the availability of low-cost rental accommodation has declined significantly.
- The simulation results included in this paper compare the impact on the incentive to invest in low-cost private residential accommodation of existing federal building write-off provisions (and variants of those policies) with targeted low-income tax credits. Under current Australian taxation arrangements (2001), building-write-off deductions apply to eligible construction expenditure in the residential rental property market. Deductions are applied on an annual basis and limited to 100 per cent of the construction expenditure. The current annual building write-off rate is 2.5 per cent of the capital expenditure. This annual deduction can be claimed over a forty-year holding period from the date construction was completed.
- An alternative to a building write-off is a targeted low-income housing tax credit (or rebate). We consider the case of a tax credit that is offered at a particular rate of the building value, without time limit, but conditional on weekly gross rents being less than some threshold level. The tax credit is not recaptured on realisation. The low-income housing tax credit has been implemented in the US but not in Australia.

- The analysis of the relative effect of the building write-off is conducted in terms of the King and Fullerton (K-F) (1984) effective marginal tax rate measure of private investment in residential housing. The K-F marginal effective tax rate is given as the difference between the pre- and post-tax rate of return on private investment in residential housing expressed as a proportion of the pre-tax rate of return. Microsimulations are conducted under alternative assumptions about real capital gains and investor holding periods.
- For a holding period of around 10 years and a real rate of capital gain growth of zero per cent, the K-F effective marginal tax rate is around 0.64 in the baseline case in which no building write-off allowance or tax credit is applied. In other words, 64% of net income return is 'taxed'. The K-F effective marginal tax rate falls as the holding period is extended or as capital appreciation rises.
- Allowing for the building write-off allowance results in a small decrease in the K-F effective marginal tax rate as compared to the baseline of no building write-off. Across all properties, the mean K-F marginal effective tax rate falls from 0.64 to 0.63 in the case of 2.5 per cent building write-off with capital gains recapture, and from 0.64 to 0.61 under a 4 per cent building write-off rate and no recapture scenario. (These estimates are based on a 10 year holding period and no capital appreciation.) Thus the building write-off provisions have a relatively small impact on the incentive to invest in general terms.
- When the building write-off is relaced by a targeted 4 per cent tax credit on low rent housing, the K-F effective marginal tax rate is substantially decreased at the low cost rental part of the market. The K-F effective marginal tax rate falls to 0.41 under a targeted tax credit scheme for properties with weekly rents less than $140 per week. At higher weekly rents, the tax credit is assumed not to apply and, therefore, K-F effective marginal tax rates remain at the baseline level. In the case of the one per cent real capital gain scenario, the K-F effective marginal tax rate falls to 0.20 under a targeted tax credit scheme for properties with weekly rents less than $140 per week.
- Using a model of landlord switching between different types of rental properties, our analysis shows that the low-income tax credit would encourage a large proportion of existing investors to invest in low-income rental housing with 66% electing to switch (under a no real property price appreciation assumption).
- The paper examines the budgetary impact of the various policy alternatives considered. The budgetary impact is calculated for one year for both the properties in our sample and on a national basis using the population weights contained in the survey data. Budgetary costs are the dollar value of tax revenues foregone when allowances or credits claimed are restricted to be less than or equal to the sum of the income units income tax liabilities. As a result, the estimates represent actual costs rather than the hypothetical cost obtained by simply grossing up the eligible annual allowance or credit over the properties in the sample.
- Despite the higher value of the tax credit in terms of tax dollars that can be claimed by an investor, this policy has the lowest annual cost for current eligible properties (AUD$38.4 million). This reflects the restriction of the credit to properties in the lowest quartile by gross weekly rent.
- By way of contrast, the estimated cost of the 2.5 per cent building write-off allowance when recapture provisions are in place is AUD$44.3 million.
- However, when we allow for switching behaviour on behalf of rental investors in response to the incentives available under the targeted tax credit the budgetary cost rises to AUD$117.0 million. This very large increase in the budgetary cost emphasises the importance of taking switching behaviour into account when costing various policy options.

INTRODUCTION

Government policy that aims to improve the affordability of housing typically does so by using some fiscal instrument which is designed to lower the price that 'consumers' of housing pay in the market place. These fiscal instruments can operate on the supply side, by lowering the costs of providers of housing, or on the demand side of the housing market in which case financial assistance to tenants or owners is offered conditional on the lease or purchase of housing.

These fiscal instruments are invariably tenure specific. For example:

- The Federal Government's rent assistance program offers assistance to private rental tenants that satisfy income tests;
- The Federal Government's first home buyer grants are, as the name suggests, offered to those who have never been home owners in their housing careers to date;
- State Governments' offer stamp duty concessions that are also targeted on first home buyers;
- The Federal Government's building write-off allowance is designed to lower the costs of landlords in the private rental-housing sector.

This project uses micro data sets to precisely measure the impacts of these types of measures on the costs of providers of housing and the price that 'consumers' of housing pay in the housing market. The microsimulation modelling techniques also permit detailed government budget estimates of fiscal instruments. We are, therefore, addressing issues that are central to the conduct of housing policy. In particular, we ask to what extent will government measures lower or raise the price that consumers in different market segments pay for housing.

The positioning paper is organised as follows. We begin by outlining the background to the present study, which includes a discussion of alternative methodological approaches. This is followed by an explanation of the theoretical framework that guides our specification of the microsimulation model. We concentrate on giving an intuitive explanation of the analytical concepts comprising our model, with technical details relegated to appendices. This is followed by a detailed description of the methods employed in measurement of the economic costs of rental investors, and the economic costs of housing consumers on purchasing housing. These are critical magnitudes in the microsimulation model.

A final section offers some preliminary findings. Our empirical work has reached a stage where we can measure the economic costs of rental investors (the supply side of the model). Measurement of housing consumers' economic costs (the demand side of the model) is not yet complete. We, therefore, concentrate on applying the supply side of our microsimulation model. A measurement exercise is conducted in which we estimate the impact of building write-off allowances on investors' economic costs. These impacts are compared with those from a targeted low-income housing tax credit. A standard approach to measurement in this context is the King-Fullerton (1984) framework, and we adopt that approach here.

BACKGROUND

Economists studying the impact of fiscal interventions on the price and consumption of housing are typically motivated by concerns about the distributional and efficiency consequences of these interventions. We want to know whether fiscal interventions that provide subsidies are targeted on households with housing affordability problems, whether they improve housing outcomes for these households and whether there are distortions attributable to fiscal interventions that have adverse impacts on efficiency in the housing market and the wider economy.

In the economics literature we find two approaches to these questions that represent alternative methodological perspectives to the microsimulation approach adopted here. The first might be labelled the econometric method, which involves statistical estimation of equations representing the demand for housing or tenure choice. In Laidler (1969), King (1981) and Yates (1981), seminal studies in this vein, we find examples of econometric estimation of the demand for owner occupied housing, with key variables such as income and price being the focus of attention. The price variable is typically measured after adjusting for the subsidies that are made available as a result of government fiscal interventions. Using the estimates that researchers obtain on the effects of price on demand, measures of the impact of subsidies can be generated. It is also possible to measure so-called deadweight welfare losses that arise as a result of subsidies. These are efficiency losses that arise because it is possible to show that an individual's economic welfare would be improved if she were handed an equivalent sum of money, rather than a subsidy granted conditional on consumption of housing.

Laidler calculates the impact of tax subsidies on price, and estimates that the consumption of housing in the USA would be 17.1% lower if subsidies to homeowners were curtailed by taxing net imputed rents[1]. The deadweight welfare loss corresponding to this subsidised increase in consumption sums to only 0.14 of one percent of the value of the housing consumption in the USA. King (1981) estimates that in the UK taxation of net imputed rent would result in a 13.7% decline in the consumption of housing services, a figure very similar to that obtained by Laidler (op cit). Once again the deadweight welfare loss is small at only 0.4 of one percent of mean income, and those with the highest incomes are worst hit. These studies indicate that government intervention in the form of subsidies has a significant effect on housing consumption. In another body of literature researchers including Rosen (1979), Rosen and Rosen (1980) and Hendershott and Shilling (1982) investigate impacts on tenure choice as well as housing demand in the USA.

Rosen (1979) applies econometric estimation techniques to a cross section database to jointly estimate the quantity of housing services demanded and tenure choice. If there were taxation of net imputed rent this study projects that the incidence of owner occupation would be 4.4 percentage points lower. Rosen and Rosen (1980) estimate a time series regression model of the tenure choice decision for the period 1949-1974. Imputing measures of the price of owner occupied housing relative to rents in the rental housing market in the absence of tax subsidies, allows the authors to employ their regression model for the purposes of generating forecasts of the proportion of home owners. Their regression model indicates that the incidence of owning would fall from 64% to 60%. Using the homeownership rate adjusted for changes in the demographic structure of the population, Hendershott and Shilling (1982) project that the incidence of homeownership would be 59% if property taxes and mortgage interest were not deductible from taxable income.

The econometric approach has its limitations. In time series analysis estimation of models is constrained by a limited number of observations, which effectively means that the data could contain insufficient information on which to base robust conclusions. The models must also employ a unique price measure for housing in each time period, yet it is well known that there is no unique price. The effective price which homebuyers pay is conditional on their marginal income tax rate, while rent relative to capital value (and hence the services yielded by the housing leased) can vary across segments of the housing stock (see Wood and Watson,

[1] Imputed rent is the notional value of the services yielded to a homeowner by the housing it occupies. When the economic costs of holding and using the housing are subtracted we obtain net imputed rent.

2001). The microsimulation approach adopted in the present study uses confidentialised unit record files from ABS surveys to provide measures of the prices paid by households given the detailed rules governing entitlement to subsidies and taxes that are levied on housing. This disaggregated approach allows us to offer a comprehensive description of the impact of subsidies and other government fiscal interventions on the economic welfare of housing consumers and landlords. It is then complementary to the econometric approach in that it fills in the detail often overlooked in the more aggregative econometric approach.

Some of these comments also apply to a comparison of the microsimulation method with the other main method of inquiry, which we could label the National Accounts approach. Studies of this kind include Yates and Flood (1987) in Australia, and Hills (1981) in the UK. National Accounts data on income flows by sector are used to measure the value of subsidies and the revenues obtained by government from levies and taxes applied to housing. This method is ideally suited to measurement of the net budgetary cost to government of its various fiscal interventions, and how this net budgetary cost is distributed across tenures. But once again this approach is at too aggregative a level of analysis to offer detailed description of the impact that government interventions have on individual housing consumers and landlords in different segments of the housing market.

Our microsimulation model is designed to address this latter issue. While the model has firm theoretical antecedents, as described in the following section, we believe this is the first time a microsimulation model of a national housing market has been operationalised using confidentialised unit record file data. We now turn to a detailed description of the model's specification.

THE MICROSIMULATION MODEL

The conceptual framework upon which our microsimulation model is based was developed in Wood (2001). In this paper, a model was designed that derived the conditions under which a potentially mutually advantageous match between landlord and tenant will arise. The basic condition, which must necessarily be satisfied, can be stated as follows; the minimum rent a landlord is willing to accept must be less than the maximum rent a 'consumer' is prepared to pay before choosing to purchase housing. If this condition is satisfied a consumer would be financially better off renting from our landlord, rather than purchasing an identical property in the market for owner occupied housing. Satisfaction of this condition is necessary but not sufficient for a mutually advantageous match to occur. The consumer might be financially better off renting, but find the type of property offered by the landlord unsuitable because of size, condition or some other housing attribute. On the other hand, a 'consumer' might be better off purchasing rather than renting from a landlord, but be unable to afford the mortgage repayments on the loan that is required to leverage purchase. In short, we accept that there are a range of factors that determine the choice of housing and tenure. However, we deliberately isolate the relative price of housing in rental and owner occupied tenures for analysis, because these are the variables over which government can exert direct influence. Our model therefore aims to ascertain whether Australian households typically find it cheaper to purchase rather than rent in different segments of the housing stock. These different segments will be defined by reference to capital value, size, age, etc. The analysis by capital value is expected to be particularly relevant as an earlier version of this model demonstrates that Australian households typically find it cheaper to purchase low capital value housing, rather than rent in this segment (Wood and Watson, 2001; Wood, 2001a).[2]

The microsimulation model is 'driven' by two fundamental equations. The first describes the economic costs (or user costs) of a landlord. The economic costs of a provider of rental housing are to be distinguished from accounting costs, where the latter only encompass outlays incurred by the landlord. Economic costs have three important characteristics that it is important to emphasise:

- They include costs outlays such as operating cost (maintenance, rates etc) and the sacrifice (opportunity cost) a landlord makes because she has equity tied up in a rental investment that could earn a return elsewhere;
- They are defined on an after-tax basis;
- The economic costs of real estate assets include the net costs of holding the asset that are reduced if the asset appreciates in value. After-tax capital gains are then taken into account in the definition of economic costs.

If a real estate investment is to be economically worthwhile, the gross rent it yields must be at least sufficient to meet these economic costs. The gross rent that just meets all economic costs is referred to as the reservation rent, and when expressed as a proportion (or percentage) of capital value (asset price), it is termed the reservation rental rate. We interpret this rent, as the minimum a landlord is willing to accept because rents below this level fail to provide landlords with a return that matches the alternative of saving in a deposit account.[3]

[2] The microsimulation model developed in this project is more sophisticated than that reported in Wood and Watson (2001) and Wood (2001a). The empirical estimates these papers presented were based on use of the ABS Rental Investors Survey only. This project is more ambitious because it will marry the Rental Investors Survey with the ABS Survey of Income and Housing Costs.

[3] An objection to this conceptual framework is the familiar one that private rental housing is a cottage industry comprising unintentional landlords or financially unsophisticated landlords who do not respond to market 'price' signals. See Wood (2001b, p428) for a defence of the assumption that landlord supply decisions will generally reflect economic returns available in the rental housing market.

The Landlord's Reservation Rental Rate

In appendix A, we derive the landlord's reservation rental rate (r_L) equation, which can be expressed as;

$$r_L = \frac{i+\alpha}{(1-\phi)} - CAP + AMORTx\left(CAPTAX + TRANSCOST - WRITEOFF\right) \qquad (1)$$

where $\alpha = \mu + t_r + (1-\lambda_s)t_l$, $CAP = \frac{\pi_h - d}{(1-t_y)(1-\phi)}$, $AMORT = \frac{\pi_h - d - (1-t_y)\,i}{(1-t_y)(e^{\delta N}-1)(1-\phi)}$,

$$CAPTAX = \tfrac{1}{2}\, t_y\left[(1-\beta)e^{\pi_h N} - (1+s) + \omega N\right]e^{-kN},\ \delta = \pi_h - d - (1-t_y)\,i,\ k = (1-t_y)i,$$

$$TRANSCOST = s + \beta e^{\delta N} \text{ and } WRITEOFF = \frac{t_y \omega\left(1-e^{-kN}\right)}{k}.$$

The reservation rental rate expression has been derived given the tax rules in place following the introduction of the GST reform package in July 2000, and the Review of Business taxation reforms to capital gains tax arrangements in October 1999. The variables and parameters used in the derivation of equation (1) are defined in table 1 below.

Table 1: Variable and Parameter Definitions

Parameter/Variable	*Definition*
i	Rate of interest applicable to both lending and borrowing
μ	Maintenance as a proportion of asset price
t_r	Rates as a proportion of asset price
λ_s	The ratio of the value of the building structure to the asset price
t_L	Land tax as a proportion of land value
ϕ	Agency costs as a proportion of asset price
π_h	Constant rate of house price inflation
t_y	Landlord's implicit marginal tax rate
d	Rate of economic depreciation
β	Brokerage fee on sale as a proportion of asset price
N	The landlord's expected holding period
s	Stamp duty as a proportion of asset price
ω	$\psi\lambda_s$
m	Outstanding mortgage debt
p(0)	Asset price of housing in current year
q	Housing capital
ρ	Rate of time preference
π	Constant rate of general inflation
r(t)	Is defined by $r(o)e^{\pi_h t}$ and is the rental price of housing in year t
ψ	Is the rate of building write-off allowance

Equation (1) is a complicated looking expression, but the components of economic cost (or user cost of capital) on the right hand side of the equation have a ready interpretation. The first term on the right hand side of equation (1) represents financing and operating costs per dollar of asset price. The former include the investor's opportunity cost of equity capital as well as debt repayments, while the latter include maintenance, management, agency costs and state and local government recurrent taxes.

The second term is a less well-understood component of a landlord's economic costs. It represents the contribution of capital gains in offsetting the costs of holding a real estate investment, if capital gains were tax exempt. To illustrate, suppose the rate of capital gain falls by one percentage point. The reservation rental rate must now increase by $1/(1-t_y)$ percentage points, since it must cover the loss of capital gains and the taxes on the compensating increase in rents.

We now have three lump sums[4]. The first, CAPTAX is the present value of the tax liability on realised capital gains; because capital gains tax is levied on realisation, rather than as they accrue, this sum is discounted. The second is TRANSCOST a parameter representing transaction costs on acquisition and realisation. Transaction costs on realisation are discounted. Finally, WRITEOFF is the present value of building write-off allowance tax savings. These are conditional on investor acquisition of a newly constructed property. The parameter AMORT converts these lump sums into an annual equivalent amount. Thus, for instance, the product of AMORT and CAPTAX is the increment that an investor must add to her rental rate (in each year of the holding period) in order to meet capital gains tax liabilities due on realisation[5].

Definitions of the landlord's reservation rental rate similar to equation (1) can be found in numerous US and Canadian studies that aim to measure the impact of government fiscal measures on rents in the private rental market (See, for example, Brueggeman, Fisher and Stern 1982, De Leeuw and Ozanne 1981, Dotzour and Levi 1995, Fisher and Lentz 1986, Follain, Hendershott and Ling 1987, Gordon, et al. 1987, Hendershott, Follain and Ling 1987, Hendershott and Ling 1984, Ling 1992 and MacNevin 1997a, 1997b). However, there are important differences between the definitions in these studies and that presented in equation (1). There are two main reasons for this:

- First, tax arrangements in Australia and North America differ. So, for example, the US federal government extends depreciation allowances on residential buildings to all landlords. This allowance is not made available by the Australian federal government.
- Second, the definition in equation (1) is more general than those typically used in North American studies. The latter invariably assume that landlords hold their residential investments for an infinite period, which is of course unrealistic. It is an unduly restrictive assumption because landlords' economic costs are significantly affected by the length of time they hold residential property investments (Wood, 2000).

The Bid Rental Rate

The second fundamental equation in our microsimulation model describes the maximum rent a housing 'consumer' is prepared to pay a landlord before choosing to purchase housing. The second equation is critical because it will be used to judge whether a mutually advantageous landlord-tenant match arises with respect to any given property in the private rental sector, and a prospective occupant. If the maximum rent (as defined by equation 2 below) a potential occupant is prepared to pay exceeds the minimum rent a landlord is prepared to accept (as defined by equation 1 above), a potential match obtains.

In appendix B, we show that this maximum rental rate, or bid rental rate (r_o) as it can be termed, is given by:

[4] These are cash sums that are not recurrent and are to be distinguished from the the operating cost, financing cost and capital gain component that accrue on a recurrent basis each year.

[5] See Wood (2001b, pp426-429) for a simplified arithmetic presentation that illustrates the contribution of each component of economic cost.

$$r_o = [(1-t_o)i + t_o iv] + \mu + t_r - \frac{t_o(\pi_h - d)v}{1-t_o} - (\pi_h - d) + AMORT_o \times [TRANSCOST_o] \quad (2)$$

Where

$$AMORT_o = \frac{\delta}{(1-t_o)(e^{\delta T} - 1)}$$

$$TRANSCOST_O = s + \beta e^{\delta T}$$

t_0 is the 'consumer's' implicit marginal tax rate,

v is the consumers loan-value ratio on purchase,

T is the consumers expected length of occupancy, and all other parameters are as defined in Table 1.

The bid rental rate expression states that the maximum rent a 'consumer' is prepared to pay a landlord equals the economic cost (or user cost) of becoming a homeowner. This economic cost, as represented by the right hand side of equation (2), has a number of important properties that deserve explanation.

The first term (in square brackets) on the right hand side of the bid rental rate definition is the after-tax financing costs of the housing 'consumer'. Unlike landlords, 'consumers' cannot deduct interest payments on debt employed to finance home purchase from assessable income. As compared to landlords' leveraged purchases of housing, 'consumers' therefore incur a tax penalty on debt-financed purchases of housing. This penalty is larger the higher is the loan-value ratio.

The second and third terms represent the 'consumer's' maintenance and management costs and state and local government recurrent taxes. Once again there are important differences between the 'consumer' and landlord's economic costs in this respect. In most Australian states 'consumers' are exempt from land taxes if they purchase. A less well-appreciated difference arises due to the absence of agency costs in the recurrent operating costs of 'consumers' who purchase. Agency costs are the resources deployed in order to monitor and police contractual arrangements between (in this case) an occupant of housing and the owner. In the case of owner occupied housing, the two roles are vested in the same person, and agency costs are zero. However, agency costs will be positive in private rental housing.[6]

The fourth and fifth terms represent the contribution of inflation and capital gains to the economic costs of becoming a homeowner. The first component is the tax saving due to reduction in the real value of mortgage debt that are untaxed additions to the resources of the housing 'consumer'[7].

Finally we have the contribution of transaction costs. The term $TRANSCOST_O$ will take the same value as in equation (1) if the consumer's expected length of occupancy is the same as a landlord's expected holding period. Note that there is no capital gains tax contribution because owner occupied housing is tax exempt. In the Australian context similar expressions for the economic costs of home purchasers can be found in Keifer (1978), Apps (1992) and Bourassa and Hendershott (1994). In the North American context see Chinloy (1991), Follain (1982), Follain and Ling (1988), Gill and Haurin (1991), Hendershott and Slemrod (1983) and Hendershott and Hu (1981).[8]

The theoretical antecedents of this microsimulation model can be traced back to the seminal contributions of Litzenberger and Sosin, (1978), Keifer (1978; 1980) and Titman (1982). These authors recognised that despite widespread subsidies to owner-occupiers, it is in principle possible for landlords from the highest tax bracket to take advantage of the tax

[6] Agency cost is a concept developed by economic analysts of corporate governance (see Jenson and Meckling, 1976). The concept has proved relevant in the economic analysis of a wide range of exchange relationships. See Wood (2001) for an application in the housing context.

[7] Wood (1996) offers a more rigorous treatment of this component.

[8] The definition employed here is more general than that employed in most of the cited studies which typically assume an infinite expected length of occupancy.

shelter (negative gearing) benefits and tax conversion (tax favoured capital gains) benefits from investment in rental housing, and offer properties to low bracket 'consumers' at a rent that places home purchase at a cost disadvantage.

There have been a number of attempts to operationalise this tax arbitrage process (Anstie, Findlay and Harper 1983, Gordon, Hines and Summers 1987, Follain and Ling 1988, Hendershott 1988, Nordvik 2000 and Wood 2001). In these studies it is assumed that 'consumers' have a pre-determined demand for housing and then choose that tenure which supplies this housing at least cost. Simplified versions of equations (1) and (2) are employed to solve for the marginal income tax rate at which an individual housing consumer is indifferent between owning and renting, and landlords are just willing to let housing.[9] Gordon et al (1987) and Keifer (1980) find that in the USA it is financially attractive for low tax bracket housing 'consumers' to rent from high tax bracket landlords, though Nordvik (2000) offers conflicting evidence. Anstie et al (1983) and Follain and Ling (1988) show that in Australia and the USA inflation is found to impact favourably on the relative economic cost of renting.[10]

A major weakness of these studies is the use of a project model approach in which a housing project's economic cost is measured using representative values for key parameters, and assuming that landlords belong to the top tax bracket. This approach has been criticised on the grounds that it rests on an oversimplified characterisation of housing supply (Yinger, 1987). Simulations are generally conducted with respect to this single representative rental housing project, rather than a distribution of rental housing properties and developments with varying characteristics. By basing the analysis on new construction, a relatively small segment of supply is focused on since most rental housing is provided by existing properties. Given a heterogeneous rental housing stock and landlords with different net worth and income positions the economic cost (per dollar of capital value) will vary across the private rental housing stock. It is then possible for many mutually advantageous tenant-landlord matches to exist for low-income housing consumers, but for these matches to be concentrated at the upper end of the housing market, which is unaffordable. The project model approach is unable to explore these issues.

The two-equation microsimulation model we have specified will be operationalised in the following way. The bid rental rate of each income unit in the ABS 1996-97 *Survey of Income and Housing Costs* (SIHC) is measured as defined by equation (2). We interpret this measure as the maximum rental rate each income unit is prepared to pay if they rent. Using the ABS 1997 *Rental Investors Survey*, we measure the reservation rental rate of landlords (as defined by equation 1) with respect to each property owned and leased. For each property we can measure the proportion of income units who would find it cheaper to rent the property than become (or remain) homeowners. For these income units the property offers a mutually advantageous tenant-landlord match. It is then possible to identify those segments of the private rental housing stock that offer 'value for money' to different subgroups of housing 'consumers'. We can also ascertain whether these segments are affordable to a particular subgroup. This model is to our knowledge a unique attempt to integrate the demand and supply sides of the housing market in cross section microsimulation exercises. In the following section we explain how our cross section data sources are used to measure the parameters on the right hand side of equations (1) and (2).

[9] The Anstie et. al. (1983) model has a different behavioural assumption. Instead of choosing the least cost tenure, individuals choose the tenure that maximises net wealth. Though similar in spirit to the breakeven tax rate models, it has different and less plausible implications (see Wood, 2000a, p4).

[10] See Wood (2001) for a more detailed literature review.

MEASUREMENT ISSUES

In this section, we discuss the measurement of the parameters on the right-hand side of equations (1) and (2) above. Collectively, these parameters determine the user cost of capital (UCC). The strategy we adopt for modelling the components of the investor reservation rental rates and consumer bid rental rates is outlined below. The treatment of income, government pensions and allowances and income tax liabilities are dealt with first as the implicit marginal tax rates that we calculate play an important role in the estimates of user cost. We then discuss the approaches we have adopted to measuring the other components of equations (1) and (2) – asset price appreciation, interest rates and housing costs under the two tenures and for the owner of residential rental housing.

To date, full estimates of the reservation rental rates have only been completed for rental investors. The application of the tax and benefit system is, however, the same in principle regardless of the tenure that is being considered. As a consequence, and reflecting our current progress, we have noted where the treatment of tax and benefit parameters for owner-occupiers and rental tenants differ from that employed in the case of rental investors. Different measurement techniques generally reflect differences in the depth of information on income structure between the two micro data sources used in this project; namely, the 1997 *Rental Investors Survey* (RIS) and the 1996-97 *Survey of Income and Housing Costs Survey* (SIHC).

Data Sources

Data used to parameterise the bid rental rate for owner-occupiers and rental tenants is taken from the 1996-97 *SIHC*, Confidentialised Unit Record File (CURF) published by the Australian Bureau of Statistics (ABS). The data set contains detailed information on the socio-economic characteristics of individuals at an income, household and dwelling unit level including detailed information on the sources of income both in the survey week and over the 1995-96 financial year.

Data used to parameterise the expression for the reservation rental rate for rental investors is taken from the 1997 *RIS CURF*. While this latter survey provides highly detailed information on the rental property portfolios of investors it does not provide as detailed coverage of the structure of the income unit's income as does the 1996-97 *SIHC*. While the 1996-97 *SIHC* allows us to identify individuals receiving income from a rental property it does not contain sufficient detail in relation to the characteristics of the property or properties that generate that income. The details of rental Investors are sourced from the RIS for this reason.

The 1997 *RIS* was conducted by the Australian Bureau of Statistics in June 1997 and was based on a survey of approximately 30,000 households across Australia.[11] The 1997 *RIS* identified the following four Australian sub-populations:

1. 584,200 income units who are current investors in residential rental property[12];
2. 222,700 income units who had sold residential rental property in the previous five years;
3. 113,500 income units who were intending to sell residential rental property in the following two years; and
4. 215,500 income units who were intending to invest in residential rental property in the next two years (ABS, 1997b).

The survey collected demographic and financial data for these populations. It also collected detailed dwelling characteristic and financial information on the properties owned by current

[11] The Rental Investors Survey (ABS, 1997a) was included as an attachment to the regular 'Monthly Population Survey' (MPS) used for calculating national employment and unemployment rates.

[12] An income unit is defined as one or more individual persons who represent the unit making the decision to invest and the likely income sharing from residential property between partners in couple families (ABS, 1997b)

investors.[13] These details were recorded for up to the six most recently acquired properties owned by the income unit.[14]

The 1997 *RIS CURF* (ABS, 1997a) contains complete records for 1576 income units (2727 individual investors and 1151 couple income units) who hold 1934 individual residential rental properties.

Implicit Marginal Tax Rates

Our estimates of user cost rely heavily on the computation of the tax rates faced by individuals if they were to change their allocation of resources across housing tenures and ownership of residential rental housing. The implicit marginal tax rates that we calculate differ from what might normally be understood as tax rates in two ways.

First, implicit marginal tax rates represent the effective rate of taxation on the additional income realised by the change in housing consumption and investment. This should be distinguished from the statutory tax rate, the rate in the income tax system schedules as actual tax paid will also reflect changes in deductions, rebates, the Medicare levy and other components of the tax system. The implicit marginal tax rate should also be distinguished from the average tax rate that will reflect tax-free thresholds and the progressive structure of statutory income tax rates with respect to income. In general, the implicit marginal tax rate will be greater than the average tax rate. The relationship between the implicit marginal tax rate and the statutory tax rate is less straightforward. As rebates tend to be targeted at the lowest income earners these individuals may well face implicit marginal tax rates which are less than their statutory tax rates. As income increases rebates and the Family Tax Benefit fall while the Medicare levy, superannuation surcharge and other charges start to have an effect. Individuals on higher incomes can then face implicit marginal tax rates in excess of their statutory rates.

The second way in which our implicit marginal tax rates differ from the common definition of tax rates is that we include changes to government pension and allowance payments as income and asset holdings change. Reductions to pensions and allowances are, from the perspective of recipients and their decision making, no different to taxes. To see this, note that pension and allowance amounts could be just as easily reduced by having a set of tax rates that applied to recipients that operated in parallel with the general tax system. The idea is similar to that applied to the analysis of poverty traps generated by the interaction of the tax and benefit system.

The implicit marginal tax rate on income for an individual (i) is calculated as:

$$IMTR_i = \frac{\Delta T_i - \Delta Ben_i}{\Delta Y_i} \qquad (3)$$

Where ΔT_i is the change in the ith individual's tax liabilities when net income increases by ΔY_i and ΔBen_i is the change in the ith individual's pension and allowance income under the appropriate administrative regime. As a result, if the change in income is positive the change in the individual's tax liability is positive, the amount of pensions or allowances falls, and the implicit marginal tax rate is positive[15].

The implicit marginal tax rate for individuals can also depend on the taxable income of their partner. Certain pensions and allowances, the Medicare Levy, some rebates, and eligibility for the Family Tax Benefit, all depend on the total income of the income unit. As a result even where one partner does not receive any of the income increment that partner's income tax liabilities or benefit payments may change[16]. To capture this effect and to allow for the role of the income unit as the decision-making unit in our analysis we adopt the following method for calculating the income unit's implicit marginal tax rate:

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[13] The 1997 survey is broadly comparable with the 1993 Rental Investor Survey (ABS, 1993) in terms of the data reported. See Wood and Watson (2001) for a detailed discussion of the 1993 survey.

[14] The survey contains property records for up to the 3 most recently acquired properties per individual giving a maximum of six properties for couple income units.

[15] Further detailed discussion of the methodology used to estimate tax rates can be found in Wood and Watson (2001, 1999).

[16] For our purposes family taxable income is defined as the sum of the reference person's and partner's taxable income.

$$IMTR_k = \frac{\Delta T_i - \Delta Ben_i + \Delta T_j - \Delta Ben_j}{\Delta Y_k} \quad (4)$$

Where i and j are the reference person and partner respectively and ΔY_k is the change in income for the k[th] income unit comprising individuals i and j. This allows us to better measure the marginal effective tax rate of the income unit that is taken to be our decision-making unit.

The Change in Income Under Alternative Tenure and Investment Decisions

Our methodology for calculating effective marginal income tax rates involves calculating the change to the income unit's income, pensions and allowances, and tax liabilities that would occur if the income unit were to alter its housing consumption and investment decisions. The alternative tenure and investment choice is different for owner-occupiers, rental investors and rental tenants.

In the case of owner-occupiers, the change in income is assumed to be the income stream from realising the family home and reinvesting the proceeds in an interest-bearing asset. The stream of payments from the asset is added to taxable income. Where one or both members of the owner-occupier income unit receives a government pension or allowance the realised value of the property, which we assume is the owner's estimate of market value less loans relating to either the acquisition of the property or alterations and additions to the property since purchase, is added to the income unit's asset base. The extended deeming provisions are then applied to the increment to the family asset base to arrive at the income increment that must be added to the individuals' pre-benefit income for the purpose of the income means test.

In the case of rental investors, we assume that the investor realises the rental property and invests the proceeds in an interest-bearing asset. The same procedure is followed in relation to the calculation of income for the purposes of the income means test for pension and allowance recipients.

In what follows, the discussion relates to the personal income tax and government pensions and allowances system, as they existed on the 29[th] of June 2001.

Construction of Implicit Marginal Tax Rate Estimates

Constructing implicit income tax rates involves several steps. These are:

1.) The recalculation of government pensions and allowances to 2001 levels;
2.) Calculation of assessable income, deductions and taxable income;
3.) Calculation of the Medicare levy and gross tax liabilities;
4.) Calculation of rebates and the family tax benefit;
5.) Calculation of net tax liabilities;
6.) Calculation of the change in income following switching to an alternative housing consumption and investment pattern;
7.) Repetition of steps 1.) – 5.) allowing for the new income and asset holdings.

Recalculation of Government Pensions and Allowances

For owner-occupiers and rental tenants, the SIHC reports current weekly income amounts received by individuals from a wide range of pensions and allowances. It also reports annual income amounts received under government transfer payment arrangements for the same pension and allowance schemes. The tenure choice and investment decisions that we are modelling are based on forward-looking behaviour on the part of income units. As a result, we use the annual data in constructing our tax rate estimates. Many allowance payments are likely to be intermittent in nature and may not truly reflect the expected income stream of the individual. For example, Newstart Allowance payments for the unemployed will in many cases not be received over the full year as the recipients will find re-employment at some time during that 12-month period. By applying the income threshold tests using annual figures we are better able to capture the impact of these factors on the individuals income stream. Again,

using the example of an unemployed Newstart recipient if that individual receives income from employment over the year that is in excess of the income cut-off under the allowance eligibility rules we record that individual as not being in receipt of a Newstart allowance for purposes of calculating the implicit marginal tax rate.

It should be stressed that the methodology outlined in the above paragraph reflects our desire to model forward looking housing tenure and investment decisions so as to be able to examine the long-run impact of policy changes on them. If we wish to also model the shorter term welfare impacts associated with those policy changes then we will need to do so using the weekly data reported in the survey.

For rental investors, our information on pension and allowance income is restricted to a variable indicating whether government transfer payments are being received by the investor at the time of the survey. In modelling these payments, the data restricts us to inferring the type of benefit that the individual is receiving based on the socio-demographic information contained in the survey. This allows us to identify age pension, unemployed Newstart recipients and parenting payment recipients from the data.

The structure of the transfer payment system has undergone significant reform since 1997 when the surveys that we use were conducted. As a result part of the process of modelling pension and allowance income for owner-occupiers and rental tenants involves converting benefit types in the survey to their 2001 equivalent payment types. For rental investors the payment types that we are able to identify remain have not changed during the reform process and so we do not need to convert payment types for this group of individuals.

In the case of rental investors we do, however, need to infer their income from sources other than the pension or allowance for the purposes of applying the income threshold tests. This issue does not arise for owner-occupiers and rental tenants for whom payment levels are available in the *SIHC*. The difficulty with the 1997 *RIS* is that income reported in the survey is inclusive of pension and allowance payments so that we need to infer the income of the investor prior to receipt of these pension and allowance payments. The following example illustrates our approach to this problem.

A simple, hypothetical benefits scheme pays *B* dollars per year when income from sources other than benefits and allowances, *Y*, is less than the income threshold, *T*, at which benefit withdrawal commences at the rate of ε cents for each dollar of income above the threshold. The investor's gross income inclusive of any benefit payment (Y_B) will then be:

$$Y_B = Y + (B - \varepsilon(Y - T))^{17} \qquad (5)$$

Rearrangement yields the following expression for pre-benefit income, the actual benefit payment $\hat{B}$ and the amount of the withdrawal of benefit W_B.

$$Y = \frac{Y_B - B - \varepsilon T}{1 - \varepsilon}$$

$$\hat{B} = Y_B - \left(\frac{Y_B - B - \varepsilon T}{1 - \varepsilon} \right)$$

$$W_B = B - \left[Y_B - \left(\frac{Y_B - B - \varepsilon T}{1 - \varepsilon} \right) \right]$$

In practice, pension and allowance means testing is more complex than the simple system outlined above with multiple withdrawal rates and, for some benefit types, the spouse's income entering into the calculation. However, in all cases it is possible to arrive at an expression for the benefit withdrawal in a similar manner.

[17] Gross income inclusive of the benefit will be $Y_B = Y + B$ when Y≤ T.

Once the individual's income from sources other than pensions and allowances has been calculated we are then able to convert these 1997 payments into their 2001 equivalents. This is done by applying the 2001 payment, income test and asset test schedules to this income. This conversion to the 2001 pension and allowance system is necessary due to the reforms to the social security system noted above.

At this stage it is also necessary to infer the asset holdings of owner-occupiers and rental tenants in the *SIHC*. Our approach to this issue is to apply the extended deeming rates used by the Department of Family and Community Services to infer the financial asset base from which investment income reported in the survey is generated[18]. For example, if the deeming rate is 3.5% and income from financial investments is $30,000 per year then the inferred value of the asset base is $857,142. This allows us to use the reported income figures in the *SIHC* in calculating withdrawal of benefits under the appropriate income and asset tests.

In the case of rental investors, we are able to directly calculate the asset value of their rental property holdings using the estimated market values reported in the *RIS*. Unfortunately, the survey does not contain sufficient information to allow us to repeat the inference exercise for financial assets using the extended deeming rates.

Assessable Income, Deductions and Taxable Income

To arrive at taxable income it is necessary to subtract deductions and income from non-taxable sources from assessable income reported in the survey. Non-taxable income includes some pension payments. Also included in non-taxable income are any child support payments received by the individual.

The computation of deductions differs depending on the survey used to obtain the income information. For rental investors, in the absence of any explicit information on the amount of income received from different sources of sources we have used average non-rental deductions by income band for 1997 reported by the Australian Taxation Office (ATO, 1998). The exclusion of rental deductions from this calculation is to allow for the explicit calculation of costs in the computation of net rent on the portfolio.

The information on income from different sources is more detailed for owner-occupiers and rental tenants. This allows us to calculate deductions per dollar of income from income sources such as dividends, interest, work-related expenses, own-business expenses and general deductions. Again, the source of these deductions rates is ATO, 1998. We are also able to calculate dividend imputation credits for those individuals who receive income from shares or via partnership and trust distributions.

Tax Liabilities

Given taxable income we are then able to calculate the individual investors tax liabilities. Tax liabilities (T_y) are:

$$T_Y = t_y^S Y_T + L_M + L_S - R \qquad (6)$$

Where t_y^S is the investor's average tax rate after application of the income tax schedule, Y_T is taxable income, L_M is any Medicare levy for which the investor is liable, L_S is any superannuation surcharge and R encompasses all rebates for which the investor is eligible.

Average Tax Rate (t_y^S)

Australian personal income taxes are based on a graduated scale with a tax-free income threshold. In practice, the size of the tax-free income threshold can depend on the structure of the taxpayer's family. The Family Tax Benefit (FTB) replaced the Family Allowance Payment and was designed to provide tax relief for those taxpayers who are supporting a

[18] Extended deeming involves applying predetermined rates of return to the financial asset holdings of pension and allowance recipients. This 'deemed income' is then used in the income eligibility test to determine withdrawal amounts. Actual income from financial investments is not taken into account.

family. The assistance package increases the tax-free threshold by $1,000 for all taxpayers with dependent children whose family taxable income is not more than $70,000 per annum plus $3000 for each dependent child. However, in practice the FTB can be received in the form of a lower weekly income tax deduction, as a rebate at the end of the tax year, or as a benefit payment from Centrelink. This last delivery mechanism allows low-income earners to receive the full benefit of the scheme when they would not be able to do so via lower tax instalments or a rebate. The introduction of the FTB occurred after the time of the surveys on which we base our calculations. As a consequence we are not able to identify the method by which a particular income unit would claim the payment. To allow for this in our calculations we model the FTB as if it were delivered as a rebate to all recipients at the end of the tax year. Where the rebate would exceed the tax paid by the income unit it is returned to the income unit in the form of a one-off, non-taxable transfer payment. Adopting this approach avoids the issue of the taxable nature of a component of the FTB when it is received as a Centrelink payment and ensures that income units with similar characteristics receive similar FTB amounts.

The Medicare Levy

Personal income is subject to an additional levy on taxable income that is used to fund the public health system. Following recent changes taxpayers receive a rebate on their private health insurance premiums if they have not elected to receive a reduction in those premiums at the time of payment. High-income individuals who do not have private health insurance are penalised by an additional 1% surcharge over and above the standard Medicare Levy (ATO, 2000). We are not able to identify privately insured individuals on the basis of the survey and so must acknowledge that our calculations may under or overstate tax liabilities to some extent given this omission.

The Medicare levy is charged on the income of both partners in the income unit and is based on the family taxable income which for our purposes is the sum of the reference person's and partner's taxable income. For single persons who earn less than $13,550 per annum no levy is applicable. For singles earning between $13,550 per annum and $14,649 the levy is calculated at 20 cents in every dollar above $13,550. When income exceeds $14,649 the levy is calculated at 1.5% of taxable income. For married couples who have no dependent children the exemption applies if family income is less than $22,865 per annum. The 20 cents in the dollar levy applies between this lower threshold and $24,718 after which the levy is calculated at 1.25% of taxable income. Each dependent child or student increases the lower limit of the phase-in region by $2100 and the upper limit by $2,270[19].

The Superannuation Surcharge

Subject to certain eligibility criteria workers receive compulsory superannuation contributions from their employer and are able to make discretionary contributions to 'top-up' their superannuation. Employer contributions are subject to lower tax rates than remuneration paid in the form of wages and salaries. In order to discourage the diversion of income into superannuation funds as a means of tax minimisation the Federal Government levies a surcharge on adjusted annual income, the sum of taxable income and employer contributions, in excess of $78,208. When superannuation contributions are between $78,208 and $94,966 the rate of the surcharge as a percentage of employer contributions is calculated on the difference between adjusted annual income and the lower threshold. When adjusted annual income exceeds the upper threshold the surcharge is set at 15% of total employer contributions (Butterworth's, 2000).

The survey does not elicit the superannuation contributions of investors. However, we assume that the employer contribution is equal to the legally mandated employer contribution of 7% of the employee's gross. This minimum contribution is then used added to taxable income to calculate the superannuation surcharge, if any, that the investor is liable for.

[19] Sole parents are also assessed for the levy under the married couple arrangements.

Rebates

Australian taxpayers who meet certain eligibility criteria are entitled to rebates that reduce tax liabilities. We are able to identify eligibility for the following rebates that can be claimed by Australian taxpayers:

Annuity Rebate[20]

Low Income Tax Payer Rebate;

Low Income Aged Person Rebate;

Dependent Spouse Rebate;

Sole Parent Rebate; and

Commonwealth Government Aged Person Rebate.

The Annuity Rebate is available on the rebatable portion of any income received from eligible superannuation of pension funds. The rebatable portion depends in turn on the reasonable benefit limit. Reasonable benefit limits are calculated using life expectancy tables to determine the total value of future payments. If the value of payments is less than the reasonable benefit limit then the rebatable portion of the payments is 100%. When the value of payments exceeds the reasonable benefit limit then the rebatable portion is calculated by dividing the reasonable benefit limit by the total value of payments. The rebate rate is 15%.

Following recent tax reform there were significant changes made to the structure of the rebate system. The dependent spouse and sole parent rebate are no longer claimed but are still calculated and used in some calculations that determine tax liabilities.

User Cost Components

In order to calculate user cost accurately we need to be able to measure certain costs that do not form a part of net rent as they are incurred only on the purchase or sale of a property, for example, brokerage fees and stamp duties, or which are not included in the definition of net rent, for example, depreciation.

Brokerage Fees

Brokerage fees are charged by real estate agents as a proportion of the sale price of a property and are paid by the vendor. Wood and Watson (2001) estimated brokerage fees on sale for use with the 1993 Rental Investors Survey. These fees were based on the regulated fee schedules in place in the individual States at that time and have been subject to deregulation. We have not been able to arrive at a way of estimating brokerage fees as of 1997 and set the brokerage rate, the ratio of brokerage fees to property value equal to their mean values by state calculated from the 1993 survey.

Stamp Duties

Stamp duties are levied by state governments on contracts including those involving the sale of a property and are paid by the purchaser. The applicable rates used in this study where taken from the Commonwealth Grants Commission report used to source land tax schedules (CGC, 1998).

Depreciation Rates

Following a survey of past research, Wood and Watson (2001) adopted a depreciation rate of 1.4% of the value of the building structure per annum. We have again adopted this rate. This rate is consistent with that chosen by De-Leeuw and Ozanne (1981), Brueggeman et. al. (1982) and Gordon et. al. (1987) in similar measurement exercises.

[20] We are only able to identify recipients of the annuity rebate for owner-occupiers and rental tenants from the Housing and Income Distribution Survey. The Rental Investors Survey does not contain information on this income source.

Inflation

User cost estimates incorporate the expected rate of inflation in order to calculate the capital gain on the rental property. We assume that the rate of house price inflation, in the long run, is equal to the rate of growth of the Consumer Price Index in our baseline scenario and then allow the real rate of house price appreciation to vary under alternative scenarios. Rather than attempting to estimate the expected rate of inflation used by investors in their decision-making we choose a baseline inflation scenario and compute estimates for this scenario as well as a high inflation and a low inflation scenario.

The Calculation of the Net Rent from a Property

Crucial to the estimation of implicit marginal tax rates on rental properties is the measurement of net rent. For rental investors, the change in net rent is the income change used to calculate the implicit marginal tax rate.[21] The 1997 RIS reports the actual profit or loss on a property over the previous twelve months. However, investor decision-making is based on an *expected* net rent that allows for the lumpiness of maintenance expenditures and the irregular nature of vacancies. We adopt the following measure of net rent for the ith property (NR_i):

$$NR_i = TR_i(1 - v_i^e) - \left[\Phi_i(1 - v_i^e) + \Lambda_i^e + T_i^L + T_i^P + \Psi_i + \Omega_i + I_i^m\right] \qquad (7)$$

Where:

$TR_i(1 - v_i^e)$ is annual gross rent weighted by one minus the expected vacancy rate;

$\Phi_i(1 - v_i^e)$ are agency costs for 12 months, including letting and property management fees, which are a function of collected rents, weighted by one minus the expected vacancy rate;

Λ_i^e are expected annual maintenance costs;

T_i^L is annual land tax;

T_i^P is annual property taxes including utilities such as water and sewerage;

Ψ_i is insurance premiums;

Ω_i is body corporate fees; and

I_i^m is mortgage interest payments.

Table 3 provides summary statistics for each of these cost components and for net rent on a property basis for the selected sample of 347 new dwellings.

The first term in the above expression, annual gross rent, utilises a vacancy weighting system. The 1997 *RIS* reports the number of weeks that the property has been vacant in the 12 months prior to the survey. However, this will diverge from the expected vacancy rate relevant to the investor's decision making which will take into account both planned vacancies required for regular significant maintenance which cannot be undertaken while the property is inhabited and unplanned vacancies associated with letting the property. To allow for this we estimated a tobit regression using the number of weeks of reported vacancies as the dependent variable.[22]

Estimates of agency fees are based on estimates from the Australian Competition and Consumer Commission (ACCC). During the implementation of the Goods and Services Tax (GST) in the second half of 2000 in Australia, the ACCC was responsible for ensuring that price increases during the adjustment phase did not exceed those suggested by the change in commodity taxation arrangements. In the course of this process, the ACCC published a set of guidelines relating to the effect of the GST on residential rental property and included estimates of the contribution of cost components. We use these estimates to measure a number of variables used in our calculation of net rent. The ACCC (2000) estimates that letting and property management fees represent 9.1 per cent of gross rents. The mean rate

[21] ΔY in equations 3 and 4.

[22] The results of this estimation exercise are summarised in appendix C.

for agent management and letting fees calculated from the 1993 *RIS* Survey by Wood and Watson (2001) was 17.9 per cent The lower rate of agent's fees estimated by the ACCC presumably reflects both the impact of deregulation of real estate agents fees during the 1990s and the use of maximum, regulated charges in Wood and Watson (2001).

We assume that all landlords engage a real estate agent to screen tenants, arrange lease contracts and manage the property during the lease term. The 1997 *RIS* reports that a real estate agent manages 58.1 per cent of properties. For those properties that are not managed by an agent we assume that the agent's fees capture the opportunity costs of self-management.

The 1997 RIS reports maintenance and repair expenses for properties over the twelve months preceding the survey. However, maintenance expenditures are likely to be lumpy in nature and an examination of the data confirms this. A number of properties report no maintenance expenditures during the time period covered by the survey. This raises the problem of inferring the ongoing, expected maintenance expenditures for a property that enter into the investor's decision-making problem. To allow for this we estimate a tobit regression model using reported maintenance expenditures in the 1997 RIS as our dependent variable and use the estimated results for predictive purposes.[23]

Australian state governments levy land taxes on the aggregate, unimproved site value of land used for commercial purposes. This land includes residential rental housing. In general, they are calculated on the basis of a graduated schedule of rates although specific exemptions apply in certain states. The Commonwealth Grants Commission (2000) publishes schedules of land tax rates.[24]

The aggregate, unimproved site value of residential rental housing properties held by income units in our survey is calculated using information contained in the 1997 RIS and building to value ratios calculated by Wood and Watson (2001).[25,26] The 1997 RIS reports property data for up to 6 properties held by the income unit and also reports the total number of residential properties held by the income unit. To calculate the aggregate property value where more than 3 properties are owned by a single parent or one person income unit, and where more than six properties are owned by a couple income unit, we assume that additional, unreported properties are each valued at the mean property value of reported properties in the income unit's portfolio.

Property taxes include other government charges and rates levied by Local Governments in Australia. They include utility connection fees, waste disposal charges and other imposts. These costs are reported in the *1996-97 SIHC CURF*. An econometric equation for property taxes as a proportion of property value was estimated on the basis of this data and used for predictive purposes.

Body corporate fees are levied on flats and apartments by the body corporate.[27] These fees are used to cover common maintenance and utility charges for blocks of flats and units. To avoid double counting where the investor owns a block of flats or apartments we calculate body corporate fees only when the investing income unit owns a single apartment or flat. Body corporate fees are set at 7.2 per cent of gross rent, which is the rate regarded as typical by the ACCC (2000).

The 1997 RIS reports the outstanding mortgage on the property if that property is in fact mortgaged. To calculate actual interest charges we multiply the outstanding mortgage amount by the variable home loan rate charged by the major banks in 1996-97 of 7.2 per cent (ABS, 1998). To take into account any fall in the interest rate as a result of fundamental tax reform a 'favourable' scenario in which the interest rate falls to 6.5 per cent is also computed.

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[23] Results are available from the authors.

[24] Land tax rates are reviewed sporadically by State governments and the rates used by the CGC in 2000 are the same as those rates in place in 1997.

[25] These building to value ratios were calculated using information provided by the Valuer-General to assist the CGC in valuing the capacity of the States to generate land tax revenue (CGC, 1995).

[26] Site value is defined as the capital sum the land might be expected to realise if sold. The valuation assumes that all improvements, other than those not separable from the land such as earthworks and underground drainage, have not been undertaken (CGC, 1993).

[27] The body corporate is the body that makes management decisions in relation to the block of flats or apartments on behalf of the owners. In general, it is a committee formed by the tenants.

Table 2: Income Units – Descriptive Statistics

	Building Write-off Eligible Properties (387 Properties)	Full Sample (1934 Properties)
Annual Gross Income (mean)	$67,523	$59,950
Annual Gross Rent (mean)[1]	$14,970	$10,908
Income Unit Type		
Couple With Dependents	43.8%	41.1%
Couple without Dependents	36.5%	32.0%
One Parent	1.0%	3.0%
One Person	18.7%	24.0%
State of Usual Residence		
NSW	20.5%	16.7%
VIC	11.9%	17.8%
QLD	27.2%	24.3%
SA	7.8%	10.6%
WA	10.6%	14.7%
TAS	2.1%	4.9%
NT & ACT	19.9%	11%
Tenure type of Residence		
Owner with mortgage	39.6%	31.4%
Owner without mortgage	37.0%	41.8%
Renter	33.4%	26.8%
Number of Children (0-14 years)		
0	64.3%	64.3%
1	14.1%	14.1%
2	15.3%	15.3%
3	5.1%	5.1%
>3	1.2%	1.2%
Number of Investment Properties Owned		
1	64.5%	80.7%
2	27.7%	15.7%
3	7.3%	3.4%
>3	0.5%	0.1%
Number of Employed Adults in the Income Unit		
0	8.5%	10.7%
1	30.8%	37.6%
2	60.6%	51.7%

1. Aggregate gross rent from all rental properties owned by the income unit.

Table 3: Characteristics of Rental Investment Properties

	Building Write-off Eligible Properties (387 Properties)		Full Sample (1934 Properties)	
	Number	Percent of Total	Number	Percent of Total
Dwelling Type				
Separate House	198	51.0	1,222	63.2
Semi-Detached/Terrace House	93	24.1	232	12.0
Single Flat/Apartment	84	21.8	417	21.6
Block of Flats/Apartments/Terrace Houses	10	2.6	58	3.0
Other	2	0.5	5	0.30
Number of Bedrooms				
1	19	4.9	126	6.5
2	125	32.4	667	34.5
3	180	46.4	907	46.9
4	57	14.8	199	10.3
5+	5	1.1	28	1.4
None/Bedsitter	1	0.5	7	0.4
State (Capital City)				
New South Wales (Sydney)	71 (48)	18.1% (67.1%)	338 (213)	17.5% (63.0%)
Victoria (Melbourne)	49 (41)	12.7% (83.7%)	360 (282)	18.6% (78.3%)
Queensland (Brisbane)	133 (63)	34.5% (47.4%)	497 (235)	25.7% (47.3%)
South Australia (Adelaide)	34 (25)	8.8% (73.5%)	219 (174)	11.3% (79.5%)
Western Australia (Perth)	39 (30)	10.1% (71.8%)	275 (216)	14.2% (78.5%)
Tasmania (Hobart)	8 (7)	2.1% (87.5)	93 (41)	4.8% (44.1%)
Northern Territory (Darwin)	9 (7)	2.3% (77.8%)	37 (24)	1.9% (64.9%)
Australian Capital Territory (Canberra)	44 (44)	11.4% (100%)	115 (115)	5.9% (100%)
Age of Property				
Less than 1 year old	42	10.9	44	22.7
1 – 4 years	184	47.4	231	11.9
5 – 9 years	80	20.7	201	10.5
10 – 19 years	50	12.9	244	12.6
20 – 50 years	26	6.7	710	36.7
50 years and more	5	1.3	291	15.0
Unknown	0	0	60	3.1
Management of Property				
Self/Spouse/Partner	114	29.5	695	35.9
Real Estate Agent	241	62.2	1124	58.1
Relative	5	1.3	46	2.4
Other	27	7.0	69	3.6

Table 4: Financial Characteristics of Rental Investment Properties

	Mean	Maximum	Minimum
Annual Gross Rent	$9,922.64 ($8,732.36)	$65,312 ($65,312)	$1,560 ($0)
Estimated Market Value	$161,400 ($138,900)	$762,000 ($762,000)	$45,000 ($15,000)
Vacancies			
Reported (Weeks)	2.3 (2.87)	39 (52)	0 (0)
Predicted (Weeks)	2.51 (2.62)	10.4 (14.1)	0.31 (0.31)
Net Rent Cost Components			
Agents Fees[1]	$902.99 ($794.66)	$5,943.39 ($5943.39)	$141.96 ($141.96)
Expected Maintenance[2]	1.91% (2.50%)	4.16% (8.97%)	0.12% (0.12%)
Land Tax	0.24% (0.21%)	2.16% (2.16%)	0% 0%
Property Tax	0.73% (0.76%)	1.12% (1.12%)	0.18% (0.18%)
Body Corporate Fees	$176.56 ($130.59)	$4,702.46 ($4,702.46)	$0 ($0)
Mortgage Interest Payments	$2,594.80 ($2,378.27)	$37,435 ($37,435)	$0 ($0)
Other Property Cost Components			
Brokerage Fees	2.75% (2.41%)	3.63% (3.63%)	2.33% (2.33%)
Stamp Duties	2.6% (2.41%)	5.33% (5.33%)	1% (1%)
Building to Value Ratio	41.1% (42.7%)	78% (78%)	20% (20%)

1. Values in parentheses are for the full sample (1934 properties).

2. Unless other wise stated statistics are as a percentage of estimated market value.

Table 5: Income Units: Income Sources & Implicit Marginal Tax Rates

	Building Write-off Eligible Properties (386 Properties)		Full Sample (1934 Properties)	
	Reference Person	Partner	Reference Person	Partner
Mean Gross Annual Income	$47,162	$20,361	$44,028	$18,208
Principal Source of Income				
Not Applicable	2.8%		3.1%	
Wages/Salary	69.9%	67.7%	65.7%	62.4%
Profit/Loss from Business	13.5%	10.8%	16.5%	14.0%
Profit/Loss from Rental Properties	4.7%	11.5%	4.3%	10.2%
Dividends/Interest	2.1%	3.1%	1.9%	2.1%
Government Pension/Allowance	2.8%	0.5%	4.8%	8.4%
Superannuation/Annuity	2.8%	0.4%	2.5%	1.0%
Other	1.3%	1.5%	1.1%	1.9%

Income Unit Mean Implicit Marginal Tax Rate on Rental Income by Income Unit Gross Annual Income Decile

	All Income Units	Sole Person	All Income Units	Sole Person
Income Bands	MTR		Maximum	
0 –23,036	0.19	0.21	0.62	0.62
23,037 – 34,528	0.23	0.31	0.63	0.32
34,529 – 44,720	0.26	0.30	0.60	0.32
44,721 – 52,000	0.25	0.30	0.38	0.38
52,001 – 59,852	0.29	0.43	0.44	0.44
59,853 – 70,200	0.31	0.48	0.49	0.49
70,201 – 80,600	0.31	0.54	0.58	0.54
80,601 – 92,196	0.38	0.53	0.64	0.55
92,197 – 113,776	0.37	0.50	0.52	0.52
113,777 – 298,324	0.42	0.50	0.65	0.50
All	0.30	0.33		

PRELIMINARY RESEARCH FINDINGS

In this section, we present preliminary research findings which illustrate the reach and effectiveness of the microsimulation modelling technique adopted in this project. Preliminary research findings are presented in respect of the following important policy issues:

1. What impact do federal tax policies have on the incentive to invest in low-income private residential accommodation?
2. What is the cost to the budget of federal tax policies that affect supply-side incentives in the private residential property market?
3. What is the contribution of state and local government tax arrangements to the total tax 'burden' faced by private rental investors?

Our discussion is undertaken in the context of a comparison of the effect of existing federal building write-off provisions (and variants of those policies) with targeted low-income tax credits as implemented in the United States in 1986.

The structure of this section is as follows. First, we outline the structure of federal building write-off provisions and targeted low-income tax credits. The model used to derive the K-F effective marginal tax rate follows. We then discuss our results, extend the essentially static model to take into account portfolio adjustment behaviour among rental investors, and present the policy implications and budgetary impact of the policy options considered. The extension of the static model is necessary because the introduction of targeted tax credits is likely to cause portfolio displacement effects. These effects occur when some landlords realise ineligible real estate investments in favour of real estate investments that are eligible for the targeted low-rent tax credit.

Building Write-off Provisions and Targeted Tax Credits

Over recent years, concerns have been raised over the availability of low-cost rental housing in the Australian private residential rental market. These concerns are well founded. Using census data for the period 1986 to 1996, Yates and Wulff (2000) show that while there has been a significant increase in the number of low-income renters in the private residential housing market, the availability of low-cost rental accommodation has declined significantly. They argue that the policy debate in Australia, as in many countries, has been too narrowly focussed on demand-side policies (e.g. income-tested private rental subsidies) or on options to limit the decline in the public housing rental stock. The missing link in the debate is on policy options designed to an increase the supply of low-cost private rental accommodation.

Our aim here is to examine the effect of federal and state tax provisions on the *incentive to invest* in private residential accommodation. We model the effect of the tax-transfer system on the decision to invest in the private residential rental market in terms of the King and Fullerton (K-F) (1984) effective marginal tax rate measure of private investment in residential housing. The K-F effective marginal tax rate is the difference between the pre- and post-tax rate of return on private investment in residential housing (the 'tax wedge') expressed as a proportion of the landlord's reservation rental rate.[28] The greater the wedge between the landlord's reservation rental rate on investment in private residential accommodation and the post-tax rate of return and the higher the K-F effective marginal tax rate, the greater is the disincentive to invest in the private rental market. The lower the wedge, the smaller is the K-F effective marginal tax rate and the greater is the incentive to invest in private residential accommodation.

To provide a focus to our discussion we examine, in detail, one important federal tax provision, which affects the size of the tax wedge and has a clear supply-side orientation; namely, Australian federal capital works tax deductions (commonly referred to as 'building-write-off allowances'). Under current Australian taxation arrangements (2001), building-write-off deductions apply to eligible construction expenditure in the residential rental property market. Deductions are applied on an annual basis and limited to 100 per cent of the construction expenditure. Deductions are allowable for both the construction of the dwelling

[28] The modelling of the K-F marginal effective tax rate is undertaken in light of the new Australian tax system prevailing in 2001.

and for extensions to existing dwellings but apply only for the period the property is rented or is available for rent.

The current annual building write-off rate is 2.5 per cent of the capital expenditure. This annual deduction can be claimed over a forty-year holding period from the date construction was completed.[29] The 2.5 per cent rate applies to construction after 15 September 1987. For properties completed prior to that date, a 4.0 per cent deduction applies. The claimant period for such properties is 25 years. Construction beginning prior to 18 July 1985 attracts no capital deduction.

Building write-off allowances reduce the effective tax burden because write-offs yield tax savings by sheltering rents or other sources of income. The higher the building write-off rate (for a given write-down period), the lower the effective tax burden. However, an important offset to this tax benefit exists. The building write-off deduction is partly recaptured in the tax system under capital gains tax provisions. Under these provisions, 50 per cent of net capital gains are chargeable to tax at the investor's marginal rate. However, building write-off allowances that the investor deducted from assessable income during the holding period are subtracted from acquisition costs. The effect of this provision is to increase, by the value of the building write-off deductions, the tax payable on net capital gains. Thus 50 per cent of building write-off allowances is recaptured on realisation.

Applying our microsimulation model to the 1997 RIS, we consider the impact of building write-off allowances on K-F effective marginal tax rates and the availability of low-cost rental accommodation under three scenarios. First, we measure the K-F effective marginal effective tax rate under current tax arrangements whereby the write-off rate is set at 2.5 per cent and capital gains recapture is provided for. Second, we compare the K-F effective marginal tax rate determined under this structure with the K-F effective marginal tax rate that applies if the rate were increased to 4.0 per cent (the allowable period is reduced to 25 years), and if the recapture provision was removed. Third, we remove altogether the building write-off provision. These three options are examined under a variety of holding period and real capital appreciation scenarios.

The Australian building write-off allowance structure is not targeted to the supply of *low-cost* private residential accommodation. An alternative to a building write-off is a targeted low-income housing tax credit (or rebate). We, therefore, extend our microsimulations to consider the case of a tax credit that is offered at a particular rate of the building value, without time limit, but conditional on weekly gross rents being less than some threshold level. The tax credit is not recaptured on realisation.

The Low-Income Housing Tax Credit (LIHTC) was adopted by the U.S. federal government in 1986 as part of a larger taxation reform process. Its principal intent was to provide incentives for private investors to undertake the development of affordable rental housing. The credit is received over a ten-year period and yields a present value of 70 per cent of the qualifying basis of the building for new construction or substantial renovation of an existing building.[30] To qualify, the property must satisfy certain conditions relating to rent restriction and the leasing families annual income relative to the mean in the area.

Cummings and DiPasquale (1999) note that the LIHTC appears to have led to the production of substantial amounts low-income housing of different types, and has served a broad range of populations. At the same time, the projects tend to have been concentrated in low-income neighbourhoods, can be more costly, particularly where non-profit organisations are involved, and generally do not service the needs of the poorest renters.[31] McClure (2000) also notes that the efficiency of the LIHTC suffers as a result of the inability of the fixed credit rate to generate financial feasibility for inner-city projects with very low rents relative to the market rate and high development and construction costs. Costs rise as developers seek further subsidised financing.

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[29] The maximum period that building write-offs can apply is simply given by the inverse of the rate itself.

[30] The credit reduces to 30 per cent of the qualified basis in present value terms when an existing building is acquired or federally subsidised financing is used for the construction of a new property. The eligible basis is depends on the location of the property and includes the value of some amenities over and above the construction costs. The credit rate itself ranges from around 9 per cent to 4 per cent per annum.

[31] The efficiency of projects receiving the LIHTC has increased over time as investors compete for LIHTC eligible projects.

The King-Fullerton Model

Building write off allowances narrow the wedge between the landlord's reservation rental rate (r_L) on a project, and the post-tax rate of return (s) that can be paid on the savings of households used to finance a project. In the King and Fullerton (1984) approach to measurement of the investment incentives offered by the tax system, this tax wedge is expressed as a proportion of the landlord's reservation rental rate to arrive at the King-Fullerton (K-F) effective marginal tax rate (t). Thus $t = \frac{r_L - s}{r_L}$.

We employ the 'fixed-r' case in which a cost of capital function is solved for the equilibrium value of the reservation rental rate that ensures all projects earn the same pre-tax real rate of return, r, for all investors. Consider an investor who has acquired housing capital.[32] It is assumed that the investor's holding period is exogenous; house prices and rents appreciate at the constant uniform rate π_h – d, with d equal to the rate of economic depreciation; the constant rate of general inflation (π) may differ.

Under present tax arrangements, the K-F effective marginal tax rate (t_1) on incremental investments in rental housing assets is:

$$t_1 = \frac{r_1 - s}{r_1} \qquad (8)$$

where

$$s = (1-\tau)i - \pi.$$

The K-F tax rate can be interpreted as the proportion of investment income from the marginal rental housing project that is taxed. It is important to recognise the critical role of capital gains in the determination of t_1. The exposition is simplified if we assume that capital gains are tax exempt, and set $\chi = \omega = 0$. The landlord's reservation rental rate now becomes

$$r_L^* = i + \alpha - \frac{\pi_h}{1-\tau}. \qquad (9)$$

If the rate of capital gain falls by one percentage point, the equilibrium reservation rental rate increases by 1/(1-τ) percentage points, since it must cover the loss of capital gains and the taxes on the compensating increase in rents.[33] This property of the equilibrium reservation rental rate reflects the preferential tax treatment of capital gains. It follows that the tax wedge and K-F effective marginal tax rate are a decreasing function of the rate of capital gains on housing capital. The more important is the contribution of tax privileged capital gains in meeting the investor's required post-tax real rate of return, the lower is the effective tax burden on total factor income. This conclusion holds under current tax arrangements because capital gains receive favourable tax treatment. Only one-half capital gains are taxable, while ordinary sources of income such as rents are fully taxed at the margin. In addition, capital gains are taxed on realisation. Ordinary sources of income are taxed as they accrue.

The role of building write-off allowances is important for two reasons. Firstly, it helps to reduce the effective tax burden because write-offs yield tax savings by sheltering rents or other sources of income. Secondly, this impact is partly offset because recapture provisions reduce the favourable tax treatment of capital gains (see CAPTAX in equation (1)).

Finally, note that the K-F effective marginal tax rate is a function of Federal, State and Local Government tax arrangements. Typically, the emphasis in past studies has been on Federal Government tax arrangements (Pender and Ross, 1993; Bourassa and Hendershott, 1992). But equation (1) demonstrates that α and χ are potentially important influences.

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[32] Defined to include both land and the building structure. The ratio of land to building structures is assumed to be fixed. The capital variable could comprise land and building structures from one or more properties. As building and land are not separable, π_h is assumed to apply to both land and building structures.

[33] If the investors is negatively geared, the compensating reduction in the net rental income deficit must also be sufficient to offset the loss of tax shelter benefits.

A focus of our microsimulations is measurement of King-Fullerton effective marginal tax rates if the original building write-off allowance arrangements were reinstated. Write-off allowances were originally introduced at a higher rate $\omega' > \omega$, and they were not recaptured on realisation. Making the appropriate changes to the expression for the landlord's reservation rental rate (equation (1)), we then have;

$$r_L^2 = i + \alpha - \frac{\pi_h - d}{1-\tau} + AMORT \times [CAPTAX_2 + \chi - WRITEOFF_2] \quad (10)$$

Where

$$CAPTAX_2 = \tfrac{1}{2}\tau[(1-\beta)e^{\delta N} - (1+\chi)e^{-kN}]$$

$$WRITEOFF_2 = \frac{\tau\omega'\lambda_s(1-e^{-(k/\omega)})}{k}$$

The K-F effective marginal tax rate under the original write-off arrangements is then:

$$t_2 = \frac{r_L^2 - s}{r_L^2} \quad (11)$$

We compare the K-F marginal effective tax rates t_1 and t_2 with rates that would prevail if a low-income housing tax credit replaced the building write-off allowance. Our microsimulations are based on a tax credit that is offered at a rate $0 \le \varepsilon \le 1$ of the building value, without time limit, but conditional on weekly gross rents being less than some threshold level. The tax credit is not recaptured on realisation. For eligible properties;

Equation (1) is now;

$$r_L^3 = i + \alpha - \frac{\pi_h - d}{1-\tau} + AMORT \times [CAPTAX_2 + \chi - TAXCREDIT] \quad (12)$$

Where

$$TAXCREDIT = \frac{\varepsilon\lambda_s(1-e^{-kN})}{k}$$

The K-F marginal effective tax rate for eligible properties is;

$$t_3 = \frac{r_L^3 - s}{r_L^3} \quad (13)$$

Finally, properties ineligible for low-income housing tax credits have an equilibrium net rental rate given by;

$$r_L^4 = i + \alpha - \frac{\pi_h - d}{1-\tau} + AMORT \times [CAPTAX_2 + \chi], \quad (14)$$

and a K-F effective marginal tax rate;

$$t_4 = \frac{r_L^4 - s}{r_L^4} \quad (15)$$

The methodology adopted in this paper is based on the K-F procedure. This latter method is sometimes claimed to be inferior to the MacNevin (1997) approach. This claim is made because MacNevin relaxes the assumption of an infinite holding period, and pays more attention to the detailed technical rules governing application of the tax regime to an asset such as real estate.

The approach presented in this paper and its differences with the MacNevin approach can be summarised as follows. As in K-F, our analysis is based on finding the minimum reservation rental rate (r_L) that a real estate investment must yield before taxes, if it is to provide the unincorporated investor with the same after-tax real return she would receive from lending at the market interest rate. We derive r_L from a present value function that discounts the future stream of cash flows at $(1-\tau)i$ where τ is the investor's statutory marginal income tax rate, and i is the market interest rate. To derive r_L we set the present value function equal to zero; at the solution value the investor will then be indifferent between lending at i and receiving the after-tax proceeds yielded by the real estate investment. The after-tax real return to the saver when she lends at i is;

$$s = (1-\tau)i - \pi \qquad (16)$$

Taxes drive a wedge between r_L and s, and this wedge is central to the measurement of the K-F marginal effective tax rate.

In measuring the tax wedge and the K-F marginal effective tax rate, Wood, Watson, and Flatau (2002) use reported values for current period rent and property value to estimate measures of operating costs and transaction costs. These estimates are combined with pre-determined values for the key parameters (inflation rates, depreciation, interest rates, real rates of property appreciation, holding periods and marginal statutory tax rates) to estimate r_L using the analytical solution derived from the present value function, as described above.

The MacNevin approach is based on a system of two equations, one determining the present value of the rental income stream, the other determining the present value of the cash flows yielded by a real estate investment. This approach has similarities to ours. In particular, MacNevin and Watson, Flatau and Wood relax the infinite holding period assumption, and also specify the present value function to accommodate the precise technical rules governing the application of the tax regime to real estate investments. However, our approach is more consistent with K-F, because r_L is an analytical solution derived from the present value function. By setting the latter equal to 0 and assuming that the discount rate is $(1-\tau)i$, we ensure that the investor is indifferent between lending at i and receiving the net rental yield from a real estate investment. This is achieved without any arbitrary assumption about the current market value of the property, a step that is necessary in the MacNevin iterative approach, which eschews an analytical solution. Furthermore, the MacNevin approach is based on a project model methodology, in which plausible values are adopted for a representative real estate investment. The use of a micro database (the 1997 RIS) allows Wood, Watson and Flatau (2002) to measure the K-F marginal effective tax rate on a sample of real estate investments. This permits investigation of variation in the K-F marginal effective tax rate across different property investments.

King-Fullerton Effective Tax Rate Results for Australia

Our key objective in this section is to provide an indication of the incentive to invest in the private residential rental properties across different policy regimes; particularly in terms of low cost residential accommodation. The impact of tax policy on the incentive to invest is captured by the K-F marginal effective tax rate.

Table 6 presents estimates of the K-F effective marginal tax rate for different rates of real capital gain and loss over expected holding periods of up to 40 years. These estimates are based on a baseline model in which no building write-off allowance or tax credit is available. For a relatively short holding period (around 5 years) and a real rate of capital gain growth of zero per cent, the K-F effective marginal tax rate is around 0.65. The K-F effective marginal tax rate falls for an increase in the holding period and an increase in the rate of capital gain. The results suggest, however, that the K-F effective marginal tax rate is relatively insensitive to the length of the holding period but changes substantially when the rate of capital appreciation varies. This is to be expected given the bias in the taxation system toward capital gains over income. As would be expected, higher real capital gains increase the impact of an increase in the expected holding period on the K-F effective marginal tax rate. For example, an increase in the holding period from 5 years to 40 years decreases the K-F effective marginal tax rate from 0.48 to 0.38 when the real rate of capital gains are 2 per cent

while a similar increase in the holding period for the zero capital gains assumption results in fall from 0.58 to 0.54.

We now turn to an examination of the impact on K-F effective marginal tax rates of different policy regimes. The four policy regimes considered are the no building write-off allowance case, a 2.5 per cent building write-off with recapture, a 4 per cent building write-off with no recapture, and the implementation of a tax credit at 4 per cent available only to low-cost rental properties. As our interest revolves around the availability of low cost rental accommodation, we present K-F effective marginal tax rates by weekly rent level. Our prime interest is in K-F effective marginal tax rates at relatively low weekly rent levels.

Tables 7 and 8 present estimates for the effective marginal tax rate by quartile of gross weekly rent on the property for the baseline scenario of no real capital gain or loss, and an alternative scenario where the rate of real capital gain equals 1 per cent.[34] An expected holding period of 10 years is assumed in both cases. Both the 2.5 per cent building write-off allowance that is subject to recapture and the 4 per cent building write-off allowance result in a small decrease in the K-F effective marginal tax rate as compared to the baseline of no building write-off. Hence, across all properties, the K-F marginal effective tax rates fall from 0.64 to 0.63 in the 2.5 per cent building write-off, no real capital gain case and from 0.64 to 0.61 under the 4 per cent no recapture scenario.

When the building write-off is relaced by a *targeted* 4 per cent tax credit on low rent housing, the K-F effective marginal tax rate falls dramatically further at the low cost rental part of the market. In the case of a zero real capital gain scenario (see table 7), the K-F effective marginal tax rate falls from 0.57/0.60 under the two building write-off provision policy regimes to 0.41 under a targeted tax credit scheme for properties with weekly rents less than $140 per week. At higher weekly rents, the tax credit is assumed not to apply and, therefore, K-F effective marginal tax rates return to the baseline level. In the case of the one per cent real capital gain scenario (see table 8), the K-F effective marginal tax rate falls from 0.51/0.47 under the two building write-off provision policy regimes to 0.20 under a targeted tax credit scheme for properties with weekly rents less than $140 per week.

The reason for the beneficial effect of a tax credit is because the actual dollar savings in the case of the building write-off depend on the income unit's effective marginal tax rate on income. The tax credit, which is the same as a tax rebate in nature, only does so in a minor way via the AMORT expression. The result is a far more substantial reduction in the K-F effective marginal tax rate for income units who currently hold eligible properties. This effect is increased by the concentration of income units with low individual marginal effective tax rates on income in the lowest quartile of properties.[35] The tax credit has more value for these income units than the building write-off.

The K-F effective marginal tax rates estimated here can be compared against the rates estimated on other assets to gain a measure of the disincentive or incentive that taxation arrangements create in relation to investment in rental housing. King and Fullerton (1984, p.272) provide estimates for industries and asset types in the United Kingdom, Sweden, West Germany and the United States. Average effective marginal tax rates in 1980 ranged from 30 per cent in the United Kingdom to 64.8 per cent in West Germany.[36] While past research on the subject of marginal effective tax rates in Australia that employ the King and Fullerton methodology pre-date much of the recent tax reform they form a useful benchmark against which to assess the results of our own simulation. Freebairn (1990) conducted estimates over a broad range of assets and ownership structures for the Economic Planning and Advisory Council of Australia. Freebairn's analysis of real estate investment is conducted assuming that the deferral of capital gains tax payments until realisation leads to a tax rate on capital gains which is half that of the tax rate on rental income. He then presents estimates of the

[34] Under the alternative policy regimes both the 4 per cent tax credit and the 2.5 per cent building write-off increase the size of the decline in the estimated marginal effective tax rate due to an increase in the expected holding period. In the case of the 4 per cent building write-off allowance this is true up to an expected holding period of 25 years. After this point the stream of write-off deductions ceases and the estimated marginal effective tax rate begins to rise again.

[35] The mean individual marginal effective tax rate in the lowest quartile is 0.27 while the rate in the highest quartile is 0.32. The lowest quartile mean is biased upwards by the presence of recipients of government benefits and allowances who face high rates due to the withdrawal of payment under income and asset tests.

[36] Average rates for the other countries were – U.S.A. 49.9 per cent and Sweden 53.6 per cent.

effective real tax rate for two projects, one in which all returns are in the form of capital gains, and a project in which half the returns take the form of capital gains while the remainder in the form of rental income. Estimates are presented for both equity and debt financed projects over various assumptions about the rate of inflation and the personal tax rate. The real rate of return is set at 5 per cent per annum. A personal tax rate of 48.25 per cent and an inflation rate of 7 per cent result in an effective tax rate of 57.8 per cent for a debt financed project.[37]

The Bureau of Industry Economics (1990) estimated effective marginal tax rates for alternative financing methods (debt, equity and retained earnings) to examine the impact of changes to manner in which company and personal taxes interact assuming a 10 per cent pre-tax real rate of return. Estimated effective marginal tax rates ranged between 50 per cent and 70 per cent depending on the financing method when dividends where fully franked.

Our estimates for Australia are roughly comparable (although somewhat on the higher end) to the above estimates in terms of magnitude. The rates are high relative to the individual implicit marginal tax rates on income. This rate averages 30.2 per cent for our sample. The K-F effective marginal tax rates, however, allow for the capital gains tax regime and state government taxes. Table 7 shows that the contribution of state government taxes is around 8 percentage points in the case where no building write-off or tax credit is present suggesting that these taxes in fact contribute more to K-F effective marginal tax rates estimates than the building write-off.

Switching Analysis Simulations

In this section, we ask how powerful are targeted tax credits as an incentive to existing landlords currently holding ineligible properties. The question is posed because the introduction of targeted tax credits is likely to cause displacement effects. These effects occur when some landlords realise ineligible real estate investments in favour of real estate investments that are eligible for the targeted tax credit.

We specify a model whose solution is a landlord's reservation rental rate at which investors are indifferent between holding on to the current ineligible investment, and switching into an eligible property investment. The model assumes that an investor obtains sales proceeds (V) if she realises the ineligible investment that has been held for T years. Given perfectly divisible real estate investments and an expected holding period of T + N years, the net present value P(T+N) of the net cash flows from re-investing V(T) in tax credit eligible real estate investments can be derived. We then solve for the landlord's reservation rental rate (see Wood, Watson and Flatau 2002 for details.)

The results of our switching model simulations are presented in tables 9 and 10. In order to examine the extent to which the increase in tax credit eligible properties flows to the least well off renters, results are presented for three tax credit eligible properties, representing the lowest, second and third quartiles by gross rent to value ratio. We then compare the gross rates of return on these hypothetical projects with the required gross rental rate of return from the investor's investment switching criteria.

Table 9 presents the switching simulation results in the case of a zero rate of real property price appreciation. Under this assumption, all income units prefer to hold their existing investment in the absence of a tax credit. The tax credit encourages a large proportion of existing investors to invest in low-income rental housing with 66 per cent of income units electing to switch when there is no real property price appreciation. The higher is the investor's marginal effective tax rate and K-F effective marginal tax rate then the greater is the incentive for the income unit to switch to the tax credit eligible project as the tax credit can be used to generate a larger fall in the K-F effective marginal tax rate. The longer the holding period associated with the current investment, the lower is the incentive for the income unit to switch to the tax credit eligible property. Those investors who are not encouraged to realise their current investment have lower marginal income tax rates on average, have been holding their existing property for a longer period and receive gross weekly rents that are higher than those received by those investors who do switch. This reflects the relatively less generous

[37] Freebairn (1991) presents the results of similar measurement exercises.

treatment of capital gains for low marginal income tax rate investors and the resulting preference for rental income over capital gains.[38]

Table 10 presents the results of simulations under the 1 per cent real rate of property price appreciation assumption. Investors who have held their existing property for short periods of time are encouraged to switch to low weekly rent investments to take advantage of the bias toward capital gains in the tax system. Consequently, 72 investors in our sample of 289 find that the rate of property price appreciation alone is sufficient to lead them to realise their current investment. Again, both the length of the holding period and the magnitude of the marginal income tax and K-F effective marginal tax rates drive the adjustment in preferred investments. The negative relationship between the gross weekly rent on the existing investment and the incentive to switch to the eligible investment is less clear when there is real property price growth. The benefits accruing to low tax rate investors from holding properties with higher gross weekly rents diminishes under the rules that govern the determination of the capital gains tax liabilities when the rate of property price inflation exceeds the general inflation rate.

Budgetary Impacts

One of the benefits of undertaking a dynamic switching analysis is that it more accurately enables policy makers to estimate the budgetary impact of various policy options as it allows for portfolio readjustment on the part of rental investors. The budgetary impact of the policy alternatives modelled in this paper is presented in table 11. The budgetary impact is calculated for one year for both the properties in our sample and on a national basis using the population weights contained in the survey data. No account is taken on second round market impacts of portfolio readjustment. Budgetary costs are the dollar value of tax revenues foregone when allowances or credits claimed are restricted to be less than or equal to the sum of the income units income tax liabilities. As a result, the estimates represent actual costs rather than the hypothetical cost obtained by simply grossing up the eligible annual allowance or credit over the properties in the sample.

Despite the higher value of the tax credit in terms of tax dollars that can be claimed by an investor, this policy has the lowest annual cost for *current eligible* properties (AUD$38.4 million).[39] This reflects the restriction of the credit to properties in the lowest quartile by gross weekly rent. By way of contrast, the estimated cost of the 2.5 per cent building write-off allowance when recapture provisions are in place is AUD$44.3 million. However, when we allow for switching behaviour on behalf of rental investors in response to the incentives available under the targeted tax credit the budgetary cost rises to AUD$117.0 million. This very large increase in the budgetary cost emphasises the importance of taking switching behaviour into account when costing various policy options.

If private sector involvement in the provision of low-cost rental housing is deemed desirable, then the incentives or disincentives created by taxation settings require significant policy attention. In this light, the role of building write-off provisions and tax credits assume some importance. Our findings suggest that the current building write-off provisions do increase the incentive to invest in rental accommodation but do so only marginally. The targeted tax credit scheme, on the other hand, is a powerful means of sharpening the incentive to invest in low cost rental accommodation.

[38] Maximum weekly rents by cohort rise from $140 per week for those investors who would be willing to switch to a property in the lowest gross rent to value range to $1120 per week for those investors who retain their current investment.

[39] Budgetary estimates assume that investors have an expected holding period of 10 years and that the government discounts the future taxation revenue at the 10 year Treasury bond rate as at July 1997 (6.37 per cent).

Table 6: Mean King and Fullerton Effective Marginal Tax Rates by Expected Holding Period & Rate Of Capital Gain[1]

	Real Rate of Capital Loss = 1 per cent	Real Rate of Capital Gain = 0 per cent	Real Rate of Capital Gain = 1 per cent	Real Rate of Capital Gain = 2 per cent
5	0.7052 (1.00, 0.43, 0.11) [2]	0.6554 (1.00, 0.35, 0.12)	0.5850 (1.00, 0.24, 0.14)	0.4768 (0.99, 0.09, 0.16)
10	0.6968 (1.00, 0.41,0.11)	0.6428 (1.00, 0.33, 0.13)	0.5650 (1.00, 0.21, 0.14)	0.4415 (0.99, 0.05, 0.16)
15	0.6939 (1.00, 0.41, 0.11)	0.6378 (1.00, 0.32, 0.13)	0.5560 (1.00, 0.20, 0.15)	0.4238 (0.98, 0.03, 0.16)
20	0.6925 (1.00, 0.41, 0.11)	0.6349 (1.00, 0.32, 0.13)	0.5502 (1.00, 0.20, 0.15)	0.4114 (0.98, 0.02, 0.16)
25	0.6916 (1.00, 0.41, 0.11)	0.6328 (1.00, 0.32, 0.13)	0.5459 (1.00, 0.20, 0.15)	0.4016 (0.98, 0.02, 0.16)
30	0.6911 (1.00, 0.40, 0.11)	0.6313 (1.00, 0.31, 0.13)	0.5424 (0.99, 0.19, 0.15)	0.3933 (0.98, 0.02, 0.16)
35	0.6904 (1.00, 0.40, 0.11)	0.6291 (1.00, 0.31, 0.13)	0.5370 (0.99, 0.19, 0.15)	0.3861 (0.98, 0.02, 0.16)
40	0.6900 (1.00, 0.40, 0.12)	0.6287 (1.00, 0.31, 0.13)	0.5366 (0.99, 0.19, 0.15)	0.3797 (0.98, 0.02, 0.15)

[1] All estimates in this table are for the base tax system in which no building write-off allowance or tax credit is present.

2 Values in parentheses are maximum, minimum and standard deviation.

Table 7: Mean King and Fullerton Effective Marginal Tax Rates by Gross Weekly Rent Quartiles under Alternative Policy Settings ($\pi_h - \pi = 0\%$)

Gross Weekly Rent	Mean Estimated Market Value	Contribution to EMTR of State Government Taxes[1]	EMTR No building write-off allowance	EMTR b=2.5 per cent Recaptured	EMTR b = 4 per cent No Recapture	EMTR Tax Credit c = 4 per cent
$30 - $140	$104,000	0.08	0.61	0.60	0.57	0.41
$140 - $ 165	$129,000	0.08	0.64	0.63	0.61	0.64
$165 - $205	$159,000	0.07	0.65	0.64	0.61	0.65
$205 - $1256	$254,000	0.08	0.67	0.66	0.64	0.67
ALL	$161,000	0.08	0.64	0.63	0.61	0.59

Expected holding period = 10 years, No real capital gain or loss.

[1] For the baseline case of no building write-off allowance. As stamp duties enter into the capital gains tax calculations there is some variation of this contribution under the different policy regimes.

Table 8: Mean King and Fullerton Effective Marginal Tax Rates by Gross Weekly Rent Quartiles under Alternative Policy Settings ($\pi_h - \pi = 1\%$)

Gross Weekly Rent	Mean Estimated Market Value	EMTR No building write-off allowance	EMTR b=2.5% Recaptured	EMTR b = 4% No Recapture	EMTR Tax Credit c = 4%
$30 - $140	$104,000	0.52	0.51	0.47	0.20
$140 - $ 165	$129,000	0.57	0.55	0.51	0.57
$165 - $205	$157,000	0.57	0.56	0.51	0.57
$205 - $1256	$254,000	0.60	0.58	0.55	0.59
ALL	$161,000	0.56	0.55	0.51	0.48

Expected holding period = 10 years, Real Capital Gain = 1%.

Table 9: Switching Behaviour (Real Property Price Appreciation = 0%)

	Gross Rent to Value Ratio %	Mean Weekly Rent $[1]	Average Holding Period (Years)	Mean Marginal Income Tax Rate	Mean K-F Tax Rate[2]	Mean K-F Tax Rate [3]	Number of Investors [4]
Switching Investors							
	0 – 5.13%	89.71	1.6	40.6	73.9	49.3	7 (2.4%)
	5.14%-6.24%	119.4	1.8	38.5	71.9	54.4	40 (13.8%)
	6.25% - 8.02%	128.1	2.6	30.3	64.0	52.7	140 (48.3%)
Non-Switching Investors							
		225.7	4.0	29.3	64.3	64.3	102 (35.2%)
Sample		216.0	3.0	31.3	65.5	57.0	289

[1] Rent figures for switching investors are the means for the gross rent to value ratio quartile calculated from the tax credit eligible properties in the sample. The mean rent for non-switching investors and the sample are based on the current property holding.
[2] Tax rate is the rate on the existing investment given no building write-off allowance or tax credit.
[3] Tax rate is the rate applicable on the new investment.
[4] Percentages in parentheses are the proportion of those investors not currently holding a tax credit eligible property.

Table 10: Switching Behaviour (Real Property Price Appreciation = 1%)

	Gross Rent to Value Ratio %	Mean Weekly Rent $[1]	Average Holding Period (Years)	Mean Marginal Income Tax Rate	Mean K-F Tax Rate[2]	Mean K-F Tax Rate [3]	Number of Investors [4]
Switching Investors							
	0 – 5.13%	89.71	2.6	38.5	65.1	26.0	17 (5.9%)
	5.14%-6.24%	119.4	2.5	32.4	58.3	35.6	61 (21.1%)
	6.25% - 8.02%	128.1	3.6	27.0	53.1	44.7	104 (36.0%)
Non-Switching Investors							
Switched due to rate of property price appreciation		213.3	1.4	35.5	61.6	46.8	72 (35.2%)
Retained existing investment		213.5	5.1	30.2	59.8	59.8	35 (12.1%)
Sample		216.0	3.0	31.3	57.8	44.1	289

[1] Rent figures for switching investors are the means for the gross rent to value ratio quartile calculated from the tax credit eligible properties in the sample. The mean rent for non-switching investors and the sample are based on the current property holding.

[2] Tax rate is the rate on the existing investment given no building write-off allowance or tax credit.

[3] Tax rate is the rate applicable on the new investment.

[4] Percentages in parentheses are the proportion of those investors not currently holding a tax credit eligible property.

Table 11: Annual Budgetary Cost of Alternative Policies

Policy[1]	Sample $	Australia $m
2.5% Building Write-off	181,000	45.5
2.5% Building Write-off - Recaptured	176,000	44.3
4% Building Write-off	288,000	72.3
4% Tax Credit Eligible Properties	162,000	38.4
Investor Switching[2]	459,000	117

1. Cost in current year. The adjustment for recapture through the capital gains tax is based on a 10-year holding period and assumes that the government's discount rate is equal to the 10 Year Treasury Bond rate as at July 1997.
2. Policy costs associated with investor switching include a correction for building write-off allowances on the current property. This correction is based on the 2.5% allowance subject to recapture.

CONCLUSION

This research project aims to construct a microsimulation model that is capable of measuring the impact of Commonwealth and State government fiscal measures and housing programs on the prices that households pay for housing (and the subsidies they receive) and the costs providers of housing face.

There are four particularly important features of the research that deserve consideration:

- It builds on a theoretically sound conceptual framework that has received international recognition as an important contribution to our understanding of the dynamics of the housing system.
- It permits the typical demand-side analysis of housing costs and subsidies by tenure, but also allows supply-side factors and policy measures to be incorporated into the analysis. The microsimulation model represents a unique attempt to integrate the demand and supply sides of the housing market in cross section microsimulation exercises. This is an innovative feature of the research.
- In addition to measurement of housing policy impacts, the microsimulation model will permit analyses of interactions with Commonwealth government pension and benefit programs.
- Finally, the microsimulation model will be capable of generating reliable estimates of the budgetary cost of Commonwealth and State government policy programs and reforms.

While the microsimulation model is still in the early stages of development, its reach and effectiveness has already been demonstrated in this positioning paper with its application to an important current policy issue; namely, the role that Commonwealth tax measures may play in the incentive to invest in the private residential property market. With further development, the *Microsimulation Model of the Australian Housing Market* will act as an important asset, which can be used in future years to inform policy development at both Commonwealth and State tiers of government.

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APPENDIX A. DERIVATION OF THE RESERVATION RENTAL RATE

As in Keifer (1978; 1982), consider a rental project comprising housing capital (q)[i] and financed with the assistance of debt (m). It is assumed that the investor's holding period (N) is exogenous; house prices and rents appreciate at the constant rate π_h-d, where d is the rate of economic depreciation; the constant rate of general inflation (π) may differ from π_h-d; the investor pursues a maintenance strategy (μ) and amortisation of debt is not required. The present value function (V) may be written as;

$$V = (m - p(0)q) + (p(N)q - m)e^{-(\rho+\pi)N} + \int_{t=0}^{N} (1-t_y)[(1-\phi)r(t)q - \alpha p(t)q - im] \times e^{-(\rho+\pi)t} dt$$

$$+ \int_{0}^{N} t_y \psi \gamma_s p(0) q e^{-(\rho+\pi)t} dt - (sp(0) + \beta p(N)) q e^{-(\rho+\pi)N}$$

$$- \tfrac{1}{2} t_y q p(0) \left[(1-\beta) e^{(\pi_h - d)N} - \left\{ (1+s) - \int_{0}^{N} \omega dt \right\} \right] e^{-(\rho+\pi)N}. \qquad (A1)$$

where p(0) is the asset price of housing in year zero, ρ is the investor's rate of time preference, t_y is the investor's statutory marginal income tax rate, ϕ are agency costs as a proportion of gross rent r(t)q, α is operating costs as a fraction of asset price and comprises maintenance (μ) and property taxes (t_r) and land taxes t_L that are levied on site value which is the proportion ($1-\lambda_s$) of asset price, λ_s being the ratio of the value of the building structure to the asset price. The parameter i is the borrower's interest rate, ψ the rate of building write-off. Transaction costs on purchase and sale as a fraction of asset price are represented by the parameters s and β respectively.

The first term on the right hand side of equation (A1) is the initial equity invested in the asset. The second term is the discounted value of the asset at resale net of the outstanding loan repayment. In the third term we define the after-tax net rental income stream. Note that all operating costs and interest payments can be deducted from rental income. Under Australian federal tax provisions passive losses can be deducted without limit from other sources of income. If the rental project involves construction of a new property, the capital expenditures incurred on the building structure can be deducted at the rate of 2.5% per annum (Deutcsh et al, 1999, p558). The fourth term is then the present value of the tax savings due to building write-off deductions. If the project involves acquisition of an existing building, it is ineligible for building write-offs. The fifth term in equation (A1) is the present value of transaction costs on purchase and sale, and the final term is capital gains tax liabilities as defined under the rules introduced following the Review of Business Taxation in 1999.

On evaluation of the integrals we obtain

$$V = \left[m - \frac{(1-t_y)im}{k} + \frac{t_y \omega p(0) q}{k} \right] \left[1 - e^{-kN} \right] + q \left[\frac{(1-t_y)\{(1-\phi)r(0) - \alpha p(0)\}}{\delta} + p(0) \right] \left[e^{\delta N} - 1 \right]$$

$$- p(0)(s + \beta e^{\delta N}) q - \tfrac{1}{2} t_y q p(0) \left[(1-\beta) e^{(\pi_h - d)N} - \{(1+s) - \omega N\} \right] e^{-kN} \qquad (A2)$$

where $k = (\rho+\pi)$, $\omega = \psi\gamma_s$ and $\delta = \pi_h - d - (\rho+\pi)$.

In equilibrium, the right hand side of equation (A2) must sum to zero. Factoring q and m and setting equal to zero, the equilibrium condition implies that;

$$\left[\frac{t_y \omega p(0) q}{k}\right]\left[1-e^{-kN}\right]+\left[\frac{(1-t_y)\{(1-\phi)r(0)-\alpha p(0)\}}{\delta}+p(0)\right]\left[e^{\delta N}-1\right]$$

$$-p(0)\left(s+\beta e^{\delta N}\right)-\tfrac{1}{2}t_y p(0)\left[(1-\beta)e^{(\pi_h-d)N}-\{(1+s)-\omega N\}\right]e^{-kN}=0 \qquad (A3)$$

$$1-\frac{1-t_y i}{k}=0 \qquad (A4)$$

Using conditions (A3) and (A4) we can solve for the gross rental yield that is just sufficient to cover the full economic costs of holding housing capital q. This yield or reservation rental rate is given by equation (1) in the text.

APPENDIX B. DERIVATION OF THE BID RENTAL RATE

We invoke the same assumptions as in Appendix A. However the housing consumer's expected length of occupancy is T and tax arrangements differ if the housing consumer purchases owner occupied housing, since the latter is exempt from capital gains tax, and generally exempt from land taxes. The present value function can now be defined as

$$V = (m - p(0)q) + (p(T)q - m)e^{-kT} + \int_0^T [r(t)q - (\mu + t_r)p(t)q - im] \times e^{-kt} dt \ ,$$

$$-(sp(0) + \beta p(T))qe^{-kT} \qquad (B1)$$

where it is assumed that $k=(1-t_o)$ with t_o representing the consumer's implicit marginal tax rate and all other parameters are as defined in Appendix A. On evaluation of the integrals we obtain;

$$V = (m - p(0)q) + (p(T)q - m)e^{-kT} + q\left[\frac{r(0) - (\mu + t_r)p(0)}{\delta}\right]\left[e^{\delta T} - 1\right]$$

$$-(sp(0) + \beta p(T))qe^{-kT} \qquad (B2)$$

Repeating the steps described in equations (A3) and (A4) we obtain equation (2) in the text.

APPENDIX C. VACANCY AND MAINTENANCE EQUATIONS

The estimated vacancy function is given by:

$$V_i = \alpha_0 + \alpha_1 \mathbf{Z}_i + \alpha_2 \left(\frac{TR_i}{P_i} - \left(\frac{TR}{P} \right)_S \right)_i + \alpha_3 \left(\frac{\Lambda_i^e}{P_i} - \frac{\Lambda_i}{P_i} \right)_i + e_i \qquad \text{(C1)}$$

where:

V_i is the number of weeks the property has been vacant in the preceding twelve months;

Zi is a vector of property characteristics;

$\left(\frac{TR_i}{P_i} - \left(\frac{TR}{P} \right)_S \right)_i$ is the difference between the ratio of gross annual rent to the estimated market value for the property and the mean of this ratio in the geographical market segment of the property[40]. This provides a proxy measurement of whether the rent on the property is high relative to the market.

$\left(\frac{\Lambda_i^e}{P_i} - \frac{\Lambda_i}{P_i} \right)_i$ is the difference between expected annual maintenance expenditures as a proportion of the estimated market value of the property and reported maintenance expenditures in the preceding twelve months as a proportion of estimated market value. This variable acts as a proxy for the state of upkeep of the property.

A priori, we would expect that a positive difference between the property's rent to value ratio and the mean rent to value ratio in the market segment would result in a higher vacancy rate. Gabriel and Nothaft (2001) analysing U.S. evidence note that the effect of rent levels on duration is ambiguous as the behavioural assumptions that govern tenant and landlord behaviour imply conflicting responses to a vacant high rent property. With respect to vacancy incidence however, they note that the presence of rent-controlled properties reduces the expected incidence as the low rents on these properties create a disincentive for tenants to move. While rent controls are not an issue in the Australian context it seems reasonable to assume that a property with a rent that is low relative to the mean in its market segment lets more readily and becomes vacant less often. Finally, a property with a better state of upkeep relative to the average could be expected to be let more readily. We would expect then, that the signs of α_1, α_3, and α_5 to be negative while α_2 and α_4 should have a positive sign.

Our estimated equation is: [41]

$$V_i^e = 8.57 - 3.74 M_i + 12.34 B_i - 1.10 BRM3_i + 34.25 \left(\frac{TR_i}{P_i} - \left(\frac{TR}{P} \right)_S \right)_i - 0.50 \left(\frac{\Lambda_i^e}{P_i} - \frac{\Lambda_i}{P_i} \right)_i \qquad \text{(C2)}$$

Where:

M_i equals 1 if a metropolitan property, 0 otherwise;

B_i equals 1 if a block of flats or apartments, 0 otherwise;

$BRM3_i$ equals 1 if the property has more than three bedrooms, 0 otherwise;

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[40] Geographical market segments used are the state capital and elsewhere in the state.

[41] T-statistics for the estimated coefficients are: α_0 = -12.37, α_1= -5.59, α_2 = 6.74, α_3 = -1.72, α_4 = 4.23, α_5 = -2.95 (F[5, 1725] = 24.95, $\overline{R}^2 = 0.065$).

Metropolitan properties have shorter expected vacancy periods than those outside the metropolitan area as we might expect, blocks of flats or apartments have higher expected vacancies as measured in the survey because of the multiple dwelling units, and properties with more than three bedrooms have lower expected vacancies.

Our model is:

$$\left(\frac{\Lambda}{P}\right)_i = \beta_0 + \beta_1\left(\frac{TR}{P}\right)_i + \beta_2\left(\frac{TR}{P} - \left(\frac{\overline{TR}}{P}\right)_S\right)_i + \beta_3 Z_i \qquad \text{(C3)}$$

Where Z_i is a vector of property characteristics including the age of the property and its location. The second term in equation (C3) is the gross rent to value ratio while the third term is the difference between this ratio and the mean gross rent to value ratio in the property's geographical market segment. Estimated coefficients are[42]:

$$\begin{aligned}\left(\frac{\Lambda}{P}\right)_i = {} & -2.00 + 1707.71\left(\frac{TR}{P}\right)_i - 12.31\left(\frac{TR}{P} - \left(\frac{\overline{TR}}{P}\right)_S\right)_i \\ & + 0.37A_i^{10} + 0.61A_i^{20} + 0.85A_i^{50} + 1.04A_i^{50+} \\ & - 0.81Hob_i - 0.63Dar_i\end{aligned} \qquad \text{(C4)}$$

Where:

A_i^{10} is a dummy variable equal to one if the property is between 6 and 10 years old;

A_i^{20} is a dummy variable equal to one if the property is between 11 and 21 years old;

A_i^{50} is a dummy variable equal to one if the property is between 21 and 50 years old;

A_i^{50+} is a dummy variable equal to one if the property is more than 50 years of age;

Hob is a dummy variable equal to 1 if the property is in Hobart; and

Dar is a dummy variable equal to 1 if the property is in Darwin.

Our estimated equation[43] is:

$$\begin{aligned}\frac{T_i^P}{P_i} = {} & 0.0090 - 0.0015SDT_i - 0.0021FA_i + 1.747OD_i - 0.0007NB_i + 0.0019VIC_i + 0.0016QLD_i \\ & 0.0016SA_i + 0.0002WA_i + 0.0028TAS_i + 0.0006NTAC_i\end{aligned}$$

Where *SDT* is a dummy variable equal to 1 if the property is a semi-detached or terrace house, *FA* denotes a dummy variable equal to 1 if the property is a flat or apartment, and *OD* denotes a dummy variable equal to 1 if the dwelling type is 'other'. *VIC*, *QLD*, *SA*, *TAS* and *NTAC* are dummy variables equal to one if the property is in the states of Victoria, Queensland, South Australia, Tasmania or the Northern Territory and Australian Capital Territory, respectively.

[42] T-statistics for the estimated coefficients are: β_0 = -4.02, β_1= 4.64, β_2 = -3.19, β_3 = 2.01, β_4 = 3.71, β_5 = 5.81, β_6 = 6.29, β_7 = -2.55, β_8 = -1.55. (F[8, 1722] = 12.32, $\overline{R}^2 = 0.050$).

[43] a_0 = 35.3, a_1 = -5.40, a_2 = -6.55, a_3 = 1.66, a_4 = -10.23, a_5 = 12.31, a_6 = 9.773, a_7 = 8.51, a_8 = 1.10, a_9 = 12.94, a_{10} = 2.67, F[10,9007] = 50.011, $\overline{R}^2 = 0.051$.

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AHURI

Australian Housing
and Urban Research Institute

Australian Housing and Urban Research Institute

Level 7 20 Queen Street, Melbourne Victoria 3000

Phone +61 3 9629 5033 Fax +61 3 9629 8536

Email information@ahuri.edu.au Web www.ahuri.edu.au