



THE AUSTRALIAN NATIONAL UNIVERSITY
Centre for Economic Policy Research

DISCUSSION PAPERS

THE EFFECTS OF INFLATION AND TAXATION ON THE
COSTS OF HOME OWNERSHIP: A THEORETICAL ANALYSIS

R. Anstie*

Discussion Paper No. 33

August 1981

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ISBN: 0 949838 33 0

ISSN: 0705-5137

- * Centre for Economic Policy Research, ANU. My interest in this topic was stimulated by discussions with Christopher Findlay and James Cassing. I also wish to thank Ian Harper and Fred Gruen for their helpful comments. Any errors are my own responsibility.

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Abstract

This paper analyses the costs of home ownership compared with the costs of renting a home. It concentrates on the effects of inflation and the taxation system on these costs. The present taxation system does not tax imputed rental income or (most) capital gains. Such a system favours the home-buyer compared with the renter.

However, in times of inflation, the present taxation system has the effect that it taxes in the hands of a lender some repayment of the principal value of a loan (rather than just the pure interest component) and allows as a tax deduction to the borrower this part repayment of the loan. Such an effect will result in the market rate of interest rising above what it would otherwise be in the absence of taxation. This imposes a cost on home-buyers because they are unable to deduct any part of their loan repayment from assessable income (whereas other borrowers can).

This additional cost is higher, the larger the size of the loan. Furthermore, the subsidy to the home-buyer (in the form of non-taxation of imputed rental income) is proportional to the level of home-buyer's equity in the house. This means that, for low levels of equity, the additional cost may outweigh the subsidy, in which case, renting would be the cheaper alternative. An expression for the critical proportion of home-buyer's equity is derived. This critical value depends on the rate of inflation and on marginal tax rates.

Two methods of eliminating the critical value are presented. The first method involves taxation of imputed rental income, hence removing the tax subsidy to home owners. Individuals on low marginal tax rates will still find renting a cheaper proposition in times of inflation under this scheme. The second method requires indexation of the tax base. Such a system would allow the retention of the tax subsidy, but would

remove the additional cost imposed on home-buyers in times of inflation.

It is stressed that tax deductibility of mortgage interest without taxation of imputed rental income is not a suitable way of reducing the inflation-induced costs imposed on home-buyers.

The policy recommendation arising from this paper is indexation of the tax base. This could be in conjunction with taxation of imputed rental income, in which case a subsidy to home-buyers could take the form of a tax rebate. Such a scheme would remove the regressive nature of the present form of the subsidy.

1. INTRODUCTION

There has recently been a great deal of debate concerning the costs of home-buying. Much of this debate has been very emotive and the issues have tended to become clouded with special pleading.

This paper attempts to set down clearly the costs involved with buying a house and to analyse the effects of inflation and taxation on these costs.

The approach is to compare the costs of home-buying with the costs of renting a house of the same value yielding the same stream of housing services. In effect, this means that the opportunity costs for home-buyers are being taken into account since the alternative to buying a house is renting it.

Using some fairly strong assumptions (outlined in section 2), section 3 shows that, in the presence of anticipated inflation, an individual may be better off renting than buying a house; this is despite the government subsidy in the form of non-taxation of imputed rental income, and the nominal capital gain on the value of the house.

It is shown that there is a critical value of the proportion of home-buyer's equity, below which an individual would be better off renting than buying. This critical value depends on the rate of inflation and the individual's marginal tax rate.

The existence of this critical value implies that there are additional costs imposed on the home-buyer (and not borne by the renter) which can outweigh the home-buyer's subsidy. These additional costs stem from the differential tax treatment of home-buyers vis-à-vis other participants

in the capital market, in the presence of anticipated inflation. The other participants determine the market rate of interest and, since the tax base is not indexed, the interest rate rises to a level which is too high for home-buyers.

This suggests two possible methods of removing the additional costs to home-buyers induced by inflation. The first is to alter the taxation system so that it treats home-buyers in the same way as other borrowers in the market, and the second is to index the tax base for inflation.

Both these methods are analysed in section 4. The first, which involves taxation of imputed rental income, removes the tax subsidy to home-buyers, but does nothing to lower the market rate of interest. Assuming that the government's objective is to encourage home-ownership by giving a tax subsidy in the form of non-taxation of imputed rental income, the second method is preferable. This method would involve the taxation of nominal capital gains on liabilities for commercial borrowers, and would allow lenders to deduct capital losses on financial assets. This would result in a lower market rate of interest. The subsidy to home-buyers could be retained, and there would be no additional costs imposed on them by inflation. In addition, total tax collections would not be altered.

The strong assumptions which are used in the analysis provide insight into the effects of inflation and taxation on costs to home-buyers. In particular, section 3 shows that a critical value for the proportion of home-buyers' equity exists. In section 5, it is shown that this critical value still exists, when these assumptions are relaxed. However, with the relaxation of the assumptions, it is no longer possible to analyse the underlying causes of the existence of

the critical value. Many factors could influence the magnitude of the critical value, through their effects on market rates of interest. One such factor is the subsidised interest rate to home-buyers. This has the effect of lowering the critical value. It can still be said, however, that regardless of the effect of these other factors, the cause isolated in section 3 (non-indexation of the tax base) still plays a role in determining market rates of interest, and hence the critical value of the proportion of home-buyers' equity.

Section 5 also analyses the consequences of allowing tax deductibility of mortgage interest payments without taxing the imputed rental income derived from the home. This proposal has been put forward by several individuals recently, but their reasons for doing so are not consistent with the consequences of such action. Two such reasons are that the government should provide greater encouragement for home ownership and that tax deductibility of mortgage interest would achieve "tax equity" with commercial borrowers. Section 5 shows that tax deductibility would encourage home purchase, but not home ownership, and that it would widen, rather than remove the difference between the tax treatment of home-buyers and commercial borrowers.

Section 6 reviews the results of the paper and draws some implications for policy, on the assumption that the government objective is to encourage home ownership in a fairly consistent way.

2. NOTATION AND ASSUMPTIONS

This paper considers an individual who possesses some financial wealth and who desires housing services. Assume that a house of value K provides the same housing services to the individual, whether it is rented or owned by the individual.

α is the proportion of equity in the house that the individual can afford.

A one time-period model allows analysis of various choices faced by the individual. We wish to determine which course of action leads to the greatest end-of-period net wealth (after tax).

The choices that will be considered in this paper are:-

- A. Rent a house of value K and buy fixed interest financial assets with net worth αK .
- B. Borrow $(1-\alpha)K$ and buy a house of value K and live in it.
- C. Rent a house of value K . Borrow $(1-\alpha)K$ and buy a house of value K and rent it out¹.

What is of most interest is the choice between renting and buying (A & B) under the conditions which exist in Australia. To analyse this question it is desirable to isolate the main factors which could cause differences in end-of-period net wealth for the different choices A,B and C. Having done this, the model can abstract from other complicating factors, initially anyway.

It is fairly obvious that one of the main factors which will affect the end-of-period net wealth is the level of income tax paid, which depends

1. This strategy is exactly the same as investing K in shares and renting a house under the assumptions of the model. (See appendix A). Choice C has been phrased in terms of buying a house because it has been suggested that this could be a cheaper way of buying a house than choice B.

on the taxation system. If all individuals were treated equally regardless of their economic activity, then the level of tax paid would not be dependent on whether the individual chooses action A, B or C.

However, home-owners receive a tax subsidy from the government in the form of non-taxation of imputed rental income. Therefore, on this basis, the answer seems to be clear-cut that the individual should take action B to maximise end-of-period net wealth. However, it is observed that many people with positive net wealth do actually rent rather than buy and so it appears that there are some factors which mitigate the tax subsidy. Many factors which would help mitigate the subsidy could be suggested but before getting involved with too many complications, it would be interesting to determine whether the present taxation system, in conjunction with inflation, could lead to some mitigation of the tax subsidy.

The assumptions that are used in the model initially are:-

1. One time period from t_0 to t_1 .
2. All transactions occur at t_0 or t_1 (e.g. rent is paid at t_1)
3. Fully anticipated increase in prices at the rate of $\dot{p}$ occurs at t_1 .
4. Uniform tax rate of τ in the economy.²
5. The tax base is not indexed for inflation.
6. There is no capital gains tax.
7. There are no real capital gains in the economy.
8. There is no taxation of imputed income for owner-occupiers.
9. Tax deductibility of interest payments for all borrowers except home-buyers/occupiers.

2. This assumption is for simplicity, and will be relaxed after the initial analysis.

10. There are no transactions costs and no risk in the capital market.

r = the real rate of return in the economy

i = market rate of interest

E = the rental payment at t_1

R = housing services at t_1 (for house of value K at t_0 or $K(1+\dot{p})$ at t_1).

(Note that whenever the expression 'real value' is used in the paper, the value will be denoted in t_1 dollars. Thus, a house of value K at t_0 has real value of $K(1+\dot{p})$).

OC = other costs at t_1 associated with owning a house (e.g. maintenance and property taxes).

3. THE CHOICE OF RENTING VERSUS BUYING A HOUSE³.

We wish to consider the net wealth of the individual at the end of the period if he has αK in net wealth at the beginning of the period.

If he chooses to rent, then net wealth at the end of the period will be

$$W(A) = R + \alpha K + (1-\tau) \alpha K - E \quad (1)$$

If he chooses to borrow and buy a house to live in, then net wealth at t_1 is

$$W(B) = R + \alpha K + K\dot{p} - i(1-\alpha) K - OC \quad (2)$$

The value of $W(A)$ and $W(B)$ must be compared, in order to make the decision of whether to rent or buy.

In order to do this, the values of E and i must be known.

Proposition 1:

The equilibrium value of the market rate of interest will be

$$i = (1+\dot{p})r + \frac{\dot{p}}{1-\tau}$$

This proposition has important implications because it shows that the market rate of interest is influenced by the tax rate if there is anticipated inflation in the economy. The effect is not insignificant and, as will be seen, this will have an important bearing on the choice between renting and buying.

Proposition 2:

The equilibrium value of the rental payment, E , will be

$$E = r(1+\dot{p})K + OC$$

The rent gives the real rate of return on the asset plus the costs⁴ incurred by the landlord, such as maintenance and rates.

3. The algebra for this section can be found in appendix A.

4. These costs do not include mortgage payments. It is assumed that the full value OC is tax deductible for the landlord.

Substituting the equilibrium values for E and i into (1) and (2) and comparing W(A) and W(B) gives the result that

$$W(A) > W(B) \text{ if } \alpha < \frac{\dot{p}}{i(1-\tau)} \quad (3)$$

This is quite significant because it says that there exists a critical value of α below which it is cheaper to rent than to buy a house.

This critical value is

$$\alpha^* = \frac{\dot{p}}{i(1-\tau)}$$

Thus, if the individual's net wealth at the beginning of the period is below α^*K , then he would be better off renting and lending his money at the market rate of interest, rather than borrowing and buying a house to live in.

REASON FOR EXISTENCE OF α^*

The reason that this critical level exists is that borrowers for houses (to occupy) are treated differently by the taxation system from any other borrower in the market. In times of inflation, the interaction of inflation and the taxation system imposes an extra cost on home-buyers that is not borne by other borrowers in the market.⁵

The market rate of interest is determined by borrowers and lenders in the market. In times of inflation, a lender suffers a decline in the real value of his financial asset, whereas a borrower gains because of the fall in the real value of his liability. As inflation comes to be expected, the market rate of interest will rise, because lenders will want

5. Note that if $\dot{p} = 0$, then the critical level of α is zero. That is, in the absence of inflation, anyone with positive net wealth would be better off borrowing and buying a house, rather than renting and investing in other assets.

a higher rate of return to compensate for the decline in the value of their assets. Moreover, borrowers will be prepared to pay a higher rate because their liabilities are being reduced by inflation. Thus, part of the higher interest receipt represents a return of capital rather than a return on capital for lenders.

In the absence of inflation, tax is levied on the return on capital (i.e. the pure interest component) but in times of inflation, all interest receipts are taxed, even though one component of the interest receipt is a return of capital (i.e. part re-payment of the loan). This additional tax amounts to a tax on wealth, which increases as the rate of inflation increases.

Under most circumstances, the value of this wealth tax is actually passed on to the borrower, since he can deduct the entire 'interest' payment from his assessable income, not just the component representing the cost of capital. That is, with each 'interest' payment, the borrower pays back part of his liability (equal to the fall in the real value of the liability) which the tax system then allows him to deduct from his assessable income. So he is made better off than he otherwise would be without inflation.

Because of the wealth tax, lenders will want a higher nominal market rate of interest in order to maintain their effective after-tax real rate of interest as inflation (and the wealth tax) increases. Borrowers will be prepared to pay a higher rate because they gain by an amount equivalent to the wealth tax paid by lenders, through the deductibility of part of the liability.

Thus, the market rate of interest will rise by even more because of the presence of the wealth tax (i.e. absence of indexation of the tax base). For a marginal tax rate of 46% and an anticipated rate of

inflation of 10%, this additional increase in the market rate of interest can be as high as 8.5%.

The home-buyer cannot deduct interest payments and so does not receive a gain from the tax department equivalent in value to the lender's loss (in the form of the wealth tax). Lenders will still demand the higher rate (which they can get from other borrowers in the market) and so the home-buyer is forced to pay an interest rate that is too high. He is made worse off than when there is no inflation, but will still be prepared to pay the higher rate as long as the tax gain resulting from the non-taxation of imputed rental income exceeds this excess interest payment.

Thus, the government subsidy to home-buyers (in the form of non-taxation of imputed rental income) is mitigated and may even be negated by the effect of the non-indexation of the tax base on the market rate of interest.

THE VALUE OF α^*

Having established the reason for the existence of a critical value of α , it would be interesting to calculate this critical value, for given rates of inflation and tax, and given real rates of return.

TABLE 1: Values of α^* - The Critical Proportion of Home-Buyers' Equity Assuming Uniform Tax Rate

$r = .04$

$p \backslash \tau$	.20	.30	.35	.40	.45
.02	.38	.41	.43	.45	.47
.05	.60	.63	.65	.66	.68
.10	.74	.76	.78	.79	.81
.15	.80	.82	.83	.84	.86
.20	.84	.86	.87	.87	.88

$r = .02$

$p \backslash \tau$	.20	.30	.35	.40	.45
.02	.55	.58	.60	.62	.64
.05	.75	.77	.79	.80	.81
.10	.85	.87	.87	.88	.89
.15	.89	.90	.91	.92	.92
.20	.91	.92	.93	.93	.94

The tables above show that the critical value, α^* , increases with an increase in $\dot{p}$ and τ and decreases with an increase in r .⁶

In this system, then, we should observe more people renting for a higher level of inflation and a higher tax rate. The response to the tax rate may seem counter-intuitive. The explanation of the response is that the nominal interest rate rises with the rise in the tax rate (unless inflation is zero) and so the home-buyer must pay more in interest payments, which outweighs the saving on the rent.

The tables show that α^* is quite sensitive to the level of anticipated

6. For a proof, see Appendix A.

inflation, but not very sensitive to the uniform tax rate in the economy.

Relaxation of the Uniform Tax Rate Assumption

The assumption that the tax rate is uniform throughout the economy may seem too restrictive and hence it may appear that the above analysis could not be applied to the Australian situation. However, the analysis can still apply, if we relax the assumption.

In Australia, there are four marginal tax rates in the personal income tax scale (0, .32, .46 and .60). Company tax is at a uniform rate of .46.

Assume that the majority of borrowers and lenders face a marginal tax rate of .46. This rate will then determine the market rate of interest i (for a given r and $\dot{p}$).

How will this affect α^* for those on either a lower or higher marginal tax rate?

If the marginal tax rate for the individual is τ^1 , he will rent if

$$\alpha < \frac{\dot{p}}{i(1-\tau)} \cdot \frac{\tau}{\tau^1}$$

Thus, for someone on a tax rate higher than τ , the critical value is lowered (because $\tau/\tau^1 < 1$) and for a person with a lower marginal tax rate than τ , the critical value is increased.

To give some idea of the magnitude of α^* for the various marginal tax rates, the following table sets out the values for different rates of inflation, assuming a real rate of return in the economy of 4% p.a.

TABLE 2: Values of α^* - The Critical Proportion of Home-Buyers Equity For Different Marginal Tax Rates

$r = .04$

$\tau = .46$

$\dot{p} \backslash \tau \quad I$	.32	.46	.60
.02	.68	.48	.36
.05	.99	.69	.53
.10	1.16	.81	.62
.15	1.23	.86	.66
.20	1.27	.89	.68

From this table, it can be seen that for an inflation rate above about 5% a person on the low marginal tax rate is better off renting, regardless of the level of equity he could have in the house.

End of period wealth for choice C

As well as the choices of renting a house and buying a house to live in, there is the option of renting a house, borrowing some money and buying a house to rent out. With this situation, the end-of-period wealth will be

$$W(B) = R + (1-\tau^1) (E-OC) + K(1+\dot{p}) - E - (1-\alpha)K - (1-\tau^1) i (1-\alpha)K$$

Using propositions 1 and 2, $W(C)$ can be written as

$$W(C) = R + \alpha K + (1-\tau^1) i \alpha K - E + \frac{\tau^1 - \tau}{1-\tau} \dot{p} K$$

If $\tau^1 = \tau$, then $W(C) = R + \alpha K + (1-\tau) i \alpha K - E$

$$= W(A)$$

In this situation, there is no difference between renting and investing in fixed interest assets or renting, borrowing and buying the house. The choice between A and B (or C and B) depends on the critical

value of α .

$$\begin{aligned} \text{If } \tau^1 < \tau, \text{ then } W(C) &< R + \alpha K + (1 - \tau^1) i \alpha K - E \\ &< W(A) \end{aligned}$$

Thus, with a marginal rate less than τ , the individual is better off if he does not borrow to buy a house and rent it out. The choice of action still depends on the critical value of α .

$$\text{If } \tau^1 > \tau, \text{ then } W(C) > W(A).$$

This simply says that an individual on a high marginal tax rate is better off as a net borrower in the market, rather than a net lender. The choice between B and C depends on a critical value of α . The critical value in this case is

$$\alpha^+ = \frac{\dot{P}}{i(1-\tau)},$$

which is independent of the individual's marginal tax rate. If $\alpha < \alpha^+$, it would be better to buy a house and rent it out, then rent another place for yourself until such time as $\alpha > \alpha^+$.

4. TWO ALTERNATIVE TAX SCHEMES⁷.

It has been shown that the government subsidy to home owners (in the form of non-taxation of imputed rental income) can be mitigated and even negated in times of inflation.

With the recent increases in interest rates, people have realised that home-buyers are being adversely affected. Several individuals and groups have called for tax deductibility of home loan interest payments to remedy the problem. However, the root of the problem is not the non-deductibility of mortgage interest payments.

Those who deduce that mortgage interest should be tax deductible on the grounds that commercial borrowers can deduct interest payments seem to forget that commercial borrowers must pay tax on the income derived from their investments, whereas home-buyers do not pay tax on imputed rental income.

To suggest that mortgage interest payments should be tax deductible, without introducing taxation of imputed rent, is to suggest that home-buyers should receive yet another subsidy. This point is more obvious if it is assumed that there is no inflation. In this case, there is no mitigation of the government subsidy to home-buyers (under the assumptions of the model) and thus to allow tax deductibility of mortgage interest is to give another subsidy to home-buyers (and the larger the loan, the higher the subsidy).

Having established that tax deductibility on its own is not a solution to the problem of inflation causing increased costs to home-buyers, let us now turn to two possible solutions.

7. The algebra for this section can be found in Appendix B

The first is to treat home-buyers the same as any other borrower in the market, which would mean that imputed rental income would become taxable and all costs associated with home ownership would be tax deductible. The second solution would be to introduce indexation of the tax base for borrowers and lenders.

1. Taxation of Imputed Income

Suppose that home owners are now taxed on imputed rental income and that this imputed value is taken to be the market rent for the house, E. Of course, costs associated with earning this income will now be tax deductible. Thus, the tax paid by home owners in respect of their house would be:

$$\tau (E-i(1-\alpha)K-OC)$$

and net wealth at end of period would be reduced by this amount compared with (2).

$$W(B) = R + \alpha K + K\dot{p} - i(1-\alpha)K-OC-\tau(E-i(1-\alpha)K-OC)$$

Lenders and other borrowers in the market are not affected by this change in the taxation system. This means that the equilibrium market rate of interest i and the equilibrium level of rent E will remain unchanged.

Using propositions 1 and 2, then, $W(B)$ can be written as

$$\begin{aligned} W(B) &= R + \alpha K + (1-\tau)i\alpha K - E \\ &= W(A) \end{aligned}$$

Thus, there is no difference between renting and buying a house under this scheme. In fact, there is no difference between borrowing for a house and borrowing for a commercial project of the same value yielding the same rate of return. This holds, whether or not there is anticipated inflation in the economy.

However, these results will change if there are differing marginal tax rates in the economy, and anticipated inflation exists. A person on a low marginal tax rate should be a net lender and a person on a high marginal tax rate should be a net borrower (see Appendix B).

Thus, with this taxation system, individuals on low marginal tax rates are better off renting, rather than borrowing and buying a house. For this reason and also because it is presumably the intention of the government to provide a subsidy to home owners in the form of non-taxation of imputed rental income, this taxation system does not appear very desirable.

The alternative proposal of indexing the tax base allows for the retention of the subsidy to home-owners and it removes the dependence of the market rate of interest on the tax rate.

2. Indexation of the Tax Base

Indexation of the tax base means in effect that tax is levied on the change in real net wealth during the period.⁸

Proposition 3

With indexation of the tax base, the equilibrium market rate of interest will be

$$i = (1+\dot{p})r + \dot{p}$$

(Note that this is lower than in the absence of indexation of the tax base. The difference is $\frac{\tau}{1-\tau}\dot{p}$)

8. In practice, this would mean that lenders could deduct their capital losses on financial assets from assessable income before being taxed; and the borrowers should include as part of their assessable income the decline in the value of their liability, due to inflation.

Proposition 4

Indexation of the tax base makes no difference to the equilibrium level of rent.

$$E = r(1+\dot{p}) K + OC$$

Using propositions 3 and 4, the end-of-period net wealth for renting and buying are, respectively

$$W(A) = R + \alpha K(1+\dot{p}) + (1-\tau)(i-\dot{p})\alpha K - E$$

$$\text{and } W(B) = R + \alpha K + i\alpha K - E$$

These expressions can be re-written as

$$W(A) = R + \alpha K(1+\dot{p}) + (1-\tau)r(1+\dot{p})\alpha K - E$$

$$W(B) = R + \alpha K(1+\dot{p}) + r(1+\dot{p})\alpha K - E$$

Comparing $W(A)$ and $W(B)$, it can be seen that the buyer is better off to the extent of $\tau r(1+\dot{p})\alpha K$. This is the subsidy to the home-buyer.

Note that the higher is the proportion of equity in the house (α), the greater is the subsidy. This would encourage home ownership (rather than just home purchase).

The subsidy remains at the same real level regardless of the rate of inflation.

If we relax the assumption of the uniform tax rate, the market rate of interest will not be affected. Neither will the market rent, E . However, the actual level of the subsidy received by the home-buyer will be greater, the higher is his marginal tax rate. Thus, the subsidy is regressive.

With this system, then, the market rate of interest is lower than it otherwise would be with anticipated inflation; the subsidy to home owners is retained, and unaffected by the level of anticipated inflation; and the real value of tax collections is not altered by the

change in the tax system.

What is important to note about this system is that in the absence of inflation, it is identical to the present system. Thus, given that the government objectives are built into the present system, this alternative tax proposal retains those objectives in full, in the presence of (anticipated) inflation.

5. DISCUSSION OF OTHER RELEVANT ISSUES⁹.

1. The critical value of α in disequilibrium

Section 3 assumed that there was only one market rate of interest and that this rate had fully adjusted for anticipated inflation. This allowed some insights to be made, concerning the decision to rent or buy a house. In particular, we were able to show that a critical level of α can exist (where α is the proportion of equity in a house). The calculated values of the critical level α^* presented in section 3 depended on the assumptions that the market rate of interest and the level of rent were at equilibrium levels.

It is still possible to calculate α^* if these assumptions are relaxed. We can also allow different market rates of interest. The end-of-period net wealth for renting and buying are, respectively

$$W(A) = R + \alpha K + (1-\tau)i_1\alpha K - E$$

$$W(B) = R + K(1+\dot{p}) - (1-\alpha)K - i_2(1-\alpha)K - OC$$

where i_1 = lending rate for the individual

i_2 = borrowing rate for the individual

$$\text{Now, } W(A) > W(B) \text{ if } \alpha < \frac{K(i_2 - \dot{p}) - (E - OC)}{(i_2 - i_1(1-\tau)) K} \quad (4)$$

The expression on the RHS is then the critical value of α . Let us consider an example using some fairly realistic figures. Take an individual who wants services from a \$50,000 house. He has the choice of renting or buying the house. Suppose

$$i_1 = .14 \quad (\text{individual can lend funds at 14\%})$$

$$i_2 = .18 \quad (\text{individual must pay 18\% on borrowed funds})$$

$$\dot{p} = .08 \quad (\text{inflation rate of 8\%})$$

$$E = 3120 \quad (\text{rent for the house is \$3120 per year, or \$60 per week})$$

9. The Algebra for this section can be found in Appendix C.

$OC = 920$ (other costs of owning the house would be \$920 per year).

$\tau = .32$ (marginal tax rate for the individual is 32%).

Then $\alpha^* = 0.66$

Thus, if the individual needs to borrow more than 34% of the purchase price (i.e. \$17,000), then he would be better off renting the house.

Under present policies in Australia, the borrowing rate for home-buyers is subsidised and thus 18% is probably too high a value to assume for the borrowing rate in the above example.

Suppose i_2 is as low as 12.5%. This would give a value of .03 for α^* .

Obviously, then, the subsidy on the borrowing rate can make a dramatic difference.

This indicates a method of helping to assess the effects of reducing or eliminating the subsidy on the borrowing rate for home-buyers. More accurate figures on the various rates would need to be obtained. It can be said that the direction of the result of such action would be that more people would be better off (in a financial sense) if they rented.

It may be noted here that (4) may be used as the criterion for decision purposes, regardless of the influences on the interest rate. It may well be that the non-indexation of the tax base has caused interest rates to rise by more than the rate of inflation (as is suggested in section 3) and it may also be that there are other influences on market rates of interest. However, expression (4) does not rely on any particular mechanism. It just takes the interest rates as given. It allows calculation of a critical value of α , regardless of

the underlying causes of the existence of such a critical value.

2. A comment on unanticipated inflation

So far, nothing has been explicitly said about unanticipated inflation and in fact, most of the analysis has assumed anticipated inflation only. The reason is that, from the point of view of making a decision at the beginning of a period, it is only anticipated inflation that is taken into account. Suppose we want to know how unanticipated inflation will affect the ex post costs of one decision compared with another. Then it can just be pointed out that if the actual rate of inflation was higher than the anticipated rate of inflation (i.e. positive unanticipated inflation), it advantages borrowers (whether home-buyers or commercial borrowers) and disadvantages lenders. Of course, the opposite holds if actual inflation was lower than anticipated inflation.

3. Consequences of Tax Deductibility of Mortgage Interest

At the beginning of section 4, it was mentioned that there is a debate in Australia at present as to whether or not mortgage interest should be tax deductible. It was pointed out that the arguments being used to support the proposal are not valid. Suppose, however, that the government decided to introduce tax deductibility of mortgage interest. Using the same framework as that employed in section 3, we can work out what effect the move would have on the decision to rent or to buy a house.

The end of period net wealth for the home-buyer would be

$$W(B) = R + \alpha K + K\dot{p} - (1-\tau^1)i(1-\alpha)K - OC$$

The end of period wealth in the case of renting remains the same at

$$W(A) = R + \alpha K + (1-\tau^1)i\alpha K - E$$

Using propositions 1 and 2 that $i = r(1+\dot{p}) + \frac{\dot{p}}{1-\tau}$
and $E = r(1+\dot{p})K + OC$,

it can be calculated that

$$W(B) = W(A) + \tau^1 i K - \frac{\tau \dot{p}}{1-\tau} K \quad (5)$$

where τ^1 = marginal tax rate for the individual. τ = most common tax rate for borrowers and lenders. Thus, the subsidy to the home-buyer is now

$$\tau^1 i K - \frac{\tau \dot{p}}{1-\tau} K$$

This will always be positive if $\tau^1 > \tau$. In the case where $\tau^1 < \tau$, the subsidy will be positive if $\tau r(1+\dot{p}) > (\tau - \tau^1)i$.

If $\tau^1 = \tau$, the subsidy can be written as $\tau r(1+\dot{p})K$.

The most important point to note is that the subsidy is now independent of the proportion of equity in the house. This means that a person with no money to put into a house could borrow the full amount K and receive the same level of subsidy as a person who fully owned a house (as long as they are on the same marginal tax rate).

This has important consequences for incentives. There is now no incentive for a person to have a high proportion of equity in a house, since he receives the same subsidy, regardless of the proportion of equity. This result holds, whether or not there is inflation and regardless of whether or not the tax base is indexed. (The actual level of the subsidy will differ, but it remains independent of the proportion of equity in the house).

It is doubtful that the government would wish incentives to be structured in such a way. Presumably the present subsidy is designed to encourage home ownership and not just home purchase. The government tax collections would fall, because of the reduced

tax base. This would lead to the usual pressures caused by a shortage in government funds.

Tax deductibility has been argued for in the press, on the grounds that it would achieve tax equity for home-buyers compared with commercial borrowers. On the contrary, it makes the difference between them even wider. All home-buyers (and not just home owners) would be better off than the commercial borrower to the full extent of the subsidy to home-buyers.

Another argument that is used in the press is that tax deductibility of mortgage interest will help the poorer sections of the community. This is to some extent true, but it will help the richer sections even more! This is because the higher the marginal tax rate, the higher the subsidy. (Also, the more expensive is the home, the greater is the subsidy). What's more, our model shows that even with tax deductibility of mortgage interest, individuals on low marginal tax rates may be better off renting rather than borrowing. Then there is the question of how the additional tax revenue (to compensate for the reduction due to tax deductibility of mortgage interest) will be raised. It may be that the poorer sections of the community end up paying for their additional subsidy anyway, through increased taxes.

Thus, tax deductibility of mortgage interest would not encourage home ownership, only home purchase, and it is quite possible that it would not help the poorer families to purchase their own homes.

6. CONCLUSION

The major result of this paper is as follows: if borrowing rates for home-buyers are any higher than the real rate of return on the house (i.e. the value of the housing services) plus the rate of increase in the nominal value of the house, there will be additional costs imposed on home-buyers which are not borne by other participants in the capital market. In some cases, these additional costs may outweigh the subsidies to home-buyers. If so, individuals would be better off as net lenders.

This result also holds for other loans (say, personal loans) where the services yielded by the purchased asset are not taxable and consequently the loan interest is not tax deductible. If the rate of return in services yielded by the asset plus nominal capital gains is less than the borrowing rate, the tax gain (in the form of non-taxation of services) will be mitigated to some extent by the high interest costs. It may be that the individual would be better off hiring the asset and lending funds on the capital market.

If the objective is to remove these additional costs, then the market rate of interest must be lowered. Tax deductibility of home loan interest will not achieve this result.

The policy recommendation arising from this paper is indexation of the tax base i.e. allowing deduction of capital losses on financial assets from assessable income and taxing nominal capital gains on liabilities. This would lower the market rate of interest and thus remove the additional costs imposed on home-buyers. It does not, however, remove the regressive nature of the government subsidy to home-buyers.

To achieve this, one would require to tax imputed rental income, and allow a tax rebate for home-buyers. The rebate could be so designed as to increase with the proportion of home-buyer's equity, thus encouraging home ownership rather than just home purchase.

APPENDIX A

Components of net wealth at t_1

A. Renting

Interest income	= $i\alpha K$ before tax
	= $(1-\tau)i\alpha K$ after tax
Asset	= αK
Rental Cost	= E
Housing Services	= R

Therefore, $W(A) = R + \alpha K + (1-\tau)i\alpha K - E$

B. Buying

Asset (house)	= $K(1+\dot{p})$ (maintained its real value)
Interest cost	= $i(1-\alpha)K$
Liability	= $(1-\alpha)K$
Housing services	= R
Other costs	= OC

Therefore, $W(B) = R + K(1+\dot{p}) - (1-\alpha)K - i(1-\alpha)K - OC$
 $= R + \alpha K + K\dot{p} - i(1-\alpha)K - OC$

Proposition 1.

The market rate of interest i is determined by lenders and borrowers in the market. Consider first the lender.

The lender lends V at t_0 .

At t_1 , he holds asset of value V and receives interest iV . He is taxed on iV and so receives $(1-\tau)iV$ after tax. Therefore, net wealth is $V + (1-\tau)iV$.

If the lender is to make a real return at the rate of $r(1-\tau)$ (which he would in the absence of inflation), he would require

Appendix A

$$V + (1-\tau)iV = V(1+\dot{p}) + (1-\tau)rV(1+\dot{p})$$

$$1 + (1-\tau)i = 1 + \dot{p} + (1-\tau)r(1+\dot{p})$$

$$i = \dot{p}(1-\tau)^{-1} + r(1+\dot{p})$$

If the market rate of interest is set at this level, the lender will always receive an effective real rate of return of r .

Now consider a borrower (other than a person borrowing to buy a house to live in).

The borrower engages in a productive project which yields a real rate of return r . At t_0 , he borrows V at interest rate i .

At t_1

$$\text{project + return to project} = V(1+\dot{p}) + rV(1+\dot{p})$$

$$\text{liability} = V$$

$$\text{interest payments} = iV$$

$$\text{tax payments} = \tau \times (\text{return on project} - \text{interest payments})$$

$$= \tau (rV(1+\dot{p}) - iV)$$

$$\text{Net gain (after tax) at } t_1 = V(1+\dot{p}) + (1-\tau)(rV(1+\dot{p})-iV)-V$$

The borrower will be prepared to pay interest rate i for funds up to the stage where net gain equals zero.

$$\text{i.e. } V(1+\dot{p}) + (1-\tau)(rV(1+\dot{p})-iV)-V = 0$$

$$\dot{p} + (1-\tau)(r(1+\dot{p})-i) = 0$$

$$(1-\tau)i = \dot{p} + (1-\tau)r(1+\dot{p})$$

$$i = \dot{p}(1-\tau)^{-1} + r(1+\dot{p})$$

Thus, the equilibrium market rate of interest in the economy is

$$i = r(1+\dot{p}) + \frac{\dot{p}}{1-\tau}$$

Appendix A

(Note that this implies that there is no increase in the real level of income tax collections in the economy induced by inflation. There is a 'wealth' tax on lenders, but this is passed straight on to borrowers because of the lack of a capital gains tax. The interest rate adjusts so that borrowers must pay back this gain to lenders).

Proposition 2.

Consider a person who has K to invest at t_0 . He has the choice of investing in fixed interest financial assets at market rate of interest i or buying a house of value K and receiving rent of E (before tax) at t_1 . (He could also invest in real assets yielding a return of r . We have shown that he will be indifferent between this and investing in fixed interest financial assets at the equilibrium rate of interest).

If he chooses to invest in fixed interest assets, net wealth after tax at t_1 is $K + (1-\tau)iK$. If he chooses to buy a house, net wealth at t_1 is $K(1+\dot{p}) + (1-\tau)(E-OC)$. (It is assumed that OC is tax deductible to the landlord.)

Competition will be such that these values will be equal in equilibrium.

$$\text{i.e. } K + (1-\tau)iK = K(1+\dot{p}) + (1-\tau)(E-OC)$$

$$\begin{aligned} \text{i.e. } (1-\tau)E &= (1-\tau)iK - K\dot{p} + (1-\tau)OC \\ &= (1-\tau)(r(1+\dot{p}) + \frac{\dot{p}}{1-\tau})K - K\dot{p} + (1-\tau)OC \\ &= (1-\tau)r(1+\dot{p})K + (1-\tau)OC \end{aligned}$$

$$\text{Therefore, } E = r(1+\dot{p})K + OC$$

Appendix A

Derivation of α^*

$$W(A) = R + \alpha K + i\alpha K - \tau i\alpha K - E$$

$$W(B) = R + \alpha K + i\alpha K + K\dot{p} - iK - OC$$

$$= R + \alpha K + i\alpha K - \tau i\alpha K - E + \tau i\alpha K + E + K\dot{p} - iK - OC$$

$$= W(A) + \tau i\alpha K + E + K\dot{p} - iK - OC$$

$$= W(A) + \tau i\alpha K + (E-OC) - K(1-\dot{p})$$

$$= W(A) + \tau i\alpha K + r(1+\dot{p})K - K(r(1+\dot{p}) + \frac{\tau\dot{p}}{1-\tau})$$

$$= W(A) + \tau i\alpha K - \frac{\tau\dot{p}}{1-\tau}K$$

$$W(B) < W(A) \text{ if } \tau i\alpha K < \frac{\tau\dot{p}}{1-\tau}K$$

$$\text{i.e. if } \alpha < \frac{\dot{p}}{i(1-\tau)}$$

$$\text{Thus, } \alpha^* = \frac{\dot{p}}{i(1-\tau)}$$

Partial Derivatives of α^*

The partial derivatives $\frac{\partial \alpha^*}{\partial \dot{p}}$, $\frac{\partial \alpha^*}{\partial r}$ and $\frac{\partial \alpha^*}{\partial \tau}$ depend on the partial derivatives of i with respect to $\dot{p}$, r and τ .

$$\begin{aligned} \frac{\partial i}{\partial \dot{p}} &= \frac{\partial}{\partial \dot{p}} (r(1+\dot{p}) + \frac{\dot{p}}{1-\tau}) \\ &= r + \frac{1}{1-\tau} = \frac{1-r}{\dot{p}} \end{aligned}$$

$$\frac{\partial i}{\partial r} = 1 + \dot{p}$$

$$\frac{\partial i}{\partial \tau} = \frac{\dot{p}}{(1-\tau)^2}$$

$$\frac{\partial \alpha^*}{\partial \dot{p}} = \frac{i(1-\tau) - \frac{\partial i}{\partial \dot{p}}}{i^2(1-\tau)^2}$$

$$= \frac{i(1-\tau) - (1-r)(1-\tau)}{i^2(1-\tau)^2}$$

$$= \frac{r}{i^2(1-\tau)}$$

$$> 0$$

Appendix A

$$\begin{aligned}\frac{\partial \alpha^*}{\partial r} &= \frac{\partial}{\partial r} \left(\frac{\dot{p}}{i(1-\tau)} \right) \\ &= - \frac{\dot{p}}{1-\tau} \cdot \frac{1}{i^2} \cdot \frac{\partial i}{\partial r} \\ &= - \frac{\dot{p}(1+\dot{p})}{i^2(1-\tau)} \\ &< 0\end{aligned}$$

$$\begin{aligned}\frac{\partial \alpha^*}{\partial \tau} &= \frac{\partial}{\partial \tau} \left(\frac{\dot{p}}{i(1-\tau)} \right) \\ &= - \frac{\dot{p}}{i^2(1-\tau)^2} \left[\frac{\partial}{\partial \tau} (i(1-\tau)) \right] \\ &= - \frac{\dot{p}}{i^2(1-\tau)^2} \left[\frac{\partial i}{\partial \tau} (1-\tau) - i \right] \\ &= - \frac{\dot{p}}{i^2(1-\tau)^2} [-r(1+\dot{p})] \quad \text{since } i = r(1+\dot{p}) + \frac{\dot{p}}{1-\tau} \\ &= \frac{\dot{p}r(1+\dot{p})}{i^2(1-\tau)^2} \\ &> 0\end{aligned}$$

Thus, $\frac{\partial \alpha^*}{\partial \dot{p}} > 0$, $\frac{\partial \alpha^*}{\partial r} < 0$ and $\frac{\partial \alpha^*}{\partial \tau} > 0$

Differing marginal tax rates

$$W(A) = R + \alpha K + (1-\tau^1)\alpha K - E$$

$$W(B) = R + \alpha K + K\dot{p} - i(1-\alpha)K - OC$$

$$= W(A) + \tau^1 \alpha K - \frac{\tau \dot{p}}{1-\tau} K$$

where τ^1 = marginal tax rate for individual

$$W(B) < W(A) \text{ if } \tau^1 \alpha K < \frac{\tau \dot{p}}{1-\tau} K$$

$$\text{i.e. } \alpha < \frac{\dot{p}}{i(1-\tau)} \cdot \frac{\tau}{\tau^1}$$

$$\text{Therefore, } \alpha^* = \frac{\dot{p}}{i(1-\tau)} \cdot \frac{\tau}{\tau^1}$$

Appendix A

Net wealth at t_1 for choice C.

Asset (house)	= $K(1+\dot{p})$
Rental Receipts	= $(1-\tau^1)E$ after tax
Maintenance, etc., costs	= $(1-\tau^1)OC$ after tax
Interest cost	= $(1-\tau^1)i(1-\alpha)K$ after tax
Liability	= $(1-\alpha)K$
Housing services	= R
Rental payments	= E

$$\begin{aligned}
 \text{Therefore, } W(C) &= R + (1-\tau^1)(E-OC) + K(1+\dot{p}) - (1-\alpha)K - (1-\tau^1)i(1-\alpha)K - E \\
 &= R + (1-\tau^1)r(1+\dot{p})K + \alpha K + K\dot{p} - (1-\tau^1)r(1+\dot{p})K(1-\alpha) \\
 &\quad - (1-\tau^1)\frac{\dot{p}}{1-\tau}(1-\alpha)K - E \\
 &= R + \alpha K + K\dot{p} + \alpha(1-\tau^1)r(1+\dot{p})K - \frac{\dot{p}(1-\tau^1)}{(1-\tau)}(1-\alpha)K - E \\
 &= R + \alpha K + K\dot{p} + \alpha(1-\tau^1)iK - \alpha(1-\tau^1)\frac{1}{(1-\tau)}\dot{p}K - \frac{\dot{p}(1-\tau^1)}{1-\tau}(1-\alpha)K \\
 &\quad - E \\
 &= R + \alpha K + \alpha(1-\tau^1)iK + K\dot{p}\left(1 - \frac{1-\tau^1}{1-\tau}\right) - E \\
 &= R + \alpha K + \alpha(1-\tau^1)iK + K\dot{p}\frac{\tau^1-\tau}{1-\tau} - E \\
 &= W(A) + K\dot{p}\frac{\tau^1-\tau}{1-\tau}
 \end{aligned}$$

$$W(C) < W(A) \text{ if } \tau^1 < \tau$$

$$\text{Since } W(B) = W(A) + \tau^1\alpha K - \frac{\tau\dot{p}}{1-\tau}K$$

$$W(C) = W(B) - \tau^1\alpha K + \frac{\tau\dot{p}}{1-\tau}K + K\dot{p}\frac{(\tau^1-\tau)}{(1-\tau)}$$

$$W(C) = W(B) - \tau^1\alpha K + \frac{\tau^1\dot{p}}{1-\tau}K$$

$$\text{Therefore, } W(C) > W(B) \text{ if } \tau^1\alpha K < \frac{\tau^1\dot{p}}{1-\tau}K$$

$$\alpha < \frac{\dot{p}}{i(1-\tau)}$$

Thus, for $\tau^1 \geq \tau$, the decision between B and C depends on the value of α compared with

$$\alpha^+ = \frac{\dot{p}}{i(1-\tau)}$$

APPENDIX B

Net wealth at t_1 assuming taxation of imputed rent.

For the home-buyer, the tax paid on net income from the house would be:

$$\tau(E - i(1-\alpha)K - OC).$$

$$\begin{aligned} \text{Therefore, } W(B) &= R + \alpha K + K\dot{p} - i(1-\alpha)K - OC - \tau(E - i(1-\alpha)K - OC) \\ &= R + \alpha K + K\dot{p} - (1-\tau)i(1-\alpha)K - OC - \tau(E - OC) \\ &= R + \alpha K + K\dot{p} - (1-\tau)r(1+\dot{p})(1-\alpha)K - \dot{p}(1-\alpha)K - OC \\ &\quad - \tau r(1+\dot{p})K \\ &= R + \alpha K + r(1+\dot{p})K + \tau r(1+\dot{p})K + (1-\tau)r(1+\dot{p})\alpha K \\ &\quad + (1-\tau)\frac{\dot{p}}{1-\tau}\alpha K - OC - \tau r(1+\dot{p})K \\ &= R + \alpha K - E + (1-\tau)(r(1+\dot{p}) + \frac{\dot{p}}{1-\tau})\alpha K \\ &= R + \alpha K + (1-\tau)i\alpha K - E \\ &= W(A) \end{aligned}$$

Differing marginal tax rates

An individual on a low marginal tax rate should be a net lender and a person on a high marginal tax rate should be a net borrower. This can be seen as follows:

The interest rate that an individual is willing to receive (if lending) or pay (if borrowing) was shown in Appendix A to be

$i = r(1+\dot{p}) + \frac{\dot{p}}{1-\tau}$ where τ^1 is the marginal tax rate for the individual.

If the market rate of interest is determined by the most common marginal tax rate, τ (which will be in between the lower and higher marginal tax rates), then it will be:

Appendix B

$i_m = r(1+\dot{p}) + \frac{\dot{p}}{1-\tau}$ where i_m = market rate of interest.

If $\tau^1 < \tau$ then $i_m > i$ and so the market rate of interest is too high for individuals on low marginal tax rates. That is, if they are borrowers, the effective after-tax rate that they pay will be greater in times of inflation than if there were no inflation. Conversely, if they are lenders, they receive a higher after-tax return than they would in the absence of anticipated inflation.

By the same reasoning, it can be deduced that an individual on a high marginal tax rate would be better off as a borrower rather than a lender in times of inflation.

Indexation of the Tax Base

Proposition 3:

The market rate of interest is determined by lenders and borrowers in the market, who try to maintain the real after-tax return of their activities.

The lender lends V at t_0 . With inflation at the rate of $\dot{p}$, this is equivalent to $V(1+\dot{p})$ at t_1 . This is the real value of wealth at t_0 measured at t_1 .

At t_1 , the lender holds asset of face value V (i.e. the nominal value of the financial asset has not changed) and receives interest iV .

The change in real wealth over the period (i.e. the income for the period) is equal to wealth at t_1 minus wealth at t_0 .

$$\begin{aligned} \text{i.e. } & V + iV - V(1+\dot{p}) \\ & = V(i-\dot{p}) \end{aligned}$$

The lender is taxed on this amount and so receives $(1-\tau)V(i-\dot{p})$ after tax.

Appendix B

If he is to make a real return at the rate of $r(1-\tau)$ (which he would in the absence of inflation), he would require:

$$V(1+\dot{p}) + (1-\tau)V(i-\dot{p}) = V(1+\dot{p}) + V(1+\dot{p})r(1-\tau)$$

$$(1-\tau)(i-\dot{p}) = (1+\dot{p})r(1-\tau)$$

$$i = (1+\dot{p})r + \dot{p}$$

Now consider a borrower (other than a person borrowing to buy a house to live in).

The borrower engages in a productive project which yields a real rate of return r . At t_0 , his net wealth is zero and he borrows V at interest rate i .

At t_1 ,

$$\text{project and return on project} = V(1+\dot{p}) + rV(1+\dot{p})$$

$$\text{liability} = V$$

$$\text{interest payments} = iV$$

Change in wealth over the period is net wealth at t_1 (since net wealth at t_0 was zero)

$$= V(1+\dot{p}) + rV(1+\dot{p}) - V - iV$$

$$= V\dot{p} + rV(1+\dot{p}) - iV$$

$$\text{Net gain (after tax) at } t_1 = (1-\tau)(V\dot{p} + rV(1+\dot{p}) - iV)$$

At equilibrium this will be zero

$$\text{i.e. } V\dot{p} + rV(1+\dot{p}) - iV = 0$$

$$i = r(1+\dot{p}) + \dot{p}$$

Thus, the equilibrium market rate of interest is

$$i = r(1+\dot{p}) + \dot{p}$$

Proposition 4.

For an individual who chooses to invest K in fixed interest assets at t_0 , his net wealth at t_1 is $K(1+\dot{p}) + (1-\tau)(i-\dot{p})K$.

Appendix B

The individual who chooses to buy a house of value K at t_0 and rent it out for E (at t_1) has net wealth at t_1 of $K(1+\dot{p}) + (1-\tau)(E-OC)$.

In equilibrium, $K(1+\dot{p}) + (1-\tau)(i-\dot{p})K = K(1+\dot{p}) + (1-\tau)(E-OC)$

$$\therefore E = (i-\dot{p})K + OC$$

$$= r(1+\dot{p})K + OC, \text{ since } i = r(1+\dot{p}) + \dot{p}$$

Net wealth at t_1

With indexation of the tax base, a person receiving $i\alpha K$ in interest pays $\tau(i-\dot{p})\alpha K$ in taxes.

Therefore,

$$W(A) = R + \alpha K + \dot{p}\alpha K + (1-\tau)(i-\dot{p})\alpha K - E$$

$$= R + \alpha K(1+\dot{p}) + (1-\tau)r(1+\dot{p})\alpha K - E$$

$$\text{since } i = r(1+\dot{p}) + \dot{p}$$

$$W(B) = R + \alpha K + i\alpha K + K\dot{p} - iK - OC$$

$$= R + \alpha K + i\alpha K - r(1+\dot{p})K - OC \text{ since } i-\dot{p} = r(1+\dot{p})$$

$$= R + \alpha K + i\alpha K - E \text{ since } E = r(1+\dot{p})K + OC$$

$$= R + \alpha K + (r(1+\dot{p}) + \dot{p})\alpha K - E$$

$$= R + \alpha K(1+\dot{p}) + r(1+\dot{p})\alpha K - E$$

APPENDIX C

Critical value of α

$$W(A) = R + \alpha K + (1-\tau)i_1 \alpha K - E$$

$$W(B) = R + K(1 + \dot{p}) - (1 - \alpha)K - i_2(1 - \alpha)K - OC$$

where i_1 = lending rate for the individual

i_2 = borrowing rate for the individual

$$\begin{aligned} W(B) &= R + \alpha K + K\dot{p} - i_2(1 - \alpha)K - OC + (1-\tau)i_1 \alpha K - E - (1-\tau)i_1 \alpha K + E \\ &= W(A) + K\dot{p} - i_2(1-\alpha)K + (E - OC) - (1 - \tau)i_1 \alpha K \end{aligned}$$

$$W(B) < W(A) \text{ if } K\dot{p} - i_2(1-\alpha)K + (E - OC) - (1-\tau)i_1 \alpha K < 0$$

$$\alpha(i_2 - (1-\tau)i_1)K < i_2K - K\dot{p} - (E - OC)$$

$$\alpha < \frac{(i_2 - \dot{p})K - (E - OC)}{(i_2 - (1-\tau)i_1)K}$$

$$\text{Therefore, } \alpha^* = \frac{(i_2 - \dot{p})K - (E - OC)}{(i_2 - (1-\tau)i_1)K}$$

Tax deductibility of mortgage interest

Mortgage interest for home-buyer is $i(1 - \alpha)K$. Therefore, the after-tax cost to the home-buyer is $(1 - \tau^I)i(1 - \alpha)K$.

$$W(B) = R + \alpha K + K\dot{p} - (1 - \tau^I)i(1 - \alpha)K - OC$$

$$= R + \alpha K + (1 - \tau^I)i\alpha K + K\dot{p} - (1 - \tau^I)iK - OC + E - E$$

$$= W(A) + K\dot{p} - (1 - \tau^I)iK + E - OC$$

$$= W(A) + K\dot{p} - (1 - \tau^I)iK + r(1 + \dot{p})K \text{ since } E = r(1 + \dot{p})K + OC$$

Appendix C

$$= W(A) + K\dot{p} + \tau^I iK - (r(1 + \dot{p}) + \dot{p} + \frac{\tau\dot{p}}{1 - \tau})K + r(1 + \dot{p})K$$

$$= W(A) + \tau^I iK - \frac{\tau\dot{p}}{1 - \tau} K$$

$$\tau^I iK - \frac{\tau\dot{p}}{1 - \tau} K < 0 \text{ if } (\tau^I - \tau)i + \tau(1 - \frac{\dot{p}}{1 - \tau}) < 0$$

$$(\tau^I - \tau)i + \tau(r(1 + \dot{p})) < 0$$

$$\tau r(1 + \dot{p}) < (\tau - \tau^I) i$$

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DISCUSSION PAPERS

<u>No.</u>	<u>Author</u>	<u>Title</u>
1	F.H. Gruen	Editor's Summary of the Papers and Proceedings of the Australian Industry Conference*
2	M. Folie	The Effects of Rising Energy Prices on The Volume and Structure of Australian Industry
3	G. Hollander & J. Marsden	The Effect of Internal Cost and Exchange Rate Changes on the Competitiveness of Australian Industry
4	B.L. Johns & J.S. Metcalfe	The Increasing Competitiveness of Developing Economies and Their Impact on Australian Industry
5	K. Anderson & R.H. Snape	The Regulation of Import Competition and its Effects on the Environment of Australian Industry
6	N. Norman	Mergers, Trade Practices Policy and Internal Competition
7	B. de Boos, P. Williamson & T. Valentine	Financing of Industry: Trends and Policy Issues
8	C.G.F. Simkin	Closer Economic Ties with New Zealand - Implications for Industry on Both Sides of the Tasman and for the Two Economies Generally
9	A. Krueger	How Best to Move Towards Freer Trade - Some International Perspectives
(* Papers 1-9 are the papers and proceedings of the Australian Industry Conference, held at the ANU on 11-13 April 1980.)		
10	W.M. Corden	Taxation, Real Wage Rigidity and Employment
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