Stockholm School of Economics
Department of Economics
Master's Thesis 2006

# The Homeowner Tax and Economic Efficiency in Sweden

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**Abstract**

Several studies have shown that housing capital receives preferential tax treatment in many countries, and that this creates welfare reducing distortions. This happens through an over-investment in housing capital that distorts the composition of the aggregate capital stock. In Sweden, the tax reform of 1991 aimed at creating tax neutrality between different types of capital. This thesis argues that the neutrality goal not yet has been reached and that there is scope for welfare enhancing reforms. It also tries to quantify the potential welfare gains. An increase in the homeowner tax to 1.5 percent is found to be welfare enhancing, while a removal of the homeowner tax and the mortgage interest deductions is found not to effect welfare. These conclusions are reached through simulations of different fiscal policy regimes in a dynamic long-run equilibrium model of the Swedish economy.

Tutor: David Domeij
Presented: 2006-11-10

**Acknowledgements:**
I would like to thank my tutor David Domeij for quick support with all kinds of practical matters and dedicated help with ideas and guidelines throughout my work. Without his help this thesis could not have been written. I would also like to thank Björn Larsson for proofreading.
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# Introduction

In Sweden, as well as in many other industrialized countries, housing capital has received preferential tax treatment relative to other types of capital (Agell et al, 1996). It has been shown in both static and dynamic models that this causes distortions (see e.g. Skinner 1996 and Gervais 2002). That is, given that capital income in general is already taxed[1], it can be shown that housing capital income should be taxed at the same rate. This tax neutrality was the aim of the Swedish tax reform of 1991. The tax reform involved a lot more than housing, with tax rate cuts and a tax base broadening, but there was widespread concern that investment in housing capital in particular was too heavy. The implication of the reform was a reallocation of the total tax burden from labor income to consumption and individual capital income, including housing (Agell et al, 1996).

Housing taxation poses specific problems due to the properties of return to housing compared to return to other types of capital investments. By owning its residence, a household in effect pays rent to itself. This is an implicit rental income, denoted *imputed rent*. It is a non-monetary transaction, and hence not subject to normal income taxation. To see this, consider an economy with only two identical households, A and B, each owning an identical house yielding the same amount of utility. Consider first the case where household A rents household B's house, and household B rents household A's house. The households will then act as both landlords and tenants, paying each other a monetary rent that can be subject to taxation. Consider then the case where households A and B live in their own houses. They will get the same utility from housing services (i.e. return to housing) as in the previous case, but no monetary transaction occurs. The amount paid in rent in the first case is now an implicit rental income, imputed rent. To be able to enjoy this imputed rent in practise, the household needs to put up capital. Therefore, imputed rents can be compared with other types of capital income, as they constitute the return to owner-occupied housing capital.

Since imputed rents are not directly observable, they have to be taxed indirectly. This can be done through adding a "standard income" of some percentage of the assessed value of the house to the household's capital income. Another way is to use a homeowner tax. With a proportional capital income tax like the Swedish, standard income taxation is in principle equivalent with a homeowner tax (Ds 1998:3). That is, for every standard income tax rate there is a corresponding

[1] Whether or not capital income should be taxed is not dealt with in this thesis. For a survey of the literature on optimal capital income taxation, see e.g. Atkeson, Chari and Kehoe (1999). They show that the optimal tax rate on capital income is zero in a realistic setting.

homeowner tax rate. Since a homeowner tax is used today, and to avoid confusion, I will discuss percentage figures in terms of homeowner tax rates only.

## *The Situation Today and Proposed Reforms*

The return to owner-occupied housing capital can be split into implicit rental income and capital gains. For equal taxation with interest rate income from bank savings, the homeowner tax should on the one hand capture the imputed rents and on the other hand compensate for the fact that the effective tax rate on capital gains is lower than the nominal rate[2]. This was the idea in the tax reform of 1991. With the assumption of a long-run real interest rate of 3 percent and an inflation rate of 4 percent, the homeowner tax implied was 2.1 percent (see e.g. Ds 1998:3 and SOU 1994:57). For housing-political reasons the level was adjusted downward to 1.5 percent. It has been adjusted several times since then, and is today 1 percent of the assessed value of the house. The assessed value of the house in turn, is 75 percent of the estimated market value of the house. In figures, the homeowner tax is a relatively important source of revenues in the government budget. In the budget proposition of 2006, the Swedish government estimates the revenues from the homeowner tax to 28.1 billion SEK. That constitutes 67 percent of the entire property taxation revenues, and can also be compared with e.g. the government income tax of 40.6 billion SEK (Budgetpropositionen, 2006).

With a homeowner tax based on assessed market values, capital gains will be taxed when they occur and not necessarily when they are realized. Englund (1994) recognizes that this is not done with other capital assets, but his conclusion is that the homeowner tax still should be adjusted to the lower efficient tax rate. He develops a model for neutral taxation of housing capital, showing how the homeowner tax rate can be determined to include both the imputed rents and the low effective tax rate on capital gains. This model is also used by the Swedish Finance Department in Ds 1998:3, leading to the conclusion that the homeowner tax rate should be set between 1.8 and 2.1 percent, depending on the interest rate used. In Ds 1998:3 real interest rates of 4-5 percent are used rather than the 3 percent that was used in the tax reform of 1991, and it also points out that business capital equity might be a more relevant comparison with housing capital than bank

[2] Tax payment upon realization of a capital gain instead of when it accrues is equivalent to giving the tax payer an interest free loan of an amount equal to the tax liability (King, 1977). This amount is then reinvested into the asset without taxation.

savings[3]. This lowers the neutral homeowner tax, since business capital equity is tax favoured relative to interest rate income from bank savings.

Boije and Shahnazarian (2000) argue against the principle of taxing capital gains when they occur and not when they are realized. They object that in this way a capital gain that is never realized will sometimes be taxed. They also point out that since the effective tax rate on capital gains decrease with the holding period of the asset, and since average holding periods have to be used when calibrating the homeowner tax rate, less mobile households will be tax favoured. The liquidity problem for certain households will also be greater when the homeowner tax is supposed to compensate for a low effective tax rate on capital gains. Boije and Shahnazarian shows, in a model where housing capital is compared with other capital assets, that for equal taxation in the short run the homeowner tax rate should follow the interest rate, and that for neutrality in the long run a homeowner tax rate of 1.2% is reasonable.

In the public debate in Sweden some groups argue for a complete removal of the homeowner tax. This is mostly a political argument, but there is also an economic argument. It is based on the view that houses are not capital assets but rather durable consumption goods like boats and cars, and hence that their return should be taxed as such (i.e. not taxed at all). Houses are considered to be bought to generate some form of non-monetary utility. This view is discussed in Lind (2000). He identifies ways to create neutral taxation between rental and owner-occupied housing when housing is considered a durable consumption good. The one most commonly heard in the public debate is to remove the homeowner tax and change the rules for mortgage interest rate deductions. With the current homeowner tax rate of 1 percent, the size of the mortgage interest deductions is about the same as the revenues from the homeowner tax (see e.g. Boije & Lind 2002, or Nordling 1999). To remove the homeowner tax and the interest mortgage deductions is also identified as the most realistic option to remove the preferential treatment of housing capital relative to other capital in the U.S. by Gervais (2002).

The view that houses are durable consumption goods can be criticised on several grounds. Other durable consumption goods represent much smaller values and have substantially shorter economic lifetimes (Englund, 2001). This shorter economic lifetime also implies that they rarely increase in value as housing can do. Several official reports from the Swedish government (see e.g. SOU 1994:57 and SOU 2004:36) also conclude that housing is to be considered a capital good.

[3] Englund (1994) also reaches this conclusion.

### *Neutrality and Economic Efficiency*

The studies mentioned in the introduction suggest that housing capital still is tax favoured relative to other types of capital and that we should have a higher homeowner tax rate, although they suggest different rates. According to the idea of no homeowner tax it is irrelevant whether or not housing capital is tax favoured relative to different capital assets, because it should be compared with durable consumption goods.

The purpose of this thesis is to quantitatively evaluate the economic efficiency and welfare aspects of different reforms of the homeowner tax. I will build a model of the Swedish economy and calibrate it based on today's fiscal policy regime. With this as the benchmark economy, I will run two different simulations. First, I will simulate the outcome of a higher homeowner tax. I will test the effects of the tax rate 1.5 percent, which is the median of the suggestions interval discussed, and also the same as the rate that prevailed right after the tax reform of 1991. Second, I will evaluate the effects of a complete removal of the homeowner tax along with a removal of the mortgage interest deductions.

# Model

I will lay out a general equilibrium model with overlapping generations and no uncertainty, where households live for six periods. Time is discrete, with a new generation consisting of one representative household being born every time period, starting at $t = 1$. The notation is borrowed from McCandless and Wallace (1991) and the framework of the model builds to a large extent on Gervais (2002), whose model follows the tradition initiated by Auerbach and Kotlikoff (1987). However, Gervais models the U.S. economy while I try to capture the Swedish case. The most important model differences are; first, I model taxation of the value of the property, whereas Gervais models taxation of imputed rents. Second, I model a small open economy, whereas Gervais models a closed economy. Third, Gervais models the household life-cycle based on 52 periods, where each period represents one year, whereas I use six ten-year periods, representing four working-age-stages and two retirement periods of the household life-cycle. Fourth, I will use only one representative household in each generation, whereas Gervais models heterogeneous households. Expectations are assumed to be rational, which in this context of no uncertainty translates into perfect foresight. The model is then solved with numerical methods.

## *Households*

*Preferences*

Assume that households derive utility from consumption of a composite consumption good, denoted *c,* and housing services, denoted *x*. Lifetime utility *U* is given by

$$U_t = \sum_{j=1}^{6} \beta^{j-1} u_t(t+j-1), \qquad \text{where } \beta > 0, \qquad u_t(t) = u\big(c_t(t), x_t(t)\big)$$

The subscript *t* denotes that the household was born in period *t*, the index *v* in parentheses represent that it is utility (or consumption of composite goods or housing services) in period *v*, and $\beta$ is the time discount factor. Assume the functional form

$$u_t(t) = \log c_t(t) + \theta \log x_t(t)$$

where $\theta$ is a scaling parameter measuring the weight of housing services in consumption.

*Housing*

The household can either rent or own a house. Housing services are perfectly divisible, where renting has the advantage that no capital is needed as a down payment. Housing capital held by a household is denoted *h*, and housing services rented by a household *s*. Homeowners obtain housing services directly from their housing capital held, so that $h_t(t) = x_t(t)$. There is a minimum down payment requirement when purchasing a house, expressed as a fraction $\gamma$ of the house value. The rest can be financed by a mortgage, denoted *b*, secured by the house. Housing capital depreciates by $\delta_h$ units per unit of capital and period. Assume also that renting and owning add up to total housing consumption and for simplicity that renting and owning are perfect substitutes in consumption, so that

$$x_t(t) = s_t(t) + h_t(t)$$

That is, there is no non-monetary motive to owning a house. Let *p* be the price of housing services in terms of the composite consumption good.

*Income*

Households are endowed with one unit of labor that they supply inelastically every period. This is transformed into $e$ efficiency units of labor every period, where each efficiency unit of labor is paid the wage $w$ in every period. By letting $e$ vary over a household's life cycle we capture the time-varying income profile. Specifically, let $e = 0$ in periods five and six when the household is retired. Instead, the household will receive a lump-sum pension. Let $z$ denote income from labor and pensions, so that $we = z$ for working age households and $\tau_p = z$ for retired households.

There are three types of assets to store wealth and generate capital income; deposits at financial institutions, business capital equity, and housing capital. The first two will pay interest rate $i$ from a no-arbitrage condition, whereas the third pays implicit rental income in the form of imputed rents. This gives the household balance sheet in period $t$

| Assets | | Liabilities | |
|---|---|---|---|
| Housing | $h_t(t)$ | Mortgage | $b_t(t)$ |
| Financial assets | $a_t(t)$ | Net worth | $y_t(t) = a_t(t) + h_t(t) - b_t(t)$ |

where financial assets include deposits at financial institutions and business capital equity.

*Decision Problem*

This specification allows the household to make five savings decisions. The household is born (enter adulthood) without endowments and unable to purchase a house (due to $\gamma$), so in the first period renting a house is the only option. The household works and consumes in the first period and chooses savings to maximize lifetime utility. In the second to fifth period the household might become a homeowner and own more or less housing capital if that is profitable. Since it only has preferences for consumption of goods and housing services it will not leave a bequest. By the end of the fifth period the household will therefore sell all (if any) housing capital still held, and in the last period it will rent all its housing services and consume all savings from previous periods.

The household decision problem can be split into an inter-temporal decision and an intra-period decision. The inter-temporal decision is to choose the amount of savings, i.e. the desired net

worth when entering the next period, whereas the intra-period decision deals with allocating consumption between the composite consumption good and housing services in a given period. Households will then optimize subject to the constraints that follow below.

*Budget constraints*

Every period the household face the budget constraint

$$c_t(t) + px_t(t) + y_t(t+1) \leq$$

$$(1-\tau_w)z_t(t) + y_t(t) + (p - \delta_h - \tau_h)h_t(t) + (1-\tau_y)ia_t(t) - (1-\tau_m)ib_t(t) \qquad (1)$$

where the left hand side shows how income is allocated and the right hand side where it comes from. To the left we have; spending on the composite consumption good and housing services, and savings (expressed as desired net worth when entering the next period). To the right we have; post-tax labor income, net worth from the previous period, post-tax and -depreciation implicit rental income from homeownership, post-tax interest rate income from financial assets, minus mortgage interest payments net of deductibility. This general form budget constraint allows us to distinguish two cases, one for those households renting their housing services and one for homeowners. For those renting their housing capital we have $h_t(t) = b_t(t) = 0$ and $y_t(t) = a_t(t)$, giving the budget constraint

$$c_t(t) + px_t(t) + y_t(t+1) \leq (1-\tau_w)z_t(t) + a_t(t)\left(1 + (1-\tau_y)i\right)$$

and for homeowners we have $x_t(t) = h_t(t)$, giving the budget constraint

$$c_t(t) + (\tau_h + \delta_h)h_t(t) + y_t(t+1) \leq$$

$$(1-\tau_w)z_t(t) + y_t(t) + (1-\tau_y)ia_t(t) - (1-\tau_m)ib_t(t)$$

In the second case *px* cancels out on both sides. Here we can see that homeowners pay housing tax and maintenance (to keep the house from depreciating) instead of paying rent for their housing services.

*Net Worth Constraints*

$$y_t(t+j) \geq \gamma h_t(t+j) \qquad \text{for } j = 0,...,5 \qquad (2)$$

$$a_t(t+j) \geq 0 \qquad \text{for } j = 0,...,5 \qquad (3)$$

*Life Cycle Constraints*

$$c_t(t+j) \geq 0 \qquad \text{for } j = 0,...,5 \qquad (4)$$

$$e_t(t+j) = 0 \qquad \text{for } j = 4,5 \qquad (5)$$

$$\tau_w z_t(t+j) + \tau_y i a_t(t+j) + \tau_h h_t(t+j) - \tau_m i b_t(t+j) \geq 0 \qquad \text{for } j = 0,...,5 \qquad (6)$$

$$a_t(t) = h_t(t) = 0 \qquad (7)$$

Constraint (6) here follows from the specification of mortgage interest deductibility. It states that total tax payments net of deductibility are non-negative.

## *Fiscal Policy*

Assume that there is a time consistent government financing constant government consumption, denoted *G,* and pensions with a balanced budget in every period. The government has at its disposal a proportional tax on labor income, denoted $\tau_w$, a proportional tax on capital income, denoted $\tau_y$, a proportional housing tax on the value of owner-occupied housing capital, denoted $\tau_h$, and another proportional tax on the value of housing capital held by financial institutions, denoted $\tau_f$. Households that finance a house purchase partly by a mortgage are allowed to deduct a share, denoted $\tau_m$, of the mortgage interest payments from tax payments. Let the feasible set of fiscal policy arrangements be given by

$$\Omega = \{\tau_w, \tau_y, \tau_h, \tau_f, \tau_m : 0 \leq \tau_w, \tau_y, \tau_h, \tau_f, \tau_m \leq 1\}.$$

## *Production sector*

Assume that output in this economy is generated by a Cobb-Douglas production function

$$f\left(K_b(t), N\right) = AK_b^{\alpha}(t)N^{1-\alpha}$$

where $A$ is a productivity parameter, $K_b(t)$ is total business capital, $N$ is the labor force and α is the capital share of income in production. Every period the stock of business capital depreciates by $\delta_k$ units per unit of capital. Assume also that output goods can be costlessly transformed into consumption goods, business investment goods and residential investment goods. From this it follows that the price of these goods will be equal, and it is normalized to unity.

## *Financial Institutions*

In the model, financial institutions are introduced to simplify matters. They will act as owners of the housing capital not owned by households, and as intermediaries reallocating credit and transforming claims. The financial institutions pool the households' deposits and purchase mortgages and housing capital without transaction costs. They borrow and lend at the same interest rate *i*, and rent all the housing capital they own to households. Assume that new financial institutions are born every period and that they live for two periods. During the first period they issue debt in the form of deposits, to finance the purchase of housing capital and mortgages. During the second period they collect interest rate on the mortgages, rent on the housing capital, sell their undepreciated housing capital and still outstanding mortgages to new financial institutions born in that period, and pay interest rate on the deposits. They pay a housing tax on housing capital held net of maintenance costs.

For a new financial institution in period *t*, the problem is

$$\max_{B(t+1),S(t+1),H_r(t+1),D(t+1)} pS(t+1) - (\delta_h + (1-\delta_h)\tau_f)H_r(t+1) + iB(t+1) - iD(t+1)$$

subject to

$$H_r(t+1) + B(t+1) \le D(t+1) \tag{8}$$

$$S(t+1) \le H_r(t+1) \tag{9}$$

For this problem to be well defined the following no-arbitrage conditions also has to hold

$$i = p - \delta_h - (1-\delta_h)\tau_f \tag{10}$$

$S(t)$ denotes total amount of housing services provided by financial institutions in period t, $H_r(t)$ the total amount of rental housing, $D(t)$ the total amount of deposits received and $B(t)$ the total amount of loans issued to households. The constraint (8) says that all housing capital and outstanding mortgages need to be covered by deposits, and the constraint (9) says that housing services provided are limited by housing capital held.

# Economic Implications

In this section I will derive some economic implications that follow from the model specification in the previous section.

### *Ownership Benefit*

By choosing to own, it follows from the budget constraint (1) that the household will increase its period *t* implicit rental income by $(p-\delta_h-\tau_h)h_t(t)$. It will also incur a mortgage cost net of deductibility equal to $(1-\tau_m)ib_t(t)$, and a net opportunity cost of holding the house equal to $(1-\tau_y)i(h_t(t)-b_t(t))$. Using the no-arbitrage condition (10) and some simple algebraic manipulations, for any $\omega \in \Omega$, we can derive the ownership net benefit $\pi$

$$\pi(b_t(t),h_t(t),\omega)=\left((i+(1-\delta_h)\tau_f-\tau_h)h_t(t)-(1-\tau_y)ih_t(t)\right)-\left((1-\tau_m)ib_t(t)-(1-\tau_y)ib_t(t)\right)$$

Inside the first brackets we have the asset benefit; implicit rental income minus the opportunity cost of the entire asset. The second brackets give the borrowing penalty; mortgage interest payments net of deductibility minus the opportunity cost of the borrowed funds. Here we can see when housing capital is tax favored relative to other types of capital. The two types of capital are treated equally when the asset benefit is equal to zero, i.e. when

$$\tau_y i \geq \tau_h-(1-\delta_h)\tau_f$$

holds with equality, and housing capital receives preferential tax treatment when the homeowner tax minus the financial institutions housing tax is smaller than the product of the capital income tax and the interest rate. The result implies that under this specification, for equal tax treatment of different types of capital, the homeowner tax should be proportional to the interest rate. The result follows directly from the Swedish taxation of the value of housing capital and does not

hold when imputed rents are taxed directly, as in Gervais's (2002) model of the U.S. economy[4]. The intuition behind this result is straightforward as soon as one recalls two underlying assumptions. Fist, the value of the housing capital is assumed to be constant. Second, from the no arbitrage condition (10) the rental price increases with the interest rate (because housing capital becomes more expensive to hold for financial institutions). *Ceteris paribus,* a higher interest rate will then increase the implicit rental income from owner-occupation, but not the amount paid in homeowner tax unless the that tax rate is increased. From the second brackets we see that there is a borrowing penalty if mortgage interest payments are deductible at a rate smaller than the capital income tax rate.

### *Return to Savings*

The household decision to save in either housing capital or financial assets will depend on the interest rate. This follows again from the Swedish specification of the model, with taxation of the property value instead of imputed rents. The post-tax return to savings for a household in period *t* is given by

$$r_t\left(a_t(t), h_t(t), b_t(t)\right) = \frac{(1-\tau_y)ia_t(t) + (i + (1-\delta_h)\tau_f - \tau_h)h_t(t) - (1-\tau_m)ib_t(t)}{y_t(t)}$$

Let the equity share $\phi_t(t) \equiv (h_t(t) - b_t(t))/h_t(t)$ represent the fraction housing equity to housing capital the household has to invest, i.e. $y_t(t) = \phi_t(t)$. Assume that this is invested either entirely in housing capital, normalized to unity and yielding the return

$$r(h) = \frac{i + (1-\delta_h)\tau_f - \tau_h - (1-\tau_m)i(1-\phi_t(t))}{\phi_t(t)}$$

or entirely in financial assets, yielding the return

$$r(a) = (1-\tau_y)i$$

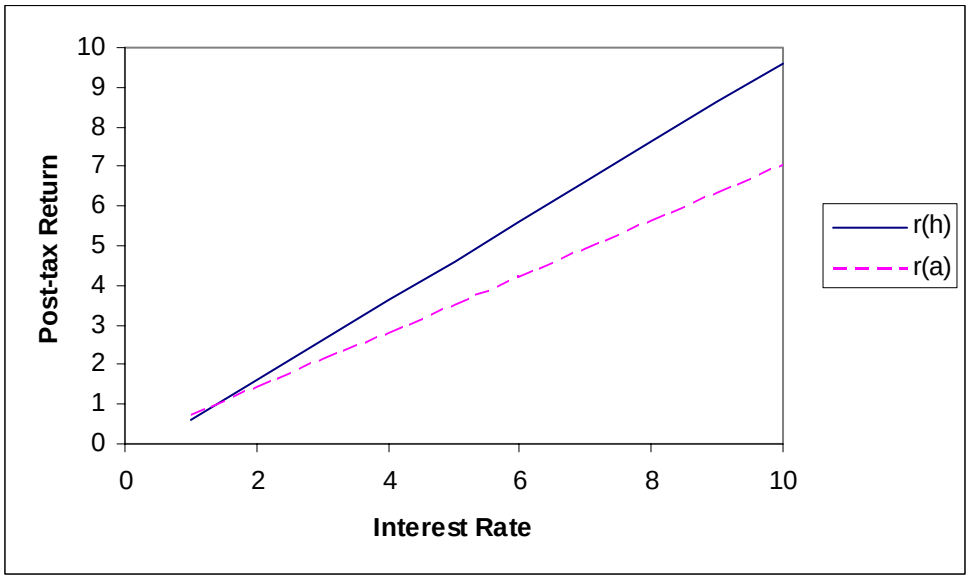
The household has an incentive to accumulate wealth to be able to invest in housing capital if

$$\frac{(1-\delta_h)\tau_f - \tau_h}{\phi_t(t)(\tau_m - \tau_y) - \tau_m} \leq i$$

[4] If imputed rents are taxed at the rate $\tau_{ir}$, then equal treatment requires that $\tau_y = \tau_{ir}$.

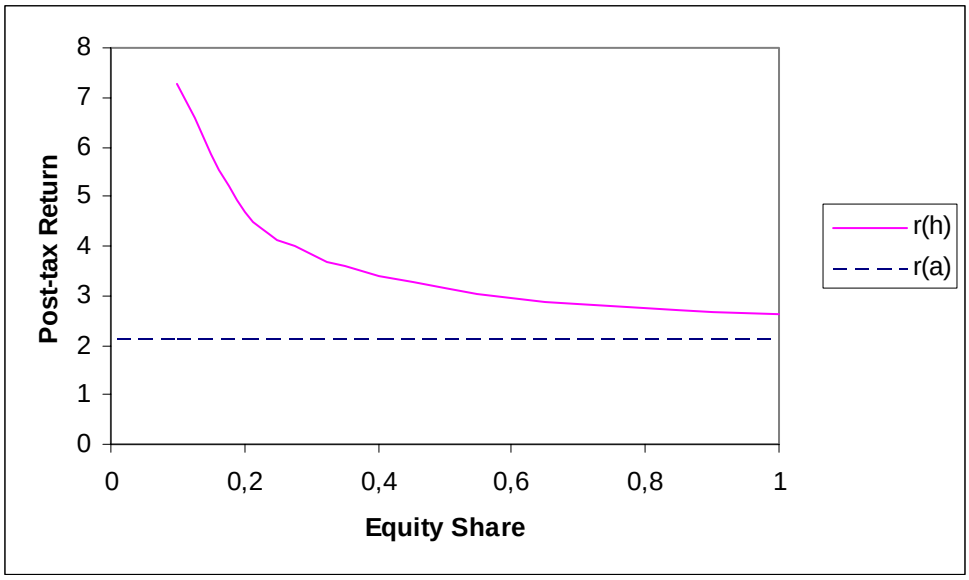
If there is no borrowing penalty, i.e. mortgage interest payments are deductible at the same rate as capital income taxation $(\tau_y = \tau_m)$, this inequality is independent of the equity share. That is, whether the household has an incentive to accumulate wealth to buy a house or not, is independent of the equity share. However, the incentive is stronger for lower equity shares as we will see below.

Graphically, for the Swedish case with $(\tau_y, \tau_h, \tau_f, \tau_m, \delta_h,) = (0.30, 0.0075, 0.00375, 0.30, 0.02)$ and $\phi_t(t) = 1$ we have




The intersection point is at the interest rate 1.275 %. For any long-run equilibrium interest rate above this, housing capital receives preferential tax treatment. An increase in the homeowner tax will shift the return schedule for housing downward, moving the intersection point to the right, and an increase in the capital income tax will reduce the slope of the return schedule for financial asset, moving the intersection point to the left. Given that the equity share is less than one, an increase in the mortgage interest deductibility rate will increase the slope of the return schedule for housing, moving the intersection point to the left. This effect is greater the lower the equity share is.

Assume now that we are still looking at the Swedish economy and that $\gamma$ = 0.10, but we fix the long-run equilibrium interest rate at 3%. If we plot the post-tax returns for financial assets and housing capital against the equity share we get the following figure




There will then be an incentive for households to accumulate wealth to afford the down payment on a house and be able to reach the higher return. Recall also that this is for a given size house. If we introduce a house of twice the size in this plot, it would start with a peak at the equity share 0.2 and then fall like the smaller one. However, since housing capital is perfectly divisible and there are no other motives for the household to own a house than financial, the household will always choose to own a house financed with 10 percent equity as its savings when possible.

# Equilibrium

In this section I will lay out the steady state equilibrium equations that are needed to solve the model. These are then solved with numerical methods.

## *Household Optimization*

The household will maximize lifetime utility subject to the budget, net worth and housing constraints 1) – 7). And also, given the model assumptions, the 10 percent equity constraint mentioned above

$$h_t(t+j) = y_t(t+j+1)/0{,}1 \qquad \text{for } j = 1,2,3,4 \qquad 11)$$

In periods one to five the household choose savings to solve

$\max \sum_{j=1}^{6} \beta^{j-1} u_t(t+j-1)$ which gives the following five first order conditions

*Period 1*

$$-\frac{1}{c_t(t)} + \beta R_a \frac{1}{c_t(t+1)} = 0 \qquad \text{i)}$$

*Periods 2-5*

$$-\frac{(1+p/0,1)}{c_t(t+j-1)} + \frac{\theta}{y_t(t+j)} + \beta R_h \frac{1}{c_t(t+j)} = 0 \qquad \text{for } j = 1,2,3,4 \qquad \text{ii)-v)}$$

In periods one and six when the household rents its housing services the intra-temporal first order condition

$$-\frac{p}{c_t(t+j)} + \frac{\theta}{s_t(t+j)} = 0 \qquad \text{for } j = 0 \text{ and } 5$$

also has to hold. This is then substituted into the budget constraints for periods one and six to make them into functions of only *c* and not *s*. Taken together we have six budget constraints and five first order conditions. That is, 11 equations and the 11 unknowns (5 *y*:s and 6 *c*:s).

## *The Public Sector*

The government uses its tax revenues to finance constant government consumption, mortgage interest deductions and pensions. It runs a balanced budget every period, so the government budget constraint

$$G(t) + \sum_{j=4}^{5} z_t(t+j) + \tau_m i B(t) = \tau_w Z(t) + \tau_y i A(t) + \tau_h H_{own}(t) + (1-\delta_h)\tau_f H_{rent}(t)$$

has to hold. Total financial assets (*A*), mortgages (*B*) and housing stocks (*H*) are determined by the households' optimization. Total labor income (*Z*), parameters and fiscal policy are exogenous to the model. Government consumption, (*G*), is set to get the share government consumption over output right. The labor income tax rate will be endogenous and solved for with this equation.

### *The Firm's Decision Problem*

The firm will maximize profits, with respect to business capital and labor input. The price of capital is $r$, where $r = i + \delta_k$, and the wage paid to workers is $w$. The firm solves

$$\max_{K_b, N} f(K_b, N) - rK_b - wN$$

where the first order conditions

$$\frac{\partial f(K_b, N)}{\partial K_b} - r = 0 \qquad \Leftrightarrow \qquad K_b = N\left(\frac{r}{\alpha A}\right)^{\frac{1}{\alpha - 1}}$$

$$\frac{\partial f(K_b, N)}{\partial N} - w = 0 \qquad \Leftrightarrow \qquad w = (1-\alpha)A\left(\frac{K_b}{N}\right)^{\alpha}$$

determine the business capital stock and the wage rate in the model.

# Calibration of the Model

The model parameters have been adjusted with the Swedish economy as benchmark, to make some relative quantities in the model fit data. I have used data from the National Institute of Economic Research for household consumption (he06.xls), output (fb01.xls) and public consumption (ok01.xls). For the share of housing services in total consumption the Household Budget Survey from Statistics Sweden (HBS 2004) has been used, and for data on the capital stock Edvinsson (2005, table: "Net stock of various types of produced assets in Sweden 1800-2000") have been used. From these datasets the average (1995-2000) relative quantities have been calculated and the parameters have been set to replicate the capital/output ratio 2.5 and the government consumption/output ratio equal to 0.3. A capital/output ratio of 2.5 in one year implies a ratio of 0.25 in one model period, since capital is a stock variable and output is a flow variable 10 times as large in a 10 year period.

## *Parameters*

The discount factor and the depreciation rates have been chosen to get the amount of capital in the economy right, and the parameter $\theta$ is set to get the amount of housing services in total consumption right. The productivity parameter $A$ is normalized to unity and the capital share parameter $\alpha$ is set to 0.3. The interest rate is given by the world interest rate since Sweden is a small open economy. I choose the long run equilibrium interest rate 3 percent, but any interest rate above the intersection interest rate of 1.275 percent discussed above would give similar results. The labor income tax is determined endogenously in the model so that the government always runs a balanced budget, and government consumption, is set to get the share of government consumption in output equal to 0.3. The other fiscal policy parameters and the down payment fraction have been set to replicate the Swedish economy in 2006. Housing taxes are adjusted to the fact that housing capital is not taxed in full, i.e. only at 75 percent of the assessed value. The parameters that achieve the relative quantities in the benchmark model are

| **Parameter values** | | **1 year** | **1 period** |
|---|---|---|---|
| Preferences | $\beta$ | 0,99 | 0,90 |
| | $\theta$ | 0,35 | 0,35 |
| Technology | $A$ | 1,00 | 1,00 |
| | $\alpha$ | 0,30 | 0,30 |
| | $\delta_h$ | 0,02 | 0,18 |
| | $\delta_b$ | 0,07 | 0,52 |
| Fiscal Policy | $\tau_y$ | 0,30 | 0,30 |
| | $\tau_w$ | 0,61 | 0,61 |
| | $\tau_h$ | 0,00750 | 0,078 |
| | $\tau_f$ | 0,00375 | 0,038 |
| | $\tau_m$ | 0,30 | 0,30 |
| Interest Rate | $i$ | 0,03 | 0,34 |
| Down payment | $\gamma$ | 0,10 | 0,10 |

The 1 period value of $\beta$ is equal to $\beta^{10}$. The depreciation rates have been adjusted in the following way, $K_{t+1} = (1-\delta)K_t \Rightarrow K_{t+10} = (1-\delta)^{10} K_t \Rightarrow (1-\delta_{10}) = (1-\delta)^{10} \Leftrightarrow$ $\delta_{10} = 1-(1-\delta)^{10}$, and the housing taxes and interest rate with the calculation $(1+x)^{10} - 1$.

### *Household Income*

To set the efficiency units of labor for the different model periods I have calculated the path of hourly wages over age. These calculations are based on the Swedish coefficients of the OLS estimation results for the initial relative wage level in Flodén and Lindé (2001, p 419). Since the model household is a representative household, there should also be adjustments to the fact that the labor force participation rate is different for different age groups. This has been done by multiplying the hourly wages with the relative labor force figure in the Labor Force Survey from Statistics Sweden (2003, p 6). Pensions in period five and six are then set as 60 percent of the income in period 4. This gives a consumption path where consumption increases the first periods to reach its maximum in period three and then fall again.

# Experiments

To see which long run equilibrium effects different homeowner tax rates might have on the Swedish economy I run two simulations, but first, to evaluate the societal effects of different fiscal policy regimes we need a measure of welfare. Let $\omega_B$ denote the fiscal policy of the benchmark economy and $\omega_S$ denote a simulated fiscal policy. The lifetime utility of a household born in period *t* can be written as a function of the fiscal policy

$$U_t(\omega) = \sum_{j=1}^{6} \beta^{j-1} u_t(t+j-1, \omega)$$

Utility under different policies can be made more easily comparable if we look at how much extra consumption that is needed in every period to make the household indifferent between the benchmark economy and a simulated economy. This is represented by $\Delta$ in the equation below

$$U_t(\omega_S) = \sum_{j=1}^{6} \beta^{j-1} \left(\log\left[(1+\Delta)c_t(t+j-1, \omega_B)\right] + \theta \log x_t(t+j-1, \omega_B)\right)$$

## *Simulations*

The effect of a higher, more neutral, homeowner tax is tested with the original rate that prevailed after the 1991 tax reform, 1.5 percent. In the second simulation the homeowner tax rate as well as the interest rate deductions allowed is set to zero. The outcome is shown in the table below

| **Relative Quantities** | | Benchmark Economy | $\tau_h = 1{,}5\%$ | $\tau_h = \tau_m = 0$ |
|---|---|---|---|---|
| Total Capital / Output | K/Y | 0,251 | 0,249 | 0,250 |
| Business Capital / Total Capital | $K_b/K$ | 0,516 | 0,521 | 0,521 |
| Housing Consumption / Consumption | pX/(pX+C) | 0,277 | 0,269 | 0,274 |
| **Absolute Quantities** | | | | |
| Total Capital | K | 0,360 | 0,354 | 0,357 |
| Housing Spending | $Y_h$ | 0,128 | 0,126 | 0,126 |
| Housing Capital | H | 0,174 | 0,170 | 0,171 |
| Owner Housing Capital | $H_{own}$ | 0,127 | 0,123 | 0,124 |
| Income Tax Rate | $\tau_w$ | 0,61 | 0,60 | 0,61 |
| Welfare Measure | $\Delta$ | | 2,54% | 0,00% |

The first simulation, with a more neutral homeowner tax rate, reduces the incentive for households to over-invest in housing capital, and a larger share of investments is allocated to productive business capital. This increases the share of business capital in the capital stock and thereby decreases the capital-output ratio. It also implies that a greater share of total consumption is allocated to the composite consumption good. The aggregate capital stock in the economy decreases because of the decrease in the housing stock. With a higher homeowner tax the labor income tax can be reduced[5] and overall welfare increases. A household would require 2.54 percent higher consumption in every period of its life in the benchmark economy to be indifferent between the two fiscal policy regimes.

[5] Government revenues increase from a value effect and decrease from a volume effect when a higher homeowner tax rate is used and the housing capital stock decreases. A third effect is that the costs of the mortgage interest deductions decrease with the housing capital stock. Taken together the government profits.

The second simulation, with a removal of the homeowner tax and the mortgage interest deductions, also reduces the incentives to over-invest in housing capital, but not to the same extent as in the first simulation. The share of business capital in the capital stock increases and the capital-output ratio decreases. Here too, a somewhat greater share of total consumption is allocated to the composite consumption good. The labor income tax rate has to be kept at the same level to keep government consumption constant and overall welfare is unchanged.

## *Transition Period*

The simulated outcomes are new long-run equilibriums, and the life-time utility underlying the welfare measure holds for a household living its entire life in the new fiscal policy regime. However, if there is a change in policy at the beginning of period *t*, there will be five older generations that have lived a part of their lives with the old policy and will live another part with the new policy. To see how these households are affected by the change in policy the simulations are repeated with the periods in the old policy regime fixed. That is, for a household born in period *t-1*, first period consumption and savings are set to the values found in the benchmark economy and then the outcome for the remaining five periods of the household's life is simulated with the new policy. This is then repeated for households born in period *t-2* to *t-5* for the two different simulated policies, yielding the following results

| **Household born in period** | **Simulation 1** Δ | **Simulation 2** Δ |
|---|---|---|
| t | 2,54% | 0,00% |
| t-1 | 1,97% | -0,02% |
| t-2 | 1,20% | -0,12% |
| t-3 | 0,71% | -0,13% |
| t-4 | 0,12% | -0,16% |
| t-5 | 0,05% | -0,07% |

For the higher, more neutral homeowner tax all households gain in welfare, although the gains decrease with the time a household lives with the new policy. When the tax rate is increased the households already living in large houses will have to pay more, but they also gain from the lower tax rate on labor income immediately.

In the second simulation, without homeowner tax and mortgage interest deductibility, all older generations lose from the policy shift, although the losses are small. The older generations loose

because they already live in large houses and the loss in mortgage interest deductions exceed the gains from no homeowner tax.

# Conclusions

Housing taxation is a politically sensitive question in Sweden, with new policy recommendations being introduced frequently. My model is a very simplified version of the Swedish economy that rests heavily on its assumptions, which clearly implies that no strict policy conclusions can be drawn. The thesis however indicates that neutral capital taxation, which was the goal of the 1991 tax reform, not yet has been reached. This is in line with what the previous studies, mentioned in the introduction, also suggest. The thesis contributes by showing that the result of non-neutrality also holds in a dynamic overlapping generations model. It also indicates that there is scope for efficiency and welfare enhancing reforms and quantifies the potential gains. The tax code provides incentives for households to own rather than to rent, and also to own larger houses than what is (macro-)economically efficient. The household's savings decision and hence also consumption profile is distorted, causing housing to crowd out business capital. The simulations suggest that a higher homeowner tax rate could increase welfare, while a removal of the homeowner tax along with the mortgage interest deductions would keep welfare unchanged.

One assumption underlying these results, that might seem unrealistic, is that prices are constant. It is important to recall that this is to be considered a long-run equilibrium model. However, in the short run it certainly does not hold. Over the last years we have seen a sharp increase in the price of housing capital, which has created a liquidity problem for certain households. These households have seen the assessed values of their houses increase a lot faster than their disposable incomes. This is part of the housing-political reasons why the homeowner tax has been adjusted downward since the tax reform, and it makes a higher tax rate complicated. The government has imposed a "limitation rule", trying to deal with this problem. It says that under certain circumstances a household should never have to pay a homeowner tax of more than 5 percent of its income. In the budget proposition 2005/05:01 it is suggested that this should be lowered to 4 percent.

For future research this model could be improved in several ways. The result that a household always choose to live in a house with a 10 percent equity share, and thus that it moves every ten years, follows from the assumptions of no transaction costs and no other motives than monetary when choosing a house. The non-monetary motives can be hard to model, but a first

improvement would be to include transaction costs when moving. Since different income and wealth groups own their houses to different extents and thus are affected differently by the homeowner tax, a second improvement would be to model heterogeneous households instead of my representative household. This is done by Gervais (2002), who concludes that households in all income groups benefit from a more neutral housing taxation.

When it comes to implementation of the simulated tax policies, the idea of a higher tax rate seems politically unviable. The homeowner tax was an important question in the debate before the election in 2006, where both of the main political alternatives seemed set on lowering the tax. The arguments for this however, are rather political than economical, and hence not relevant in this thesis.

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