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ON THE POLITICAL ECONOMY OF HOUSING'S TAX STATUS***

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ABSTRACT: We analyze housing taxation from a political economy perspective. Our aim is to understand why the US tax system favors owner housing with respect to business capital despite the efficiency losses involved. The starting point of our analysis is the observation that housing wealth is much more evenly distributed than total wealth. We build a simple dynamic general equilibrium model where households vote over the effective capital income tax rates for housing and business capital under a government budget constraint. We calibrate the model so that it roughly matches the joint distribution of total wealth and housing wealth among US households. The median voter turns out to be a household with a large share of his wealth in the form of housing. The key trade-off he faces is that a low tax rate on housing 1) shifts the tax burden to wealthier households but 2) leads to a high tax rate on business capital and hence low wages and high interest rates. In our calibrated model economy, the first effect dominates, and the equilibrium tax rate on housing is much lower than the tax rate on business capital.

Keywords: Housing taxation, capital taxation, political economy

JEL Classification: E62, H31, P16

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TIIVISTELMÄ: Tarkastelemme omistusasumisen verotuksellista asemaa poliittisen taloustieteen näkökulmasta. Pyrimme ymmärtämään, miksi verojärjestelmä suosii omistusasumista siitä aiheutuvista tehokkuustappioista huolimatta. Lähtökohtana on havainto, että asuntovarallisuus on paljon tasaisemmin jakautunut kotitalouksien kesken kuin finanssivarallisuus. Asuntovarallisuuden suosiminen finanssivarallisuuden kustannuksella siirtää tämän vuoksi suuren osan verorasituksesta kaikkein varakkaimmille kotitalouksille. Analyysiä varten rakennamme suhteellisen yksinkertaisen, neoklassiseen kasvumalliin perustuvan dynaamisen yleisen tasapainon mallin. Kalibroimme mallin siten, että se replikoi suhteellisen tarkasti kokonais- ja asuntovarallisuuden empiiriset jakaumat yhdysvaltalaisten kotitalouksien keskuudessa. Mallissa taloudenpitäjät äänestävät asuntoverotuksen ja muun pääomaverotuksen suhteesta. Suurin osa mediaaniäänestäjän kokonaisvarallisuudesta on asuntovarallisuutta. Tällöin asuntovarallisuuden suosiminen vähentää hänen omaa verorasitustaan. Toisaalta se myös vähentää tuotannollisen pääoman kertymistä laskien yleistä palkkatasoa ja nostaen korkotasoa. Mallissa ensimmäinen vaikutus dominoi ja poliittis-taloudellisessa tasapainossa omistusasumisen tuottoa verotetaan selvästi finanssivarallisuuden tuottoa kevyemmin.

Avainsanat: Asuntoverotus, pääomaverotus, poliittinen taloustiede

1 Introduction

The US tax system favors owner housing. The main tax advantage of owner housing is that unlike the return to business capital, the return to owner housing - usually referred to as the imputed rent - is untaxed. In addition, mortgage interest payments are to a large extent tax deductible.[1] It is by now well understood that the preferential tax treatment of housing creates substantial efficiency losses. At the very least, it distorts households' consumption decision by affecting the relative price of housing and consumption goods. In a general equilibrium framework, it also crowds out business capital. Berkovec and Fullerton (1992), Poterba (1992), Skinner (1996), and Gervais (2002), among others, have evaluated quantitatively the effects of the tax favored status of housing in the US.[2] Especially the last two of these papers, which employ dynamic models, found that setting a higher tax rate on housing and lowering the tax rate on non-housing capital would yield substantial efficiency gains.

The obvious question is then why, despite the efficiency losses, the tax system favors housing. The purpose of this paper is to answer this question by analyzing the tax status of housing from a political economy perspective. While there is a large literature on the political economy of capital income taxation, there seems to be no previous analysis focusing on the different tax treatment of housing and business capital. Given that the stock of housi ng capital is very large, comparable in size with the stock of business capital, this seems an important gap in the existing political economy literature on taxation.

The starting point of our analysis is the observation that in the US data housing wealth is much more evenly distributed than non-housing wealth. Because of this, it may be the case that politically decisive voters have a very large share of their overall wealth in the form of housing. In order to analyze how this is reflected in the political economy of housing taxation, we use a simple dynamic general equilibrium model with wealth and labor income heterogeneity. We consider a situation where there are two assets available for the households: housing and a financial asset. We first assume that only owner housing is available, that is, the market for rental housing is closed. This allows us to focus on the distributional effect we are interested in. We frame the political problem as one of choosing the tax rates on housing and on the financial asset under a balanced budget constraint. Since the aggregate amount of the financial asset corresponds to the aggregate stock of business capital, the tax rate on the financial assets is also the effective average

[1] Most OECD countries have similar tax benefits for owner housing. See Hendershott and White (2000) for an international comparison of housing taxation.

[2] Rosen (1985) presents a survey of the earlier literature on housing taxation.

tax rate on the return to business capital.

We calibrate the model so as to match the joint distribution of total wealth and labor income as well as certain aggregate ratios in the data. The endogenously determined distribution of housing roughly matches the data as well. In particular, housing wealth is much more evenly distributed than total wealth. We find that the median voter chooses to tax housing capital at a much lower rate than business capital even though this implies a small business capital stock and hence a low wage rate and a high interest rate. This result is closely linked to distributional issues. The median voter has a large share of his overall wealth in the form of housing. By taxing financial wealth at a much higher rate than housing wealth he can shift a large part of the tax burden on the richest households who own most of the financial, or non-housing, wealth. In the absence of wealth and labor income heterogeneity, the equilibrium tax rate on housing would be much higher, reflecting the usual efficiency cost of taxing business capital in a dynamic economy.

About one third of US households rent their housing and they are likely to have very different policy preferences than homeowners. Therefore, we reconsider our results in a setting where some of the households are renters. In this case, we assume that the return to rental housing is taxed at the same rate as the return to business capital. It turns out that the equilibrium tax structure does not change substantially with the introduction of renters. Although the median voter is now richer in terms of overall wealth and has a somewhat lower share of his wealth in the form of housing, he still votes for a very low tax rate on housing. A low tax rate on housing shifts the tax burden towards renters as well as the richest households owning most of the non-housing wealth.

We proceed as follows. In the next section, we present data on the distribution of housing wealth and non-housing wealth. In section 3, we describe the model. We discuss calibration in section 4. The results are presented in section 5. In section 6 we introduce renters. We conclude in section 7.

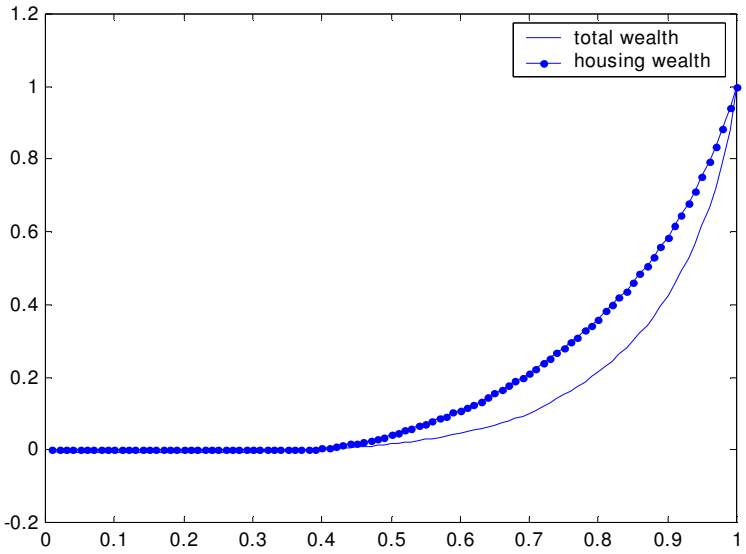
2 The distribution of non-housing wealth and housing wealth

In this section, we briefly look at the distribution of housing wealth and total wealth. We use family data from the 2001 wave of the Panel Study of Income Dynamics (PSID). In PSID, households are asked to report their estimate about the market value of their house. For total wealth, we take 'total wealth' (including main home equity). Its main components are typically stocks, mortgages, bank deposits, and owner housing. When

calibrating our model, we also need labor income, which we define as the sum of 'labor income' of the household 'head' and 'wife' together with private pension income. We exclude a number of households from the sample. First of all, we exclude all households who do not either own or rent their home. Second, we exclude households with information missing about any of the above mentioned variables. In addition, we need to exclude a small number of households which have negative total wealth together with a very low labor income, since they could not afford positive consumption in the model.[3] After this procedure, we are left with 6691 households.

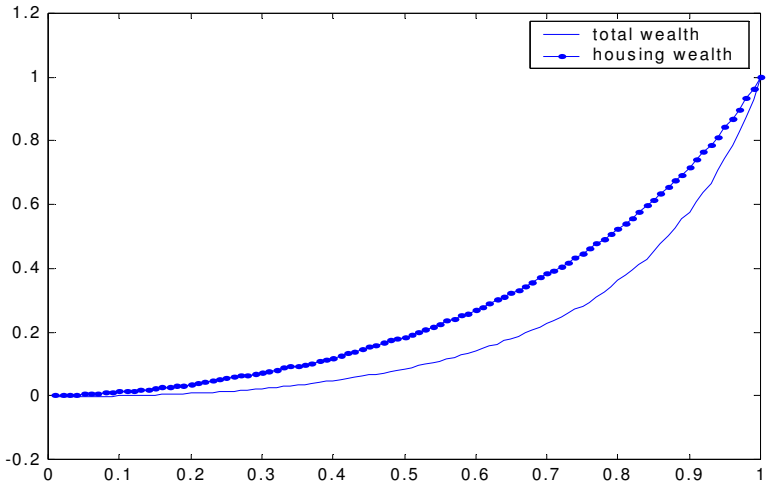
Figure 1 presents the cumulative holdings of total wealth and housing wealth for all the 6691 households. Figure 2 in turn displays the total wealth and housing wealth distribution for only middle-aged homeowners. This is the subsample that we will focus on in Sections 4 and 5.

Figure 1: Distribution of total wealth and housing wealth, all households.



[3] To be more specific, we exlude all households for which $0.1 * Total\ wealth + labor\ income \leq 0$.

Figure 2: Distribution of total wealth and housing wealth, middle-aged homeowners.



About 30% of households are renters. This shows up as a flat line in the lorenz-curve for housing wealth in the first figure. It is clear, however, that in both cases housing wealth is much more evenly distributed than total wealth or non-housing wealth. Since the aggregate value of the housing stock is about one half of the aggregate total wealth, these figures also imply that most households have most of their wealth in the form of housing.[4] The main purpose of our theoretical analysis is to study how this is reflected in the tax status of housing.

3 The model

We consider a simple heterogenous agent version of the deterministic neoclassical growth model where the aggregate capital stock is disaggregated into business capital and housing capital. The tax code in the model differentiates between the interest income from business capital and the imputed rent from housing capital. An important feature of the model

[4]We are by no means the first to stress the fact that for most households housing is the single most important component of their total wealth. See, for instance, Flavin and Yamashita (2002) who focus on homeowners' portfolio choice.

is that it allows any relative steady state distribution of total wealth. Furthermore, any steady state distribution of total wealth is compatible with any labor income distribution, as long as households can afford positive levels of consumption and housing.[5]

In this section, we first present the model economy with given tax rates and then discuss the voting process and the politico-economic equilibrium.

3.1 The neoclassical growth model with housing

Time is discrete and goes on forever. There are I types of infinitely lived households with different amounts of total wealth and different labor productivities. There is a continuum of households of each type. We use $m^i > 0$ to denote the mass of households of type i. The total mass of households is normalized to one.

Each household derives utility from consumption of a composite consumption good, c, and housing, h. In addition to housing, households can save (or borrow) using a financial asset which we denote by a.

There is also a government. It needs to finance in each period an amount G of public consumption and an amount Tr of transfers that it pays to the households. The transfers are paid evenly to all households in a lump-sum fashion. The government has three tax instruments at its disposal, a capital income tax, τ_k, a tax on housing (i.e. on the imputed rent), τ_h, and labor income tax, τ_l. It faces a balanced budget constraint which we specify below.[6]

The problem of a household of type i in period s is

$$\max \sum_{t=s}^{\infty} \beta^t u(c_t^i, h_t^i) \tag{1}$$

subject to

$$c_t^i + a_t^i + h_t^i = [1 + (1 - \tau_{k,t}) r_t] a_{t-1}^i + (1 - \tau_l) \varepsilon^i w_t + (1 - \delta_h - \tau_{h,t} r_t^{ir}) h_{t-1}^i + Tr, \tag{2}$$

where $\sigma > 0$ denotes the inverse of the intertemporal elasticity of substitution, $\gamma > 0$ the housing share parameter, and $\beta \in (0, 1)$ is the discount factor. Financial savings are denoted by a, and $\varepsilon > 0$ a labor productivity parameter. The depreciation rate of housing is $\delta_h \in (0, 1)$, and r^{ir} is the imputed rent from housing. We allow the tax rates on business

[5] Krusell and Ríos-Rull (1999) present a detailed analysis of this issue in the context of a very similar neoclassical growth model with wealth and income heterogeneity. See also Caselli and Ventura (2000).

[6] Transfers make the distribution of total income more equal. They are therefore important in shaping the distribution of housing relative to the distribution of total wealth.

capital and housing to be negative as long as the government budget constraint is satisfied. Finally, Tr denotes a lump sum government transfer.

The imputed rent is defined as the market value of housing services net of depreciation. Even though there is no rental housing, it is easy to see what the rental rate would be. In the absence of uncertainty, the return to rental housing must equal the return to the financial asset, that is, the rental rate of housing would be equal to $r_t + \delta_h$. The imputed rent is therefore simply $r_t^{ir} = r_t$.

The holdings of the financial asset can be negative, in that case we could think of them as mortgages. Note also that we assume that interest payments on loans ($a < 0$) are tax deductible. We do this because in the data most of household borrowing corresponds to mortgages and mortgage interest payments are indeed to a large extent tax deductible within the current US tax system.

The supply side of the economy consists of an aggregate production function which uses business capital and labor to produce output goods. These output goods can be costlessly transformed into business capital, consumption goods, and housing. The production function is of the usual Cobb-Douglas form. The labor productivity parameters are normalized so that aggregate effective labor is one (i.e $\sum m^i \varepsilon^i = 1$) The aggregate stocks of business capital, housing, and consumption are

$$H_t = \sum_{i=1}^{I} m^i h_t^i, K_t = A_t = \sum_{i=1}^{I} m^i a_t^i,\ C_t = \sum_{i=1}^{I} m^i c_t^i \tag{3}$$

and the resource constraint is

$$C_t + K_t - (1-\delta_k)K_{t-1} + H_t - (1-\delta_h)H_{t-1} + G = K_{t-1}^{\alpha}, \tag{4}$$

where $\delta_k \in (0,1)$ denotes the depreciation rate of business capital, $\alpha \in (0,1)$ the capital share in the production function, and $G > 0$ an exogenously given and constant level of public spending.

The interest rate and the wage rate are given by

$$r_t = \alpha K_{t-1}^{\alpha-1} - \delta_k \tag{5}$$

and

$$w_t = (1-\alpha)K_{t-1}^{\alpha}. \tag{6}$$

Finally, the budget constraint of the government is

$$\tau_l w_t + \tau_{k,t} r_t A_{t-1} + \tau_{h,t} r_t H_{t-1} \equiv T = G + Tr. \tag{7}$$

3.2 Politics

The mechanism of collective decision making we consider is direct voting. At period t households vote over the tax rate on housing $\tau_{h,t+1}$. The tax rate on interest income from business capital, $\tau_{k,t+1}$, is determined as a residual from the government's budget constraint. The tax rate on labor income is assumed to be constant. An important assumption we make is that households take future housing tax rates as given. In other words, when households consider different tax rates on housing, they do not take into account how this period's voting outcome affects the voting outcome in the following period through its effect on the wealth distribution. This assumption is sometimes referred to as 'political myopia'.[7] Households do, however, take into account how the choice of τ_h affects τ_k and factor returns in the future periods given fixed τ_h.

Our equilibrium concept differs from the recursive political equilibrium with fully forward looking agents presented in Krusell et al. (1997). The reason for adopting the simpler approach is that it results in dramatically lower computational cost, which allows us to solve for the political equilibrium with many types. This is important here. There are two exogenous distributional features in the model, the steady state wealth distribution and labor income distribution. In the extension, we will introduce a third dimension, namely renters vs. homeowners. With a small number of different household types, we would have to sort households in the data along a single dimension. The problem with this approach is that the resulting equilibrium tax rate is then likely to depend on the sorting criteria. With the simpler equilibrium concept we use, we can have a sufficiently large degree of heterogeneity in the model. That is, we can divide the households in the data according to all the exogenous distributional dimensions of the model and use the resulting groups as a basis for our calibration. In the benchmark case, we sort homeowners into 25 groups according to their labor income and total wealth.

In solving for the political equilibrium, we need to check that the policy preferences of the households are such that the median voter theorem applies. A sufficient condition for this is that the preferences are single-peaked. With single-peaked preferences, the equilibrium tax rate determined by direct voting of all households coincides with the median tax rate in the distribution of the most preferred tax rates of all households. In all cases that we looked at, the policy preferences were indeed single-peaked.

[7] Using the terminology of positive political theory, we could see this equilibrium concept as capturing the idea of sincere voting, while the recursive political equilibrium would correspond to strategic voting. See Austen-Smith and Banks (1999).

3.3 Definition of steady state equilibrium

A politico-economic steady state equilibrium of this economy consists of aggregates $\{K, H\}$, household policies $\{a^i, h^i, c^i\}_{i=1}^I$, prices $\{r, w\}$, and tax rates $\{\tau_k, \tau_h\}$ such that:

1) Prices satisfy (5) and (6).

2) Household policies $\{a^i, h^i, c^i\}$ solve household's problem in (1)-(2) (together with a transversality constraint).

3) Markets clear:

$$\begin{aligned} \sum m^i a^i &= K \\ \sum m^i h^i &= H \\ \sum m^i c^i &= C \\ C + \delta_k K + \delta_h H + G &= K^\alpha \end{aligned} \tag{8}$$

4) Government budget constraint (7) is satisfied.

5) τ_h wins any other feasible tax rate τ_h' in a pairwise voting with majority rule.

3.4 Solving for the steady state equilibrium

We find the politico-economic steady state equilibrium in the following way. First, we guess the equilibrium housing tax rate. Using the steady state conditions, we can then find the equilibrium tax rate on business capital and the steady state housing distribution. Starting from this distribution of business and housing capital we consider other tax rates on housing for the following period. In practice we consider tax rates on a discrete grid with a step size of 0.01. Each tax rate on housing in the following period is associated with certain transitional dynamics (including varying business capital tax rates which are determined by the government budget constraint) implying a certain discounted sum of future periodic utilities to each household type. Thus for each possible tax rate, we need to solve for the corresponding transitional dynamics. Given the structure of the model, this is easily done by solving a system of non-linear equations that consists of the first-order conditions and aggregate resource constraints for each period during the transition. Once we have calculated the utility associated with each housing tax rate for each household type, we can find the most preferred tax rates of the different types of households. If any feasible tax rate wins the current tax rate (our guess for the steady state tax rate) in the voting, we conclude that our guess for the steady state housing tax rate was wrong. We then adjust our guess for the steady state housing tax rate until we find a tax rate that wins all other tax rates in a pairwise voting.

4 Calibration

In this section we describe our benchmark calibration. Our purpose is to determine the equilibrium structure of capital taxation in a steady state that replicates, as closely as possible, the empirical distribution of total wealth, housing, and labor income. In addition to this, we want the model to match certain aggregate ratios.

We consider only homeowners between 35 and 55 years of age (the age of the household head). We focus on middle-aged households because the model abstracts from life cycle features. The resulting housing distribution also matches the data much better when we exclude very young and very old households from the sample. With only middle-aged homeowners the size of our sample is 2380.

We consider 25 different types of households who differ in terms of their labor income and steady state total wealth. When mapping the data into the model, we simply divide household's total wealth into business capital and housing capital. We then match the distributions of total wealth (defined as $k + h$ in the model) and labor income presented below in table 1. As discussed above, we can match them perfectly. In contrast, the model does not have enough degrees of freedom to perfectly match the housing distribution. However, we will find that our calibration matches reasonably well the housing distribution as well.

Table 1 has been constructed in the following manner. We first determine for each household the total wealth quintile and the labor income quintile it belongs to. This creates 25 groups of households. For each group, we then compute the average total wealth and the average labor income. Finally, for each group we divide the average total wealth of the group by the average total wealth in the whole sample and similarly for the labor income. Hence, for instance, 0.06 in the first row of the first column in the table means that the average wealth of households belonging to the first wealth quintile and the first labor income quintile is 6% of the average total wealth in the whole sample.

Table 1: Distribution of total wealth and labor income.

	Total wealth					Labor income				
	Labor income quintile									
Wealth quintile	1	2	3	4	5	1	2	3	4	5
1	0.06	0.06	0.05	0.05	0.00	0.23	0.54	0.79	1.14	1.75
2	0.21	0.21	0.22	0.22	0.23	0.23	0.54	0.82	1.13	1.79
3	0.43	0.43	0.45	0.46	0.42	0.21	0.56	0.81	1.14	1.82
4	0.85	0.87	0.86	0.88	0.92	0.14	0.51	0.83	1.17	1.85
5	2.99	2.27	2.35	2.22	4.65	0.13	0.53	0.79	1.16	2.93

The left-hand part of the table shows that, in each wealth quintile, the distribution of wealth is quite equal across different labor income quintiles. The wealthiest quintile makes an exception though. In that group, differences in wealth are substantial across labor income groups: the average wealth in the fifth labor income quintile is one third higher than the average wealth in the first income quintile. The right-hand part of table 1 shows a similar pattern. For the middle income groups, the average income does not vary much when the wealth quintile changes. However, for the first income quintile, labor income decreases as wealth increases while for the last income quintile the labor income increases with wealth. Labor income is clearly much more evenly distributed than total wealth.

Table 2 shows the share of homeowners in each of the 25 total wealth-income groups. Note that the groups are of very different size.[8] The smallest groups consist of very wealthy households with modest labor income and the poor households with high labor income. The smallest group in the sample consists of those homeowners who belong to the first wealth quintile and the fifth income quintile. These households constitute only 0.7 percent of the sample.

Table 2: Population shares (%).

	Labor income quintile				
Wealth quintile	1	2	3	4	5
1	8.1	5.0	3.9	2.7	0.7
2	4.7	4.8	5.0	4.1	1.2
3	3.4	4.4	4.5	4.8	2.9
4	2.7	2.9	3.5	4.8	6.2
5	2.3	2.2	2.7	3.6	0.9

We take the model period to be 4 years. However, in what follows, we express all parameters and variables in yearly terms. We set $\sigma = 3$, a standard value in the related literature. Greenwood et al. (1995) have estimated the share of business capital in the production function when total capital stock is disaggregated into housing and business capital. Based on their estimate we set $\alpha = 0.29$. The depreciation rates of business capital and housing are set at $\delta_k = 0.1$ and $\delta_h = 0.06$. The National Income and Product Accounts (NIPA) suggest a depreciation rate for housing capital around $\delta_h = 0.015$. By choosing a higher depreciation rate, we want to take maintenance costs into account.

[8] Of course, in principle each wealth and labor quintile should have 20% of the total mass. However, since we have a finite number of households in the data with households having very different weights attached to them, the quintiles end up being of slightly different sizes.

Rest of the parameters are chosen so that with empirically plausible tax rates the model matches certain aggregate ratios in the data. There are various estimates for the effective tax rates on housing, business capital, and labor in the US. We set the tax rate on labor income at $\tau_l = 0.34$ which is roughly the sum of average effective tax rates on labor income and consumption in the US as estimated by Mendoza et al. (1994). We set the housing tax rate at $\tau_h = 0.15$. This is somewhat higher than what many analysts have assumed to be the current effective tax rate on housing, but still in the range of estimates presented by Fullerton (1987).[9] We didn't want to assume a much lower tax rate on housing because that would have implied an implausibly high tax rate on business capital in our model. We then choose parameters β, γ, and T so as to match the following aggregate ratios. 1) Business capital-to-housing ratio $K/H = 1$. 2) Total capital-to-total output ratio $(K+H)/Y = 3.0$, where $Y = K^{\alpha} + rH$. 3) Government expenditure-to-total output ratio $T/Y = 0.28$. 4) Transfers-to-total government expenditure ratio $Tr/T = 0.33$. The first two of these targets are based on the NIPA. We interpret all business capital in the model as private non-residential assets and housing capital as private residential assets. The third target is from the OECD Revenue Statistics.[10] The fourth target corresponds to calculations in Krusell and Ríos-Rull (1999) about the share of transfers of all government expenditures. These targets imply the following parameter values: $\gamma = 0.1895$, $\beta = 0.9555$, $G = 0.1512$, and $Tr = 0.0747$. The tax rate on business capital is determined as a residual from the government budget constraint and is $\tau_k = 0.4004$.

5 Results

We first compare the distribution of housing in the model to the data. For table 3, we have calculated the average amount of housing in each of the 25 wealth-income groups. The table presents this average housing divided by the average housing among all homeowners. So, for instance, figure 0.29 for the lowest income and poorest group means that households in the group own, on average, 29% of the average amount of housing in the sample. It should be noted that this distribution is the distribution of housing given the initial tax system which is exogenously determined. To the extent that the tax system is different in the political equilibrium, the distribution of housing is also different. However, in all political equilibria considered in this section the distribution of housing differs only

[9] The estimate of the effective tax rate on housing depends in part on whether property taxes are included. If property taxes are not considered as taxes on housing (but rather as fees for community services) the effective tax rate on housing is lower.

[10] The estimated share of total tax revenue of GDP has increased from 26.9% in 1975 to 28.9% in 1999.

marginally from this distribution.

Table 3: Distribution of housing; data (left) and model (right).

	Labor income quintile									
Wealth quintile	1		2		3		4		5	
1	0.29	0.30	0.45	0.50	0.48	0.65	0.75	0.87	1.00	1.25
2	0.43	0.35	0.56	0.53	0.68	0.71	0.82	0.90	0.94	1.32
3	0.70	0.37	0.76	0.59	0.86	0.75	1.10	0.97	1.18	1.38
4	1.03	0.43	0.82	0.66	1.04	0.86	1.17	1.08	1.42	1.51
5	1.32	0.91	1.37	1.00	1.26	1.18	1.67	1.38	2.41	3.05

Table 3 shows that our model roughly matches the distribution of housing the data. Both in the data and in the model, households in a given wealth quintile tend to own more housing as their labor income increases. In the same manner, in any given labor income quintile, wealthier households own more housing than poorer households. The biggest difference between data and our model is that wealthy low income households own too little housing while the poorest high income households own too much housing in the model. This may reflect an income effect with poor households spending a larger fraction of their total expenditure in housing than richer ones. However, we believe that these differences are still reasonably small, especially given that (as table 2 shows) the groups in question are the smallest in our sample.

Comparison with the left-hand part of table 1 shows that housing wealth is much more evenly distributed than total wealth. The reason is the following. Without a rental market consumption of housing is tied to ownership. Consumption of housing in turn is related to total income. Since labor income is more evenly distributed than total wealth, consumption of housing is more evenly distributed than total wealth.

Consider then the political equilibrium. The equilibrium tax rate on housing is $\tau_h = 0.10$. This tax rate on housing implies a tax rate on business capital $\tau_k = 0.460$. This is our main result: consistently with the actual US tax system, and in contrast to normative analyses, in our model economy the equilibrium effective tax rate on housing is substantially lower than the tax rate on business capital. The median voter belongs to the third income and third wealth quintile. In the politico-economic equilibrium his total wealth is 45% of the average wealth while his housing wealth is 75% of the average housing wealth. That implies a housing-to-total wealth ratio of about 0.83 compared to the aggregate ratio of 0.48.

As one would expect, households have very different policy preferences. In table 4 we show the most preferred housing tax rate for each homeowner group in the politico-economic steady-state equilibrium. We consider housing tax rates between 0 and 1.

Wealthier households prefer a higher housing tax rate than poor households. Indeed, all households in the first wealth quintile would prefer zero or even negative tax rate on housing, while all households in the fifth quintile would prefer a tax rate equal to or above 1.[11] In addition to total wealth, labor income also matters. In a given wealth quintile, homeowners with higher labor income tend to prefer a lower tax rate on housing. This is because they consume more housing than households with lower labor income. Note that this difference in policy preferences is not explained by higher labor income being accompanied by higher total wealth. As table 1 shows, in third and fourth wealth quintiles the total wealth is almost the same across different labor income quintiles.

Table 4: The most preferred housing tax rates.

	Labor income quintile				
Wealth quintile	1	2	3	4	5
1	0	0	0	0	0
2	0	0	0	0	0.01
3	0.42	0.13	0.1	0.08	0.05
4	1	1	0.58	0.34	0.20
5	1	1	1	1	1

In order to clarify the role of distributional issues, we reconsider the model with a single group. Since wealth and labor income heterogeneity doesn't affect aggregate variables in this model, the calibration is in all other respects exactly the same as in the above case with 25 different groups. When the housing tax rate equals the empirical estimate ($\tau_h = 0.15$), all households then have housing-to-business capital ratio equal to one, which was one of our aggregate targets in the calibration.

We also consider different values for the intertemporal elasticity parameter, σ, which is the only free preference parameter we have. In addition to $\sigma = 3$, used in the benchmark calibration, we try $\sigma = 2$ and $\sigma = 4$. For both these values of elasticity, we recalibrate the model setting again $\tau_h = 0.15$ and targeting the previously discussed four aggregate ratios.[12] In table 5, we present the equilibrium tax rates as well as the main aggregate

[11] It is important to understand, however, that a part from the most preferred tax rate of the median voter, the tax rates in this table do not correspond to any politico-economic steady state equilibrium. If, starting from this steady state, some other household than the median voter was allowed to choose the tax rate his most preferred tax rate would first change over time before the economy converges to a new steady state. This partly explains the 'extremism' that we observe here.

[12] For $\sigma = 2$ this leads to $\beta = 0.9555$, $\gamma = 0.2412$, $G = 0.1512$, and $Tr = 0.0747$. For $\sigma = 4$, we have $\beta = 0.9555$, $\gamma = 0.1489$, $G = 0.1512$, and $Tr = 0.0747$. The corresponding tax rates on business capital will be $\tau_k = 0.368$ and $\tau_k = 0.525$, respectively.

ratios in all the four cases considered.

Table 5: Equilibrium tax rates for different model specifications.

Model specification	τ_h	τ_k	K/H	$(K+H)/Y$	T/Y
Benchmark	0.10	0.460	0.933	2.890	0.282
$\sigma = 2$	0.18	0.368	1.035	3.048	0.279
$\sigma = 4$	0.06	0.525	0.867	2.760	0.284
One group	0.43	0.148	1.228	3.321	0.274

With only one group, the steady state equilibrium tax rates are $\tau_h = 0.430$ and $\tau_k = 0.148$. Without distributional incentives, the median voter is less willing to distort business capital accumulation. This reflects the usual non-optimality of introducing a tax wedge on savings in similar infinite-horizon models. In consequence, without the distributional conflict present in the model, the economy would end up with a dramatically higher capital-to-output ratio. The preference parameter σ affects the equilibrium tax rates as well. A higher value of σ means a lower intertemporal elasticity of substitution. Households then become less willing to lower business capital taxes because for the poor households the benefits would come at the cost of lower consumption during the first periods of transition. Consequently the tax on business capital is higher and the tax on business capital is smaller.

6 Introducing renters

Perhaps the main shortcoming of the present model is that all households own their housing. With the current US tax system, the main tax benefit of housing - the non-taxation of the imputed rent - is related to owner housing since the rental income received by landlords is subject to capital income taxation. As a result, renters should have very different policy preferences than homeowners. Therefore, in this section we consider how introducing renters affects the conclusions of the previous analysis.

We do not attempt to endogenize the tenure choice. We simply assume that some households rent their housing while others are homeowners.[13] We also assume that rental income received by a landlord is subject to the same tax rate as the return from business

[13] Gervais (2002) presents a life cycle model where the tenure choice stems from the intereaction of a borrowing constraint and the tax preferential treatment of owner housing. In his model a down payment constraint forces the poorest households to be renters even though owner housing is tax favored compared to rental housing. Given that in the data most renters are relatively poor in terms of total wealth, this might seem a reasonable way to model the tenure choice in our analysis as well. However, in our

capital. This pins down the tax treatment of rental housing with respect to owner housing and business capital.[14]

The problem of homeowners remains exactly the same. However, we rewrite the household's problem so that it applies to both renters and homeowners. The problem of a household of type i in period s is now:

$$\max \sum_{t=s}^{\infty} \beta^t u(c_t^i, s_t^i + h_t^i) \tag{9}$$

subject to

$$c_t^i + a_t^i + h_t^i = [1 + (1 - \tau_{k,t}) r_t] a_{t-1}^i + (1 - \tau_l) \varepsilon^i w_t + (1 - \delta_h - \tau_{h,t} r_t^{ir}) h_{t-1}^i - r_t^h s_{t-1}^i + tr, \tag{10}$$

where s denotes rental housing and r_t^h is the rental rate in period t. For homeowners, $s = 0$ and $h > 0$, for renters $s > 0$ and $h = 0$. As already discussed in section 3, we have $r_t^h = r_t + \delta_h$.

The aggregate stock of business capital is now

$$K_t = \sum_{i=1}^{I} m^i (a_t^i - s_t^i) \tag{11}$$

and the government budget constraint reads as:

$$\tau_l w_t + \tau_{k,t} r_t A_{t-1} + \tau_{h,t} r_t H_{t-1} \equiv T = G + Tr. \tag{12}$$

In order to understand the tax status of the two different types of housing in the model, let y denote total wealth including interest payments and labor income and consider a household with current wealth y_t who wishes to transfer wealth y_{t+1} to the following period. Then the budget constraint can be written as (for notational convenience, we drop time indices from the tax rates and prices):

$$c_t + a_t + h_t = y_t \tag{13}$$

and

$$y_{t+1} = [1 + (1 - \tau_k) r] a_t + (1 - \tau_l) \varepsilon w - (r + \delta_h) s_t + (1 - \delta_h - \tau_{ir} r) h_t. \tag{14}$$

infinite-horizon model all borrowing constrained households would accumulate wealth so as to be able to eventually afford the amount of owner housing they wish to have. See also Henderson and Ioannides (1983) for a model that incorporates several other aspects that may be relevant for the tenure choice.

[14] One issue related to renters is that especially poor households probably receive direct subsidies for rental housing. Therefore, it is not clear whether rental housing is treated that differently from owner housing and we could think of the housing tax rate as a tax (or subsidy) also on rental housing. In that case, whether households rent or own their housing would be irrelevant. We consider, however, the extreme case where there are no subsidies to rental housing at all.

Solving the latter equation for a and plugging into the first one gives

$$c_t = y_t - \frac{y_{t+1} - (1-\tau_l)\varepsilon w}{R} - \frac{r + \delta_h + r\left(\tau_h - \tau_k\right)}{R} h_t - \frac{r+\delta_h}{R} s_t \tag{15}$$

where $R = 1 + (1-\tau_k)r$. Hence, if $\tau_h = \tau_k$, the cost of rental housing (in terms of current consumption) is the same as the cost of owner housing. If $\tau_h < \tau_k$ ($\tau_h > \tau_k$) the cost of owner housing is lower (higher) than the cost of rental housing.

The policy preferences of renters would not display substantial variation; all renters obviously prefer a high tax on housing since that shifts the tax burden towards all other households and increases business capital accumulation. For this reason, we consider all renters as a single group while still sorting homeowners in the same way as previously into 25 wealth-income groups. As before, we consider households of age 35-55. There are now 3416 households in the sample, the renters constituting 29% of the total population.

The mean wealth and labor income in our sample are now different because of the introduction of renters. The average wealth falls substantially with the introduction of renters. The average labor income also falls. Therefore, homeowners are now on average wealthier and have a higher labor income in relation to the total population.

More specifically, while the average wealth in our sample without renters is 308170 dollars, it is 231620 dollars with renters. Therefore, in order to obtain a table corresponding to the left-hand part of table 1, each figure for the 25 groups of homeowners should be multiplied by $308170/231620 \simeq 1.33$. The mean wealth among renters is 38280 dollars, which is about 17% of the average wealth. The average labor income in turn falls from 74420 to 63820 dollars when renters are included. The figures in the right-hand part of table 1 should therefore be multiplied by about 1.16. The average labor income among renters is 37070 dollars, and consequently their labor income is about 58% of the average labor income.

We calibrate the model as in the benchmark case with only homeowners. Again we start by fixing the tax on labor income at $\tau_l = 0.34$ and the housing tax rate at $\tau_h = 0.15$. We then choose the remaining parameters so as to match the same aggregate ratios as in section 4. This procedure implies now parameter values $\gamma = 0.1814$, $\beta = 0.9495$, $G = 0.1482$, and $Tr = 0.0730$. The tax rate on business capital, which is determined as a residual from the government budget constraint, is $\tau_k = 0.3308$.

The equilibrium tax rates are now $\tau_h = 0.02$ and $\tau_k = 0.461$. The corresponding aggregate ratios are $K/H = 0.873$, $K/(K+H) = 2.784$, and $T/Y = 0.284$. The tax rate on housing is thus lower than with only homeowners while the tax on capital income is almost the same. The median voter is now in the third wealth quintile and the first labor income quintile. In this politico-economic equilibrium the average housing-to-total wealth

ratio is 0.47. The median voter has 57% of average wealth and 51% of the average housing. Hence, his housing-to-total wealth ratio is 0.45.

Table 6 presents the policy preferences of the 25 groups of homeowners and the renters in the steady state equilibrium. Again, wealthy households tend to prefer a high tax rate on housing. In addition, homeowners in the third and fourth wealth quintiles prefer a lower tax rate on housing when their income increases. Actually, households with high labor income in the fourth wealth quintile prefer a lower tax rate on housing than low income households in the third wealth quintile. Table 6 shows that two effects are relevant for the tax structure when we introduce renters. First, the tax bases are now different, as part of housing is effectively taxed by the capital income tax τ_k. This is why the tax on business capital is almost the same as without renters even if the tax rate on housing is somewhat lower. By voting for a low housing tax rate, poor homeowners can try to shift the tax burden not only on the richest households but also on renters. Second, the identity of the median voter changes because all renters prefer a very high housing tax rate. It is interesting,.although not very surprising, to note that renters, who are relatively poor in terms of total wealth, have similar policy preferences as the very richest homeowners.

Table 6: The most preferred housing tax rates.

Homeowners	Labor income quintile				
Wealth quintile	1	2	3	4	5
1	0	0	0	0	0
2	0	0	0	0	0
3	0.02	0	0	0	0
4	1	0.52	0.11	0.01	0
5	1	1	1	1	1
Renters			1		

7 Conclusions

We have analyzed the political economy of housing's tax status. As is well known, tax systems in most OECD economies strongly favor investing in owner housing instead of financial assets. We argued that this is likely to be related to the distribution of housing wealth and other forms of wealth. At least in the US data - and we suspect the same to be true for other economies as well - housing wealth is distributed much more evenly than total wealth. Therefore, the median voter has a very large share of his overall wealth in the form of housing. The key trade-off he faces is that a low tax rate on housing 1) shifts

the tax burden to wealthier households but 2) leads to a high tax rate on business capital and hence low wages and high interest rates. In our calibrated model economy, the first effect dominates, and the equilibrium tax rate on housing is close to zero. Adding renters doesn't change the overall picture. A low tax on housing then shifts the tax burden towards renters as well as the wealthiest households owning most of the non-housing wealth.

Perhaps the most important extension for future work would be to consider these issues taking life cycle aspects into account. Age might be an important determinant of policy preferences in itself. In addition, a life cycle model would allow to model the tenure choice based on borrowing constraints. We chose to use a simpler infinite-horizon framework because it makes it easy to focus on the effect of the asymmetric distribution of housing and non-housing wealth that we were interested in. We believe that this distributional aspect would remain important for the political economy of housing taxation in otherwise more elaborate models.

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