On the Political Economy of Housing's Tax Status*

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Abstract

Most households have most of their wealth in the form of housing. We analyze how this distributional feature shapes the political economy of housing taxation. We build a simple dynamic general equilibrium model where households vote over the tax treatment of housing and business capital. The model is calibrated so as to match the joint distribution of financial wealth and housing wealth among US households. The median voter has a large share of his wealth in the form of housing and most of his income is wage earnings. The key trade-off he faces is that lowering the tax burden on business capital while increasing the tax burden on housing leads to higher wages but also increases his own share of the overall tax burden.

JEL Classification: E62, H31, P16

1 Introduction

The total stock of tangible capital in the US economy can be divided into two parts of roughly the same size: the stock of business capital and the stock of housing capital. The estimates of the effective tax burden on business and housing capital vary. The general view, however, is that the effective tax rate

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on the return to business capital is much higher than the effective tax rate on the return to housing capital, mainly because the return to owner housing, the imputed rent, is not taxed.[1] This asymmetric tax treatment of the two capital stocks is likely to increase the overall efficiency cost of taxation substantially. See e.g. Skinner (1996) and Gervais (2002).[2]

An obvious question is then why the tax system favors housing despite the efficiency losses involved. The purpose of the present paper is to analyze this question by considering the tax status of housing from a political economy perspective. To our knowledge, there exists no previous political economy analysis focusing on the different tax treatment of housing and business capital. Given the fiscal importance of housing's tax status, this seems an important gap in the existing political economy literature on taxation.[3]

The starting point of our analysis is the observation that housing wealth is much more evenly distributed than financial wealth. Therefore, even though housing wealth makes up about half of all household wealth in aggregate terms, most households have most of their wealth in the form of housing.[4] These households may see a low tax rate on housing together with a high tax rate on other assets as a way of shifting the tax burden towards the very wealthiest households. We are interested in whether such a distributional effect may dominate efficiency arguments.

In order to analyze this question, we use a dynamic general equilibrium model with wealth and labor income heterogeneity. In the model economy, there are two assets: owner housing and a financial asset. Government expenditures are financed by a capital income tax on the return to the financial asset, a housing tax on the imputed rent to owner housing, and a labor tax. The aggregate amount of the financial asset corresponds to the aggregate stock

[1] This is true for most OECD economies. See Hendershott and White (2000) for an international comparison of housing taxation.

[2] Skinner (1996) and Gervais (2002) analyze the efficiency and welfare costs of not taxing housing using dynamic general equilibrium models. Other quantitative analyses of housing taxation include Berkovec and Fullerton (1992), Hendershott and Won (1992), and Poterba (1992). Rosen (1985) presents a survey of the earlier literature on housing taxation.

[3] Berkovec and Fullerton (1992) and Gervais (2002) do consider the distributional effects of various housing tax reforms, but present only steady state results. That is, they do not consider the problem of households alive when the reforms are implemented. Therefore, their results are not directly relevant for a political economy analysis. On the other hand, both papers include aspects which are not present in our analysis but may be relevant for the political economy issues as well. In particular, Berkovec and Fullerton take house price risks into account and Gervais' model includes rental housing.

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

of business capital. Hence, the capital income tax is the effective tax rate on business capital.

We focus on the capital tax structure by considering the tax mix between the housing tax and the capital income tax. Specifically, we frame the political problem so that households decide upon constant shares of housing and business capital tax revenues in total tax receipts with the share of labor tax revenue being fixed. We use the median voter approach to determine the political outcome.[5]

A key part of our analysis is the calibration procedure. We use a sub-sample of the 2001 wave of the Survey of Consumer Finances. We sort households in the data into 25 different groups according to their financial wealth and housing wealth. The structure of the model allows us to perfectly match the resulting joint distribution of housing and financial wealth. This is done by choosing the labor income distribution so that, given the steady state distribution of financial wealth, households in the model economy choose the correct amount of housing. Our interpretation is that each household's housing wealth reflects its permanent labor income.

Increasing the tax burden on housing while lowering the tax burden on business capital would increase the tax bill of a large majority of households having most of their wealth in housing. Only the wealthiest households having a large part of their wealth in financial assets would see their tax bill reduced. However, in the long-run, such a reform would also imply a higher wage rate. The increased wage rate is especially beneficial to households having most of their wealth in housing because most of their income is labor earnings. Therefore, the tax burden effect and the general equilibrium effects have largely opposing distributional implications.

The policy preferences of households with different levels of financial savings and housing turn out to depend on the transitionary dynamics. We find that the tax burden effect is likely to dominate in the sense that households having most of their wealth in housing prefer to collect a relatively small share of all tax revenue with the housing tax. As a result, the politically determined tax structure consists of a much lower tax burden on housing and a higher tax burden on capital income than what would maximize aggregate efficiency.

In an extension, we consider the overall structure of taxation by letting the households vote over labor taxation as well. Households then disagree both on the structure of capital taxation, i.e. taxing housing versus taxing business

[5] Of course, we recognize that voters typically do not directly decide on tax rates. Still, for instance, the state of California has a long tradition of direct democracy including frequent referenda on taxation. The most famous example of these is probably the 1978 initiative on property taxes that passed and reduced the property taxes by about 57%.

capital, and on how to split the overall tax burden between capital and labor.

We proceed as follows. In the next section, we describe the model. We discuss calibration in section 3. Our results are presented in sections 4 and 5. We conclude in section 6.

2 Model

We employ a version of the neoclassical growth model where infinitely lived households, or dynasties, decide upon consumption, housing and saving. Households are heterogenous in their initial financial wealth and labor productivity. Each household's financial wealth and labor productivity determine the amount of its owner housing through the consumption demand for housing.

There are two capital goods: business and housing capital. Business capital is used in the production of an output good which can be converted into a consumption good and new business and housing capital. The tax code differentiates between interest income, labor income, and the imputed rent from housing.

Housing and business capital are subject to adjustment costs. Adjustment costs slow down the transition towards a new steady state. They also imply that the relative prices of housing and business capital may change as a result of changes in the tax system. In the absence of adjustment costs, after a change in the tax system, part of the existing housing capital stock could be freely and instantaneously converted into business capital, or vice versa, which is unrealistic.[6]

For our purposes, the model has two very useful qualities. First, it allows for a representative agent. That is, for any sequence of future tax rates, all aggregate variables can be found by solving the problem of a household that has the average amount of financial and housing wealth and average labor income. The tax reform that maximizes the welfare of the representative household, or aggregate efficiency, provides a natural benchmark to which the politically determined tax reform can be compared.

Second, we can freely choose the initial steady state joint distribution of financial wealth and labor productivity. This allows us to calibrate the model so as to perfectly match, in a sense that we will make clear below, the joint distribution of housing and financial wealth in the data. This is crucial for our analysis and would not be possible in a model including, say, life cycle features, uncertainties, or transaction costs. See Krusell and Ríos-Rull (1999) and

[6] See Davis and Heathcote (2005) for a business cycle model with a much more detailed modelling of the supply of housing. In particular, their model incorporates land.

Caselli and Ventura (2000) for a detailed analysis of this type of representative agent models with wealth and labor income heterogeneity.

Perhaps the most important simplification in our analysis is that we abstract from rental housing. The main reason we consider only owner housing is that the choice between rental and owner housing is closely related to life cycle aspects. Rental housing is most common among relatively young households and many renters presumably expect to become homeowners later in life.

Introducing renters would also add a new policy dimension, namely the tax treatment of rental housing. The current US tax system favors owner housing over rental housing. This is because rental income is taxed whereas the imputed rent from owner housing goes untaxed. In a life cycle model, Gervais (2002) models the choice between rental and owner housing with a down-payment constraint, minimum house size constraints, and a tax system favoring owner housing over rental housing. In his model, the non-taxation of the imputed rent induces young households to strive to accumulate savings for the down-payment thereby distorting their life cycle consumption profile. This distortion is absent from our model.

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

2.1 Neoclassical growth model with housing

Time is discrete and goes on forever. The supply side of the economy consists of two representative firms. One of them combines business capital and labor to produce output goods. The production function is of the usual Cobb-Douglas form. Let K_t and L_t denote aggregate stock of business capital and aggregate supply of effective labor in period t, α the capital share parameter, and δ_k the depreciation rate of business capital. Aggregate production, rental rate of capital, and wage rate in period t are given, respectively, by

$$\begin{aligned} Y_t &= K_t^{\alpha} L_t^{1-\alpha}, && (1) \\ \widetilde{r}_t &= \alpha K_t^{\alpha-1} L_t^{1-\alpha} - \delta_k, \text{ and} && (2) \\ w_t &= (1-\alpha) K_t^{\alpha} L_t^{-\alpha}. && (3) \end{aligned}$$

Changing the stocks of housing and business capital is subject to adjustment costs. In period t, a representative construction firm buys 'old' housing and business capital and output goods. The price of old housing capital is denoted by p_t^o, the price of old business capital by q_t^o, and the price of the output good is normalized to one. The construction firm then combines old housing and business capital and output goods to produce 'new' housing and

business capital, which it sells at prices p_t^n and q_t^n. Its problem is the following:

$$\max_{H_{t+1},H_t,K_{t+1},K_t} \{p_t^n H_{t+1} - p_t^o H_t - (H_{t+1} - (1-\delta_h)H_t) - \frac{\phi(H_{t+1}-H_t)^2}{2H_t} \quad (4)$$
$$+q_t^n K_{t+1} - q_t^o K_t - (K_{t+1} - (1-\delta_k)K_t) - \frac{\phi(K_{t+1}-K_t)^2}{2K_t}\},$$

where H_t and K_t are the stocks of old housing and business capital the construction firm buys and H_{t+1} and K_{t+1} the amounts of new housing and business capital it sells. Parameter δ_h denotes the depreciation rate of housing capital and ϕ determines the adjustment costs associated with the two capital goods. The problem of the construction firm implies the following prices:

$$p_t^n = 1 + \phi(H_{t+1} - H_t)/H_t \quad (5)$$
$$p_t^o = (1-\delta_h) + \phi(H_{t+1} - H_t)/H_t + \phi(H_{t+1} - H_t)^2/(2H_t^2) \quad (6)$$
$$q_t^n = 1 + \phi(K_{t+1} - K_t)/K_t \quad (7)$$
$$q_t^o = (1-\delta_k) + \phi(K_{t+1} - K_t)/K_t + \phi(K_{t+1} - K_t)^2/(2K_t^2) \quad (8)$$

It is straightforward to show that the construction firm makes zero profits in every period.

There is also a financial institution which issues a financial asset and invests in business capital which it rents to the firm producing output goods.[7] It is the easiest to think of it as having a two-period problem. In period t, it sells an amount A_{t+1} of financial assets to the households and buys an amount K_{t+1} of business capital with a unit price of q_t^n which it then rents to the firm producing output goods. In period $t+1$ it pays and collects interest payments related to the financial asset, the interest rate being r_{t+1}, and sells the capital goods for price q_{t+1}^o to the construction firm. Formally, its problem is:

$$\max_{K_{t+1},A_{t+1}} \{q_{t+1}^o K_{t+1} + \widetilde{r}_{t+1} K_{t+1} - (1+r_{t+1})A_{t+1}\} \quad (9)$$

subject to

$$q_t^n K_{t+1} = A_{t+1}. \quad (10)$$

We assume that the financial institution makes zero profits in every period. This implies

$$r_t = \frac{q_t^o + \widetilde{r}_t - q_{t-1}^n}{q_{t-1}^n}. \quad (11)$$

[7] The financial institution is introduced for ease of exposition only. Equivalently, we could let the households trade directly with business capital goods and define the tax system so that the capital income tax applies to the capital gains they make as well as the rental rate of capital.

There are I types of infinitely lived households and a continuum of households of each type. The mass of households of type i is denoted by $q^i > 0$. The total mass of households is normalized to one. Different household types have different labor productivities. We use ε^i to denote the relative labor productivity of households of type i. We normalize so that $\sum_{i=1}^{I} q^i \varepsilon^i = 1$.

The households derive utility from the consumption of a composite consumption good, c, the consumption of housing services, and leisure. Their time endowment is one and the time spent working is denoted by l. We follow Gervais (2002), Broadbent and Cremer (2001), Davis and Heathcote (2005), and others in assuming that housing services are proportional to housing capital, h.

Periodic utility is given by

$$u(c,h,l) = \frac{\left[c^{\gamma_c} h^{\gamma_h} (1-l)^{(1-\gamma_c-\gamma_h)}\right]^{1-\sigma}}{1-\sigma} \tag{12}$$

where $\gamma_c > 0$ is the utility share of consumption, $\gamma_h > 0$ the utility share of housing, and σ the inverse of the intertemporal elasticity of substitution. As is well known, this utility function is consistent with the fact that hours worked have remained roughly constant over a long period of time. As noted by Kydland (1995), it is also consistent with the fact that historically US households have spent a roughly constant fraction of their overall expenditures in durable goods even though their relative price has declined.[8]

Households have two assets at their disposal: owner housing and a financial asset, a. Households pay flat rate taxes on the interest income from the financial asset, labor income, and the imputed rent from owner housing. We refer to these taxes as the capital income tax, τ^k, the labor tax, τ^l, and the housing tax, τ^h. The imputed rent from a house of size h is defined as rh.[9]

The problem of a household of type i in period s is the following:

[8] We have also experimented with a more general CES function. The results were not very sensitive to moderate changes in the elasticity parameter. It should be noted, however, that even within a CES function, we have to restrict the elasticity parameter to be the same between any two of the three goods. This is because we have to restrict the utility function to be homothetic. If the utility function was not homothetic, the model would not allow for a representative household and we could not freely choose the initial distribution (see Krusell and Ríos-Rull, 1999, p. 1161-62).

[9] The imputed rent is defined as the rental price of housing services. If rental markets existed, the return to rental housing should equal the return to the financial asset. Thus, the rental price of housing would be $r + \delta_h$, assuming that landlords pay for the depreciation and that the tax rate on rental income equals the capital income tax rate. Hence, the tax base for an amount h of housing capital is the imputed rent net of depreciation, i.e. rh.

$$\max_{\left\{c_t^i, l_t^i, h_{t+1}^i, a_{t+1}^i\right\}_{t=s}^{\infty}} \sum_{t=s}^{\infty} \beta^t u(c_t^i, h_t^i, l_t^i) \tag{13}$$

subject to

$$c_t^i + a_{t+1}^i + p_t^n h_{t+1}^i = [1 + (1 - \tau_t^k) r_t] a_t^i + (1 - \tau_t^l) \varepsilon^i w_t l_t^i + \left(p_t^o - \tau_t^h r_t\right) h_t^i, \tag{14}$$

where $\beta \in (0, 1)$ is the discount factor.

Households may hold debt, i.e. a may be negative. In that case, the financial asset can be interpreted as a mortgage. It should be noted that in the model the mortgage interest payments are fully tax deductible at the capital income tax rate. This is roughly in line with the current US tax system, where households can deduct mortgage interest payments from their taxable income.

The first-order conditions for household of type i are the following:

$$\frac{u_{c_t^i}}{u_{c_{t+1}^i}} = \beta \left(1 + (1 - \tau_{t+1}^k) r_{t+1}\right) \tag{15}$$

$$\frac{u_{h_{t+1}^i}}{u_{c_{t+1}^i}} = p_t^n \left(1 + (1 - \tau_{t+1}^k) r_{t+1}\right) - \left(p_{t+1}^o - \tau_{t+1}^h r_{t+1}\right) \tag{16}$$

$$\frac{u_{l_t^i}}{u_{c_t^i}} = -(1 - \tau_t^l) \varepsilon^i w_t \tag{17}$$

Note that equation (15) implies that the steady state after-tax interest rate depends only on β.

The government finances a fixed amount of government expenditures, G, each period and faces a balanced budget constraint. Let H denote the aggregate capital stock. The government budget constraint then reads as:

$$\tau_t^l w_t L_t + \tau_t^k r_t A_t + \tau_t^h r_t H_t \equiv G. \tag{18}$$

The three tax rates correspond to effective average tax rates on labor, business capital, and housing. Of course, in reality, these effective tax rates are formed as a combination of a number of taxes levied on both households and firms. Here, it is immaterial whether capital and labor taxes are paid by firms or households.

2.2 Politics

Initially, the economy is in a steady state. We refer to this initial steady state as period 0. The tax structure in the initial steady state is calibrated so as

to match the actual tax structure in the US economy. We consider once and for all voting over the tax structure and use the median voter approach to determine the political outcome. Voting takes place in the beginning of period 1, before households make other decisions.

We frame the political problem so that households vote over the shares in total tax revenues to be collected by different taxes. Let us denote the shares in total tax revenue collected by the housing tax, the capital income tax, and the labor tax in period t by x_t^H, x_t^K, and x_t^L, respectively. Given the balanced budget constraint, these shares can be computed as:

$$\begin{aligned} x_t^H &= \tau_t^h r_t H_t/G, \\ x_t^K &= \tau_t^k r_t A_t/G, \text{ and} \\ x_t^L &= \tau_t^h w_t L_t/G. \end{aligned}$$

We first assume that households vote over the capital tax structure in the sense that they choose a constant share of housing tax revenue in total tax receipts, to be in place from period 2 onwards, with the share of labor tax revenue being fixed. That is, $x_1^H = x_0^H$, $x_1^K = x_0^K$, and $x_t^L = x_0^L$, for all $t \geq 1$. The voting is over $x^H = x_t^H$, for $t \geq 2$. Hence, for all $t \geq 2$, the capital income tax revenue share is determined as $x_t^K = x^K = 1 - x^H - x_0^L$. A higher housing tax revenue share will therefore mean a lower capital income tax revenue share, and vice versa.

Each housing tax revenue share is associated with certain sequences of tax rates, wages, interest rates, and prices of new and old housing and business capital, all consistent with the general equilibrium. When voting, households take these transitionary dynamics into account.

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. When this is the case, households may be ordered by their most preferred x^H. The equilibrium housing tax revenue share is then the median of the most preferred housing tax revenue shares. In all the cases we considered, the policy preferences were indeed single-peaked.

In an extension, we consider the overall structure of taxation by letting the households vote over labor taxation as well. To keep the analysis simple, we assume the following sequential voting procedure: Again voting takes place in the beginning of period 1 and concerns tax revenue shares from period 2 onwards. Households first vote over a constant labor tax revenue share $x^L = x_t^L$, for all $t \geq 2$, and after that over a constant housing tax revenue

share, $x^H = x_t^H$, for all $t \geq 2$.[10] When voting over the housing tax revenue share, households take the labor tax revenue share as given. When voting over x^L, they correctly anticipate what will be the equilibrium x^H for any given x^L. Again, x^K is determined residually as $x^K = 1 - x^H - x^L$.

We solve for the political equilibrium recursively by first finding the median voter's choice for x^H given each possible x^L. This gives us the equilibrium x^H as a function of x^L. Since the policy preferences over x^L are single-peaked, we can apply the median voter theorem again to find the equilibrium x^L.

There are three reasons why we consider once and for all voting instead of repeated voting. First, housing taxation is not always on the political agenda. We find it reasonable to assume that whenever the question is on the agenda, it is to be resolved for a relatively long period of time. Second, focusing on once and for all voting makes it easy to illustrate how transitional dynamics affect policy preferences. As we will show, the transitional dynamics play a key role in this respect. Third, once and for all voting is computationally much simpler than repeated voting with fully forward looking agents (as in Krusell et al., 1997, and Krusell and Ríos-Rull, 1999). With once and for all voting, we can have a large number of household types. This is very useful when considering the distributional features that we are interested in. We discuss this point in more detail in section 3.

It should also be noted that the way we frame the political problem rules out, by construction, a second best tax reform with time-varying tax revenue shares. The solution to a standard Ramsey problem in this set-up would involve very high tax rates on both capital stocks during the first periods of the transition and zero long-run tax rates on both capital stocks.[11]

2.3 Equilibrium

For a given initial distribution of assets $\{a_1^i, h_1^i\}_{i=1}^I$, and sequence of tax revenue shares $\{x_t^H, x_t^L, x_t^K\}_{t=1}^\infty$ satisfying $x_t^H + x_t^L + x_t^K = 1$, for all t, a competitive economic equilibrium consists of aggregates $\{K_t, H_t, L_t\}_{t=1}^\infty$, household policies $\{a_{t+1}^i, h_{t+1}^i, c_t^i, l_t^i\}_{t=1}^\infty$ for all $i = 1, ..., I$, prices $\{\widetilde{r}_t, r_t, w_t, p_t^o, p_t^n, q_t^o, q_t^n\}_{t=1}^\infty$, and tax rates $\{\tau_t^k, \tau_t^h, \tau_t^l\}_{t=1}^\infty$ such that:

[10] Simultanous voting would imply a multidimensional policy space and we could not apply the median voter theorem. An example of a paper employing the same political procedure within a quantitative model is İmrohoroğlu et al. (2000).

[11] Eerola and Määttänen (2005) analyze the optimal tax treatment of housing capital in a similar neoclassical growth model but without distributional features.

i) For all $t \geq 1$, tax rates satisfy

$$\begin{aligned} \tau_t^h r_t H_t &= x_t^H G \\ \tau_t^l w_t L_t &= x_t^L G \\ \tau_t^k r_t A_t &= x_t^K G \end{aligned}$$

ii) Prices satisfy (1)-(3), (5)-(8), and (11).

iii) Household policies solve household's problem in (13)-(14) (together with a transversality constraint).

iv) Markets clear:

$$\sum_{i=1}^{I} q^i a_t^i = A_t \tag{19}$$

$$\sum_{i=1}^{I} q^i h_t^i = H_t \tag{20}$$

$$\sum_{i=1}^{I} q^i c_t^i = C_t \tag{21}$$

$$\sum_{i=1}^{I} q^i \varepsilon^i l_t^i = L_t \tag{22}$$

$$q_t^n K_{t+1} = A_{t+1} \tag{23}$$

v) Aggregate consistency condition

$$\begin{aligned} & C_t + K_{t+1} + H_{t+1} + \frac{\phi(H_{t+1} - H_t)^2}{2H_t} + \frac{\phi(K_{t+1} - K_t)^2}{2K_t} + \\ G &= K_t^\alpha L_t^{1-\alpha} + (1-\delta_k)K_t + (1-\delta_h)H_t \end{aligned} \tag{24}$$

holds.

vi) Government budget constraint (18) is satisfied.

As explained above, we consider two different politico-economic equilibria. In our benchmark case, we consider only the structure of capital taxation and fix the labor tax revenue share at its initial steady state level. That is, we set $x^L = x_0^L$. A politico-economic equilibrium then consists of an x^H which wins any other $\widetilde{x}^H$ in a pair wise voting with majority rule together with the corresponding system of prices, household policies, and tax rates that are consistent with the competitive economic equilibrium. The equilibrium x^H determines the capital income tax revenue share residually as $x^K = 1 - x_0^L - x^H$.

In an extension, we consider the overall tax structure by assuming that households first vote over x^L and then over x^H. A politico-economic equilibrium then consists of tax revenue shares x^L and x^H both determined by the majority rule according to the procedure explained in the previous subsection, together with the competitive equilibrium associated with them.

3 Calibration

In the calibration procedure, we first fix the labor tax, the housing tax, the technological parameters, and some of the preference parameters at empirically plausible levels. We then choose other parameters so that the model replicates certain aggregate ratios. Finally, we calibrate the distributional features.

We use the 2001 wave of the Survey of Consumer Finances (SCF). We construct two variables for the analysis: 'housing wealth' and 'financial wealth'. We define housing wealth as the value of primary residence and the value of other residential real estate. Financial wealth is defined as the sum of all financial assets, the net equity in non-residential real estate, and the value of net equity in businesses less all debt (including mortgages).[12] We consider only homeowners between 35 and 60 years of age (the age of the household head). We focus on middle-aged households because our model abstracts from life cycle features. There are 9824 households in our sample.

There are various estimates for the effective tax rates on housing, capital income, and labor in the US. We set the housing tax at $\tau_0^h = 0$. This is in the range of estimates for the effective tax rate on housing presented by Fullerton (1987). Property taxes are usually considered as user fees for housing-related community services, rather than distorting taxes, see e.g. Fullerton (1987) and Skinner (1996). If property taxes were included, the effective tax rate on housing would of course be higher. Based on the results in Carey and Rabesona (2004), we set the labor tax at $\tau_0^l = 0.2307$.[13]

We take the model period to be 4 years. Having a relatively long model period helps in solving the model accurately over a large range of housing tax revenue shares especially when we have high adjustment costs. We also believe that 4 years is a reasonable assumption about the time it would take to

[12] We use the extract of the full public data set from the 2001 survey results. In the extract file the relevant variables are: FIN (total financial assets), NNRESRE (net equity in non-residential real estate), BUS (business interests), HOUSES (value of primary residence), ORESRE (other residential real estate) and DEBT. Total financial assets in the data include, for instance, savings accounts, stocks, retirement accounts, and bonds.

[13] The figure in Carey and Rabesona (2004) is 0.23. We adjust it slightly in order to get a revenue share of labor income tax, x^L, *exactly* equal to 0.75.

first decide, through a political process, about a major tax reform concerning the tax status of housing and then to implement it (recall that in period 1 households vote over the capital tax structure that will be in place from period 2 onwards).[14]

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 $\delta_k = 0.3439$ and $\delta_h = 0.2193$. These correspond to annual deprecation rates of 0.1 and 0.06, respectively. The National Income and Product Accounts suggest an annual depreciation rate for housing capital around 0.015. By choosing a higher depreciation rate, we want to take maintenance costs into account.

In our benchmark calibration, the inverse of the intertemporal elasticity of substitution (or risk aversion) is set at $\sigma = 3$, which is a relatively standard value in the literature. Empirical estimates about capital adjustment costs vary substantially. We set the adjustment cost parameter, somewhat arbitrarily, at $\phi = 2$. In the sensitivity analysis, we will consider changes to these two parameters.

Parameters β, γ_c, γ_h, and G are chosen so as to match the following aggregate ratios. 1) Housing-to-business capital ratio $H_0/K_0 = 0.6863$. 2) Total capital-to-total output ratio $(K_0 + H_0)/Y_0 = 0.78$, where $Y = K^\alpha L^{1-\alpha} + rH$. 3) Government expenditure-to-total output ratio $G/Y_0 = 0.202$. 4) Aggregate supply of effective labor $L_0 = 0.333$. The first target is calculated from our sample by dividing average housing wealth by average financial wealth. The second and third targets are taken from Castañeda et al. (2003), where the annual capital-to-output ratio is 3.13. The fourth target means that individuals spend on average one third of their overall time endowment at work.

These targets imply the following parameter values: $\gamma_c = 0.3059$, $\gamma_h = 0.0680$, $\beta = 0.8874$, and $G = 0.0548$. The capital income tax is determined as a residual from the government budget constraint and is $\tau_0^k = 0.4625$. In terms of tax revenue shares, the initial steady state features $x_0^H = 0$, $x_0^L = 0.75$, and $x_0^K = 0.25$. The interest rate is $r_0 = 0.2361$, which corresponds to a yearly interest rate of 0.0651.

In order to calibrate the distributions, we sort the households in our sample along two dimensions: financial wealth and housing wealth. We first determine for each household the financial wealth quintile and the housing wealth quintile it belongs to. This creates 25 groups of households with different levels of

[14] We also experimented with a model period of two years and found that the results of section 4.3 were not affected very much.

financial wealth and housing wealth. Accordingly, we also create 25 different household types in the model, i.e. $I = 25$.

It should be stressed that it is important to sort the households in the sample along both financial and housing wealth. If we sorted them only along one dimension - financial wealth, housing wealth, or perhaps total wealth - the political outcome would depend on the sorting dimension. In addition, we would obviously get less information about the political preferences of different households.

Table 1 displays the relative size of the household groups. For instance, figure 5.1 in the first row and second column means that households belonging to the first financial wealth quintile and the second housing wealth quintile constitute 5.1% of the overall population in our sample.[15] Parameters $\{q^i\}_{i=1}^I$ are calibrated based on this table. For instance, letting type $i = 2$ correspond to households in the first financial wealth quintile and the second housing wealth quintile, we have $q^2 = 0.051$.

	Housing wealth quintile				
Financial wealth quintile	1	2	3	4	5
1	1.2	5.1	4.8	5.4	3.6
2	7.5	5.0	3.5	2.5	1.5
3	8.5	4.3	3.7	2.6	1.0
4	2.6	3.4	5.6	4.4	4.0
5	1.1	1.6	2.9	4.7	9.8

Table 1: Population shares (in percents).

For each of the 25 groups, we compute the average financial wealth and the average housing wealth in our sample. We then divide the average financial wealth in each group by the average financial wealth of all households in our sample and similarly for the housing wealth. Table 2 shows the resulting financial and housing wealth distributions. The left-hand part shows the relative financial wealth and the right-hand part the relative housing wealth in each group. For instance, figure -0.23 in the first row and first column of the table means that households in the first financial wealth quintile and the first housing wealth quintile hold debt, the average size of which is 23% of the average financial wealth of all households in the sample. Similarly, figure 0.27 in the first row and the sixth column means that the average housing wealth of

[15] The figures in each row and column do not add up to exactly 20%. This is because households have very different weights attached to them and we do not 'split' any observations into two groups.

households belonging to the first financial wealth quintile and the first housing wealth quintile is 27% of the average housing wealth in the sample.

	Housing wealth quintile									
	Financial wealth					Housing wealth				
Financial wealth q.	1	2	3	4	5	1	2	3	4	5
1	-0.23	-0.27	-0.29	-0.36	-0.57	0.27	0.43	0.64	1.02	2.33
2	-0.09	-0.09	-0.10	-0.09	-0.08	0.20	0.40	0.62	0.96	1.96
3	0.03	0.06	0.07	0.07	0.09	0.17	0.41	0.62	0.97	2.38
4	0.37	0.36	0.40	0.42	0.41	0.21	0.41	0.63	0.98	2.06
5	1.51	2.46	2.32	2.81	7.59	0.18	0.42	0.65	0.99	3.45

Table 2: Relative distributions of financial wealth and housing wealth.

Consider first the left-hand side of table 2. In the first financial wealth quintile, higher housing wealth is accompanied by lower financial wealth, that is, bigger mortgages. In the second to fourth financial wealth quintile, households with different housing wealth have roughly the same amount of financial wealth. In the last financial wealth quintile, higher housing wealth is associated with much higher financial wealth. The right-hand part of the table shows a similar pattern for the housing wealth distribution. The main difference between the two distributions is that housing wealth is much more evenly distributed than financial wealth.

We replicate the joint distribution of financial wealth and housing wealth displayed in table 2. As a first step, we assign financial wealth holdings $\{a_1^i\}_{i=1}^I$ for each household type, so that the relative financial wealth distribution across the 25 different types matches that in the table. After that, we choose the labor productivity parameters $\{\varepsilon^i\}_{i=1}^I$ so that, given the distribution of financial wealth, the initial steady state distribution of housing wealth also matches the empirical distribution presented in table 2. In practice, this is done by using the households' first-order conditions (15)-(17) and budget constraints.

Table 3 displays the resulting labor productivity distribution as well as the amount of labor, l^i, supplied by each household type in the initial steady state. For instance, figure 0.28 in the first row and first column means that the labor productivity of households in the first financial wealth quintile and the first housing wealth quintile is 28% of the average labor productivity. Denoting the corresponding household type by $i = 1$, we have $\varepsilon^1 = 0.28$.

In any given financial wealth quintile, households with more housing have a higher labor productivity. This is why they can afford their housing. Note that the labor supply is fairly constant across different household types (except for

	Housing wealth quintile									
	Labor productivity					Labor supply				
Financial wealth quintile	1	2	3	4	5	1	2	3	4	5
1	0.28	0.46	0.67	1.07	2.43	0.38	0.37	0.37	0.37	0.36
2	0.21	0.42	0.64	1.01	2.04	0.37	0.36	0.36	0.36	0.36
3	0.18	0.43	0.64	1.01	2.46	0.35	0.35	0.36	0.36	0.36
4	0.21	0.41	0.64	1.00	2.13	0.31	0.34	0.34	0.35	0.35
5	0.12	0.34	0.58	0.92	3.29	0.05	0.18	0.26	0.28	0.30

Table 3: Labor productivities and initial steady state labor supplies.

the extreme case in the fifth financial wealth quintile and first housing wealth quintile). This is a realistic property of the utility function we employ.

In the calibrated model economy, labor income is more evenly distributed than capital income (which is proportional to financial wealth).[16] The reason why this implies that housing is more evenly distributed than financial wealth is simple: Households' demand for housing is proportional to the sum of their after-tax capital and labor income, or total income. Since labor income is more evenly distributed than capital income, total income is more evenly distributed than financial wealth. Hence, the distribution of housing wealth, which is proportional to the distribution of total income, is more even than the distribution of financial wealth.

There are three distributional dimensions - financial wealth, housing, and labor income - in the model. As discussed above, we can always perfectly match two of them. Instead of matching the joint distribution of financial wealth and housing, we could match the joint distribution of financial wealth and labor income. The problem with this approach is that annual labor income observed in a cross-section data may be a poor proxy for permanent labor income. In matching housing wealth and financial wealth distributions, our underlying assumption is that given a household's financial wealth position, its housing wealth reflects its expectations about its future average labor income.

4 Results

In this section, we present our main results. In order to highlight the workings of the model, we start by displaying the aggregate dynamics following a change

[16] This reflects the well-known fact that total wealth is much more unevenly distributed than labor income. See e.g. Díaz-Giménez et al. (1997).

in the capital tax structure. We then show how taxing housing would affect the distribution of the tax burden across different households. After that, we display the policy preferences of different household types and compare the median voter outcome to the tax reform that would maximize the welfare of a representative household. Finally, we discuss the importance of transitionary dynamics and present some sensitivity analysis.

4.1 Aggregate dynamics

In this subsection, we display the aggregate dynamics of the economy following a tax reform which increases the share of housing tax revenue in total tax receipts (x^H) from 0 to 0.1. As a result, the share of capital income tax revenue (x^K) decreases from 0.25 to 0.15. In all figures, period 0 refers to the initial steady state.

Figure 1 shows the evolution of the two capital stocks, aggregate consumption, and aggregate supply of effective labor. Following the tax reform, the business capital stock increases and the housing capital stock decreases. Both stocks adjust gradually towards their new steady state levels.

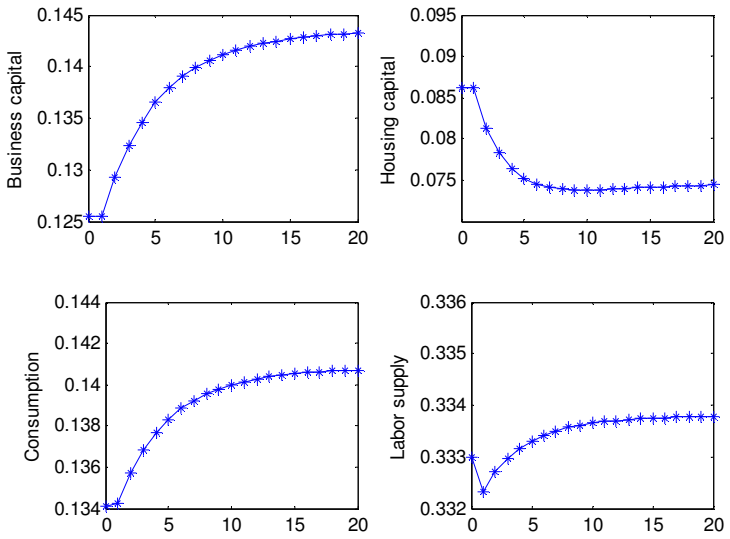

Figure 1. Evolution of capital stocks, consumption and labor supply after setting $x^H = 0.1$.

Figure 2 shows the dynamics of the three tax rates. All tax rates converge close to their new steady state levels in a few periods. Note that the capital income tax decreases already in period 1, even though the capital income tax revenue share is held fixed until period 2. This is because the interest rate peaks in period 1 (see figure 3 below) which in turn increases the tax base of the capital income tax. Also the labor income tax is slightly altered already in period 1 because of changes in the labor supply.

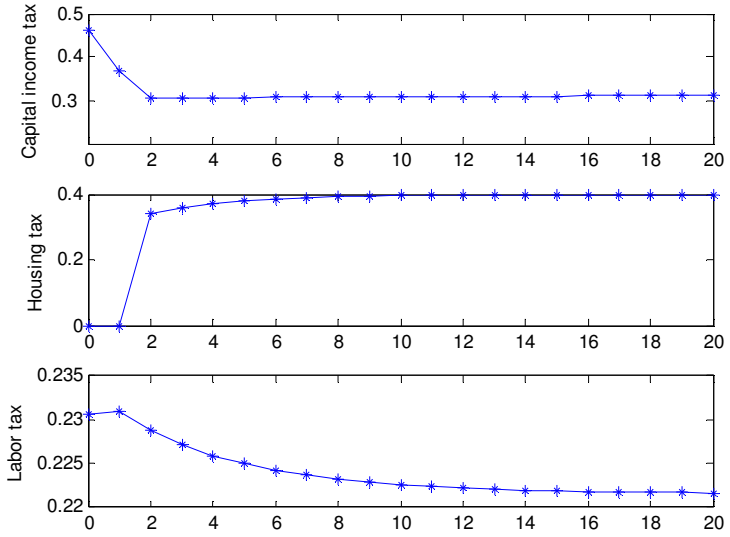

Figure 2: Evolution of tax rates after setting $x^H = 0.1$.

Figure 3 shows the price effects. The price of new housing capital falls and the price of new capital stock increases on impact. Both prices eventually return to their steady state levels. The prices of old housing and business capital (not shown) follow very similar patterns. The wage rate increases gradually towards its new steady state level. The net interest rate peaks in period 1 because of the increase in the price of old business capital.

The capital price effects depend on the adjustment costs: the larger the adjustment costs, the bigger are the price effects of a given tax reform. In this example, the first period fall in the price of new housing is about 11% and the increase in the price of new business capital is about 6%. We find these to be relatively moderate effects given the dramatic increase in the tax burden

on housing and the decrease in the tax burden on business capital. Therefore, we believe that our benchmark value for the adjustment cost parameter is not unrealistically high.

Adjustment costs affect not just the dynamics of housing investment and the price of housing capital but also the dynamics of business capital investment and hence also wage and interest rates. Without adjustment costs, the wage rate would reach the new, higher steady state level much faster while the temporary increase in the after-tax interest rate would remain more modest.

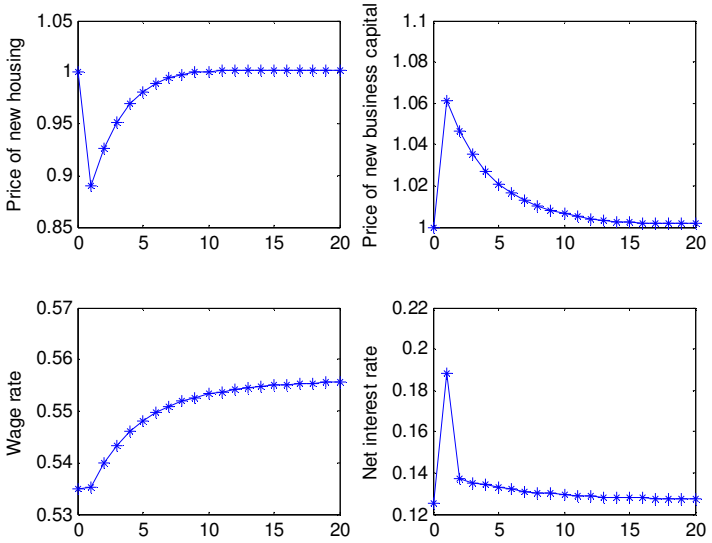

Figure 3: Evolution of prices after setting $x^H = 0.1$.

The general equilibrium price effects are very important for households' welfare. The increase in the wage rate benefits especially households whose main source of income is labor. The temporary increase in the after-tax interest rate benefits households with positive holdings of the financial asset. However, many households hold debt in the initial steady state. They are of course adversely affected by this interest rate effect.

4.2 Distribution of tax burden

Changing the capital tax structure changes the distribution of the tax burden across different households. Table 4 shows, for each household type, the relative change in the discounted sum of all taxes paid following the tax reform

discussed in the previous section.[17] When computing taxes paid under the new tax system, we have taken the transitional dynamics into account.

	Housing wealth quintile				
Financial wealth quintile	1	2	3	4	5
1	22	18	15	13	11
2	14	11	10	9	9
3	6	6	7	7	8
4	-9	-2	1	3	6
5	-34	-28	-20	-16	-12

Table 4: Relative change in the present value of taxes paid (in percents).

Increasing the housing tax and lowering the capital income tax leads to most households paying more taxes. Only the households in the last financial wealth quintile and those in the fourth financial wealth quintile with little housing would pay less. For many households, the difference is also very large. For instance, for households in the first financial wealth quintile, the discounted sum of taxes paid is between 11% and 22% higher than in the initial steady state. Households in the fifth financial wealth quintile in turn would pay between 12% and 34% less taxes.

4.3 Policy preferences and political outcome

In order to determine the policy preferences of the households, we consider x^H's from -0.10 to 0.25 (with a grid step of 0.0025). The tax revenue share of the labor tax is kept fixed at $x^L = 0.75$ and hence $x^K = 0.25 - x^H$. Note that a negative housing tax revenue share implies a housing subsidy, whereas the highest housing tax revenue share we allow for, (0.25) implies a capital income tax equal to zero.

We first determine for each x^H the associated paths for tax rates, interest rate, and wage rate. We then solve for each household type and for all x^H's the optimal consumption, housing, and labor supply paths given the initial financial and housing wealth of the household. Finally, we compute the associated discounted sums of periodic utilities and determine the most preferred x^H for each household.

[17] The discount rate is the after-tax interest rate.

Table 5 shows the most preferred housing tax revenue shares. The first thing to note is that households in different groups have very different policy preferences. Households with little financial and housing wealth prefer to subsidize housing whereas some households with lots of financial wealth would actually like to collect more than 25% of capital tax revenue from housing. Since the labor tax revenue share is fixed at 75%, this means that they would like to subsidize financial savings.

	Housing wealth quintile				
Financial wealth quintile	1	2	3	4	5
1	-3.25	-1.50	0.25	0.50	1.25
2	-0.25	1.25	2.00	2.25	2.75
3	4.50	4.00	4.00	3.50	2.25
4	14.75	9.25	7.50	6.00	4.50
5	25.00	25.00	23.75	20.50	17.25

Table 5: Most preferred housing tax revenue shares (in percents).

The table displays a systematic pattern along the financial wealth dimension: in any given housing wealth quintile, households with more financial wealth want a larger fraction of capital income taxes to be collected by using a tax on housing. An increase in the housing tax implies a lower capital income tax and hence a higher after-tax interest rate during the transition. This benefits households with a positive financial wealth and hurts households who hold debt (as can be seen from table 2, all households in the first two financial wealth quintiles hold debt).

Things are more complicated when we look at policy preferences along the housing wealth dimension. In the first two financial wealth quintiles, households with more housing wealth prefer a higher tax burden on housing. This reflects the importance of general equilibrium effects: Households with little financial wealth and a lot of housing wealth have high labor income (otherwise they could not afford their housing). A higher housing tax implies a higher wage rate and is therefore beneficial for households relying mostly on labor income. For households in the other financial wealth quintiles, the tax burden effect considered in table 4 dominates so that households with more housing wealth prefer a lower housing tax.

In order to determine the political outcome, we first order the most preferred housing revenue shares in table 5 and then find the median revenue share by using the population shares in table 1. The median voter belongs to the third financial wealth quintile and the second housing wealth quintile.

In table 6, we display the capital tax structure that is chosen by the median voter and compare it to the tax structure that would maximize the welfare of a representative household. In addition to the equilibrium tax structures, we show some aggregate ratios and the wage rate in the two cases.

	$x^H(\%)$	τ^h	τ^k	τ^l	$\frac{H}{K}$	$\frac{H+K}{Y}$	w
Median voter	4.00	0.126	0.406	0.227	0.614	0.786	0.544
Representative	10.00	0.399	0.311	0.222	0.520	0.792	0.556

Table 6: Equilibrium tax rates, some aggregate ratios, and wage rate in new steady state.

As the table shows, the two tax structures are very different. The reform that is preferred by the median voter implies a long-run housing tax $\tau^h = 0.126$ and a capital income tax $\tau^k = 0.406$. The representative household would choose a much higher tax burden on housing, implying $\tau^h = 0.399$ and $\tau^k = 0.311$. The reform chosen by the median voter naturally leads to a higher housing-to-business capital ratio, a lower capital-to-output ratio, and a lower wage rate than the one that would maximize the welfare a representative household.

Recall that for a given sequence of tax rates, the aggregate dynamics of the model economy are independent of the distribution. Hence, the difference between the median voter outcome and the representative outcome is solely due to the distributional conflict between households with different asset positions and labor productivities. Following an increase in the tax burden on housing, the median voter enjoys positive general equilibrium effects but also pays more taxes. The negative tax burden effect is immediate, whereas the positive general equilibrium effects come with a delay.

4.4 Importance of transitionary dynamics

Transitional dynamics are crucial in the political conflict between different households. In order to highlight this, we determine the preferred housing tax revenue shares under the counterfactual assumption that after a permanent change in the capital tax structure, all prices and tax rates converge immediately to their new steady state levels. To this end, we follow the same procedure as in section 4.3 with the difference that when determining the discounted sums of periodic utilities for different household types and for different tax reforms, we assume that the households face the new steady state tax rates and prices from period 1 onwards.

	Housing wealth quintile				
Financial wealth quintile	1	2	3	4	5
1	25.00	17.25	16.25	16.00	15.50
2	16.25	15.25	15.00	14.75	14.50
3	13.50	13.75	14.00	14.00	14.25
4	7.00	10.75	11.75	12.50	13.50
5	-0.10	-0.10	-0.03	1.75	5.00

Table 7: Most preferred housing tax revenue shares (in percents) with new steady state prices.

Table 7 displays the results. The pattern of the most preferred housing tax revenue shares is completely different from that in table 5. Recall that the true transition towards a new steady state following an increase in the housing tax features a temporary increase in the after-tax interest rate and gradually increasing wages (see figure 3). This experiment, in contrast, features a constant after-tax interest rate and a wage rate that increases immediately to its new steady state level. The immediate increase in the wage rate explains why households receiving most of their income as wage earnings now prefer taxing housing at a very high rate. The absence of a temporary increase in the after-tax interest rate in turn explains why households with lots of financial wealth and little housing wealth now prefer a very low housing tax. Since they have very little wage income (at least in relation to total income), the increase in the wage rate is not enough to compensate them for the increased cost of housing.

4.5 Sensitivity

Given our calibration targets, we have two 'free' parameters: the intertemporal elasticity of substitution, σ, and the parameter determining the adjustment costs, ϕ. In this section, we consider the sensitivity of our results to changes in these parameters.

Compared to the benchmark case, where $\sigma = 3$ and $\phi = 2$, we change only one of the parameters at a time. Changes in these two parameters affect the transitionary dynamics but not the initial steady state.

Table 8 shows the tax rates chosen by the median voter and the representative household under different parameter values. For instance, the first row of the results corresponds to the case where $\sigma = 1$ and $\phi = 2$. In order to make the comparison of the different cases easier, we also display (twice) the tax structures associated with the benchmark case.

	Median voter			Representative		
Parameter values	$x^H(\%)$	τ^h	τ^k	$x^H(\%)$	τ^h	τ^k
$\sigma = 1$	4.50	0.144	0.398	10.00	0.399	0.311
$\sigma = 3$	4.00	0.126	0.406	10.00	0.399	0.311
$\sigma = 5$	3.50	0.108	0.413	10.00	0.399	0.311
$\phi = 0$	11.25	0.472	0.289	10.25	0.413	0.307
$\phi = 2$	4.00	0.126	0.406	10.00	0.399	0.311
$\phi = 4$	-0.50	-0.013	0.469	9.75	0.392	0.319

Table 8: Equilibrium tax structures for different parameter values.

Consider first the intertemporal elasticity of substitution. It affects the way households feel about changes in consumption, housing, and leisure over time. However, the results are not very sensitive to changes in this parameter. The median voter's preferred housing tax revenue share decreases only very slowly as we increase σ while the efficient housing tax revenue share stays constant. Consequently, for all parameter values considered, the median voter prefers a capital tax structure with a much lower tax burden on housing than the representative household.

In line with the above analysis on the importance of the transitionary dynamics, the results *are* very sensitive to the adjustment cost parameter.[18] When adjustment costs are high, wages increase slowly after an increase in the housing tax revenue share. In addition, the temporary increase in the after-tax interest rate is rather pronounced. Therefore, higher adjustment costs aggravate the conflict of interest between different households: Households relying mostly on labor income and having a mortgage prefer a lower tax burden on housing and households with substantial capital income prefer a higher tax burden on housing. The end result is that the median voter prefers a smaller housing tax revenue share when adjustment costs are higher. Indeed, when $\phi = 4$, the median voter prefers a housing tax rate that is just below zero. The efficient housing tax revenue share, in contrast, is almost unaffected by changes in the adjustment cost parameter. As a result, when adjustment costs are high, the politically determined tax structure involves a dramatically lower tax burden on housing than what would correspond to an efficient tax structure. On the other hand, in the (unrealistic) case where there are no adjustment costs, the median voter prefers a slightly higher tax burden on

[18] We have also experimented with different adjustment costs for the two capital stocks changing one of the adjustment cost parameters while keeping the other fixed. The results (not shown) indicate that the two adjustment costs have a similar effect on the median voter outcome.

housing than the representative household. In this sense, even the question of whether the median voter prefers to tax housing more or less than the representative household is purely quantitative.

5 Labor taxation

So far, we have considered the tax mix between housing and capital income taxes alone. In this section, we analyze how the political conflict over the capital tax structure is influenced by changes in the tax burden on labor.

We consider first a situation where the society has somehow decided to change the labor tax revenue share to some given new level from period 2 onwards. The initial steady state, with the labor tax revenue share equal 75%, is the same as in the previous sections. We ask how the new labor tax revenue share affects the difference between the capital tax structures chosen by the median voter and the representative household. Table 9 displays the corresponding housing tax revenue shares for different labor tax revenue shares.

	$x^L(\%)$			
x^H (%)	55	65	75	85
Median voter	13.50	8.75	4.00	-0.50
Representative	18.00	14.00	10.00	6.25

Table 9: Equilibrium housing tax revenue shares for different labor tax revenue shares.

For any labor tax revenue share, the median voter prefers a lower housing tax revenue share than the representative household. However, the relative difference between the median voter outcome and the efficient outcome depends on the labor tax revenue share. For instance, when the labor tax revenue share is just 55%, the representative household prefers to collect 13.5% and the median voter 18% of all tax revenue with the housing tax. On the other hand, when the labor tax revenue share is as high as 85%, the representative household prefers a housing tax revenue share of 6.25% whereas the median voter prefers a small subsidy on housing.

We next ask what would be the most preferred overall tax structure of different households. Table 10 shows the combinations of housing and labor tax revenue shares that would be chosen by each household if it could just

dictate both the labor and housing tax revenue shares. Here we consider labor tax revenue shares between 0.5 and 0.8 (with a grid step of 0.01) and housing tax revenue shares between 0 and 0.2 (with a grid step of 0.0025).

	Housing wealth quintile									
	$x^L(\%)$					$x^H(\%)$				
Financial wealth quintile	1	2	3	4	5	1	2	3	4	5
1	50	50	50	50	50	13.75	6.25	7.50	8.50	9.75
2	50	50	51	53	54	8.75	9.75	10.25	10.75	11.00
3	59	58	57	56	55	12.25	12.00	12.00	11.75	11.50
4	80	77	71	64	59	20.00	16.25	14.75	13.75	12.25
5	80	80	80	80	80	20.00	20.00	20.00	20.00	20.00

Table 10: Most preferred labor and housing tax revenue shares.

The left-hand side of table 10 shows that households with less financial wealth prefer a smaller labor tax revenue share than households with more financial wealth. In our benchmark case with a fixed labor tax revenue share (table 5), households with less financial wealth preferred a lower housing tax revenue share than households with more financial wealth. Hence, a small labor tax revenue share serves a similar distributional purpose as a small housing tax revenue share.

In contrast to the benchmark case, households with less financial wealth do not in this experiment always prefer a lower housing tax revenue share than households with more financial wealth. However, they still prefer to collect a smaller fraction of all capital taxes from housing. For instance, all households in the first financial wealth quintile would choose the lowest labor tax revenue share we allow (50%). Of the remaining tax revenue, they would collect only around 30%, or less, with the housing tax. In contrast, all households in the fifth financial wealth quintile would choose the highest labor tax revenue share we allow (80%), and collect all the remaining tax revenue with the housing tax.

Finally, we consider how the overall tax structure would be determined through a political process. As explained in section 2.2, we assume that households vote separately and sequentially over the two revenue shares: they first vote on x^L and then on x^H. This timing assumption means that the households first determine the share of capital tax revenue of all tax revenue and

after that determine how the capital tax burden is divided between housing and capital income.[19] Table 11 displays the tax structures associated with the median voter outcome and the representative household's choice as well as the related tax rates, some aggregate ratios and the wage rate in the new steady states.

	Median voter	Representative
$x^L(\%)$	58	82
$x^H(\%)$	12	7.50
$x^K(\%)$	30.00	10.50
τ^h	0.353	0.319
τ^k	0.520	0.232
τ^l	0.179	0.240
$\frac{H}{K}$	0.590	0.520
$\frac{H+K}{Y}$	0.706	0.824
w	0.525	0.564

Table 11: Equilibrium tax revenue shares, tax rates, some aggregate ratios, and wage rate in new steady state.

As in our benchmark case with a fixed labor tax revenue share (table 6), the median voter chooses to collect a much smaller share of all capital tax revenue with the housing tax than the representative household. The share of housing tax revenue of all capital tax revenue is about 0.29 (12.00/42.00) in the median outcome and about 0.42 (7.50/18.00) in the representative outcome.

However, in contrast to our benchmark results, the median voter now prefers a bigger housing tax revenue share than the representative household and the new steady state housing tax rate implied by the median voter outcome is higher than the one associated with the representative household's preferred tax structure. This because the median voter prefers a much lower labor tax revenue share than the representative household and hence an unrealistically high tax burden on the two types of capital. In other words, while our results concerning the structure of capital taxation appear to be robust to letting the households vote over labor taxation as well, the model fails to explain the distribution of the overall tax burden between all the three tax bases.

It seems to us that in order to explain the overall tax structure, we would need more dimensions of heterogeneity. In the present model, households with

[19] In this example the median voter outcome - a pair of housing and labor tax revenue shares - remains the same if the timing of the votes is reversed so that households vote first on x^H.

most of their wealth in the form of housing also have high labor income relative to their wealth. As a result, households preferring a low tax burden on housing vis-à-vis business capital, also prefer a relatively low tax burden on labor. In order to explain the overall tax structure, we would need a situation where some households with most of their wealth in the form of housing have little labor income. Perhaps the most natural extension to this direction would be to consider a life cycle model. Many old households have little labor income compared to their housing wealth. We conjecture that they would prefer a low tax burden on housing together with a high tax burden on labor.[20]

6 Conclusions

Housing wealth is much more evenly distributed than financial wealth across US households. We have analyzed how this distributional feature shapes the political economy of housing's tax status. In particular, we were interested in seeing whether it can explain the current very asymmetric tax treatment of housing and business capital with a relatively high tax burden on business capital and a low tax burden on housing.

Using a calibrated general equilibrium model, we isolated two mechanisms that determine the policy preferences of different households. The first one is a direct tax burden effect: a revenue neutral tax reform that consists of increasing the tax burden on housing while lowering the tax burden on business capital would increase the tax bill of households having most of their wealth in housing. The second one is a general equilibrium effect: a higher tax burden on housing and a lower tax burden on business capital imply a higher wage rate resulting from increased business capital accumulation and a temporary rise in the net interest rate. The median voter benefits from the general equilibrium effect because most of her income is labor earnings, but also pays more taxes because most of her wealth is in the form of housing.

The trade-off between the tax burden effect and the general equilibrium effect is determined by the transitional dynamics. We found that the tax burden effect is likely to dominate in the sense that the median voter prefers to collect a much smaller share of all capital tax revenue from housing than the representative household.

[20] We would also expect that introducing life cycle aspects would tend to imply a lower housing tax revenue share when the labor tax revenue share is fixed. This is because older households do not have much time to enjoy from the beneficial general equilibrium effects of a lower tax burden on business capital.

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