

Positional Preferences for Housing: Income Taxation as a Second-Best Policy?*

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Abstract

This paper analyzes whether marginal taxation of labor and capital income might be useful second best instruments for internalizing the externalities caused by conspicuous housing consumption, when the government is unable to implement a first best corrective tax on housing wealth. The rationale for studying income taxation in this particular context is that first best taxes on housing wealth may be infeasible (at least in a shorter time perspective), while income taxes indirectly affect both the level and composition of accumulated wealth. We show that a suboptimally low tax on housing wealth provides an incentive for the government to subsidize financial saving and tax labor income at the margin.

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1. Introduction

This short paper examines whether income taxation/subsidization might be useful as a means of externality correction when consumers' housing choices partly emanate from positional preferences, in which case housing choices impose externalities on other people. There is a growing body of evidence showing that people are concerned with their relative consumption. A typical finding in this literature is that individual wellbeing increases if the individual's own consumption or income increases relative to the consumption or income of referent others (e.g., Easterlin, 2001; Johansson-Stenman et al., 2002; Blanchflower and Oswald, 2005; Luttmer, 2005; Solnick and Hemenway, 1998, 2005; Clark and Senik, 2010).¹ If concerns for relative consumption are driven by the desire to signal status or wealth, one would expect that clearly visible goods are more positional than less visible goods, i.e., that the utility of consuming visible goods to a larger extent is driven by preferences for relative consumption. Evidence from survey-experimental studies suggests that this is also the case, since visible goods such as houses and cars have been found to be more positional than other, less visible goods (Alpizar et al., 2005; Solnick and Hemenway, 2005; Carlsson et al., 2007). Calculations presented in Alpizar et al. (2005) show that the degree of positionality (the extent to which relative consumption matters compared to absolute consumption) for housing is substantial: on average, about 50 per cent of the utility gain of additional expenditures on housing may be due to increased relative consumption.² Therefore, individuals' choices of housing seem to impose substantial externalities on other people.

If housing, at least in part, represents conspicuous consumption, a first best policy would be to tax housing wealth such that the externality that each individual imposes on other people becomes fully internalized. Yet, although taxes on housing wealth are used in many countries, the tax rates are often quite low; at least by comparison with the magnitude of the positional externality mentioned above. This argument will be substantiated below, where we show that our model combined with empirical evidence of relative consumption concerns would imply an annual tax on housing wealth of between 2 and 3 per cent of the market value under reasonable assumptions. However, in many countries (Denmark being a notable exception)

¹ Academic work on conspicuous consumption dates back at least to Veblen (1899), although the associated policy implications were briefly touched upon already by Mill (1848). An economic theory of relative consumption was first presented in Duesenberry (1949).

² See also Zahirovic-Herbert and Chatterjee (2011), who find that people are willing to pay more for homes with a name attached to it.

property taxes are substantially below this rate.³ One reason for setting such low tax rates might be that property taxes are politically controversial, and homeowners constitute an influential group in society. In Sweden, for instance, the Homeowners' Association was formed partly for the purpose of collective action against taxation of housing wealth and most likely contributed to the significant reduction in effective tax rates during the latest decade. Also, since taxes on housing wealth (or property in general) are often local or regional, the policy incentives implicit in such taxes may not correctly reflect positional externalities; at least not if the consumption comparisons go beyond the local or regional jurisdiction.⁴ Therefore, if an optimal corrective tax on housing wealth is not feasible, it is important to consider other instruments to correct for the externalities caused by conspicuous consumption of housing. The mixture of labor and capital income taxes constitutes an interesting option, since it will affect both the level and composition of accumulated wealth.

Our study contributes to a large literature on tax and other policy responses to consumption positionality. Earlier studies in this area have typically focused on the effects of positional preferences for non-durable goods and optimal policy responses in terms of income taxation (and in some cases commodity taxation) and public expenditure.⁵ To our knowledge, the only exception is Aronsson and Mannberg (2013). They consider an overlapping generations model where each consumer lives for three periods and analyze the joint tax policy implications of positional concerns for housing and a self-control problem caused by quasi-

³ In Sweden, for instance, the tax on housing property is 0.75 per cent of the value of the property up to a maximum limit (where the value attached to each property by the tax authority is typically lower than the market value). The corresponding rate is between 0.2 and 0.7 per cent in Norway, where the municipalities freely decide on the implementation (about 30 per cent of the municipalities did not implement such a tax in 2009). Denmark applies a system with two rates: 1 per cent if the market value of the property is less than 3 million DKK and 3 per cent otherwise. The corresponding tax in Finland is 0.32-0.75 per cent of the market value. In Germany, the tax rate varies between 0.26 and 0.35 per cent. Great Britain also applies a zero rate except for homes with very high market values. Property taxes in the U.S. are based on the market value and the rates vary between states (although the tax is formally collected at the local level); in California, the maximum rate is 1 per cent. Source: the Swedish Homeowners' Association, Wikipedia (USA, UK, Norway and Denmark), Germany Trade and Invest (<http://www.gtai.de/GTAI/Navigation/EN/Invest/Investment-guide/The-tax-system/taxation-of-property.html>), International living (<http://internationalliving.com/real-estate/countries/france/taxes/>), <http://internationalliving.com/real-estate/countries/spain/taxes/>), Properties in Europe (http://www.properties-in-europe.com/info_italy_tax.htm), Soumi.fi,

⁴ Recent evidence suggests that social reference groups are not formed solely based on the local environment; possibly due to technological developments of social media and the Internet. For instance, Becchetti et al. (2010) found that the importance of social comparisons between countries has increased over time, and Clark and Senik (2010) found that that Internet access is positively correlated with relative consumption concerns.

⁵ See, e.g., Boskin and Sheshinski (1978), Oswald (1983), Ng (1987), Tuomala (1990), Ljunqvist and Uhlig (2000), Dupor and Liu (2003), Aronsson and Johansson-Stenman (2008, 2010, 2014), Wendner and Goulder (2008) and Eckerstorfer and Wendner (2013).

hyperbolic discounting (both of which may create incentives for households to over-accumulate housing debt). Their contribution is to show how the optimal mix of taxes on housing wealth and capital income varies over the individual life-cycle, as well as how it depends on whether consumers have naïve or sophisticated attitudes to their self-control problems.

The present paper contributes to the literature in primarily two ways. First, we analyze indirect instruments to correct for the externalities caused by conspicuous consumption when a direct instrument is not available; a scenario of clear practical relevance for reasons discussed above. Our setting also means that we extend the study of optimal income taxation in dynamic economies where the consumers have positional preferences beyond the standard setting with only one private (non-durable) consumption good (in which case income taxes constitute direct instruments for correction).⁶ Second, there is not much research on the tax policy implications of positional durable goods; the only earlier study that we are aware of is Aronsson and Mannberg (2013) referred to above. We supplement their study by considering (i) a different policy problem, (ii) another mix of tax instruments, and (iii) by examining a second best optimal tax policy. As such, the present paper's focus on durable consumption also contributes to the literature on a more general level.

In Section 2, we present the benchmark model and briefly describe how a government may implement a first best optimum through marginal taxation of housing wealth. Section 3 assumes that the possibility to tax housing wealth is restricted and examines the optimal second best taxation of labor and capital income.

2. A Reference Model

The model presented here aims at capturing two aspects of housing: (1) the possibility that individuals derive utility from their relative consumption compared to referent others, and (2) that the individual invests in housing wealth when young and may consume this housing wealth along with other accumulated wealth when old. To accomplish this task in the simplest possible way, we abstract from the price formation process in assuming that the supply of housing units is infinitely elastic in each period, and that the individual can sell any remaining

⁶ See Ljungqvist and Uhlig (2000) and Aronsson and Johansson-Stenman (2010, 2014).

units of the house when old. As such, and by analogy to a large literature on optimal taxation, we assume that the production technology (in our case in both the durable and non-durable goods sectors) is such that the producer and factor prices are fixed in each period, although not necessarily constant over time.

The economy is represented by an overlapping generations model, in which individuals live for two periods; they work in the first and are retired in the second. Each individual derives utility from the consumption of two goods: a durable good referred to as housing and a non-durable good. Housing is assumed to be a positional good in the sense that individuals derive utility from their relative consumption compared to referent others (in addition to the utility gain of the absolute consumption), while the non-durable good is completely non-positional.⁷ Individuals also derive disutility from work effort. To simplify the notation (since we are focusing on efficiency aspects of public policy), we also assume that individuals of the same generation are identical and normalize the number of individuals per generation to one.

An individual born at the beginning of period t , to be referred to as generation t , is young in period t and old in period $t+1$. Let $c_{0,t}$ and $c_{1,t+1}$ denote the consumption of the non-durable good by the young and old generation t , respectively, l_t denotes labor supply, while h_t denotes housing consumption. The lifetime utility function facing an individual of generation t is given by

$$U_t = U(c_{0,t}, l_t, h_t, \bar{h}_t, c_{1,t+1}) = u_0(c_{0,t}) + v(l_t) + \phi(h_t) + \Phi(h_t - \bar{h}_t) + u_1(c_{1,t+1}). \quad (1)$$

Equation (1) means that the individual derives utility both from his/her absolute consumption, h_t , and relative consumption, $h_t - \bar{h}_t$, of housing, as well as from his/her absolute consumption of the non-durable good and use of leisure. The variable \bar{h}_t denotes the reference consumption in period t .⁸ We assume that the functions $u_0(\cdot)$, $\phi(\cdot)$, $\Phi(\cdot)$, and $u_1(\cdot)$ are increasing and strictly concave in their respective arguments, while $v(\cdot)$ is decreasing and strictly concave. All goods are normal. Also, the individual is assumed to act as an atomistic

⁷ The assumption that the non-durable good is completely non-positional is a simplification, yet of little practical importance as long as non-durables are less positional than durable goods.

⁸ Instead of measuring the relative consumption as the difference between the individual's consumption and the reference measure, one may use the ratio between them. Since this choice is of no significance for the qualitative results derived below, we have chosen the technically convenient difference measure in what follows.

agent and treat \bar{h}_t as exogenous. The separable structure of equation (1) allows us to sign key comparative statics (see equations (16a) and (16b) below).

Let $y_t = w_t l_t$ denote labor income, w_t the wage rate, s_t saving, r_t the interest rate, and P_t the price per unit of housing in period t . Before imposing any restriction on the possibility to tax housing wealth, the individual's budget constraint can be written as follows:⁹

$$c_{0,t} = y_t - s_t - P_t h_t - \Gamma_0(P_t h_t) - T_0(y_t) \quad (2)$$

$$c_{1,t+1} = s_t(1 + r_{t+1}) - T_1(s_t r_{t+1}) + P_{t+1} h_t(1 - \delta) \quad (3)$$

where δ denotes the rate of depreciation of a house, $\Gamma_0(\cdot)$ is a tax on housing wealth paid when young, $T_0(\cdot)$ a labor income tax paid when young, and $T_1(\cdot)$ a capital income tax paid when old. When young, the individual consumes (and invests in) housing, consumes the non-durable good, and saves on the capital market; when old, he/she uses the financial wealth and housing wealth for non-durable consumption.

An individual of generation t chooses housing, non-durable consumption, and work hours to maximize the utility given by equation (1) subject to the budget constraint in equations (2) and (3), while treating w_t , r_{t+1} , P_t , P_{t+1} , and \bar{h}_t as exogenous. By substituting the budget constraint into the objective function to replace the consumption of non-durable goods, we obtain a decision-problem in s_t , h_t , and l_t with the first order conditions

$$s_t: \quad -U_{t,c_0} + U_{t,c_1}[(1 + r_{t+1}) - T_1'(s_{0,t} r_{t+1}) r_{t+1}] = 0 \quad (4a)$$

$$h_t: \quad -U_{t,c_0}[P_t + P_t \Gamma_0'(P_t h_t)] + U_{t,h} + U_{t,c_1} P_{t+1}(1 - \delta) = 0 \quad (4b)$$

$$l_t: \quad U_{t,c_0} w_t(1 - T_0'(y_t)) + U_{t,l} = 0 \quad (4c)$$

where $U_{t,c_0} = \partial U_t / \partial c_{0,t}$, $U_{t,h} = \partial U_t / \partial h_t$, $U_{t,c_1} = \partial U_t / \partial c_{1,t+1}$, and $U_{t,l} = \partial U_t / \partial l_t$, denote partial derivatives of the utility function, while $\Gamma_0'(P_t h_t)$, $T_0'(y_t)$ and $T_1'(s_{0,t} r_{t+1})$ are the marginal tax rates on housing wealth, labor income, and capital income, respectively. Note also that the old consumer makes no active decision: he/she just spends the remaining wealth for consumption of the non-durable good.

⁹ Since each individual only makes one housing investment in our model, and given that the individual pays a tax on housing wealth in the first period, a second period tax on housing wealth (to be paid before the house is sold) would become redundant.

Optimal Tax Policy in the Reference Model

The government is first mover vis-à-vis the private sector and aims at correcting for the positional externalities. We assume a general social welfare function that is increasing in the lifetime utility faced by each generation

$$W = W(U_0, U_1, \dots). \quad (5)$$

The resource constraint for the economy as a whole in period t can be written as¹⁰

$$y_t + k_t(1 + r_t) - P_t(h_t - h_{t-1}(1 - \delta)) - c_{0,t} - c_{1,t} - k_{t+1} = 0 \quad (6)$$

where k_t is the physical capital stock defined such that $s_{t-1} = k_t$ for all t . The resource allocation preferred by the government can be derived by choosing $c_{0,t}$, l_t , $c_{1,t}$, h_t and k_t for all t to maximize the social welfare function subject to the resource constraint and $\bar{h}_t = h_t$ for all t . The latter follows because the individuals are identical, and the (externality correcting) government recognizes how the reference consumption is determined. The Lagrangean corresponding to this decision-problem is given by

$$L = W + \sum_t \lambda_t (y_t + k_t(1 + r_t) - P_t(h_t - h_{t-1}(1 - \delta)) - c_{0,t} - c_{1,t} - k_{t+1}) \quad (7)$$

where λ_t is the Lagrange multiplier of the resource constraint in period t . Define

$$MRS_{h,c_0}^t = \frac{U_{t,h}}{U_{t,c_0}} > 0, MRS_{l,c_0}^t = \frac{U_{t,l}}{U_{t,c_0}} < 0, MRS_{c_0,c_1}^t = \frac{U_{t,c_0}}{U_{t,c_1}} > 0$$

to be the marginal rates of substitution between housing and first period consumption; between work effort and first period consumption; and between the first and second period consumption, respectively, for an individual of generation t . The social first order conditions can then be written as follows:

$$MRS_{c_0,c_1}^t = (1 + r_{t+1}) \quad (8a)$$

$$MRS_{h,c_0}^t + \frac{U_{t,\bar{h}}}{U_{t,c_0}} - P_t + \frac{1}{MRS_{c_0,c_1}^t} P_{t+1}(1 - \delta) = 0 \quad (8a)$$

$$-MRS_{l,c_0}^t = w_t \quad (8a)$$

¹⁰ Note that the analysis presupposes that $h_t \geq h_{t-1}(1 - \delta)$; otherwise, old consumers would not be able to consume all their housing wealth.

Now, let $\Delta_t = h_t - \bar{h}_t$, and notice from equation (1) that $U_{t,\bar{h}} = -\partial\Phi(\Delta_t)/\partial\Delta_t = -\Phi_{t,\Delta}$, and $U_{t,h} = \phi_{t,h} + \Phi_{t,\Delta}$ where $\phi_{t,h} = \partial\phi(h_t)/\partial h_t$. We can then define the degree of positionality for housing in period t as the fraction of the overall utility gain from an additional dollar spent on housing that is due to increased relative consumption, i.e.,

$$\alpha_t = -\frac{U_{t,\bar{h}}}{U_{t,h}} = \frac{\Phi_{t,\Delta}}{\phi_{t,h} + \Phi_{t,\Delta}}. \quad (9)$$

The first best optimal tax policy can then be summarized as follows based on equations (4), (8) and (9):¹¹

Observation 1. *The optimal tax policy in the benchmark model satisfies $T'_0(w_t l_t) = 0$, $T'_1(s_{0,t} r_{t+1}) = 0$ and $P_t \Gamma'_0(P_t h_t) = \alpha_t MRS_{h,c_0}^t$ for all t .*

Clearly, since the government of the benchmark model has access to a flexible tax on housing wealth, it may use this tax to fully internalize the externality caused by conspicuous housing consumption, which also explains why the marginal labor and capital income tax rates are equal to zero (there are no other distortions than the externality caused by each consumer's desire to have more units of housing than other people). The left hand side of the tax formula for housing measures the marginal tax on housing wealth times the price paid per unit of housing in period t , i.e., the tax payment for an additional unit of housing, which is set equal to the degree of positionality times the marginal willingness to pay for housing in period t . Therefore, if α_t is in the neighborhood of 0.5, as suggested by empirical evidence presented in the introduction, about 50 per cent of the consumer's marginal willingness to pay for housing represents social waste and should be taxed away. To exemplify and give some substance to the argument made in the introduction that existing taxes on housing wealth often fall short of the marginal positional externality, we assume that $P_t = P_{t+1}/(1 + r_{t+1})$ (in which case there is no "bubble-component" in the price), and that δ is between 2 and 4 per

¹¹ In the related study by Aronsson and Mannberg (2013), in which relative consumption concerns for housing are integrated with quasi-hyperbolic discounting, optimal marginal taxes on housing wealth are shown to vary over the individual life-cycle as well as depending on whether the consumers are naïve or sophisticated hyperbolic discounters.

cent.¹² If we further assume that the first period corresponds to 30 years (i.e., that an individual owns a house for 30 years), our model implies that the optimal yearly tax on housing wealth is between 1.3 and 2.7 per cent if $\alpha_t = 0.4$, and between 2 and 4 per cent if $\alpha_t = 0.5$. Except for Denmark, the countries surveyed above (see footnote 3) apply much lower rates.

3. Suboptimal Marginal Taxation of Housing Wealth

Suppose that the government is unable to implement the optimal tax on housing wealth described in the previous section. The tax is now given by $\Gamma_0(P_t h_t) = \tau_t P_t h_t$, in which τ_t is a nonnegative tax rate such that $\tau_t \leq \bar{\tau}_t$, where $\bar{\tau}_t$ denotes an upper limit. We can interpret the upper limit as reflecting the resistance against taxes on housing properties described in the introduction. This formulation is also convenient as it encompasses an economy without taxation of housing wealth (in which $\bar{\tau}_t = 0$ for all t) and the first best optimal tax policy characterized above (where the constraint does not bind) as special cases. In this section, we assume that the constraint is binding, such that the tax rate on housing wealth is fixed. The question is then whether marginal taxation/subsidization of labor and capital income may be useful as supplementary instruments to correct for positional externalities.

To address this question, it is convenient to model the individual's decision-problem in two stages. In the first stage, we choose h_t to maximize lifetime utility in equation (1) subject to the following budget constraint:

$$b_{0,t} = c_{0,t} + P_t h_t (1 + \tau_t) \quad (10a)$$

$$b_{1,t+1} = c_{1,t+1} - P_{t+1} h_t (1 - \delta) \quad (10b)$$

where $b_{0,t}$ and $b_{1,t+1}$ are treated as fixed incomes in the first and second period of life for generation t . This gives the first order condition

$$-U_{t,c_0} P_t (1 + \tau_t) + U_{t,h} + U_{t,c_1} P_{t+1} (1 - \delta) = 0 \quad (11)$$

¹² Harding, Rosentahl, and Sirmans (2007) estimate the gross annual rate of depreciation to 3 per cent for the typical home in the U.S. and the depreciation net of maintenance to 2 per cent. A slightly higher opportunity cost might be motivated from commuting costs and other time-costs associated with a typical home.

which implicitly defines the individual's demand for housing as a function of $P_t(1 + \tau_t)$, $P_{t+1}(1 - \delta)$, $b_{0,t}$, $b_{1,t+1}$ and \bar{h}_t , i.e.,

$$h_t = h(P_t(1 + \tau_t), P_{t+1}, b_{0,t}, b_{1,t+1}, \bar{h}_t). \quad (12)$$

Notice that equation (12) is interpretable as a conditional demand function in the sense of measuring this demand conditional on the individual's income and saving (which are part of $b_{0,t}$ and $b_{1,t+1}$). By substituting equations (10a), (10b) and (12) into equation (1), the corresponding conditional indirect utility function can be written as

$$\begin{aligned} V_t &= V(P_t(1 + \tau_t), P_{t+1}(1 - \delta), b_{0,t}, b_{1,t+1}, l_t, \bar{h}_t) \\ &= U(b_{0,t} - P_t(1 + \tau_t)h_t, l_t, h_t, \bar{h}_t, b_{1,t+1} + P_{t+1}h_t(1 - \delta)) \end{aligned} \quad (13)$$

where h_t is given by equation (12). In the second stage, we derive the savings and labor supply behavior by choosing s_t and l_t to maximize the indirect utility function given by equation (13) subject to

$$b_{0,t} = y_t - s_t - T_0(y_t) \quad (14a)$$

$$b_{1,t+1} = s_t(1 + r_{t+1}) - T_1(s_t r_{t+1}). \quad (14b)$$

The first order conditions for this problem can be written as

$$-V_{t,b_0} + V_{t,b_1}[(1 + r_{t+1}) - T'_1(s_t r_{t+1})r_{t+1}] = 0 \quad (15a)$$

$$V_{t,b_0}w_t(1 - T'_0(y_t)) + V_{t,l} = 0 \quad (15b)$$

in which $V_{t,b_0} = \partial V_t / \partial b_{0,t}$, $V_{t,b_1} = \partial V_t / \partial b_{1,t+1}$ and $V_{t,l} = \partial V_t / \partial l_t$.

Second Best Optimal Income Taxation

As explained above, the savings and labor supply choices by generation t affect the conditional demand for housing via $b_{0,t}$ and $b_{1,t+1}$. It is, therefore, instructive to begin by deriving comparative statics of the housing demand with respect to $b_{0,t}$ and $b_{1,t+1}$. Since the government aims at internalizing the positional externality and incorporates into its decision-

problem that $\bar{h}_t = h_t$, we differentiate equation (11) with respect to h_t , $b_{0,t}$ and $b_{1,t+1}$, while using $\bar{h}_t = h_t$. This gives

$$\frac{dh_t}{db_{0,t}} = \frac{U_{t,c_0c_0}P_t(1+\tau_t)}{\Theta} > 0 \quad (16a)$$

$$\frac{dh_{0,t}}{db_{1,t+1}} = \frac{-U_{t,c_1c_1}P_{t+1}(1-\delta)}{\Theta} < 0 \quad (16b)$$

where $U_{t,c_0c_0} < 0$, $U_{t,c_1c_1} < 0$ and

$$\Theta = U_{t,c_0c_0}[P_t(1+\tau_t)]^2 + U_{t,hh} + U_{t,c_1c_1}[P_{t+1}(1-\delta)]^2 + U_{t,h\bar{h}} < 0.$$

Double sub-script (e.g., c_0c_0) denotes second order partial derivative.

With a fixed tax on housing, the social decision-problem is a second best problem, which can be written as

$$\text{Max}_{b_{0,t}b_{1,t},k_t,l_t \forall t} W(V_0, V_1, \dots,) \quad (17)$$

$$s.t: \quad y_t - b_{0,t} + k_t(1+r_t) + \tau_t P_t h_t - b_{1,t} - k_{t+1} = 0 \quad \text{for all } t$$

where the resource constraint is here expressed in terms of the “savings-adjusted” measures of disposable income given in equations (14a) and (14b). The resource constraint is derived by using $\tau_t P_t h_t + T_0(y_t) + T_1(s_{t-1}r_t) = 0$ and $s_{t-1} = k_t$ in combination with equations (10a), (10b), (14a), and (14b). By using λ_t to denote the Lagrange multiplier of the resource constraint in period t (as before), the social first order conditions for $b_{0,t}$, $b_{1,t+1}$, k_{t+1} , and l_t (the conditions characterizing an optimal allocation for generation t) become

$$b_{0,t}: \quad \frac{\partial W}{\partial V_t} \left(V_{t,b_0} + V_{t,\bar{h}} \frac{dh_t}{db_{0,t}} \right) + \lambda_t \left(-1 + \tau_t P_t \frac{dh_t}{db_{0,t}} \right) = 0 \quad (18a)$$

$$b_{1,t+1}: \quad \frac{\partial W}{\partial V_t} \left(V_{t,b_1} + V_{t,\bar{h}} \frac{dh_t}{db_{1,t+1}} \right) + \lambda_t \tau_t P_t \frac{dh_t}{db_{1,t+1}} - \lambda_{t+1} = 0 \quad (18b)$$

$$k_{t+1}: \quad \lambda_{t+1}(1+r_{t+1}) - \lambda_t = 0 \quad (18c)$$

$$l_t: \quad \frac{\partial W}{\partial V_t} V_{t,l} + \lambda_t w_t = 0. \quad (18d)$$

By using equation (18a)-(18d) together with $(1 + r_{t+1}) - V_{t,b_0}/V_{t,b_1} = T'_1(s_t r_{t+1})r_{t+1}$ and $w_t + V_{t,l}/V_{t,b_0} = w_t T'_0(y_t)$ from the private first order conditions given in equations (15a) and (15b), respectively, we can derive the following result:

Proposition 1. *If the marginal tax on housing wealth is fixed at τ_t for all t , the optimal marginal income tax rates will take the form*

$$T'_1(s_t r_{t+1})r_{t+1} = [\Pi_t \alpha_t MRS_{h,c_0}^t - (1 + r_{t+1})\tau_t P_t] \left(MRS_{c_0,c_1}^t \frac{dh_t}{db_{1,t+1}} - \frac{dh_t}{db_{0,t}} \right)$$

$$w_t T'_0(y_t) = -MRS_{l,c_0}^t \left[\frac{\Pi_t}{1 + r_{t+1}} \alpha_t MRS_{h,c_0}^t - \tau_t P_t \right] \frac{dh_t}{db_{0,t}}$$

for all t , where $\Pi_t = \frac{\partial W}{\partial V_t} \frac{V_{t,b_0}}{\lambda_{t+1}} > 0$.

Proof. See Appendix

In each tax formula in the Proposition, the second term within square brackets on the right hand side is proportional to the actual (and possibly suboptimal) tax on housing wealth, while the first term reflects the use of capital and labor income taxation, respectively, as a supplemental instrument for correction. Before we interpret the tax formula in the proposition in greater detail, note that Proposition 1 and equations (16a) and (16b) together imply the following result in the special case where the marginal tax on housing wealth is equal to zero:

Corollary 1. *If $\tau_t = 0$ for all t , Proposition 1 implies*

$$T'_1(s_t r_{t+1})r_{t+1} = \Pi_t \alpha_t MRS_{h,c_0}^t \left(MRS_{c_0,c_1}^t \frac{dh_t}{db_{1,t+1}} - \frac{dh_t}{db_{0,t}} \right) < 0$$

$$w_t T'_0(y_t) = -MRS_{l,c_0}^t \frac{\Pi_t}{1 + r_{t+1}} \alpha_t MRS_{h,c_0}^t \frac{dh_t}{db_{0,t}} > 0.$$

Therefore, in the absence of the tax on housing wealth, there is a policy incentive to subsidize savings and tax labor earnings at the margin. The intuition is that increased savings in financial wealth leads to less investments in housing and, as a consequence, that the positional consumption externality attached to housing decreases. Similarly, reduced labor income reduces the resources available for all types of wealth accumulation.

Returning to the general policy rule in Proposition 1, the marginal savings subsidy and earnings tax, respectively, is counteracted by the second term in square brackets on the right

hand side, which depends on the actual marginal tax on housing wealth. However, by using a continuity argument, it holds that $T'_1(s_t r_{t+1}) < 0$ and $T'_0(y_t) > 0$ as long as τ_t is sufficiently small. The first best policy summarized by Observation 1 follows as a special case of the more general result derived in Proposition 1: in a first best resource allocation where $P_t \tau_t = \alpha_t MRS_{h,c_0}^t$ and $\Pi_t = 1 + r_{t+1}$, we obtain $T'_1(s_t r_{t+1}) = T'_0(y_t) = 0$. Finally, notice that these two extreme cases also suggest the more general policy rule that $T'_1(s_t r_{t+1}) < 0$ and $T'_0(y_t) > 0$ if $P_t \tau_t < \alpha_t MRS_{h,c_0}^t$, i.e., if the tax payment per unit of housing falls short of the marginal externality.¹³

Finally, the multiplier $MRS_{c_0,c_1}^t(dh_t/db_{1,t+1}) - dh_t/db_{0,t} < 0$ in the marginal capital income tax formula in Proposition 1 and Corollary 1 appears because the capital income subsidy constitutes an indirect instrument to reduce the housing wealth, and works through the effect of savings on the housing demand. As such, the more an increase in savings reduces the demand for housing (through a decrease in $b_{0,t}$ and corresponding increase in $b_{1,t+1}$), the more effective will be the savings subsidy as an instrument to reduce the positional externality. On the other hand, if $dh_t/db_{0,t}$ and $dh_t/db_{1,t+1}$ are close to zero, the savings subsidy would not be a useful instrument to influence the accumulation of housing wealth, in which case the subsidy would be close to zero or not used at all. The multiplier in the marginal labor income tax formula, $dh_t/db_{0,t} > 0$, has an analogous interpretation.

At least two issues are worth further discussion. First, our analysis neglects altruism and intergenerational transfer of housing (or other wealth), which is potentially restrictive. However, since the only underlying efficiency problem refers to a positional externality of housing, nothing essential would change if we were to allow the individuals to leave bequests to the next generation. The tendency for the consumer to over-consume housing from society's point of view would still remain. Yet, if taxes on housing wealth cannot be used to their full potential (as we assumed in Section 3), taxes on inheritance or gifts also constitute potential second best instruments through which to correct for positional externalities in such a broader framework. This is clearly an interesting topic for future research. Second, we have assumed away that conspicuous consumption may influence prices; an argument of potential importance for understanding the housing market. This simplification is of no major concern

¹³ Formally, this argument presupposes that $1 - \alpha_t MRS_{h,c_0}^t(dh_t/db_{0,t}) > 0$, which means that $\Pi_t > 1 + r_{t+1}$ if $P_t \tau_t < \alpha_t MRS_{h,c_0}^t$.

for the qualitative results derived in the present paper, since the efficiency costs of relative consumption would be driven by the mechanisms laid out above also in a more general model with endogenous producer prices. Price formation is, nevertheless, important for our understanding of wealth accumulation and distribution more generally and, therefore, a relevant topic to address in future research on positional preferences for housing.

Appendix

Proof of Proposition 1

By using the measure of positionality defined in equation (9), equations (18a) and (18b) can be rewritten as follows:

$$\frac{\partial W}{\partial V_t} V_{t,b_0} = \frac{\partial W}{\partial V_t} V_{t,b_0} \alpha_t MRS_{h,c_0}^t \frac{dh_t}{db_{0,t}} + \lambda_t \left(1 - \tau_t P_t \frac{dh_t}{db_{0,t}} \right) \quad (A1)$$

$$\frac{\partial W}{\partial V_t} V_{t,b_1} = \frac{\partial W}{\partial V_t} V_{t,b_0} \alpha_t MRS_{h,c_0}^t \frac{dh_t}{db_{1,t+1}} - \lambda_t \tau_t P_t \frac{dh_t}{db_{1,t+1}} + \lambda_{t+1}. \quad (A2)$$

Equations (A1), (A2) and (18c) can be used to derive

$$\begin{aligned} \lambda_{t+1} \left[(1 + r_{t+1}) - \frac{V_{t,b_0}}{V_{t,b_1}} \right] &= \frac{\partial W}{\partial V_t} V_{t,b_0} \alpha_t MRS_{h,c_0}^t \left(\frac{V_{t,b_0}}{V_{t,b_1}} \frac{dh_t}{db_{1,t+1}} - \frac{dh_t}{db_{0,t}} \right) \\ &\quad - \lambda_t \tau_t P_t \left(\frac{V_{t,b_0}}{V_{t,b_1}} \frac{dh_t}{db_{1,t+1}} - \frac{dh_t}{db_{0,t}} \right), \end{aligned} \quad (A3)$$

while equations (A1) and (18d) can be combined such that

$$\lambda_t \left[w_t + \frac{V_{t,l}}{V_{t,b_0}} \right] = - \frac{V_{t,l}}{V_{t,b_0}} \left[\frac{\partial W}{\partial V_t} V_{t,b_0} \alpha_t MRS_{h,c_0}^t - \lambda_t \tau_t P_t \right] \frac{dh_t}{db_{0,t}}. \quad (A4)$$

Substituting $(1 + r_{t+1}) - V_{b_0}/V_{b_1} = T_1'(s_t r_{t+1}) r_{t+1}$ into equation (A3), and $w_t + V_{t,l}/V_{t,b_0} = w_t T_0'(y_t)$ into equation (A4), while using $MRS_{c_0 c_1}^t = U_{t,c_0}/U_{t,c_1} = V_{t,b_0}/V_{t,b_1}$, $MRS_{l,c_0}^t = U_{t,l}/U_{t,c_0} = V_{t,l}/V_{t,b_0}$, and $\Pi_t = (\partial W/\partial V_t)(V_{t,b_0}/\lambda_{t+1})$, we obtain the marginal income tax rates in Proposition 1. ■

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