How Fiscal Decentralization Flattens Progressive Taxes

Roland Hodler
Kurt Schmidheiny

CESifo Working Paper No. 1575
Category 1: Public Finance
October 2005

CESifo *Working Paper No. 1575*

HOW FISCAL DECENTRALIZATION FLATTENS PROGRESSIVE TAXES

Abstract

We study the tension between fiscal decentralization and progressive taxation. We present a multi-community model in which households differ in incomes and housing preferences and in which the local income tax rate is a function of an exogenous progressive tax schedule and an endogenous local tax shifter. The progressivity of the tax schedule induces a self-sorting process that results in substantial though imperfect income sorting. The actual tax structure is thus less progressive than the exogenous tax schedule. Empirical evidence from the largest Swiss metropolitan area supports the predictions of our model.

JEL Code: H73, R23.

Keywords: progressive taxation, fiscal decentralization, income segregation.

Roland Hodler
University of Bern
Department of Economics
Schanzeneckstr. 1
3000 Bern
Switzerland
roland.hodler@vwi.unibe.ch

Kurt Schmidheiny
Tufts University
Department of Economics
Braker Hall
Medford, MA 02155
USA
kurt.schmidheiny@tufts.edu

We would like to thank John Ashworth, Bruno Heyndels, Mark Schelker and participants at the 2005 meetings of the PCS and the EPCS for helpful comments.

1 Introduction

In this paper, we study the tension between fiscal decentralization and progressive taxation. We investigate to what extent fiscal decentralization reduces the progressivity of a common tax schedule in a federation in which communities can set the level of taxation. We find that progressive taxation and fiscal decentralization lead to income sorting, which reduces the progressivity of the tax schedule.

We base our analysis on a multi-community model, in which the income tax rate is a function of an exogenous progressive tax schedule and an endogenous local tax shifter. Local tax revenue is used to finance a local good. In the basic version of the model, the mobile individual households differ only in their incomes.

In equilibrium, no household wants to move, local housing markets clear and the communities' budgets are balanced. It follows that the local tax shifters must be higher in communities in which housing prices are lower. The progressivity of the tax schedule then induces a self-sorting process that results in perfect income sorting. Poor households locate in high tax communities while rich households locate in low tax communities. Different from most of the previous literature,[1] sorting is a direct result of the progressive tax schedule and does not require strong assumptions on the preferences for either public goods or housing. The perfect spatial segregation of the population by incomes implies that the actual tax structure must be less progressive than the exogenous tax schedule if progressive at all.

While some degree of income sorting is observed in reality, this sorting is never perfect (see e.g. Epple and Sieg, 1999, Hardman and Ioannides, 2004,

[1]See e.g. Ellickson (1971), Westhoff (1977), Epple and Romer (1991) and the literature surveyed in Ross and Yinger (1999).

and Ioannides, 2004). A potential reason for *im*perfect income sorting is that households differ in their preferences. We therefore add heterogeneity in the households' preferences to our model. In particular, we assume heterogeneity in the preferences for housing. As each household's location choice depends now on its income and its preferences, the income sorting is imperfect in equilibrium: households with the same income are found in different communities, though rich households are still more likely to locate in low tax communities than poor households.

To investigate the quantitative implications of this model, we calibrate a fully-specified version to the Zurich area, the largest Swiss metropolitan area. Swiss metropolitan areas offer an excellent laboratory for the analysis of fiscal decentralization. In Switzerland, each community can individually set the *level* of income taxes by a local tax shifter while the cantons (states) fix the (progressive) *schedule* of income taxes. The equilibrium values of this simulation show the same pattern across communities as we observe in the Zurich area: Rich households locate mainly, but not exclusively, in communities with low tax shifters and poor households mainly in communities with high tax shifters.

We then use data on the spatial distribution of incomes in the Zurich area to estimate the actual tax structure, i.e. average tax rates as a function of income as faced by the households in this area. We find that the actual tax structure is substantially less progressive than the tax schedule implemented by the canton because rich households are more likely to live in low tax communities than poor households. This finding is in line with the predictions of our theoretical model.

This paper is most closely related to Feldstein and Wrobel (1998), Epple and Platt (1998) and Schmidheiny (2004). Feldstein and Wrobel show that a shift in a single US state's tax progressivity has no redistributive effects since migration leads to an adjustment of the net wages and the employment structure. Complementary, we show that location choices undermine the redistributive effect of progressive taxation in presence of fiscal decentralization even if wages do not adjust. Our theoretical model shares the formal structure with Epple and Platt. Schmidheiny shares the location choice part of our model and shows empirically that rich households are more likely to move to low tax communities than poor households.

More generally, our paper relates to the literature on fiscal federalism.[2] It is a well known normative principle of this literature that income redistribution should be centralized. As progressive income taxes are a particular mean to redistribute income, it directly follows that "progressive income taxation [...] - if substantial in scope - must be uniform within the entire area over which there is a high degree of capital and labor mobility" (Musgrave 1971, p. 7). In this paper, we provide some support for this view by showing that fiscal decentralization does indeed undermine the progressivity of the tax schedule. However, we also find theoretical and empirical evidence that the income sorting of the population does not completely offset progressivity; hence leaving room for substantial redistribution through progressive income taxation at the local level.

The paper is organized as follows: Section 2 briefly informs about fiscal decentralization and progressive taxation in Switzerland and some other countries with a comparable tax system. Section 3 presents the theoretical model and some results concerning the agents' location choice. It further proves that an (asymmetric) equilibrium exists. Section 4 presents the simulation of a fully-specified version of our model, which is calibrated to the

[2] For a recent survey of this literature see Oates (1999).

Zurich metropolitan area. Section 5 estimates the actual tax structure faced by the households in this area. Section 6 concludes.

2 Fiscal Decentralization and Progressive Taxation in Switzerland (and elsewhere)

Switzerland is an exemplary federal fiscal system. The Swiss federation comprises 26 states, the so-called cantons. The cantons are divided into roughly 3000 municipalities of varying size and population. All three state levels finance their expenditures essentially by their own taxes and fees. 46% of the total tax revenue are imposed by the federation, 32% by the cantons and 22% by the municipalities.[3] While the federal government is mainly financed by indirect taxes (61% of federal tax revenue) such as the VAT, the cantons and municipalities largely rely on direct taxes. Income taxes account for 60% of cantonal and 84% of municipal tax revenue.

The cantons organize their tax systems autonomously. For example, they decide upon the level of income and corporate taxes and the degree of tax progression. The individual municipalities in turn can set a tax shifter for income and corporate taxes. The municipal tax is then the cantonal tax rate multiplied by the municipal tax shifter. Federal and cantonal systems of fiscal equalization limit the tax differences across cantons and across municipalities within the same canton to some extent, but still leave room for considerable variation.

The above outlined federal system leads to ample differences of income taxes across Swiss municipalities. For example, for a two-child family with a gross income of 80,000 Swiss francs (CHF) combined cantonal and municipal

[3]All figures in this paragraph apply to 2001. Source: Swiss Federal Tax Administration (2002), Öffentliche Finanzen der Schweiz 2001, Neuchâtel: Swiss Federal Statistical Office.

income taxes ranged from 3.6% to 11.3% in the year 1997 (and its federal income tax was 0.7%). With an income of 500,000 CHF a two-child family faced much higher tax rates due to the progressivity of the tax schedules. Combined cantonal and municipal income taxes ranged from 10.9% to 28.7%[4] for this household (and its federal income tax was 9.4%). Within metropolitan areas the (municipality) tax differences are smaller but still differ by a factor of 1.5 in e.g. the Zurich area.

While local taxation of *property* is widespread, especially in the United States, local taxation of *income* is rarer. Local income taxation at municipal level is e.g. observed in four U.S. states (Indiana, Maryland, Ohio, and Pennsylvania) and in Denmark. Different from the progressive local tax scheme in Switzerland, these states and countries apply a *flat* local tax. Belgium is to our knowledge the only country with a similar system of fiscal decentralization at municipal level as Switzerland. In Belgium, each of the three regions, i.e. Flanders, Wallonia and the Brussels Region, collects progressive income taxes. Furthermore, each municipality can generate its own income tax revenue by adding a fixed percentage surcharge on the (progressive) regional income tax. Canada had a similar system at provincial level between 1977 and 1996 (see Boadway and Kitchen, 1980): Personal income taxes in Canadian provinces (except Quebec) were a percentage of the (progressive) federal tax.

3 The Model

In this section, we introduce and solve the model. After presenting the general setting, we characterize the preferences and derive the resulting alloca-

[4] Note, however, that this high tax rate is rather hypothetical as it is very unlikely to find a household with such high income in one of the very high tax municipalities.

tion of households across distinct communities. We then prove the existence of an asymmetric equilibrium. Finally, we introduce heterogeneity in the households' preferences and discuss how this affects our results.

3.1 The Setting

Given is a metropolitan area with J communities. This area is populated by a continuum of households, which differ in their income $y \in [\underline{y}, \overline{y}]$. Income follows a distribution function $f(y) > 0$.

There are three goods in the economy: private consumption b, housing h and a publicly provided local good g. The housing h is provided by absentee landlords, and the housing market is competitive. Hence, the price for housing p_i equates the housing supply HS_i with the aggregate housing demand HD_i. We assume that the housing supply $HS_i = HS(L_i, p_i,)$ is a non-decreasing function of the land area L_i and the price p_i.

Each community i spends the amount $n_i g$ to provide the local good g, where n_i is the measure of households living in community i. The communities levy income taxes to finance the local good. In each community i, the tax rate consists of two parts, a local tax shifter t_i and a progressive tax rate structure $r(y)$. We assume $r(y)$ continuous and increasing in y, $r(y) > 0$, the average tax rate $t \cdot r(y) \in [0, 1)$ and the marginal tax rate $t[r + yr'(y)] \in [0, 1)$. The tax rate structure $r(y)$ is exogenous (to the communities) and identical across communities.

We assume that the local good g is fixed and identical across communities. In each community i, the tax shifter t_i is therefore determined by budget balance. There are two reasons for assuming exogeneity of the local good. First, the local good g can be thought as a locally provided, locally financed but centrally decided good. We think that many locally financed goods, particularly in Switzerland, satisfy this description. Schooling, for example, accounts for the largest item in municipal budgets in Switzerland; local neighborhood schools are locally provided and locally financed, however, cantonal regulation leave little discretionary power for financially relevant decisions.[5] Our model focuses therefore on the revenue side of fiscal decentralization. Second, we think that the progressivity of income taxes is a very important factor for income sorting in Switzerland. However, our model would become intractable allowing for both progressive taxation and endogenous provision of local goods. Schmidheiny (2005) studies endogenous local goods determined in municipal majority votes, but financed by *flat* local income taxes. His model exhibits very similar equilibrium properties.

Further, we assume that each household can move costlessly and chooses the community maximizing its utility as place of residence.

3.2 Preferences and Location Choice

The preferences of the households are described by the utility function

$$U(h, b) \ , \tag{1}$$

where h is the consumption of housing and b the consumption of the private good.[6] We assume the utility function to be strictly increasing, strictly quasiconcave, twice continuously differentiable in h and b and homothetic.

Households face the budget constraint (omitting community indices)

$$ph + b \leq y_d = y[1 - t \cdot r(y)] \ , \tag{2}$$

[5] In particular, teachers' salaries and class size are regulated by cantonal law. Furthermore, cantonal courts ruled, based on equity considerations, that schools (in rich neighborhoods) are not allowed to provide additional tutoring or extra classes for extraordinary strong or weak pupils.

[6] Since the local good g is constant across communities and not of primary interest for our considerations, we assume for simplicity that it does not enter the utility function. Equivalently, we could assume that it enters separably.

where p is the price of housing; the price of the private good is set to unity. Disposable income y_d depends on the local tax shifter t and the tax rate structure $r(y)$.

Maximization of the utility function (1) with respect to h and b subject to constraint (2) yields housing demand $h^* = h(p, y_d) = h(t, p, y)$, demand for the private good $b^* = y(1-t) - ph(t, p, y)$, and indirect utility

$$V(t, p, y) = U(h^*, b^*) \; . \tag{3}$$

For later use note that V is continuous in t, p and y.

We assume that the elasticity of housing with respect to the disposable income is smaller or equal to unity, i.e.,

$$\varepsilon_{h,y_d} := \frac{\partial h^*}{\partial y_d} \frac{y_d}{h^*} \leq 1 \quad \text{for all } y_d \text{ and } p. \tag{4}$$

The assumption of income elasticity for housing demand below one is well supported by the large empirical literature on housing demand. Mayo's (1981) seminal survey of empirical studies using microdata reports consistent income elasticity below one. This result is robust controlling for housing prices, demographic household variables (e.g. Mayo 1981, Hansen, Formby and Smith, 1998), tenure choice (e.g. Henderson and Ioannides 1986, Hansen, Formby and Smith, 1998) and functional form (Hansen, Formby and Smith, 1996). The assumption is also support by the Swiss data used in the calibration of our model.

Next, we present two properties of the households' indifference curves that will lead to segregation of the population by incomes:

Property 1

$$M(t, p, y) := \left.\frac{dt}{dp}\right|_{dV=0} = -\frac{\partial V / \partial p}{\partial V / \partial t} = -\frac{h^*}{y \cdot r(y)} < 0$$

Property 1 follows from the strictly increasing utility function after applying the implicit function theorem and the envelope theorem. It implies that a household can be made indifferent towards an increase in the tax shifter t when it is compensated by decreased housing prices p, and vice versa.

Property 2

$$\frac{\partial M}{\partial y} = [1 - \frac{\partial h^*}{\partial y_d}\frac{y_d}{h^*}\frac{\partial y_d}{\partial y}\frac{y}{y_d}]\frac{h^*}{y^2 r(y)} + \frac{\partial r(y)}{\partial y}\frac{h^*}{y^2 r^2(y)} > 0 \text{ for all } y,\, t \text{ and } p.$$

Proof: By assumption, $(\partial h^*/\partial y_d)(y_d/h^*) \leq 1$. Our assumptions about the bounds of the average and the marginal tax rate guarantee $(\partial y_d/\partial y)(y/y_d)$ $= [1 - tr - tyr'(y)]/[1 - tr(y)] \in [0, 1)$. The assumption that $r(y)$ increases in y, implying $\partial r(y)/\partial y > 0$, concludes the proof. $\square$

Property 2 implies that the decrease in housing prices p which compensates a household for a higher tax shifter t has to be larger for poor households than for rich ones.

Given a set of community characteristics, (p_i, t_i) for $i = 1..J$, a household prefers community i if and only if

$$V(p_i, t_i, y) \geq V(p_j, t_j, y) \quad \text{for all } j \neq i\ . \tag{5}$$

From this, the following proposition directly follows:

Proposition 1 (Order of community characteristics)
If any two populated communities differ in their characteristics (p_i, t_i), then the community with the higher housing prices p_i must impose a lower tax shifter t_i.

Proof: Suppose the opposite, i.e., that the housing prices p_i and the tax shifter t_i are both higher in one community. In this case, no household would choose to live in this community (for the same reason that leads to property 1). This is a contradiction. □

In the remaining part of this section, we show how households allocate themselves across *distinct* communities. Distinct communities differ in both tax shifters and prices. Note that our model allows for groups of communities with identical community characteristics (t_i, p_i). Such groups appear as one community in our notation.

Lemma 1 (Boundary indifference)
There is a 'border' household between any two communities i and j that is indifferent between these two communities. That is, if a household with income y' prefers to live in i and another household with income $y'' > y'$ prefers to live in j, then there exists a household with income $\hat{y}_{ij} = \hat{y}(p_i, t_i, p_j, t_j)$, $y' \leq \hat{y}_{ij} \leq y''$, such that $V(p_i, t_i, \hat{y}_{ij}) = V(p_j, t_j, \hat{y}_{ij})$.

Proof: Let $V_i(y) := V(p_i, t_i, y)$ be a household's utility in i and $V_j(y) := V(p_j, t_j, y)$ in j. The household with income y' prefers i to j, hence $V_i(y') - V_j(y') \geq 0$. The opposite is true for a household with income y'': $V_i(y'') - V_j(y'') \leq 0$. From the continuity of V in y follows the continuity of $V_i(y) - V_j(y)$ in y. The intermediate value theorem proves that there is at least one $\hat{y}$ between y' and y'' such that $V_i(\hat{y}) - V_j(\hat{y}) = 0$. □

Lemma 2 (Two-community income segregation)
Given two populated communities i and j with distinct characteristics $(t_i, p_i) \neq (t_j, p_j)$, where $t_i < t_j$, then any household in i is richer than any household in j. That is, if a household with income $\hat{y}$ is indifferent between i and j, then any household $y' < \hat{y}$ strictly prefers j and any household $y'' > \hat{y}$ strictly prefers i.

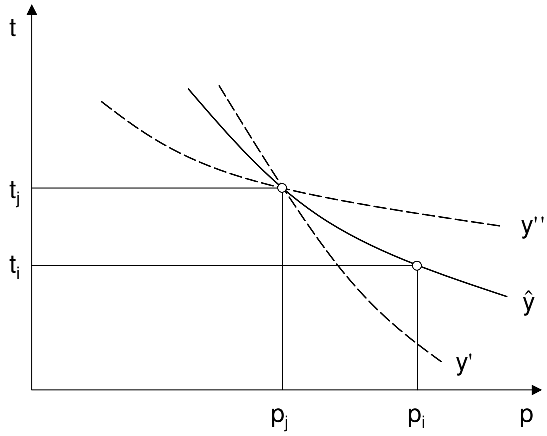

Figure 1: Indifference curves in the (t, p) space

Proof: The proof uses figure 1, which shows the indifference curves in the (t, p)-space for three different income levels $y' < \hat{y} < y''$. The indifference curves represent all (t, p) combinations that households consider as good as community j's (p_j, t_j)-pair. Each household prefers pairs south-west of its indifference curve. It follows from property 1 that the indifference curves decrease in the (t, p)-space and from property 2 that they become flatter as income rises. Imagine now a community i, characterized by $t_i < t_j$ and $p_i > p_j$, where household $\hat{y}$ is indifferent to j. All poorer households, e.g. y', prefer j to i and all richer households, e.g. y'', prefer i to j. $\square$

Proposition 2 (Multi-community income segregation)
Given J populated communities with distinct characteristics (t_i, p_i), then it holds for any two communities i and j with $t_i < t_j$ that any household in i is richer than any household in j.

Proof: The proposition implies that $[\underline{y}, \overline{y}]$ must be partitioned into J non-empty and non-overlapping intervals. Suppose the opposite, i.e., y' as well as y'' prefer community i, but y''', $y' < y''' < y''$, strictly prefers another community j. Then it follows from lemma 1 that there is a $\hat{y}_{ij}$, $y' \leq \hat{y}_{ij} < y'''$. Lemma 2 implies that $y'' > \hat{y_{ij}}$ strictly prefers j to i, which is a contradiction. $\square$

3.3 Equilibrium

In this section, we prove that an asymmetric equilibrium exists. That is, we show that an allocation in which communities exhibit different characteristics (p_i, t_i) can be an equilibrium.

An equilibrium requires that each household is located in the community that maximizes its utility, that each household maximizes its utility within the given community, that the housing market clears in each community, that each community has a balanced public budget and that each community has a positive population.

There always exists a symmetric equilibrium in which all communities have identical characteristics (p_i, t_i) and in which the households allocate themselves such that all communities show the same income distribution.[7] However, we are interested in the case in which at least some communities differ in their characteristics (p_i, t_i). We therefore show that an asymmetric equilibrium, i.e., an equilibrium in which $(p_i, t_i) \neq (p_j, t_j)$ for some i and j, exists too. For simplicity, we focus thereby on the case of two distinct communities, 1 and 2.

We assume with no loss of generality that $t_1 > t_2$. Hence, any household in 2 must be richer than any household in 1, as lemma 2 implies. We define

$$\Delta V(\hat{y}) = V_1(p_1(\hat{y}), t_1(\hat{y}), \hat{y}) - V_2(p_2(\hat{y}), t_2(\hat{y}), \hat{y}), \tag{6}$$

[7] Other equilibria in which all communities have identical characteristics (p_i, t_i) might exist as well.

where $p_i(\hat{y})$ and $t_i(\hat{y})$ are the equilibrium housing price and the equilibrium tax shifter, respectively, in i given that households with $y < \hat{y}$ live in 1 and households with $y > \hat{y}$ in 2. Hence, $V_i(p_i(\hat{y}), t_i(\hat{y}), \hat{y})$ is the indirect utility of a household with $\hat{y}$ in i given this allocation of households.

In addition, we assume:[8]

(i) The housing supply $HS(L_i, p_i)$ satisfies $HS(L_i, 0) = \underline{L}_i > 0$ for $i = 1, 2$.

(ii) The minimum income $\underline{y} > g$.

(iii) If $h_i \to \infty$, $b_i > 0$, $h_j < \infty$ and $b_j < \infty$, then $U(h_i, b_i) > U(h_j, b_j)$.

Proposition 3 (Existence of an asymmetric equilibrium)
There exists an equilibrium in which the communities 1 and 2 exhibit different characteristics, i.e. $t_1 > t_2$ *and* $p_1 < p_2$.

Proof: We prove proposition 3 by showing (1) that $\Delta V(\hat{y})$ is continuous and (2) that $\Delta V(\hat{y}) > 0$ as $\hat{y} \to \underline{y}$ and that $\Delta V(\hat{y}) < 0$ as $\hat{y} \to \overline{y}$. It follows then from the intermediate value theorem that there is at least one $\hat{y}$, $\underline{y} < \hat{y} < \overline{y}$, such that $\Delta V(\hat{y}) = 0$. This implies - from the definition of ΔV - that the border household $\hat{y}$ is indifferent between the two communities, the prices p_1 and p_2 clear the local housing markets and the tax shifters t_1 and t_2 balance the community budgets.

(1) The equilibrium housing price p_i is determined by $HS(L_i, p_i) = HD_i$. It follows from lemma 2 that

$$HD_i = \int_{\underline{y}_i}^{\overline{y}_i} h(p_i, t_i; y) f(y) dx, \tag{7}$$

where $\underline{y}_i$ and $\overline{y}_i$ are the highest and lowest incomes in community i. The hereby implicitly defined p_i is continuous in $\overline{y}_i$ and $\underline{y}_i$ given continuity of

[8]As it will become evident in section 4, these assumptions are sufficient, but not necessary for the existence of an asymmetric equilibrium.

$HS(\cdot)$, $h(\cdot)$ and $f(\cdot)$. The balanced budget requirement and lemma 2 imply that the equilibrium tax shifter in community i is

$$t_i = \frac{n_i g}{\int_{\underline{y}_i}^{\overline{y}_i} r(y) f(y) dx}, \tag{8}$$

where

$$n_i = \int_{\underline{y}_i}^{\overline{y}_i} f(y) dx. \tag{9}$$

Given continuity of $r(\cdot)$ and $f(\cdot)$, t_i is continuous in $\overline{y}_i$ and $\underline{y}_i$. Since the indirect utility V_i is continuous in p_i, t_i and y and since p_i and t_i are continuous in y, $\Delta V(\hat{y})$ is continuous in $\hat{y}$.

(2) If follows from equations (7) and (9) that $HD_1 \rightarrow 0$ and $n_1 \rightarrow 0$ as $\hat{y} \rightarrow \underline{y}$. Since assumption (i) guarantees that $HS(L_1, 0) = \underline{L}_1 > 0$ (and since $\partial HS(L_i, p_i)/\partial p_i \geq 0$), it holds that $h^*(p_1, t_1; y) \rightarrow \infty$ and $p_1 \rightarrow 0$ as $\hat{y} \rightarrow \underline{y}$. Hence, $b^* \rightarrow \underline{y} - g > 0$, where the strict inequality follows from assumption (ii). Assumption (iii) then guarantees that $\Delta V(\hat{y}) > 0$ as $\hat{y} \rightarrow \underline{y}$. Analogously, it can be shown that $\Delta V(\hat{y}) < 0$ as $\hat{y} \rightarrow \overline{y}$.[9] $\square$

3.4 Adding Heterogeneous Preferences

So far, we have assumed that households differ in their incomes y only. This set of assumptions has led to perfect income sorting, which is not observed in reality. In this section, we extend the model by assuming that the households' preferences are heterogenous as well. As we will show, income sorting is imperfect in this extended model.

The household preferences are now represented by the utility function $U(h, b; \alpha)$, where the parameter α describes the taste for housing. The higher α, the more a household is, ceteris paribus, willing to spend on housing.

[9] The only difference is that $b^* \rightarrow \overline{y} - g$, which exceeds $\underline{y} - g$.

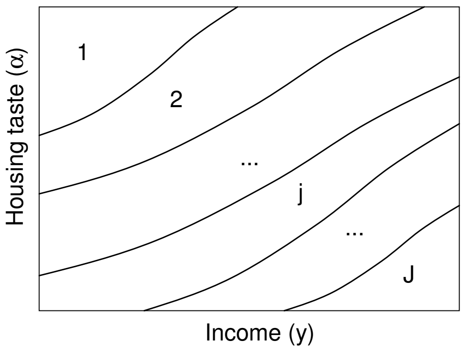

Figure 2: Simultaneous income and preference segregation. The areas denoted by $j = 1, ..., J$ show the attributes of the households that prefer community j.

Hence, the housing demand increase in α, i.e.

$$\frac{\partial h^*}{\partial \alpha} = \frac{\partial h(t, p; y, \alpha)}{\partial \alpha} > 0 \text{ for all } t,\ p,\ y \text{ and } \alpha. \tag{10}$$

Income and preferences are jointly distributed according to the density function $f(y, \alpha)$.

It follows that perfect income segregation still holds, but only within the subpopulation of households with identical preferences. Preference segregation occurs as well: That is, among the subpopulation of households with the same income y, households with a high α, i.e. a strong taste for housing, tend to allocate themselves to communities with higher tax shifters t_i than households with a low α.

Simultaneous heterogeneity by incomes and tastes leads to a more realistic pattern of household segregation. Although income groups tend to gather, the segregation is no longer perfect. Figure 2 shows the resulting allocation of household types to communities. The households on the borders are indifferent between neighboring communities j. Community 1 with the lowest housing prices is populated by the poorest households with strong taste for housing, while the richest households with low housing taste are situated in community J with the lowest tax shifter and the highest housing prices. However, rich households with strong taste for housing prefer lower-priced communities, and poor households with weak taste for housing group with relatively rich households in lower-tax communities.

4 A Specified Version of the Model

To investigate the qualitative and quantitative properties of the model we construct a fully specified example in this section. The specification is kept as simple as possible but still captures all mechanisms of the model. The example is calibrated to the Zurich area, the largest Swiss metropolitan area.

The tax schedule is taken from Young (1990)

$$r(y) = r_0\{1 - [1 + r_2\,(y - d)^{r_1}]^{-1/r_1}\}$$

with parameters $r_0 > 0$, $r_1 > 0$ and $r_2 > 0$. Different from Young, we also include a deductible $d > 0$. The average local tax rate $t\,r(y)$ and the local marginal tax rate $t[y_t\,\partial r(y)/\partial y + r(y)]$ are increasing in income y. The marginal tax rate is above the average tax rate for all incomes exceeding the deductible d, and both asymptotically approach a maximum $t\,r_0$.

Household preferences are described by a Cobb-Douglas utility function:

$$U = h^{\alpha}\, b^{1-\alpha}\,,$$

where $0 < \alpha < 1$ stands for the taste parameter of the general model. Utility function and tax schedule satisfy properties 1 and 2.

We adopt the housing supply function

$$HS_i = L_i(p_i)^{\theta}$$

from Epple and Romer (1991).[10]

We calibrate the above outlined model to the Zurich metropolitan area, the largest metropolitan area in Switzerland. The city of Zurich has about 330 thousand inhabitants and is the capital of the canton (state) of Zurich. The canton of Zurich counts 1.2 million inhabitants in 171 individual communities. As described in section 2, each of these communities can choose its own tax shifter.

We restrict the analysis to the city of Zurich and a ring of the most integrated communities around the center. This ring is formed by all communities in the canton of Zurich with more than 1/3 of the working population commuting to the center.[11] The top-left map in figure 4 shows the city of Zurich and the thus defined ring of 40 communities. This agglomeration is modelled as two distinct jurisdictions with equal land size. In the asymmetric equilibrium, we refer to these two communities as the *low-tax* and the *high-tax community*, respectively. The details of the calibration are described in the appendix. Table 1 summarizes the parameters and reports various descriptive statistics for the Zurich metropolitan area in the last six columns.

4.1 Simulated Equilibrium

The equilibrium values p_i and t_i in both communities satisfy equations (7) and (8) and guarantee that no households wants to move. As there is no closed form solution to this nonlinear system of four equations and four un-

[10]Epple and Romer derive this housing supply function from an explicit production function, where $0 \leq \theta \leq 1$ is the ratio of non-land to land input.

[11]The number of commuters to the city of Zurich and the size of the working population in the communities is based on the 1990 Census. This definition of the urban area is chosen to justify the model's assumption that households income is exogenous, i.e. that they choose their place of residence independent of where they work. It results in a set of communities closest to the central business district.

Table 1: Equilibrium values of the specified model.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	model simulation					data, metropolitan area of Zurich					
		homogeneous preferences		heterogeneous preferences		including city of Zurich			without city of Zurich		
	unified	high-tax	low-tax	high-tax	low-tax	all	high-tax[a]	low-tax[a]	all	high-tax[b]	low-tax[b]
L: area	1	0.50	0.50	0.50	0.50	1	0.496	0.504	1	0.497	0.503
p: rent	11.3	9.3	12.7	10.2	12.2	232[c]	233[c]	228[c]	223[c]	210[c]	237[c]
t: tax shifter	0.86	2.95	0.57	2.11	0.63	0.85-1.31	1.19-1.31	0.85-1.15	0.85-1.31	1.10-1.31	0.85-1.07
n: inhabitants	1	0.41	0.59	0.38	0.62	1	0.650	0.350	1	0.499	0.501
Ey: mean income	68,656	38,628	89,954	43,829	84,039	68,656[d]	61,700[d]	76,553[d]	69,049[d]	61,770[d]	77,480[d]

The calibrated model parameters: $g = 2500$, $E(ln\, y) = 11.0$, $SD(ln\, y) = 0.517$, $y_{min} = 15,300$, $y_{max} = 500,000$, $E(\alpha) = 0.25$, $S.A.(\alpha) = 0$ (homogeneous preferences), $S.A.(\alpha) = 0.11$ (heterogeneous preferences), $\theta = 3$, $r_0 = 0.2$, $r_1 = 0.5$ and $r_2 = 0.00065$.

[a] 32 communities with lowest taxes vs. 9 communities with highest taxes

[b] 23 communities with lowest taxes vs. 18 communities with highest taxes

[c] population weighted mean, [d] based on the same estimation as the calibration and described in section 5.1

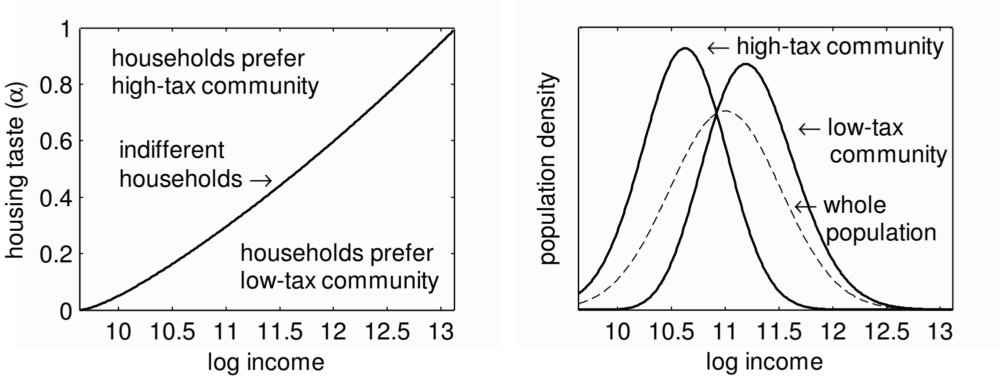

Figure 3: Income and taste segregation in equilibrium. The left figure shows the preferred community for all household types. The right figure shows the resulting income distributions in both communities.

knowns, we solve numerically for the equilibrium values of the model.[12]

Column 1 in table 1 gives the equilibrium values for the hypothetical case that the two communities merged or harmonized their taxes. Columns 2 and 3 show the equilibrium values for the case of *homogeneous tastes*. In this case, households are perfectly segregated: All households in the low-tax community are richer than all households in the high-tax community. This causes large differences in mean incomes, taxes and housing prices between the two communities: Compared to the low-tax community, the mean income in the high-tax community is less than half, taxes are about five times higher and housing prices about 25 % lower.

The prediction of perfect segregation and the implied differences in community characteristics are extreme. The consideration of *heterogeneous hous-*

[12]The aggregation of individual behavior requires double integrals over the community population. These integrals cannot be calculated analytically. We use Gauss-Legendre Quadrature with 40 nodes in each dimension to approximate the various double integrals. We numerically solve for the equilibrium values by minimizing the sum of squared deviations from the equilibrium conditions with the Gauss-Newton method.

ing tastes leads to a more realistic situation. Table 1 shows in columns 4 and 5 the equilibrium values allowing for heterogeneous tastes. The differences between the two communities are still substantial but smaller than with homogeneous tastes: The high-tax community exhibits now about three times higher taxes and about 15 % lower housing prices than the low-tax community. The left graph in figure 3 shows the segregation pattern in the income-taste space. The population is now imperfectly sorted by incomes: While it is still true that more rich households are found in the low-tax community, rich households with a strong taste for housing prefer the high-tax low-price community and poor households with a low taste for housing prefer the low-tax high-price community. The right graph in figure 3 shows the resulting income distributions in the two communities. The mean income in the high-tax community is now slightly more than half the one in the low-tax community.

Figure 4 shows the actual local housing prices (upper right map), the local tax shifters (lower left map) and the spatial income distribution (lower right map) in the 41 communities within the calibrated area.[13] Comparing the two lower maps demonstrates the striking relationship between income taxation and spatial income distribution: the local share of rich households is almost an inverted picture of the local tax shifters. In addition, comparing the two maps on the right shows the positive correlation between local housing prices and the local share of rich households.

The last six columns in table 1 summarize the information in figure 4. It reports the actual housing rents, tax shifters and mean income for three sets of communities: Column 6 shows averages for the whole metro area, column

[13] Data from the following sources: Housing prices: Wüest & Partner, Zürich. Tax rates: Statistisches Amt des Kantons Zürich, Steuerfüsse 1997. Income distribution: Swiss Federal Tax Administration. Considered are all communities where more than 1/3 of the working population is commuting to the center community.

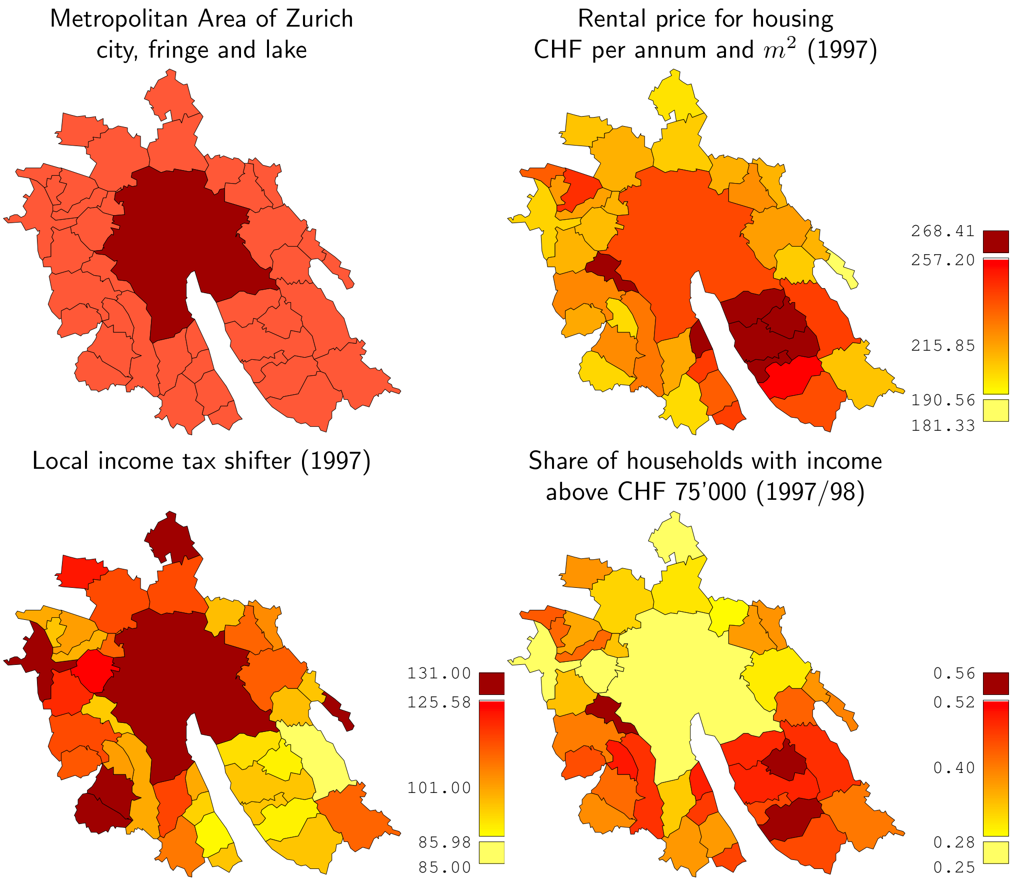

Figure 4: Housing prices, taxes and incomes in the Zurich metropolitan area.

7 shows the values for the 9 communities with highest taxes and column 8 for the 32 communities with lowest taxes. Note that these two groups have equal land area dedicated to development. A comparison of our simulation results with the actual data shows that our simple two-community model captures the relation of taxes and incomes across communities. The predicted relation of housing prices and incomes is only supported by the data when the city of Zurich is excluded (see columns 10 and 11).[14]

[14]The city of Zurich is the central business district (CBD) where both housing prices

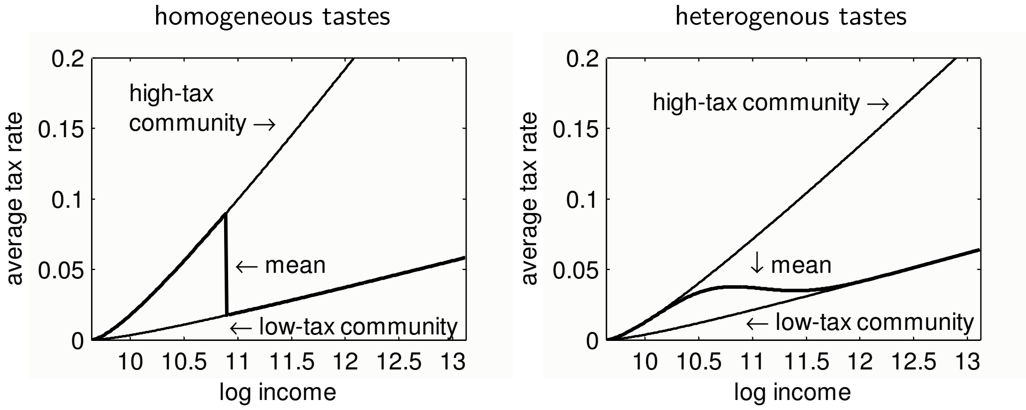

Figure 5: Mean average tax rate by income in the case of homogeneous (left) and heterogenous (right) tastes.

4.2 The Resulting Tax Schedule

The average tax rate $t_i\, r(y)$ depends not only on the individual household's income but also on its place of residence. As the model shows the place of residence is not random and rich households are more likely to reside in low-tax communities. In this section, we ask what tax schedule is realized after considering the sorting of the population. In other words, we ask what tax rate a household with income y pays on average.

In the case of homogeneous taste this question is trivial. All households with income below the median income household face the average tax rate in the high-tax community; rich households the one in the low-tax community. The left graph in figure 5 shows the resulting tax schedule. While progressive within the communities, it is insofar regressive as most relatively rich households face lower average tax rates than many relatively poor households.

---

and taxes are relatively high. This is most likely due to the center's intrinsic attractiveness (e.g. its cultural life, low commuting costs) which is not captured in our model. Multi-community models usually abstract from geography, i.e. physical distance, and exclude the CBD in the empirical test (see e.g. Epple and Sieg, 1999).

In general, the expected or mean average tax for a household with income y is

$$E[t\,r(y)|y] = \sum_i \left[P(i|y) \cdot t_i\, r(y)\right], \tag{11}$$

where $t_i\, r(y)$ is the average tax rate for a household with income y in community i. The probability that a household with income y lives in community i,

$$P(i|y) = \frac{f(y|i)P(i)}{f(y)}, \tag{12}$$

is calculated from the income density $f(y|i)$ in community i, the probability $P(i)$ that an arbitrary household resides in community i and the income distribution $f(y)$ of the whole area.

In the case of heterogenous tastes, the marginal income distribution $f(y|i)$ in a community i (shown in the right figure 3) is calculated by integrating over tastes in community i:

$$f(y|i) = \int_{\underline{\alpha}_i}^{\overline{\alpha}_i} f(y,\alpha)d\alpha\,,$$

where $\underline{\alpha}_i$ and $\overline{\alpha}_i$ are the lowest and highest tastes in community i.

The right graph in figure 5 shows the mean average tax rate in case of heterogenous tastes. The realized tax schedule becomes much smoother: While very poor and very rich households still face the tax rates of the high-tax and the low-tax community, respectively, (as they actually live in these communities,) middle income households face on average tax rates in between. In this part, the realized tax schedule is evidently much flatter than the tax schedule implemented by the canton.

5 Evidence

In this section, we *estimate* the mean average tax rates that households with a given income face in the Zurich metropolitan area. We then compare our estimates to the results obtained in the previous section.

5.1 Method

In principle, the mean average tax rate can be estimated from a random sample of households in the studied area. Knowing each households' income and community tax rate allows to directly estimate the mean average tax rate with e.g. a kernel regression. The random sampling automatically accounts for the sorting of the population by incomes. Unfortunately, we do not have such microdata with tax information. Furthermore, available survey data suffers from small sample sizes and stratified sampling over communities.

We therefore follow an alternative estimation strategy. The mean average tax rate of a household with income y can be estimated from equation (11):

$$\hat{E}[t\, r(y)|y] = \sum_i [\hat{P}(i|y) \cdot t_i\, r(y)]$$

As the canton sets the tax structure $r(y)$ and the individual communities their tax shifters t_i, the average tax rate $t_i r(y)$ for any income y in any community i is known.

The estimated probability that a household with income y lives in community i is given by equation (12):

$$\hat{P}(i|y) = \frac{\hat{f}(y|i)\hat{P}(i)}{\hat{f}(y)} = \frac{\hat{f}(y|i)n_i}{\sum_j [\hat{f}(y|j)n_j]}\,,$$

where n_i is the known number of households living in community i.

It remains, therefore, estimating the income density $\hat{f}(y|i)$ of each community i in the area. We estimate $\hat{f}(y|i)$ from publicly available local income distribution data. The federal tax administration publishes the number of households with taxable income in seven different income classes.[15] We as-

[15] Swiss Federal Tax Administration, Steuerbelastung in der Schweiz, Natürliche Personen nach Gemeinden 1997, Neuchâtel: Swiss Federal Statistical Office.

sume that incomes are log-normally distributed and estimate mean and variance of this distribution using maximum likelihood.[16] We estimate a truncated log-normal distribution as the first reported income interval is empty for technical reasons. The log likelihood function for any community i is

$$log\,\mathcal{L}_i = \sum_{k=1}^{6} s_k \cdot log\left[\frac{\Phi\left(\frac{c_{k+1}-\mu_i}{\sigma_i}\right) - \Phi\left(\frac{c_k-\mu_i}{\sigma_i}\right)}{1-\Phi\left(\frac{c_1-\mu_i}{\sigma_i}\right)}\right],$$

where μ_i and σ_i^2 are mean and variance of log income in community i. s_k is the number of households in income class k with lower interval limit $c_k \in \{log(15000), log(20000), log(30000), log(40000), log(50000), log(75000), \infty\}$. $\Phi(.)$ is the cdf of the standard normal distribution. The income density in community i is then estimated as

$$\hat{f}(y|i) = \frac{1}{\hat{\sigma}_i y\sqrt{2\pi}}\, exp\left[-\frac{1}{2}\left(\frac{log(y)-\hat{\mu}_i}{\hat{\sigma}_i}\right)^2\right].$$

5.2 Results

Figure 6 shows that the average tax rates that households with income y face in the Zurich metropolitan area. The top line is the average tax rate $t_i r(y)$ of households living in the community with the highest tax shifter t_i. The bottom line is the average tax rate of households in the community with the lowest tax shifter t_i. The middle line is the estimated mean average tax rate that households in this area face, $\hat{E}[t\,r(y)|y]$. This is the expected unconditional, i.e. not conditioned on the place of residence, average tax rate. As one can see, the average poor household faces almost the average tax rate in the highest-tax community (or in the city of Zurich).[17] This is,

[16]Note that this maximum likelihood estimator corresponds to an ordered probit with known thresholds.

[17]The tax shifter is 131 in the highest-tax community and 130 in the city of Zurich.

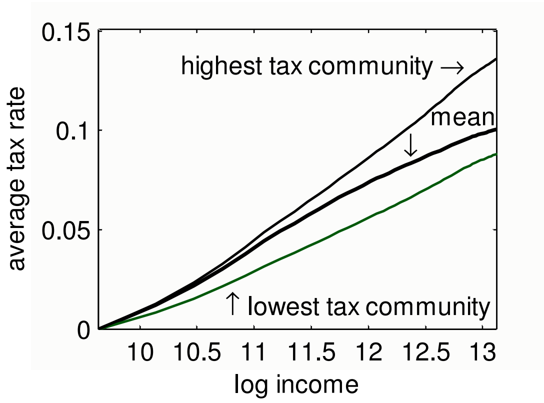

Figure 6: Estimated mean average tax rate by income.

of course, because most poor households live in high tax communities. As households become richer, they live more often in the low-tax communities and thus face an average tax rate that is on average substantially smaller than in high-tax communities. The mean average tax rate of households with very high incomes y is even relatively close to the average tax rate of very rich households living in the lowest-tax community.

The results from the estimation (figure 6) are very similar to the predictions of the calibrated model with taste heterogeneity (right figure 5). There are though two noteworthy differences: First, the difference between the highest and the lowest tax shifters is in reality smaller than our model predicts. Second, the mean average tax rate of very rich households remains in reality above the average tax rate of very rich households in the lowest-tax community, unlike in our simulation. While polito-economical considerations may account for the first difference,[18] the second might indicate that the location choice depends also on preference characteristics other than the taste

[18] The threat of a so-called tax harmonization often prevents low-tax communities from further lowering their tax shifters.

for housing.

6 Conclusions

We have focused on the tension between fiscal decentralization and progressive taxation. We have presented a multi-community model in which the local income tax rate depends on an exogenous progressive tax schedule and a tax shifter that can differ across communities. The progressivity of the tax schedule induces a self-sorting process that results in income sorting. This income sorting is however imperfect if households differ in their preferences for housing. But rich households are, of course, still more likely to locate themselves in communities with low tax shifters than poor households. As a consequence, the actual tax structure becomes less progressive than the exogenous tax schedule. Empirical evidence from the largest Swiss metropolitan area, the Zurich area, supports our predictions: Rich households are more likely to live in communities with low tax shifters than poor households, and the actual tax structure is thus substantially less progressive than the tax scheme of the state (canton) of Zurich.

These findings suggest, in line with the literature on fiscal federalism, that progressive taxes should indeed be implemented at the state or national level if one wants them to unfold their full redistributive effect. But they also show that substantial redistribution through progressive income taxation is even possible at the community level.

Appendix: Calibration

Tax schedule: The parameters $r_0 = 0.2$, $r_1 = 0.5$ and $r_2 = 0.00065$ almost perfectly approximate the tax scheme of the canton of Zurich for a married couple. The deductible $d = 15,300$ is based on a family with one child.[19]

Income Distribution: The income distribution is calibrated with data from the Swiss Federal Tax Administration. We use a log-normal distribution to approximate this right-skewed distribution. The estimation of the mean $E(ln\, y) = 11.0$ and standard deviation $SD(ln\, y) = 0.517$ from the observed income bins is described in the empirical section 5.1. For numerical tractability, the model distribution is truncated at a minimum income equal to the deductible $y_{min} = 15,300$ and a maximum income $y_{max} = 500,000$.

Taste Distribution: The distribution of the taste for housing is calibrated with data from the Swiss labor force survey.[20] The Swiss labor force survey contains the monthly housing expenditure of renters.[21] Note that the taste parameter α in the Cobb-Douglas utility function is the share of housing in a utility maximizing household. We therefore estimate each household taste parameter as $\alpha = (ph)/y_d$, where ph is observed households housing expenditure and y_d is observed household income minus federal, state and communal taxes. A beta distribution with mean $E(\alpha) = 0.25$ and standard deviation $SD(\alpha) = 0.11$ describes the distribution of the so calculated taste parameter well. Taste and income are assumed to be uncorrelated.

Housing and Public Good Production: The price elasticity of housing supply is $\theta = 3$ as in Epple and Romer (1991) and Goodspeed (1989). The tar-

[19] Tax scheme according to Steuergesetz vom 8. Juni 1997, Tarif a.

[20] Swiss Federal Statistical Office, Schweizerische Arbeitskräfterhebung (SAKE) 1995.

[21] Of course, there is a selection bias by only considering renters. This seems nevertheless justified because the proportion of renters is very high in Switzerland (65% in the data set used).

geted public goods provision $g = 2,500$ is such that the (population) weighted average tax shifter in the calibrated model with heterogeneous tastes equals the observed one.

References

[1] Boadway, Robin W. and Harry M. Kitchen (1980), Canadian Tax Policy, Toronto, Canada: Canadian Tax Foundation.

[2] Ellickson (1971), Jurisdictional Fragmentation and Residential Choice, American Economic Review, 61, 334-339.

[3] Epple, Dennis and Glenn J. Platt (1998), Equilibrium and Local Redistribution in an Urban Economy when Households Differ in both Preferences and Income, Journal of Urban Economics, 43, 23-51.

[4] Epple, Dennis and Holger Sieg (1999), Estimating Equilibrium Models of Local Jurisdictions, Journal of Political Economy, 107, 645-681.

[5] Epple, Dennis and Thomas Romer (1991), Mobility and Redistribution, Journal of Political Economy, 99(4), 828-858.

[6] Feldstein, Martin and Marian V. Wrobel (1998), Can State Taxes Redistribute Income?, Journal of Public Economics, 68(3), 369-396.

[7] Goodspeed, Timothy J. (1989), A Re-Examination of the Use of Ability to Pay Taxes by Local Governments, Journal of Public Economics, 38, 319-342.

[8] Hansen, Julia L., Formby, John P., and Smith, W. James (1998), Estimating the Income Elasticity of Demand for Housing: A Comparison of Traditional and Lorenz-Concentration Curve Methodologies, Journal of Housing Economics, 7, 328-342.

[9] Hansen, Julia L., Formby, John P., and Smith, W. James (1996), The Income Elasticity of Demand for Housing: Evidence from Concentration Curves, Journal of Urban Economics, 39, 173-192.

[10] Hardman, Anna and Yannis M. Ioannides (2004), Neighbors income distribution: economic segregation and mixing in US urban neighborhoods, Journal of Housing Economics, 13(4), 368-382.

[11] Ioannides, Yannis M. (2004) Neighborhood income distributions, Journal of Urban Economics, 56(3), 435-457.

[12] Mayo, Stephen K. (1981), Theory and Estimation in the Economics of Housing Demand, Journal of Urban Economics, 10, 95116.

[13] Musgrave, Richard M. (1971), Economics of Fiscal Federalism. Nebraska Journal of Economics and Business, 10, 3-13.

[14] Oates, Wallace E. (1999), An Essay on Fiscal Federalism, Journal of Economic Literature, 37(3), 1120-1149.

[15] Ross, Stephen and John Yinger (1999), Sorting and Voting: A Review of the Literature on Urban Public Finance. In: Paul Ceshire and Edwin S. Mills (eds.), Handbook of Regional and Urban Economics, Vol. 3, Amsterdam: North-Holland.

[16] Schmidheiny, Kurt (2004), Income Segregation and Local Progressive Taxation: Empirical Evidence from Switzerland, CESifo Working Paper 1313.

[17] Schmidheiny, Kurt (2005), Income Segregation from Local Income Taxation When Households Differ in Both Preferences and Incomes, Department of Economics Working Paper 2005-09, Tufts University.

[18] Westhoff, F. (1977), Existence of Equilibria in Economies with a Local Public Good, Journal of Economic Theory, 14, 84-112.

[19] Young, Peyton H. (1990), Progressive Taxation and Equal Sacrifice, American Economic Review, 80(1), 253-266.

CESifo Working Paper Series

(for full list see www.cesifo-group.de)

1513 Christian Keuschnigg and Martin D. Dietz, A Growth Oriented Dual Income Tax, July 2005

1514 Fahad Khalil, David Martimort and Bruno Parigi, Monitoring a Common Agent: Implications for Financial Contracting, August 2005

1515 Volker Grossmann and Panu Poutvaara, Pareto-Improving Bequest Taxation, August 2005

1516 Lars P. Feld and Emmanuelle Reulier, Strategic Tax Competition in Switzerland: Evidence from a Panel of the Swiss Cantons, August 2005

1517 Kira Boerner and Silke Uebelmesser, Migration and the Welfare State: The Economic Power of the Non-Voter?, August 2005

1518 Gabriela Schütz, Heinrich W. Ursprung and Ludger Wößmann, Education Policy and Equality of Opportunity, August 2005

1519 David S. Evans and Michael A. Salinger, Curing Sinus Headaches and Tying Law: An Empirical Analysis of Bundling Decongestants and Pain Relievers, August 2005

1520 Michel Beine, Paul De Grauwe and Marianna Grimaldi, The Impact of FX Central Bank Intervention in a Noise Trading Framework, August 2005

1521 Volker Meier and Matthias Wrede, Pension, Fertility, and Education, August 2005

1522 Saku Aura and Thomas Davidoff, Optimal Commodity Taxation when Land and Structures must be Taxed at the Same Rate, August 2005

1523 Andreas Haufler and Søren Bo Nielsen, Merger Policy to Promote 'Global Players'? A Simple Model, August 2005

1524 Frederick van der Ploeg, The Making of Cultural Policy: A European Perspective, August 2005

1525 Alexander Kemnitz, Can Immigrant Employment Alleviate the Demographic Burden? The Role of Union Centralization, August 2005

1526 Baoline Chen and Peter A. Zadrozny, Estimated U.S. Manufacturing Production Capital and Technology Based on an Estimated Dynamic Economic Model, August 2005

1527 Marcel Gérard, Multijurisdictional Firms and Governments' Strategies under Alternative Tax Designs, August 2005

1528 Joerg Breitscheidel and Hans Gersbach, Self-Financing Environmental Mechanisms, August 2005

1529 Giorgio Fazio, Ronald MacDonald and Jacques Mélitz, Trade Costs, Trade Balances and Current Accounts: An Application of Gravity to Multilateral Trade, August 2005

1530 Thomas Christiaans, Thomas Eichner and Ruediger Pethig, A Micro-Level 'Consumer Approach' to Species Population Dynamics, August 2005

1531 Samuel Hanson, M. Hashem Pesaran and Til Schuermann, Firm Heterogeneity and Credit Risk Diversification, August 2005

1532 Mark Mink and Jakob de Haan, Has the Stability and Growth Pact Impeded Political Budget Cycles in the European Union?, September 2005

1533 Roberta Colavecchio, Declan Curran and Michael Funke, Drifting Together or Falling Apart? The Empirics of Regional Economic Growth in Post-Unification Germany, September 2005

1534 Kai A. Konrad and Stergios Skaperdas, Succession Rules and Leadership Rents, September 2005

1535 Robert Dur and Amihai Glazer, The Desire for Impact, September 2005

1536 Wolfgang Buchholz and Wolfgang Peters, Justifying the Lindahl Solution as an Outcome of Fair Cooperation, September 2005

1537 Pieter A. Gautier, Coen N. Teulings and Aico van Vuuren, On-the-Job Search and Sorting, September 2005

1538 Leif Danziger, Output Effects of Inflation with Fixed Price- and Quantity-Adjustment Costs, September 2005

1539 Gerhard Glomm, Juergen Jung, Changmin Lee and Chung Tran, Public Pensions and Capital Accumulation: The Case of Brazil, September 2005

1540 Yvonne Adema, Lex Meijdam and Harrie A. A. Verbon, The International Spillover Effects of Pension Reform, September 2005

1541 Richard Disney, Household Saving Rates and the Design of Social Security Programmes: Evidence from a Country Panel, September 2005

1542 David Dorn and Alfonso Sousa-Poza, Early Retirement: Free Choice or Forced Decision?, September 2005

1543 Clara Graziano and Annalisa Luporini, Ownership Concentration, Monitoring and Optimal Board Structure, September 2005

1544 Panu Poutvaara, Social Security Incentives, Human Capital Investment and Mobility of Labor, September 2005

1545 Kjell Erik Lommerud, Frode Meland and Odd Rune Straume, Can Deunionization Lead to International Outsourcing?, September 2005

1546 Robert Inklaar, Richard Jong-A-Pin and Jakob de Haan, Trade and Business Cycle Synchronization in OECD Countries: A Re-examination, September 2005

1547 Randall K. Filer and Marjorie Honig, Endogenous Pensions and Retirement Behavior, September 2005

1548 M. Hashem Pesaran, Til Schuermann and Bjoern-Jakob Treutler, Global Business Cycles and Credit Risk, September 2005

1549 Ruediger Pethig, Nonlinear Production, Abatement, Pollution and Materials Balance Reconsidered, September 2005

1550 Antonis Adam and Thomas Moutos, Turkish Delight for Some, Cold Turkey for Others?: The Effects of the EU-Turkey Customs Union, September 2005

1551 Peter Birch Sørensen, Dual Income Taxation: Why and how?, September 2005

1552 Kurt R. Brekke, Robert Nuscheler and Odd Rune Straume, Gatekeeping in Health Care, September 2005

1553 Maarten Bosker, Steven Brakman, Harry Garretsen and Marc Schramm, Looking for Multiple Equilibria when Geography Matters: German City Growth and the WWII Shock, September 2005

1554 Paul W. J. de Bijl, Structural Separation and Access in Telecommunications Markets, September 2005

1555 Ueli Grob and Stefan C. Wolter, Demographic Change and Public Education Spending: A Conflict between Young and Old?, October 2005

1556 Alberto Alesina and Guido Tabellini, Why is Fiscal Policy often Procyclical?, October 2005

1557 Piotr Wdowinski, Financial Markets and Economic Growth in Poland: Simulations with an Econometric Model, October 2005

1558 Peter Egger, Mario Larch, Michael Pfaffermayr and Janette Walde, Small Sample Properties of Maximum Likelihood Versus Generalized Method of Moments Based Tests for Spatially Autocorrelated Errors, October 2005

1559 Marie-Laure Breuillé and Robert J. Gary-Bobo, Sharing Budgetary Austerity under Free Mobility and Asymmetric Information: An Optimal Regulation Approach to Fiscal Federalism, October 2005

1560 Robert Dur and Amihai Glazer, Subsidizing Enjoyable Education, October 2005

1561 Carlo Altavilla and Paul De Grauwe, Non-Linearities in the Relation between the Exchange Rate and its Fundamentals, October 2005

1562 Josef Falkinger and Volker Grossmann, Distribution of Natural Resources, Entrepreneurship, and Economic Development: Growth Dynamics with Two Elites, October 2005

1563 Yu-Fu Chen and Michael Funke, Product Market Competition, Investment and Employment-Abundant versus Job-Poor Growth: A Real Options Perspective, October 2005

1564 Kai A. Konrad and Dan Kovenock, Equilibrium and Efficiency in the Tug-of-War, October 2005

1565 Joerg Breitung and M. Hashem Pesaran, Unit Roots and Cointegration in Panels, October 2005

1566 Steven Brakman, Harry Garretsen and Marc Schramm, Putting New Economic Geography to the Test: Free-ness of Trade and Agglomeration in the EU Regions, October 2005

1567 Robert Haveman, Karen Holden, Barbara Wolfe and Andrei Romanov, Assessing the Maintenance of Savings Sufficiency Over the First Decade of Retirement, October 2005

1568 Hans Fehr and Christian Habermann, Risk Sharing and Efficiency Implications of Progressive Pension Arrangements, October 2005

1569 Jovan Žamac, Pension Design when Fertility Fluctuates: The Role of Capital Mobility and Education Financing, October 2005

1570 Piotr Wdowinski and Aneta Zglinska-Pietrzak, The Warsaw Stock Exchange Index WIG: Modelling and Forecasting, October 2005

1571 J. Ignacio Conde-Ruiz, Vincenzo Galasso and Paola Profeta, Early Retirement and Social Security: A Long Term Perspective, October 2005

1572 Johannes Binswanger, Risk Management of Pension Systems from the Perspective of Loss Aversion, October 2005

1573 Geir B. Asheim, Wolfgang Buchholz, John M. Hartwick, Tapan Mitra and Cees Withagen, Constant Savings Rates and Quasi-Arithmetic Population Growth under Exhaustible Resource Constraints, October 2005

1574 Christian Hagist, Norbert Klusen, Andreas Plate and Bernd Raffelhueschen, Social Health Insurance – the Major Driver of Unsustainable Fiscal Policy?, October 2005

1575 Roland Hodler and Kurt Schmidheiny, How Fiscal Decentralization Flattens Progressive Taxes, October 2005