An Empirical Test of Migration and Fiscal Externality: The Swedish Case

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Abstract: Tiebout hypothesis posits that residential sorting can lead to efficient provision of local public goods in a decentralized society. By contraries, literatures on tax competition find two types of tax externalities where different hierarchical government levels locally tax the same base: a horizontal tax externality working among governments of the same level would bring to tax rates that are too low compared to social optimum; but a vertical tax externality acting between different levels of governments would yield suboptimally high tax rates. This paper aims to empirically investigate the two contrary hypotheses about fiscal decentralization by using Swedish regional data during the period 2000-2006. Consequently, our empirical results derive two conclusions. First, Tiebout's argument appears to be valid only if there is some available housing on the market. Second, contrary to Brülhart and Jametti (2006, Journal of Public Economics 90, pp.2027-2067), a dominant horizontal tax externality would lower suboptimally municipal tax rates.

Key Words: Fiscal federalism; Vote with the feet; Tax externality; Housing market; Swedish fiscal constitution.

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1. Introduction

Over the past decades, a considerable number of studies have been made on fiscal decentralization from various viewpoints. While a “good side” of fiscal decentralization has been clearly demonstrated by Tiebout literatures, it also has a “bad side,” which has been the focus of literatures on tax competition that started with Zodrow and Mieszkowski (1986) and Wilson (1986). Our concern is to empirically investigate two contrary hypotheses about fiscal decentralization.

Tiebout (1956) hypothesized that if mobility is costless, households with similar demand for publicly supplied goods will sort themselves into the communities that provide the best available combination of taxes and services. While Tiebout’s idea have been informally developed, Wooders (2000) provides a formal model of an economy with local public good and endogenous jurisdiction structures which permits the proof of his conjectures. If Tiebout hypothesis hold, the policy implication is simple: a decentralized allocation of local public goods, in which the levels of tax and service are set locally, is preferable to provision imposed by a central authority such as federal government.

There are fairly supportive evidences on “vote with the feet” appealed by Tiebout hypothesis. Conway and Houtenville (1998) noticed that governmental spending, environments, and state taxes are all important to the migration decisions of residents. Moreover, Conway and Houtenville (2001) finds a significant impact of state fiscal policy upon the geographic mobility of consumer-voters in the United States. In addition, Conway and Rork (2006) presents some evidence that state governments with high elderly in-migration may be more likely to subsequently eliminate or reduce their incremental taxes on estate, inheritance and gift.[1]

By contraries, numerous literatures have pointed out that wasteful fiscal competition among local governments would involve some types of departure from the idealized settings of Tiebout model (for a survey, see Keen 1998 and Wilson 1999). The main source of departure is the existence of fiscal externality.

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[1] Some empirical studies test on “Tiebout sorting” as well. For instance, Rhode and Strumpf (2003) finds a decreasing heterogeneity for policies and preferences across local jurisdictions in the United States.

The fiscal externalities can arise either through taxation or expenditure decisions, and they may be either positive (beneficial) or negative (harmful).[2] For example, if regions are constrained to finance local public goods by taxes on mobile factor, the fiscal externality via taxation, i.e. tax externality, would distort the efficient level of local government's taxation. In particular, where different hierarchical governments share the tax base, a horizontal tax externality acting among governments of the same level would yield tax rates that are too low compared to the social optimum; and a vertical tax externality working between different levels of governments would derive suboptimally high tax rates.

A sizeable empirical literatures document the horizontal interactions among tax-setting authorities (for a survey, see Brueckner 2003). The pioneering empirical study on the tax externality was done by Case et al. (1993), who investigated an empirical model of strategic interaction among state governments in the United States. They confirmed the existence of significant fiscal reaction functions among jurisdictions, both inter- and intra-nationally.

Moreover, there are also a few empirical studies on the vertical tax externality. Besley and Rosen (1998) finds a positive relationship between the gasoline or cigarettes taxes chosen by the federal and the state governments in the United States. According to Hayashi and Boadway (2001), the business taxes at the provincial level decrease as a response to higher federal taxation in Canada. The empirical result of Anderson et al. (2006) shows a negative relationship between the income tax rates in the different level of governments by employing the panel data for Swedish local and regional public sectors.

As we have seen before, both types of tax externalities are likely to distort levels of taxation in the opposite directions. The theoretical discussion of Keen and Kotsogiannis (2003, 2004) shows that the government's objective would

[2] Dahlby (1996) points out two types of fiscal externality, direct and indirect. While the direct fiscal externality influences the utility functions of non-residents, the indirect one affects the budget constraints of other governments. In this paper, we deal only with the indirect fiscal externality which causes interdependency among local governments. Moreover, tax competition is very broadly defined as any form of non-cooperative tax setting by independent governments. However, a broad class of models known as "yardstick competition" gives no story about interdependency between governmental budgets. Hence, we exclude it from our category of tax competition.

affect the question of whether lower-level government's equilibrium taxes are likely to be too high or low: if governments are revenue-maximizing leviathan, tax rates of different hierarchical government levels are suboptimally high; and if governments are resident's utility-maximizing benevolent, it is ambiguous. However, the empirical analysis of Brülhart and Jametti (2006) finds a dominant vertical tax externality in a sample of Swiss municipalities that feature direct-democratic fiscal decision making.

Numerous articles have been devoted to the study of two contrary aspects about fiscal decentralization. For example, Brueckner (2004) theoretically analyzes Tiebout sorting as well as tax competition. However, so far the simultaneous studies of both sides have been superficial in the empirical analysis. This paper aims to address it.

Our test is implemented by using Swedish regional data during the period 2000-2006. In Sweden, the councils of municipalities and counties are entitled to levy taxes in order to finance their activities, as well as various levels of governments share the tax base on income. Moreover, the data also contain information about mobility across jurisdictions, allowing us to explicitly argue the contrast hypotheses about fiscal decentralization.

Consequently, the main results are somewhat contrary to the recent empirical literatures. Unlike existing literatures, the first regression considers some housing conditions as one of migration determinants. As a result, the argument of Tiebout appears to be valid only if there is some available housing on the market. The second regression supports that contrary to Brülhart and Jametti (2006), a dominant horizontal tax externality would lead to suboptimally low municipal tax rates.

The remainder of this paper is organized as follows. Section 2 and 3 theoretically develop two contrary hypotheses about fiscal decentralization respectively. The empirical results are reported in Section 4. Finally section 5 offers a concluding discussion.

2. Discussion on Vote with the Feet

This section will explain its good side, demonstrated by Tiebout's literatures. Based on Conway and Houtenville (2001), we illustrate with a simple model in which households choose location to maximize utility over private consumption and local government services, subject to a budget constraint incorporating income taxes, property taxes, and other taxes.

The resulting indirect utility of household at location i can be written as $V_i(\mathbf{G}_i, \mathbf{A}_i, \mathbf{P}_i, \mathbf{T}_i, \mathbf{X}_i)$, where $\mathbf{G}$ is a vector of local fiscal characteristics, $\mathbf{A}$ is a vector of local amenities including housing condition and population density, $\mathbf{P}$ is a vector of local prices for consumption, $\mathbf{T}$ is a vector of local taxes which may vary across jurisdictions, and $\mathbf{X}$ is a vector of household characteristics, including income and wealth. A household selects the location that maximizes V and moves if and only if the best alternative location k satisfies

$$\Omega_{ik} \equiv V_k(\mathbf{G}_k, \mathbf{A}_k, \mathbf{P}_k, \mathbf{T}_k, \mathbf{X}_k) - V_i(\mathbf{G}_i, \mathbf{A}_i, \mathbf{P}_i, \mathbf{T}_i, \mathbf{X}_i) > 0 . \quad (1)$$

The household migrates if any, Ω_{ik}, is greater than zero, and chooses the location for which Ω_{ik} is highest. Equation (1) also reveals why a variable at the destination is expected to have the opposite effect at the origin. We do not observe Ω_{ik} or even whether it is positive for a certain household. Instead, net benefit of moving from one region to another can be predicted by observing the net migration flow:

Proposition 1. *Net migration flow (m_i), which is the pure number of households who move from the location i to k, is the number of times that Ω_{ik} is positive and greater than all others.*

Accordingly, we will estimate the “vote with the feet” hypothesis as a standard net migration model (for example, see Cebula 1974). In accordance to equation (1), the net migration will be a function of amenities, government provided goods, cost-of-living, income tax, income, and so on. Hence, the net migration model looks like as follows:

$$m_i = \alpha_0 + \alpha_1 t_i + \alpha_2 \mathbf{Y}_i + \alpha_3 (t \cdot \mathbf{Z})_i + \eta_i ,$$

where t is municipal tax rate, $\mathbf{Y}$ is a vector of exogenous explanatory variables such as population, income and public expenditures, and $\mathbf{Z}$ is a vector of exogenous controls such as housing density or vacancy.

Concretely, we have five types of econometric equations. The first model (Model A1) assumes that α_3 is equal to zero. It is testing whether Tiebout-hypothesis is valid or not, hence, whether α_1 is statistically significant (negatively). If the estimated parameter is negative, a raise in income tax will decrease net migration; namely, it will decrease in-migration given out-migration. The second model (Model A2) assumes that α_3 is different from zero. Thus, the hypothesis is that the Tiebout's hypothesis is more valid in a certain housing market situation, such as high housing stocks. The third model (Model A3) excludes the labor market of Stockholm. As most of the economic activity is in the Stockholm region, we are testing if the results are robust if Stockholm is excluded. The fourth model (Model A4) includes fixed temporal effects. Moreover, Moran I-test has been utilized for measuring spatial correlation in OLS residuals. In these tests, inverse squared distance is used as spatial weight matrix. The last model (Model A5) is thus a spatial autoregressive model that we use in order to take care of the spatial dependency problem.

3. Theory of Tax Externality

As we stated before, fiscal decentralization has a bad side, i.e. tax externality as well. This section will turn to the arguments about it.

3.1. Horizontal versus vertical tax externality

The model used in this paper is the income tax version of Brülhart and Jametti (2006). The economy consists of one upper-level local government (hereafter, county) and $N \geq 1$ identical lower-level ones (hereafter, municipality). In each municipality j, a single firm produces a private good according to a concave production function $F(L_j)$, using labor L_j as only input. Labor is costlessly mobile across the municipalities and so relocates until it earns a unique post-tax wage ω in each municipality. Municipality j's government levies a source-based tax t_j on each unit of labor within its jurisdiction, while the county's government levies a unit tax at the rate T, common to all municipalities. The consolidated tax rate in municipality j is then $\tau_j = T + t_j$.

Normalizing the price of the private good to one, the profit maximizing condition $F'(L_j) = \omega + \tau_j$ implies the demand for labor in each municipality: $L_i = L(\omega + \tau_j)$ with $L'(\omega + \tau_j) = 1/F''(L_j) < 0$. In addition, labor would be supplied within the economy where it provides the labor for the productive sector ($\sum_j L_j = \sum_j Z_j$ where Z_j denotes the hours spent working).[3] The level of rents to the fixed factor in municipality j is defined as the difference between the value of production and the cost of labor:

$$\pi(\omega + \tau_j) = F[L(\omega + \tau_j)] - (\omega + \tau_j) \cdot L(\omega + \tau_j). \quad (2)$$

Hence each resident receives the post-tax wage income ωZ_j plus the rents earned in the jurisdiction $\pi(\omega + \tau_j)$.

In addition to the private good, there exist two distinct publicly provided goods. The municipality j's government employs t_j to provide g_j, while the county's one uses T to finance G. The level of g_j denote a local public goods in the municipality j and the level of G express the county's governmental spending per municipality (which, although specific to each municipality, we shall refer to as "public goods"). Taxes are spent exhaustively on the respective public goods, which are produced with constant returns.[4] The governments' budget constraints can be then written as:

$$g_j = t_j \cdot L(\omega + \tau_j), \quad (3)$$

$$G = \frac{1}{N} \sum_j T \cdot L(\omega + \tau_j). \quad (4)$$

The residents derive utility from the labor incomes, the rent incomes, the leisure ($Z_j^0 - Z_j$) where Z_j^0 is the total number of available hours, and the public goods provided by both hierarchical level of governments, g_j and G.

[3] Since each municipality is populated by a large number of identical residents, the mass of residents in each municipality is assumed to be one.

[4] There are no inter-governmental transfers, either vertically between hierarchical government levels, or horizontally across the municipalities.

Specifically, we assume the utility function for respective residents in municipality j :

$$U_j = \left[\omega Z_j + \pi(\omega + \tau_j)\right] + u(Z_j^0 - Z_j) + \Gamma(g_j, G), \tag{5}$$

where both u and Γ are strictly increasing and concave, so $u' > 0 > u''$ and $\Gamma_m > 0 > \Gamma_{mm}$ ($m = g$, G).

Making use of equations (2) - (4) and of the utility-maximizing condition with respect to Z_j, the indirect utility function for respective residents in municipality j can be written:

$$W_j = \left[\omega Z_j(\omega) + \pi(\omega + \tau_j)\right] + u\left[Z_j^0 - Z_j(\omega)\right] + \Gamma\left[t_j \cdot L(\omega + \tau_j); \frac{1}{N}\sum_j T \cdot L(\omega + \tau_j)\right]. \tag{6}$$

The post-tax wage ω is determined by the labor-market clearing condition:

$$N \cdot Z(\omega) = \sum_j L(\omega + \tau_j),$$

which implies the effect of a change in t_j on ω:

$$\frac{\partial \omega}{\partial t_j} = \frac{L'}{NZ' - \sum_j L'}. \tag{7}$$

If we impose symmetry of municipal tax rates, such that $t_j = t$, $\forall j$, then

$$\frac{\partial \omega}{\partial t} = \frac{L'}{Z' - L'} = N\frac{\partial \omega}{\partial t_j} \in [-1, 0),$$

where the last equation holds if all municipalities are identical.

Consider then the problem that the policy maker of the typical municipality j. Municipal governments are assumes to be benevolent in the sense that they maximize the welfare of their own residents. They do not thus consider the effect of their actions on residents in other municipality.

We can have the derivative of W_j with respect to t_j, evaluated at the symmetric equilibrium:

$$\hat{W}_j \equiv \left.\frac{\partial W_j}{\partial t_j}\right|_{t_j = t} = -L + \Gamma_g\left[L + t \cdot L'\left(\frac{\partial \omega}{\partial t_j} + 1\right)\right] + \Gamma_G\left[T \cdot L'\frac{\partial \omega}{\partial \tau_j} + T \cdot L'\frac{1}{N}\right]. \tag{8}$$

Setting equation (8) to zero implicitly determines the (symmetric) equilibrium municipal tax rate. Furthermore, the first-order condition of W (defined as the indirect utility under symmetry of tax rates) with respect to the symmetric municipal tax rate, is given by:

$$\hat{W} \equiv \frac{\partial W}{\partial t} = -L + \Gamma_g \left[L + t \cdot L' \cdot \left(\frac{\partial \omega}{\partial t} + 1 \right) \right] + \Gamma_G \left[T \cdot L' \cdot \left(\frac{\partial \omega}{\partial t} + 1 \right) \right]. \tag{9}$$

Setting equation (9) to zero implicitly defines the socially optimal municipal tax rate for a given T.

Subtracting equation (8) from (9) and introducing notation for the elasticity of utility with respect to the supply of public goods [$\varepsilon_g \equiv (\partial\Gamma/\partial g)\cdot(g/\Gamma)$ and $\varepsilon_G \equiv (\partial\Gamma/\partial G)\cdot(G/\Gamma)$] would yield:

$$\Phi \equiv \hat{W} - \hat{W}_j = -\frac{L'}{L} \cdot \Gamma \cdot \left(1 - \frac{1}{N}\right) \cdot \left[-\varepsilon_g \cdot \frac{\partial \omega}{\partial t} - \varepsilon_G \cdot \left(\frac{\partial \omega}{\partial t} + 1 \right) \right], \tag{10}$$

where the term $-\varepsilon_g (\partial\omega/\partial t) > 0$ expresses a horizontal tax externality, whereas the term $-\varepsilon_G (\partial\omega/\partial t + 1) < 0$ represents a vertical one (due to the negative sign of L', the terms outside bracket are definitely positive).[5] If Φ is positive (negative), a slight increase in all municipal taxes would increase (decrease) social welfare, and municipal taxes are therefore too low (high) from a social viewpoint.

By the way, the equation (10) depends on (i) the elasticity of the public goods in the utility function (ε_g and ε_G), and (ii) the sensitivity of the rate of return to changes in the municipal tax rates $(\partial\omega/\partial t)$. However, we cannot observe ε_g, ε_G and $\partial\omega/\partial t$. Therefore, our practical empirical analysis requires a reduced form of the model that is based on observables. For the purpose of doing it, the next subsection will consider the relationship between the observable number of municipalities and the equilibrium tax rates.

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[5] If the supply of labor is completely inelastic ($Z = \overline{Z}$), then municipal tax policies never affect the tax base ($Z' = 0$), and then only a horizontal tax externality exists due to $(\partial\omega/\partial t) = -1$.

3.2. From theory to empirical model

The manipulation of equation (8) would compute the effect of a change in N on t_j:

$$\frac{\partial t_j}{\partial N} = -\frac{\partial \hat{W}_j \big/ \partial N}{\partial \hat{W}_j \big/ \partial t}. \tag{11}$$

Making use of equation (8), we can express the numerator of (11) as

$$\frac{\partial \hat{W}_j}{\partial N} = -\frac{1}{N^2}\frac{L'}{L}\Gamma \cdot \left[\varepsilon_g \cdot \frac{\partial \omega}{\partial t} + \varepsilon_G \cdot \left(\frac{\partial \omega}{\partial t} + 1\right)\right].$$

Moreover, the above can be rewritten by employing equation (10):

$$\frac{\partial \hat{W}_j}{\partial N} = -\frac{1}{N(N-1)}\Phi. \tag{12}$$

According to the simulations of Brülhart and Jametti (2006), $\partial \hat{W}_j \big/ \partial t$ is nearly negative. Since the effect of a change in N on t_j is inversely related to Φ (the balance between both types of tax externalities), we can derive the same proposition as Brülhart and Jametti:

Proposition 2. *When a horizontal tax externality dominates (Φ>0), an increase in N reinforces the tax externality (and lowers the equilibrium municipal tax rates). Conversely, when a vertical tax externality dominates (Φ<0), an increase in N leads to even the stronger one (and raises the equilibrium municipal tax rates).*

This proposition states that the sign of $\partial t_j \big/ \partial N$ reflects the relative dominance of horizontal or vertical externality. In terms of the vertical tax externality, an autonomous municipal government places less weight on the county's government the smaller its size relative to the county, irrespective of how many other municipalities there are. Second, in terms of the horizontal tax externality, an increase in the number of municipalities causes municipal tax rate to fall in the symmetric tax competition (see Hoyt 1991).[6] Hence, more

[6] More fragmentation reduces each municipality's market power in the labor market. An increase of tax rate in small municipalities would raise the pre-tax wage rate one for one. Hence, the

fragmented federation (and thus smaller sub-federal jurisdictions) will have lower municipal tax rates if the horizontal tax externality dominates; but it will have higher ones in the reverse case.

The basic empirical task is therefore straightforward: regress t_j on N. Since theory provides no guidance as to the appropriate functional form. The natural starting point is a linear additive specification:

$$t_j = \beta_0 + \beta_1 N + \beta_2 T + \varepsilon_j , \qquad (13)$$

where ε_j is a stochastic error term.

Our theoretical model features symmetric municipalities and identical municipal taxes in Nash equilibrium. If these assumptions were to hold in reality, the empirical strategy would be to estimate equation (13) by regressing county-level averages of t_j on N and T. However, municipalities have different sizes, they set different tax rates, and they differ in numerous relevant respects other than size. Therefore, we estimate equation (13) municipality-by-municipality.

From the municipalities' point of view, a high N in a symmetric county implies that each municipality is small. Hence, we express fragmentation as a municipality-specific variable "smallness", S_{ij}, defined as the population share of municipality *j* in its corresponding county *i*. That is to say, the positive coefficient on S_{ij} indicates the relative dominance of horizontal tax externality; conversely, the negative coefficient presents that the vertical tax externality dominates.

In addition, we control for relevant characteristics of county and municipalities which impact on equilibrium tax rates. Our estimating equation thus becomes:

$$t_{ij} = \beta_0 + \beta_1 S_{ij} + \beta_2 T_i + \beta_3 \sum_{j=1}^{N} \left(t_{ij} / N \right) + \beta_4 \mathbf{X_{ij}} + \varepsilon_i \qquad i \neq j,$$

where $\sum_{j=1}^{N} \left(t_{ij} / N \right)$ is the average tax rate in the surrounding municipalities, and $\mathbf{X}$ is a vector of exogenous controls such as population, the proportion of 0-17 years old in the population, and social welfare recipients.[7]

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municipality's decision would distort the level of taxable labor input the smaller their size.

[7] The basic model below bares some resemblance to the models used by Besley and Rosen (1998),

Concretely, we have four types of econometric equations. The first model (Model B1) explains the variation in municipal tax rate as a function of the county's tax rate and the tax rate in other municipalities and the size of the municipalities. The second model (Model B2) includes a vector of exogenous control variables comparable to the Brülhart and Jametti's model. Finally, the third model (Model B3) is an extended model where we have included more control variables. Model B1 assumes that β_4 is equal to zero, and Model B2 and B3 assume that β_0 is constant across municipalities.

The model, described above, with a variable indicating the average tax rate among the surrounding regions, is similar to a spatial autoregressive model where the definition of surrounding regions is the spatial weight matrix. We have defined the spatial weight matrix in two different ways. The first is defined according to the regions in the same county (model B3) and, second, as the regions in the same labor market (Model B4). If two municipalities are in the same labor market, it is indicated by ones, else zero.

Our additional hypothesis is that the average tax rate in the same labor market is more important than such tax rate within the same county. In order to detect for spatial dependency, Moran's I statistics has been estimated on the OLS residuals. The spatial weight matrix is defined as the inverse squared distance.

4. Empirical Analysis

This section explains data and variable selection, and then shows our empirical findings about fiscal decentralization.

4.1. Swedish fiscal constitution

Today, Sweden consists of 290 municipalities and 20 counties. The size of the counties varies from including only one municipality to including as many as 49 municipalities (The average size is about 10 municipalities). Even if it is not a federal system, Sweden has a decentralized parliamentary system with a long tradition of local self-government (see SALAR 2006). The constitution (the Local Government Act from 1992) guarantees the local authorities a considerable degree

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Goodspeed (2000), Revelli (2001), Brülhart and Jametti (2006), and Devereux et al. (2007).

of political and financial autonomy (see Loughlin and Martin 2004). The Swedish electorate directly elects the councils of municipality and county and thereby the participation rates are high.

The tasks of the municipality councils is, for example, city planning, planning and financing the transportation system of the municipality, primary and secondary education, social welfare functions, child and elderly care. Around 40 percent of the municipalities' expenditures go to compulsory schools and elderly care. Counties are mainly responsible for health care (more than 90 percent of their expenditures), but in some cases also public transportation and regional development issues. The councils can organize their activities as they see fit (SALAR 2006).

The councils of municipalities and counties are entitled to levy taxes in order to finance their activities. However, various levels of governments share the tax base on income. Since they are free to set their own tax rates, such tax base share makes it possible to test the hypothesis about horizontal or vertical tax externality. As much as 74 percent of the county's councils revenues are funded locally and around 69 percent municipality's ones likewise. Even though the income tax is the tax base for national, regional and local levels, about 85 percent of income earners pay only municipal and county's income tax. There is no minimum level of local taxation, but there is a minimum welfare standards decided by the central government.

In Sweden, there exists a financial equalization system even if Sweden has experienced a move away from the imposition of uniform standards across the whole county (see Loughlin and Martin 2004). The objective of the financial equalization system (SALAR 2005) is to "put all municipalities and county councils in the county on an equal footing to deliver equivalent levels of services to their residents irrespective of income of local authority residents and other structural factors." The main components of the system are the cost and income equalization parts. According to Loughlin and Martin (2004), those municipalities who raise higher taxes receive smaller grants from central government.

4.2. Data description and variable selection

Our first focus is on the net migration and its determinants, while the second one is on the relationship between the municipal income tax and fragmentation. We are using a cross-sectional time series data to estimate two different kinds of empirical models.

The cross-section consists of 290 municipalities in Sweden and the time series is over the period 2000 to 2006. For each municipality, we have data concerning the tax level and net migration, as well as a number of determinants. Besides information of the income tax in the municipality, we also have information about the tax level in Sweden's 25 counties.

The independent variables that we are going to use in the econometric modeling, consist of information about the population (*Pop*) and the share of municipality population less than 18 years and above 64 years (*Pop17* and *Pop64*). There also exists information about the size of the municipality measured in square kilometers and, hence, the density.

Furthermore, we have estimated the relative size of the municipality in comparison to the other municipalities in the county (*Smallness*). There is also information about the average taxable income per capita in the municipality (*Income*), which will be used in both models.

Brülhart and Jametti (2006) uses population over 20 and 65 years of age as proxies for government spending on education, health care and social security. Our extended tax externality model uses the actual expenditures on these public services instead of using proxies. Hence, in order to control for the cost side of the responsibilities of the local governments, we also have data on the number of social welfare recipients in the municipality (*Social*) and the cost for primary school in the municipal divided by the average cost in Sweden (*School*). Moreover, we also have information on the cost of elderly care (*Elderly*), and, finally, the cost if children care (*Children*).

One of our hypotheses is that a large housing stock per capita makes it easier to move to the region compared to a region with a low housing stock per capita. Thus, we utilize housing stock per capita (*H-stock*) as a proxy for how easy it is to move to a region. We also use vacancy rate within the municipal rental apartment market (*Vacancy*) as proxy for how hard, or easy, it is to move to the region. We use the latter in relation to income.

Justified by re-allocation goal, Sweden has a system to re-allocate resources (financial equalization system) among the municipalities, that is, to equalize the tax base. To control for re-distribution between municipalities in our econometric models, we have information about the net contribution from each municipality measured in SEK per capita (*Equalizing*).[8] We also have two regional dummy variables. One variable is controlling for Gotland where the municipality and the county is the same thing (*Gotland*). The other regional dummy is for Stockholm (*Stockholm*) where the county is responsible for more than just health care as it is in the rest of the county. In Stockholm, the county is more responsible for public transportation compared to the rest of the municipalities.

[Insert Table 1]

Finally, let us describe the data based on table 1, which presents the mean and the standard deviation. The average income tax rate in Sweden is 31 percent, while the standard deviation is low with a minimum tax rate of 26 percent and a maximum tax rate of 34 percent. The tax rate is higher in the municipality than in the county.[9] The tax rate has increased over time and the range has decreased slightly. The net migration varies from -2.5 percent to 3.9 percent. There is a rather big difference in demographics among the municipalities. The share municipal population less than 18 years is as low as 15 percent in one municipality and as high as 29 percent in another. The spread is even higher in the share of municipal population above 65 years, from 8 percent to 30 percent. There are huge differences in public expenditures among the municipalities. The number of social welfare recipients confirms the patter. This is one reason why the national government is trying to harmonize the tax base by re-distributing tax revenues among the municipalities. The net gainers among the municipalities receive up to SEK 3,594 per capita and the net losers have to pay up to SEK

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[8] Smart (1998) points out that equalization grants effectively compensates sub-national governments for a portion of the deadweight loss associated with taxes, and consequently the grants may tend to increase the distortionary tax rate chosen by sub-national governments.

[9] The maximum tax rate in the municipality and the minimum tax rate in the county is Gotland.

13,196 per capita. The size of the municipalities is very different, which the data on population, area, and density confirm. Employment rate varies substantially signifying that it is an important driver of migration. However, it also seems that the housing market does play an important role in explaining migration. In some municipalities, the housing stock per capita is very large, suggesting that it may be expansive to construct new housings. In municipalities, the housing prices are very high, and in principal, no vacant apartments on the rental market exist. Hence, even if the taxes are low and income high, as well as low unemployment, it can be impossible to move to the region.

4.3. Vote with the feet regression

This regression aims not only to test the validity of the Tiebout's argument about voting with your feet, but also to examine the effect on the municipal net migration of discrepancy in municipality and county's income taxes and financial equalization policies in Sweden. In the regression models, the dependent variable is the ratio of annual net migration between municipalities over the period 2000-2006 to the previous year's population. That is, we measure the net migration variable - dependent variable - as a percentage of population. This sub-section considers two types of basic models about the "vote with the feet" hypothesis.

[Insert Table 2]

As we have seen before, the first model (Model A1) includes the following independent variables: income per capita, population, density included together with indicators of welfare benefits such as social welfare recipients, cost of childcare, elderly care and primary school. As presented in table 2 below, the second group of models (Model A2-A5) is extended, with a number of variables interacting tax rates with different indicators of the housing market such as housing stock, density and vacancy rates.

If the Tiebout's hypothesis holds, we expect that income tax relates negatively to net migration for given the welfare benefits and vice versa. That is, if the tax rate increases given public expenditures, we expect that net-migration decrease (in-migration is reduced or out-migration is increased). As anticipated, migrants prefer areas with a lower income tax, ceteris paribus. Moreover, we also observe that the social welfare system relates negatively to the net migration. That is to say, municipalities with a high level of public expenditures (an indication of high social costs) are less attractive, given the tax level, size and income level.

The results do not alter even if we apply the second model (Model A2) where we have introduced the interaction variables. Income and population correlate positively to net migration. However, density associates inversely to net migration. In other words, highly dense areas will experience less net migration. It suggests that the availability of land has some impact on the “vote with the feet” hypothesis. Namely, the Tiebout’s argument appears to be valid only if the housing stock is high, vacancy rate within the rental apartment market is high, and housing density is low. We do not reject our hypothesis that the housing market has an effect on net migration. Contrary, it seems that the impact is both statistically and economically strong.

In Model A3, we exclude the largest metropolitan area (the city of Stockholm) in order to test the robustness. The main result here is that nothing happens. The inclusion of Stockholm seems not to drive the results. In Model A4, we have included fixed municipality effects. Naturally, some of the independent variables lose its explanatory power (for instance, income and population). However, it is interesting to observe that our main conclusion still holds.

We have tested for spatial dependency with the Moran’s I Statistics in all our models. The spatial weight matrix is based on the inverse squared distance each year. The results indicate that the hypothesis about no spatial autocorrelation can be rejected. Hence, net-migration in neighboring municipalities have only an effect on net-migration in a given time period. Consequently, we have estimated a spatial autoregressive model (Model A5). Our main conclusion still holds.

4.4. Tax externality regression

As mentioned in the previous section, we have estimated four different models of tax externality regression models. The first model (Model B1) is a simple fixed effect model with only the tax rate in the county and the average tax rate among the municipalities in the county. The second model (Model B2) is a model similar to Brülhart and Jametti (2006) and Devereux et al. (2007), and the third and fourth models (Model B3 and B4) are extended by including not only the variables in Brülhart and Jamettis but also variables concerning the welfare benefits, income and housing market. Table 3 reports the findings.[10]

[Insert Table 3]

As the estimated coefficient on the county's tax rate variable indicates, municipalities do respond inversely when county's government encroaches on their tax bases. However, the conclusion is only valid for the Brülhart and Jametti's model and the extended model, not the pure fixed effect model.[11] Contrary to Brülhart and Jametti, we find a positive and significant coefficient on smallness. Municipalities with a smaller share of the inverse county's population have lower tax rates, ceteris paribus. Our results support the horizontal tax externality which leads sub-optimally low tax rates.[12]

Furthermore, our results imply that taxes are complements among the municipalities in a specific county, but that they are substitutes between the county and the municipalities. Since the coefficient concerning the variable average municipality tax rate is larger than zero and statistically significant, it indicates that cross-border migration is high. If the tax rate goes up by 1 percent on average in all the municipalities, we expect that the tax rate would go up with around 0.25 percent in the municipality. In short, if it is easy to move, the coefficient should be close to one, but if the housing market is tight, we expect that the coefficient to be low or negative. If it is zero, there is no "spillover" between the municipalities.

According to Brueckner (2003), almost all empirical studies have estimated a positive relationship and, thus, that the governments behave as strategic complements to each other. Contrary to Esteller-Moré and Solé-Ollé (2001,

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[10] Almost by definition, the average municipality tax rate is endogenous. It means that we need to apply a two-stage estimation procedure with instrument variables (see discussion in Brueckner 2003). As instruments, the average concerning the control variables is used.

[11] The instrument diagnostic tests are satisfactory (Anderson and Sargan statistics). Moreover, our explanation power is overall lower than previous estimations, for instance Brülhart and Jametti (2006) and Devereux et al. (2007).

[12] This result is supported by Hoyt (1991), who presents that an increase in the number of municipalities would cause municipal tax rate to fall in the standard model of horizontal tax competition.

2002), we find that municipality taxes respond negatively to increases in county income taxes, which implies that municipal and county's taxes are substitutes.

The estimated parameter concerning the equalizing system is highly significant and positively related to tax rate in Model B2 but not in Model B3. That is, if the municipality is a net contributor to the equalizing system, the tax rate is higher in comparison to what they otherwise should be. However, when we control for local public provision of public goods, the estimated parameter is not significant.

With increasing returns to scale, the expected sign of the estimated parameter on the variable municipality size is negative. As anticipated, the population has a negative effect on the tax rate. Larger municipalities have lowered the income tax rates, ceteris paribus. As not anticipated, the size measured in square kilometers has negative impact on the tax rate, indicating that the cost of providing local public goods decreases by size. The income level has a positive impact on the tax level.

Density has a negative impact on the tax rate, that is, highly dense areas can have a lower tax rate, but if the housing density is high, the empirical results imply that the tax rate is higher. In other words, in metropolitan areas with a high housing density and thus with less unexplored land, has higher tax rates as household mobility is lower.

5. Conclusion

There is not only a good aspect appealed by the classic argument of Tiebout but also a bad aspect claimed by numerous literatures on tax competition in a fiscal decentralized society. In this paper, two regressions tested both symmetric hypotheses about fiscal decentralization by employing the Swedish regional data during the period 2000-2006.

The first regression investigates not only the validity of Tiebout's argument about voting with their feet, but also the influence on municipal net migration of discrepancy in municipality and county's income taxes and financial equalization policies. The second regression examines the superiority of horizontal versus vertical tax externality. This regression is based on a fixed effect model, a similar model of Brülhart and Jametti (2006), and its extended model including variables concerning welfare benefits, income and housing market.

These empirical analyses find the following two outcomes. First, migrants prefer areas with a lower income tax, ceteris paribus; and municipalities with a high level of high social costs are less attractive, given the tax level, size and income level. However, this argument appears to be valid only if the housing stock is high, vacancy rates within the rental apartment market are high, population density is high, and housing density is low. Second, unlike Brülhart and Jametti's estimation, a dominant horizontal tax externality would lead to suboptimally low municipal tax rates; and taxes are complements among municipalities in a specific county whereas they are substitutes between counties and municipalities. The main difference seems to arise from our contribution that a determinant of migration contains some housing availability.

The findings would draw some policy implications: if there is some available housing on the market, the competition among jurisdictions would improve the circumstances for an efficient allocation of the population over communities; but in the fragmented federation, smaller sub-federal jurisdictions will have suboptimally low local tax rates and provide an inefficient level of public goods because a horizontal externality dominates.

References

Andersson, L, Aronsson, T. and Wikstrom, M.: Testing for Vertical Fiscal Externalities. International Tax and Public Finance 11, 243-263 (2004).

Besley, T. and Rosen, H.: Vertical Externalities in Tax Setting: Evidence from Gasoline and Cigarettes. Journal of Public Economics 70, 383-398 (1998).

Brueckner, J. K.: Strategic Interaction among Governments: an Overview of Empirical Studies. International Regional Science Review 26, 175-188 (2003).

Brueckner, J. K.: Fiscal Decentralization with Distortionary Taxation:Tiebout vs. Tax Competition. International Tax and Public Finance 11, 133-153 (2004).

Brülhart, M. and Jametti, M.: Vertical versus Horizontal Tax Externalities: An Empirical Test. Journal of Public Economics 90, 2027-2062 (2006).

Case, A. C., Rosen, H. S. and Hines, J. R.: Budget Spillovers and Fiscal Policy Interdependence: Evidence from the States. Journal of Public Economics 52, 285-307 (1993).

Cebula, R. J.: Interstate Migration and the Tiebout Hypoyhesis: An Analysis According to Race, Sex and Age. Journal of American Statistical Association 69, 876-879 (1974).

Conway, K. and Houtenville. A.: Do the Elderly 'Vote with Their Feet'?. Public Choice 97, 663-685 (1998).

Conway, K. and Houtenville, A.: Elderly Migration and State Fiscal Policy: Evidence from the 1990 Census Migration Flows. National Tax Journal 54, 103-123 (2001).

Conway, K. S. and Rork, J. C.: State 'Death' Taxes and Elderly Migration -The Chicken or the Egg? National Tax Journal 59, 97-128 (2006).

Dahlby, B., Fiscal Externalities and the Design of Intergovernmental Grants. International Tax and Public Finance 3, 397-412 (1996).

Devereux, M.P., Lockwood, B. and Redoano, M.: Horizontal and Vertical Indirect Tax Competition: Theory and Some Evidence from the USA. Journal of Public Economics 91, 451-479 (2007).

Esteller-More, A. and Sole-Olle, A.: Vertical Income Tax Externalities and Fiscal Interdependence: Evidence from the US. Regional Science and Urban Economics 31, 247-272 (2001).

Esteller-More, A. and Sole-Olle, A.: Tax Setting in a Federal System: The Case of Personal Income Taxation in Canada. International Tax and Public Finance 9, 235-257 (2002).

Goodspeed, T.: Tax Structure in a Federation. Journal of Public Economics 75, 493-506 (2000).

Hayashi, M. and Boadway, R.: An Empirical Analysis of Intergovernmental Tax Interaction: the Case of Business Income Taxes in Canada. Canadian Journal of Economics 34, 481-503 (2001).

Hoyt, W. H.: Property Taxation, Nash Equilibrium, and Market Power. Journal of Urban Economics 30,123-131 (1991).

Keen, M.: Vertical Tax Externalities in the Theory of Fiscal Federalism. IMF Staff Papers 45(3), 454-485 (1998).

Keen, M. and Kotsogiannis, C.: Leviathan and Capital Tax Competition in Federations, Journal of Public Economic Theory 5, 177-199 (2003).

Keen, M. and Kotsogiannis, C.: Tax Competition in Federations and the Welfare Consequences of Decentralization. Journal of Urban Economics 56, 397-407 (2004).

Loughlin, J. and Martin, S.: Local Income Tax in Sweden: Reform and Continuity, Paper BoF 20, School of European Studies, Cardiff University (2004).

Revelli, F.: Spatial Patterns in Local Taxation: Tax Mimicking or Error Mimicking?. Applied Economics 33, 1101-1107 (2001).

Rhode, P. and Strumpf, K.: Assessing the Importance of Tiebout Sorting: Local Heterogeneity from 1850 to 1990. American Economic Review 93, 1648-1677 (2003).

SALAR: Local Government Financial Equalization in Sweden. Swedish Association of Local Authorities and Regions (2005).

SALAR: Levels of Local Democracy in Sweden. Swedish Association of Local Authorities and Regions (2006).

Smart, M.: Taxation Incentives and Deadweight Loss in a System of Intergovernmental Transfers. Canadian Journal of Economics 31, 189-206 (1998).

Tiebout, C.: A Pure Theory of Local Expenditures. Journal of Political Economy 65, 416-424 (1956).

Wilson, J. D.: A Theory of Interregional Tax Competition. Journal of Urban Economics 19, 296-315 (1986).

Wilson, J. D.: Theories of Tax Competition. National Tax Journal 52, 269-304 (1999).

Wooders, M.: The Tiebout Hypothesis: Near Optimality in Local Public Good Economies. Econometrica 48, 1467-1485 (1980).

Zodrow, G. R. and Mieszkowski P.: Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods. Journal of Urban Economics 19, 356-370 (1986).

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Tax-muni (%)	21.31549	1.316605	16.18	33.25
Tax-county (%)	10.18712	0.8469438	0	12.27
Tax-total (%)	31.50261	1.15143	26.5	34.24
Net-migr	0.0014422	0.0066892	-0.0252078	0.038768
Pop	31006.3	59049.03	2541	782885
Pop17	0.2205853	0.0207482	0.1538637	0.2865435
Pop65	0.1915716	0.0369334	0.0824937	0.2998466
Areal	1429.262	2496.663	8.82	19446.78
Density	126.7233	424.29	0.2434152	4190.068
H-stock	0.4847046	0.0488743	0.342112	0.6465912
H-density	60.6439	221.4913	0.1364	2258.53
Social	0.0225204	0.0084282	0	0.070075
Equalizing	725.0405	2504.864	-3594	13196
Smallness	0.0725002	0.1106263	0.0031854	1
Emp-rate	0.4508881	0.0321178	0.3176143	0.5421206
Vacancy (%)	4.414828	5.043045	0	37.6
Housing prices	930.9748	701.6251	198	5357
School	100.93	12.09	58	150
Child	98.90	17.27	49	171
Elderly	102.33	30.11	28	238

Table 2: Net Migration Regression (Dependent Variable: Net Migration, percent)

	Model A1	Model A2	Model A3	Model A4	Model A5
Tax rate total	-0.0632	-0.0108	-0.0061	-0.0035	0.0074
	(-4.31)	(-0.57)	(-0.31)	(-0.14)	(0.44)
Interaction variables					
Tax × housing stock	-	-0.0999	-0.0782	-0.1256	-0.0782
		(-5.86)	(4.46)	(-5.12)	(-4.86)
Tax × vacancy rate	-	-0.0011	-0.0011	-0.0009	-0.0008
		(-10.96)	(-10.80)	(-7.05)	(-8.99)
Tax × housing density	-	0.0001	0.0001	0.0001	0.0001
		(5.04)	(0.24)	(1.84)	(49.72)
Income/1000	0.0050	0.0043	0.0052	0.0008	0.0007
	(7.32)	(5.87)	(5.58)	(0.54)	(0.81)
Pop/1000	0.0010	0.0005	0.0001	0.0005	0.0006
	(3.30)	(1.88)	(0.18)	(1.18)	(2.13)
Density	-0.0002	-0.0022	-0.0002	-0.0011	-0.0014
	(-4.83)	(-5.38)	(-0.15)	(-1.96)	(-29.89)
Social	-3.6601	2.1889	1.4073	2.9244	2.0096
	(-1.94)	(1.15)	(0.69)	(1.15)	(1.14)
School	-0.0097	-0.0112	-0.0134	-0.0125	-0.0101
	(-7.70)	(-8.42)	(-9.34)	(-7.09)	(-8.23)
Child	-0.0020	-0.0016	-0.0031	-0.0018	0.0014
	(-1.95)	(-1.57)	(-2.95)	(-1.30)	(1.49)
Elderly	-0.0050	0.0005	0.0004	-0.0005	0.0002
	(-7.71)	(0.60)	(0.41)	(-0.43)	(0.29)
Constant	3.0491	2.6308	2.3864	3.8157	1.9543
	(7.13)	(6.14)	(5.18)	(5.80)	(4.07)
ρ	-	-	-	-	0.5481
					(12.78)
Moran's I Statistics	19.38	15.57	12.15	13.78	-
Adj R-square	0.2021	0.2840	0.3075	0.3067	0.3712

Note: t-values with parenthesis. The coefficients concerning the specific time effects are not shown in the table. The squared inverse distance is used as a spatial weight matrix.

Table 3: Tax externality Regression (Dependent Variable: Tax Rate in Municipality)

	Fixed effect model (Model B1)		Brülhart and Jametti's (Model B2)		Extended model (Model B3)		(Model B4)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
County Tax rate	0.0732022	1.10	-0.5266259	-10.83	-0.5721631	-8.73	-0.12981	-0.85
Average municipal tax rate in county	0.6575267	5.66	0.3860485	18.20	0.2527443	12.37	0.10873	1.83
Average municipal tax rate in labor market	-	-	-	-	-	-	1.25434	3.51
Smallness	15.5051	3.17	5.109169	13.78	2.54227	7.13	3.00138	4.45
Equalizing	-	-	0.000107	8.23	0.0000009	-0.06	-0.00005	-1.77
Gotland	-	-	-3.038113	-4.62	0.0901695	0.12	7.14489	2.96
Areal	-	-	-0.0000118	-1.14	-0.0000377	-3.76	-0.00004	-2.16
Pop	-	-	-0.0000059	-8.68	-0.000002	-2.55	-0.00001	-1.62
Pop65	-	-	3.439246	2.70	-2.042901	-1.43	0.98827	0.35
Pop17	-	-	-6.097839	-3.39	-13.14797	-6.46	1.21852	0.24
Stockholm	-	-	0.7196788	1.39	-0.2220952	-0.22	2.33102	2.14
Capital	-	-	-0.5511642	-4.48	-0.4529428	-4.15	-0.71609	-3.39
Social	-	-	-	-	25.34159	10.34	22.46321	4.76
Child	-	-	-	-	0.0257071	13.04	0.00085	0.29
Elderly	-	-	-	-	0.0076392	5.52	0.01615	6.22
School	-	-	-	-	0.0129486	9.28	0.02630	7.36
Income	-	-	-	-	0.000006	4.66	0.00001	0.91
Density	-	-	-	-	-0.0062721	-9.69	-0.00254	-1.69
Housing density	-	-	-	-	0.0104286	8.55	0.00363	1.30
Constant	6.419868	3.36	19.52874	18.55	19.24102	17.27	-11.73522	-1.36
Adj R-square	0.2647		0.6219		0.7140		0.1928	
Moran's I statistics	-		39.81		28.69		20.19	
Anderson Statistics	-		1162.370	p-value: 0.0000	597.808	p-value: 0.0000	16.009	p-value: 0.0003
Sargan Statistics	-		202.791	p-value: 0.0000	61.222	p-value: 0.0000	9.175	p-value: 0.0025

Note: Instrument variable estimations with average control variables as instruments. The squared inverse distance is used as a spatial weight matrix.