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Tax Competition and the Choice of Tax Structure in a Majority Voting Model

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Abstract

This note studies the choice of tax structure in a majority voting model with tax competition. Regions may tax mobile capital or immobile labor. Individuals differ with respect to their relative endowments of labor and capital. Even though a lump sum tax is available, the equilibrium capital tax in a jurisdiction may be positive. In a symmetric equilibrium, this will be true if the median capital endowment is smaller than average.

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1 Introduction

In the standard tax competition model of Zodrow and Mieszkowski [10], it is assumed that jurisdictions tax capital which is mobile among them. Tax revenue is used to provide public goods to immobile consumers. In equilibrium, capital is undertaxed and public goods are underprovided. The reason is that taxing capital produces a fiscal externality: A jurisdiction which taxes capital ignores the positive externality on other jurisdictions caused by the outmigration of capital. Given that capital is fixed for the economy as a whole, the capital tax is lump sum from the viewpoint of the economy; hence, the decentralized equilibrium is inefficient.

However, the model assumes that capital is taxed even though labor is in perfectly inelastic supply and a tax on labor therefore equivalent to a lump sum tax. Indeed, the fiscal externality would disappear if labor were taxed instead of capital. Therefore, a welfare maximizing government should not tax capital. In extensions of the Zodrow-Mieszkowski model, it may be optimal to tax both capital and labor, for instance, if regions are large and labor supply endogenous (Bucovetsky and Wilson [2]). In the simple model, however, it is usually assumed that lump sum taxes (or alternatively, efficient residence based capital taxes) are not feasible for political reasons (see, e.g., Wilson [9]). For instance, Margaret Thatcher's introduction of the poll tax in Britain is usually seen as one of the reasons that removed her from office.

But if lump sum taxes are politically disadvantageous, this should be modelled explicitly. If the political gain of supplementing a lump sum tax with a tax on mobile capital outweighs the political cost, then in equilibrium capital taxes may prevail despite their deadweight costs. Wilson [9] argues that political economy explanations should be used to explain the choice of tax structure in tax competition models. Fuest and Huber [3] analyze a voting model of tax competition where regions are small, and may tax capital or labor. In this model, the optimal capital tax rate is zero, as in Bucovetsky and Wilson [2] when regions may use residence based capital taxes.

This note explores the effect of introducing heterogeneity among individ-

uals in a model of large regions. I use a standard tax competition model where individuals differ with respect to their capital and labor endowments. Labor supply is exogenous. Individuals vote on the tax rates on labor and capital income. In the voting equilibrium, the capital tax rate may be positive even though labor supply is completely inelastic. The reason is that the tax mix has redistributive consequences. Persson and Tabellini [5] present a similar model which analyzes the choice of labor versus capital taxes in a closed economy.

The model is introduced in the next section. Section 3 analyzes the properties of the voting equilibrium. The last section concludes the paper.

2 The Model

I use the standard tax competition model originally developed by Zodrow and Mieszkowski [10], with the distinction that regions are large enough to affect the interest rate.[1] There are $N \geqq 2$ regions, indexed by $i = 1, ..., N$, each inhabited by an identical number of immobile residents with mass one who each supply one unit of labor. The capital stock in region i is given at $\bar{k}_i$. A region may attract capital through the use of taxes. There are two taxes in the model: a unit wage tax at rate τ and a unit tax on capital at rate t (the capital tax may be negative). Since labor is immobile, the wage tax is effectively an efficient lump sum tax while the capital tax is distortionary from the viewpoint of a single jurisdiction. In the standard model with identical individuals, this would imply that each region is better off using only wage taxes.

Output is produced using capital and labor. The production function is written in intensive form, $f(k_i)$, with $f' > 0, f'' < 0$, where k_i is the region's capital stock per worker. The net return to capital is given by r. Capital is

[1] See Wildasin [6, 7] for a model with large regions, and Bucovetsky [1] and Wilson [8] for models of asymmetric tax competition. Wilson [9] surveys the thteoretical literature on tax competition.

mobile between regions so the net return to capital will be equalized across regions:

$$f'(k_i) - t_i = r \quad \text{for } i = 1, ..., N. \tag{1}$$

Together with the market clearing condition $\sum_i k_i = \sum_i \bar{k}_i$ we get the capital level in each region, $k_i(r(t_i, t_{-i}) + t_i)$, where t_{-i} denotes the vector of all other regions' tax rates. Differentiating the N equations in (1) and the market clearing condition for $i = 1, ..., N, j \neq i$, gives:[2]

$$\frac{dr}{dt_i} \leqq 0, \lim_{N\to\infty} \frac{dr}{dt_i} = 0 \tag{2}$$

$$\frac{dk_i}{dt_i} = k_i' \left(1 + \frac{dr}{dt_i}\right) < 0 \tag{3}$$

$$\frac{dk_i}{dt_j} = k_i' \frac{dr}{dt_j} > 0. \tag{4}$$

Individual preferences are assumed to be quasilinear: $U = u(g) + x$, where x is private consumption, and g a publicly provided private good. The function $u(g)$ satisfies $u' > 0, u'' < 0$, and $u'(0) = \infty$. I assume that individuals are heterogeneous: An individual will be identified by her endowment of labor, $1+a$, and capital, $(1-a)\bar{k}_i$, where $\bar{k}_i$ is the average capital endowment in jurisdiction i. Thus individuals' labor and capital endowments are perfectly negatively correlated, which is unrealistic, but allows to capture heterogeneity in a single parameter.[3] The labor tax varies between individuals, so it amounts to a lump sum tax but not a head tax. This assumption is made to bring out the results most clearly; restricting the lump-sum tax to a head tax would, however, not affect the main results as long as capital endowments vary among individuals.[4]

In jurisdiction i, a is assumed to be distributed according to the distribution function $\Phi_i(a)$ with density $\phi_i(a)$. Assume that the mean of a is zero,

[2]See Wildasin [7] for the derivation of these equations.

[3]Persson and Tabellini [5] also make this assumption to characterize the equilibrium tax structure in a closed economy.

[4]It would, however, affect the efficiency of public good supply; see below.

so the average labor endowment is 1, the average capital endowment $\bar{k}_i$, and the median labor endowment $1 + a_i^m$. If the distribution of a is skewed to the left, $a_i^m > 0$, that is, the median labor endowment exceeds the average endowment.

The government and private budget constraints are, respectively:

$$g_i = t_i k_i + \tau_i \tag{5}$$

$$x_i = (1+a)(f(k_i) - (r+t_i)k_i - \tau_i) + (1-a)r\bar{k}_i. \tag{6}$$

The regional government uses the proceeds from the capital and wage tax to finance public goods provision. The level of the two tax rates is determined by majority voting within each jurisdiction.

3 Voting

Individuals vote for their preferred tax rates. Since the policy choice is two-dimensional, existence of a voting equilibrium is not ensured for general utility functions. However, the assumption on preferences guarantees existence of an equilibrium. Let $\mathbf{q_i} = (t_i, \tau_i)$ be the vector of policy choice. Using (5) and (6), utility can be written as

$$\begin{aligned} V(\mathbf{q_i}, a) &= u(t_i k_i + \tau_i) + (1+a)(f(k_i) - (r+t_i)k_i - \tau_i) + (1-a)r\bar{k}_i \\ &= u(\mathbf{q_i}) + ah(\mathbf{q_i}). \end{aligned} \tag{7}$$

Equation (7) implies that preferences satisfy the intermediate preferences condition of Grandmont [4]. Therefore, there exists a unique Condorcet winner, namely, the policy preferred by the voter with the median endowment, $\mathbf{q_i^m} \equiv \arg\max_{\mathbf{q}} V(\mathbf{q_i}, a_i^m)$.[5]

Therefore, I now investigate the optimal choice of tax rates by the median voter within a jurisdiction. The first order conditions for interior solutions for the voter with the median endowment, a_i^m, are:

[5] A proof is contained for instance in Persson and Tabellini [5].

$$u' - (1 + a_i^m) = 0 \quad (8)$$

$$u'\left(k_i + t_i \frac{dk_i}{dt_i}\right) - (1 + a_i^m)k_i + ((1 - a_i^m)\bar{k}_i - (1 + a_i^m)k_i)\frac{dr}{dt_i} = 0. \quad (9)$$

An interior solution for the wage tax is guaranteed by the assumptions on the utility function. A voter's optimal capital tax rate may, on the other hand, be positive or negative. Subsidization of capital is allowed.

These first order conditions imply the following result.

Proposition 1 *If the number of jurisdictions is small, the tax rate on capital in region i is positive in equilibrium if and only if $a_i^m > \frac{\bar{k}_i - k_i}{k_i + \bar{k}_i}$.*

Proof. Using (8) in (9) and simplifying gives

$$(1 + a_i^m)t_i \frac{dk_i}{dt_i} + \left((1 - a_i^m)\bar{k}_i - (1 + a_i^m)k_i\right)\frac{dr}{dt_i} = 0. \quad (10)$$

Since $\frac{dk_i}{dt_i}, \frac{dr}{dt_i} < 0$, it follows that $t_i > 0$ if and only if $(1 - a_i^m)\bar{k}_i < (1 + a_i^m)k_i$, which gives the result. ■

The interpretation is straightforward. Given that the lump sum tax is chosen optimally, the capital tax has two effects on utility (see equation (10)). First, there is a tax base effect, which is the first term on the right side of (10) (noting that the lump sum tax is set optimally). Second, there is a redistributive effect which corresponds to the second term on the right of (10). The tax base effect is negative if $t_i > 0$ and positive if $t_i < 0$. The redistributive effect is positive if $(1 - a_i^m)\bar{k}_i < (1 + a_i^m)k_i$. The individual voter gains from a fall in the rental rate of capital if her capital endowment is relatively small. Note that if the distribution were symmetric ($a_i^m = 0$), the median voter would gain from the capital tax if the jurisdiction imports capital (the usual terms of trade effect). With a skewed distribution where $a_i^m > 0$, the median income earner may benefit from the redistribution implied in the capital tax even if there is no interregional capital trade or if the region exports capital.

A drawback of Proposition 1 is that it doesn't provide a closed form solution for the level of a_i^m leading to a positive tax rate, since the level of capital employed in a jurisdiction depends on the median endowment. In the case of a symmetric equilibrium, a closed form solution may be obtained. Since symmetry of regions implies that a symmetric equilibrium with zero net trade exists, setting $k_i = \bar{k}_i$ in Proposition 1 implies the following result.

Corollary 1 *If regions have identical distribution functions with median endowment $a_i^m = a^m$ for all i, the capital tax rate in each jurisdiction is positive if and only if $a^m > 0$.*

In order to shed some light on when the condition stated in Proposition 1 is satisfied, I now present an illustrative example.

Example Suppose there are two jurisdictions, and let $u(x) = \log(x)$, and $f(k) = k - k^2/2$. This implies $k_i = \frac{1}{2}(1 - t_i + t_j), i = 1, 2$, and $r = \frac{1}{2}(1 - t_1 - t_2)$. Starting from a symmetric situation, where $\bar{k}_1 = \bar{k}_2 = 0.5$ and $a_1^m = a_2^m = a^m = 0$, the equilibrium has $t_1 = t_2 = 0, \tau_1 = \tau_2 = 1$. If the distribution functions differ such that $a_1^m = -a_2^m = 0.1$, in equilibrium jurisdiction 1 will tax capital and jurisdiction 2 will subsidize it: $t_1 = 0.04, t_2 = -0.06, \tau_1 = 0.89, \tau_2 = 1.44$. In equilibrium, jurisdiction 1 therefore exports capital to jurisdiction 2: $k_1 = 0.45, k_2 = 0.55$. Going back to the identical distribution case, let capital endowments differ:[6] $\bar{k}_1 = 0.6, \bar{k}_2 = 0.4$. Now jurisdiction 1 subsidizes capital and jurisdiction 2 taxes it: $t_1 = -0.05, t_2 = 0.05, \tau_1 = 1.03, \tau_2 = 0.98$. While the capital rich region 1 has the lower capital tax rate, it still exports capital to the capital poor region 2: $k_1 = 0.55, k_2 = 0.45$. Finally, for $\bar{k}_1 = 0.6, \bar{k}_2 = 0.4$, if a_1^m is sufficiently larger than a_2^m, the result is reversed. Letting $a_1^m = 0.2 = -a_2^m$, region 1 taxes capital and region 2 subsidizes it: $t_1 = 0.05, t_2 = -0.05, \tau_1 = 0.81, \tau_2 = 1.28$.

[6] Bucovetsky [1] and Wilson [8] analyze tax competition between regions which differ in population size and show that the large region (low per capita capital endowment) ends up with the higher capital tax rate.

The capital allocation is reversed: $k_1 = 0.45, k_2 = 0.55$.

The result that the capital tax will be positive if the median voter is endowed with relatively little capital income holds as long as regions can affect the world interest rate. When regions are small, they take the interest rate as given (see equation (2)). Hence, the terms of trade effect disappears:

Corollary 2 *For $N \to \infty$, the optimal capital tax tends to zero in each region.*

This result is also shown by Bucovetsky and Wilson [2] in a welfare optimizing framework and by Fuest and Huber [3], who analyze voting on labor and capital taxes in the large number case and show that each jurisdiction chooses not to tax capital in equilibrium.

In the Zodrow-Mieszkowski model [10], a coordinated increase of the capital tax increases welfare, since at the non-cooperative equilibrium public goods are underprovided. In the present model, comparing (8) to the Samuelson condition, $u' = 1$, implies that public goods are under-(over-)provided if the median labor endowment is larger (smaller) than the average endowment. However, this stems solely from the fact that the lump sum tax is not a head tax. In fact, in the symmetric case, underprovision occurs when t is positive ($a^m > 0$). Conversely, overprovision occurs when t is negative ($a^m < 0$). If a head tax were used instead of the wage tax, it could easily be seen that the supply of publicly provided goods would be efficient. If the lump sum tax is not a head tax, then the median voter benefits from an overexpansion of publicly provided goods if his tax price is less than the average price.

Likewise, using a utilitarian welfare function, one can show that in the present model, changing the tax mix has no effect on welfare. This is true since both tax bases are inelastic in supply so from the viewpoint of the economy both taxes are equally inefficient and the tax mix is a matter of indifference. If capital and labor supply were endogenized, the efficient tax mix would depend on the respective price elasticities of capital and labor,

and the efficiency of the tax mix chosen by the median voter would depend on his relative endowment (Persson and Tabellini [5]). However, these efficiency effects are present without tax competition as well and stem from the intraregional redistribution implied by the tax structure.

While average welfare is not affected by a coordinated change of the tax mix, median welfare is. In fact, one can study whether a coordinated change in the tax structure will find the support of the majority in a jurisdiction. Denote the median voter utility by $V_i^m = V(\mathbf{q_i}, a_i^m)$.

Proposition 2 *A coordinated revenue neutral change of the tax mix, $dt = dt_i > 0 > d\tau_i$ for all i, is supported by a majority of voters in jurisdiction i if and only if $(1 + a_i^m)k_i > (1 - a_i^m)\bar{k}_i$.*

Proof. Differentiating V_i^m gives

$$\begin{aligned} dV_i^m &= (u' - (1 + a_i^m))d\tau_i \\ &+ \left((u' - (1 + a_i^m))k_i + ((1 - a_i^m)\bar{k}_i - (1 + a_i^m)k_i)\frac{dr}{dt_i}\right)dt, \quad (11) \end{aligned}$$

use having been made of $\frac{dk_i}{dt_i} = 0$ due to the coordinated tax increase in t_i. Using (8), (9), $dg_i = d\tau_i + k_i dt = 0$, and $dr = -dt$ gives

$$dV_i^m = u'((1 + a_i^m)k_i - (1 - a_i^m)\bar{k}_i)dt. \quad (12)$$

Hence, the median voter (and therefore a majority of voters) supports the coordinated change in the tax structure iff $(1 + a_i^m)k_i - (1 - a_i^m)\bar{k}_i > 0$. ■

In the case of a symmetric equilibrium with identical jurisdictions, $a_i^m = a^m$, $k_i = \bar{k}_i = k$, $t_i = t$ and $\tau_i = \tau$ for all i, (12) simplifies to:

$$dV^m = u'(2a^m k)dt. \quad (13)$$

This implies the following corollary to Proposition 2.

Corollary 3 *In a symmetric equilibrium with identical jurisdictions, a coordinated change of the tax mix, $dt > 0 > d\tau$ for all i, is supported by the majority of all voters if and only if $a^m > 0$.*

In the symmetric case, if the median labor endowment is larger than average, a coordinated change of the tax mix would enable the median voters to exploit capital in order to increase redistribution towards themselves. While tax competition (with inelastic tax bases) has no efficiency consequences for the tex mix, it does result in too little redistribution from the median voters' point of view. In the asymmetric case, there would be conflict between the jurisdictions over a coordinated change of the tax structure. Jurisdictions with a skewed distribution (in the sense of a small median capital endowment), and those which import capital benefit from a coordinated change towards capital taxes, other things equal.

4 Conclusion

Capital taxes may be chosen democratically over labor taxes even if capital can move freely between jurisdictions. If regions are large enough to affect the net return to capital, the capital tax redistributes income between regions as well as within regions. Hence, individuals with low capital endowment may favor capital taxes.

The analysis could be extended to more realistic settings, including endogenous labor and capital supply or labor mobility. However, the point of the paper was to show that there may be political reasons for the use of capital taxes even when non-distortionary taxes are available. The claim that head taxes are politically costly can be derived in a rigorous way, which provides a theoretical basis for analyzing tax competition models with distortionary taxes. Inefficiency of public goods supply in this model is, however, not a consequence of tax competition but rather of the redistributive nature of the lump sum tax.

The model also has potential empirical implications. For instance, there seems to be a common belief that globalization leads to a shift of taxes from mobile to immobile tax bases. This may indeed have occurred in the last decades, at least on average. However, a single country might even increase

taxes on mobile factors, despite the threat of globalization, if the ownership of mobile factors becomes more concentrated.

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