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The consequences of labour mobility for redistribution: tax vs. transfer competition

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Abstract

In a context where both the poor and the rich are (imperfectly) mobile, this paper compares the Nash equilibrium levels of income redistribution from the rich to the poor when jurisdictions compete either in taxes, in transfers or both in taxes and transfers. Although taxes and transfers are linked through the budget-balanced requirement, the analysis reveals intriguing differences. Indeed, it turns out that transfer competition results in much less redistribution than tax competition, while tax-transfer competition involves an intermediate level of redistribution. In each approach, the mobility of the rich is detrimental to redistribution and an increase in the dependency ratio reduces taxes. Concerning the effect of the mobility of the poor, these approaches reach opposite conclusions. That is, the mobility of the poor is beneficial to redistribution under tax competition but reduces redistribution under transfer competition. © 1999 Elsevier Science S.A. All rights reserved.

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1. Introduction

The ongoing integration of markets and the associated greater mobility of labour

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has raised a widespread concern about the capacity of local governments to redistribute income as this may attract the poor and chase away the rich. In this paper we argue that the consequences for redistribution of a greater mobility of labour depends crucially on the nature of the strategic interaction between local governments. Most of the existing literature has formalised this interaction as a tax competition game where tax rates are the strategic variable.[1] In this paper, we compare this approach with two other forms of interaction. Namely, the transfer competition game in which transfers are the strategic variable and the tax-transfer competition game in which both transfers and taxes are the strategic variable.

The framework we study involves a fixed number of jurisdictions and a large set of individuals who differ in their endowed income and their preference for jurisdiction. We emphasize that the number of jurisdictions is fixed and thus that we abstract from the difficult issue of the endogenous formation of jurisdictions. There is no production and no federal government intervention.[2] Both jurisdictions abide to the free mobility and equal treatment principles. They choose their redistributive policies non-cooperatively and are required to balance their budget. We consider local redistributive policies that take from the rich residents to give to the poor residents. (Note that virtually all forms of government intervention can be regarded as taking from one group to give to another group). Both the rich and the poor are mobile across jurisdictions.[3] Throughout, we focus on the policy-based approach of fiscal competition (see Caplin and Nalebuff, 1997). This is the approach of a Nash equilibrium which takes the policies of other jurisdictions as given.[4] In equilibrium (i) no jurisdiction wishes to change its policy, (ii) no individual wishes to move and (iii) the budget is balanced within each jurisdiction.

In that context, we show that the equilibrium depends crucially on the exact nature of the strategic interaction. In the tax competition game, tax rates are the strategic variables. Each jurisdiction selects its tax rate taking as given the tax rate of other jurisdictions and the transfer levels are determined by the final repartition of the population between jurisdictions. Thus, by increasing its tax rate, jurisdiction i induces a transfer increase in jurisdiction j as a result of the migration of the rich. In the transfer competition game, transfers are the strategic variable. Each

[1] See for example, Leite-Monteiro (1997) and Wildasin (1991, 1994). See also Cremer et al. (1995) for a review of this literature.

[2] See Gordon (1983) for a comprehensive review of fiscal games with a federal government and Greenberg (1983) for a general equilibrium analysis.

[3] This contrasts with most of the existing literature which considers redistribution between mobile and immobile factors. For instance, Wildasin (1991) considers redistribution from immobile rich individuals to mobile poor individuals; Epple and Romer (1991) study redistribution from immobile landlords to mobile renters; and most models with capital mobility consider redistribution from mobile capital to immobile labour.

[4] It differs from the membership-based approach which takes the memberships of jurisdictions as given, meaning that each jurisdiction ignores the migration effects of their policy choice (like Westhoff, 1977; Epple et al., 1984).

jurisdiction selects its transfer taking as given the transfer level of other jurisdictions, and the tax rates required to finance the transfer levels are determined by the final repartition of the population across jurisdictions. Thus, by increasing its transfer, jurisdiction *i* attracts the poor enabling other jurisdictions to reduce their tax rate. In the tax-transfer competition game, strategies are taxes and transfers. Each jurisdiction selects its tax-transfer policy, taking as given other jurisdictions' policy. (This is the approach adopted by Epple and Romer (1991), except that they use a majority voting decision rule).

The non-equivalence between tax competition and spending competition was first pointed out by Wildasin (1988). In a model where each jurisdiction is populated by a representative agent and levies a tax on a perfectly mobile capital factor to finance a local public good, Wildasin has shown that expenditure competition always led to a lower provision of local public goods than tax competition. Note that tax-transfer competition is not considered in this analysis. We extend this result to a redistribution context in which both the rich and the poor are mobile.[5] This extension is not trivial because it implies that both the tax base and the transfer base are mobile while in Wildasin (1988) only the tax base is mobile. We also go beyond the work of Wildasin (1988) by providing explicit values of equilibria as well as their comparative static properties. For example we study the consequences for redistribution of a change in the degree of mobility of each group. Interestingly, we find that the mobility of the poor has opposite effect on redistribution whether jurisdictions compete in taxes or transfers. Less surprising is that the mobility of the rich undermines the capacity to redistribute income.

The remainder of the paper is organised as follows. Section 2 lays out the basic model and introduces the three approaches with which we are concerned. Sections 3 to 5 calculate and compare the symmetric Nash equilibria for each game (respectively, tax competition, transfer competition and tax-transfer competition). Section 6 summarizes the results and extends the model to (i) an arbitrary number of jurisdictions, (ii) a general distribution of preferences for jurisdictions, and (iii) distortionary taxation. Section 7 concludes the paper.

2. A simple model

In order to keep the analysis tractable and to derive explicit solutions, we construct the minimal model useful to make our point. Moreover, as we shall see later, our results have considerable intuitive appeal and are robust to many extensions of the model (see Section 6). We consider an economy with a single

[5] Empirical evidence on the fiscally-induced mobility of the poor and the rich can be found in Moffitt (1992).

private good and two symmetric jurisdictions (called domestic and foreign jurisdiction for sake of definiteness). This economy is populated by a large number of individuals who differ both in their endowed income and their preference for jurisdiction. A number (measure) n_1 of individuals are poor (with zero income) and a number (measure) n_2 of individuals are rich with income equal to one. Following Mansoorian and Myers (1993), we describe the preference for jurisdiction by a single taste parameter $x \in [0, 1]$.[6] We assume that x is uniformly distributed in each class (rich or poor) on the segment [0, 1]. As we show later this assumption is not crucial for the results. Both jurisdictions impose a per capita tax T and T^* on their rich residents, and pay a per-capita transfer B and B^* to their poor residents (where the superscipt (*) refers to the foreign jurisdiction). Each jurisdiction is required to balance its budget, and each individual freely joins the jurisdiction that maximises his utility, given the redistributive policies $z = (T, B)$ and $z^* = (T^*, B^*)$. Since the population is large, no individual believes that his location choice will influence the policy outcome.

Throughout, we shall refer to the poor and the rich by use of the subscript $i = 1$ and $i = 2$, respectively.

Each individual cares only about his income net of taxes and transfers and the jurisdiction where he lives. For any configuration of redistributive policies (z, z^*), the payoff of a poor individual with preference x is $U_1(z, z^*, x) = B - d_1 x$ in the domestic jurisdiction and $U_1^*(z, z^*, x) = B^* - d_1(1 - x)$ in the foreign jurisdiction; where d_1 is a measure of the degree of attachment to home of the poor. Note that a greater attachment to home is akin to a lower degree of mobility. The payoff of a rich individual with preference x is $U_2(z, z^*, x) = (1 - T) - d_2 x$ in the domestic jurisdiction and $U_2^*(z, z^*, x) = (1 - T^*) - d_2(1 - x)$ in the foreign jurisdiction; where d_2 is a measure of the degree of attachment to home of the rich. Notice that the degree of attachment to home (and thus the degree of mobility) need not be the same between the two income groups. If $d_2 > d_1$ the rich are more attached to home and thus less mobile than the poor, and vice versa.[7] Therefore, for each policy configuration (z, z^*), the partition of the population between the two jurisdictions is given by

$$S(z, z^*) = \{x \in [0, 1]: U_i(z, z^*, x) \geq U_i^*(z, z^*, x)\ (i = 1, 2)\}$$

$$S^*(z, z^*) = \{x \in [0, 1]: U_i(z, z^*, x) < U_i^*(z, z^*, x)\ (i = 1, 2)\}.$$

[6] Mansoorian and Myers (1993) focus on the efficiency of inter-regional transfers and not on redistributive issue.

[7] Attachment to home, as a kind of mobility costs, plays an important role in lending stability to the model. That is, it precludes complete depopulation. It is also a reasonable assumption since it is consistent with the notion that migrants have differing degrees of attachment to their home region (see, Epple and Sieg (1997) for a recent empirical study of this attachment to location). Note also that imperfect mobility precludes complete stratification as in Epple and Romer (1991).

Each jurisdiction selects its redistributive policy taking as given the policy choice of the other jurisdiction and anticipating the division of the population between jurisdictions that will result. Since each jurisdiction is constrained to balance its budget, there is a strict relationship between the tax rate and the transfer level within each jurisdiction. The feasible transfer level associated to any tax rate depends upon the repartition of the population between jurisdictions as this determines the number of taxpayers and transfer recipients in each jurisdiction. In the following we shall compare three different types of Nash equilibrium depending on what we believe are the most relevant strategic variables.

In the *tax competition game*, strategies are tax rates. (This is, in fact, the traditional assumption.) Each jurisdiction chooses its tax rate taking the tax rate of the other jurisdiction as given, and anticipating correctly the migration flows and the transfer level that will result. So, each jurisdiction imposes a tax on its rich residents and divides the proceeds equally among its poor residents. Equilibrium is a fixed-point in which no individual wishes to move and no jurisdiction wishes to change its tax rate given the tax rate chosen by the other jurisdiction. Formally,

Definition 1. A policy outcome $\bar{z}, \bar{z}^*$ is a (pure strategy) Nash equilibrium in taxes iff

$$\bar{z} = D(S(\bar{z}, \bar{z}^*)|\bar{t}^*) \quad \text{with} \quad \bar{z} \in Z(S(\bar{z}, \bar{z}^*))$$

$$\bar{z}^* = D(S^*(\bar{z}, \bar{z}^*)|\bar{t}) \quad \text{with} \quad \bar{z}^* \in Z(S^*(\bar{z}, \bar{z}^*)),$$

where D is the exogenous decision rule, common to both jurisdictions, which maps their respective membership into the set of budget-balanced policies Z, given the tax choice of the other jurisdiction.

In the *transfer competition game*, strategies are transfers. Each jurisdiction chooses its transfer level taking the transfer level of the other jurisdiction as given, and anticipating the resulting division of the population across jurisdictions and the tax rate required to finance its transfer level. So, each jurisdiction selects its transfer and adjusts its tax rate in response to the migration flows so as to keep its budget in balance. Equilibrium is a fixed-point in which no individual wishes to move and no jurisdiction wishes to change its transfer given the transfer choice of the other jurisdiction. Formally,

Definition 2. A policy outcome $\hat{z}, \hat{z}^*$ is a (pure strategy) Nash equilibrium in transfers iff

$$\hat{z} = D(S(\hat{z}, \hat{z}^*)|\hat{B}^*) \quad \text{with} \quad \hat{z} \in Z(S(\hat{z}, \hat{z}^*))$$

$$\hat{z}^* = D(S^*(\hat{z}, \hat{z}^*)|\hat{B}) \quad \text{with} \quad \hat{z}^* \in Z(S^*(\hat{z}, \hat{z}^*)).$$

In the *tax-transfer competition game*, strategies are both taxes and transfers. Each jurisdiction chooses a balanced budget tax-transfer policy taking the tax-transfer policy of the other jurisdiction as given. This is the approach adopted by Epple and Romer (1991).[8] The corresponding equilibrium definition is,

Definition 3. A policy outcome $\tilde{z}, \tilde{z}^*$ is a (pure strategy) Nash equilibrium in taxes and transfers iff

$$\tilde{z} = D(S(\tilde{z}, \tilde{z}^*)|\tilde{z}^*) \quad \text{with} \quad \tilde{z} \in Z(S(\tilde{z}, \tilde{z}^*))$$

$$\tilde{z}^* = D(S^*(\tilde{z}, \tilde{z}^*)|\tilde{z}) \quad \text{with} \quad \tilde{z}^* \in Z(S^*(\tilde{z}, \tilde{z}^*)).$$

This type of equilibrium has been strongly criticised by Caplin and Nalebuff (1997) on the grounds that it does not require that jurisdiction budget is balanced out of equilibrium (contrarily to the two previous equilibria). When contemplating a deviation from the equilibrium, each jurisdiction takes the policy of the other jurisdiction as fixed even if this policy is no longer feasible given the deviation. Of course this problem is generally true for any Nash equilibrium in which the set of feasible policies for one player is influenced by the policy choice of other players. For example, in models of insurance markets, insurance companies offer contracts to attract the most profitable customers and so the set of feasible contracts for one insurance company depends on the contracts offered by its competitors. What you offer determines who you attract and who you attract determines what you can offer. In the standard (Rothschild–Stiglitz) Nash equilibrium each insurance company takes its competitors' contract as fixed assuming therefore that even if it steals the most profitable customers from its rivals they will not change their contract in response. The main idea of the literature on reasonable-beliefs refinements is that such equilibria are unlikely because they rely on inappropriate out of equilibrium conjectures. The reason why we still consider this equilibrium in this paper is twofold. First, it is fair to say that there is at the moment no consensus on what are appropriate out of equilibrium conjectures, so that there is no compelling reason to believe that this equilibrium is less likely than any other Nash equilibrium. Second, as we shall see, this equilibrium turns out to provide an intermediate case between tax competition and transfer competition.

It remains to define the decision rule, *D*. Since our purpose is to study the consequences of labour mobility for redistribution, it seems reasonable to assume that jurisdictions do care about income inequality and seek to redistribute income. However, we shall also assume that jurisdictions do not want to push redistribution

[8] In their model the level of taxes and transfers is chosen by the median voter (among the current members of the jurisdiction), who takes as given the policy choice of other jurisdictions. In equilibrium, each jurisdiction budget is balanced, no one wants to move and the median voter in each jurisdiction does not want to change policy given the policy choice of other jurisdictions.

so far that the rich would end up with less income than the poor. Formally, the domestic jurisdiction selects a budget-balanced policy that solves

$$\text{Max}\, B + \alpha(1 - T)$$

subject to

$$B \leq 1 - T,$$

where $\alpha \in (0, 1)$ measures the preference for redistribution (low α means a strong preference for redistribution). By symmetry, the foreign jurisdiction faces a similar optimization problem.

Two remarks about this decision rule are in order. First, it is non-welfaristic because we do not want that the objective function be influenced by the idiosyncratic preferences for location. Second it is normative to make our work comparable with Wildasin (1988). In a companion paper, Hindriks (1998), we adopt the majority decision rule like Epple and Romer (1991).[9] We view normative and positive approaches as complementary.

Given the symmetry of the model, it makes sense to restrict attention to symmetric equilibria. We emphasize that this assumption of symmetry is mainly needed to ensure the existence of equilibria and to derive explicit solutions. Typically, in asymmetric fiscal competition games, equilibria may fail to exist or cannot be characterized in an explicit form, and so it is difficult to obtain comparative static results (see Wildasin, 1988).

3. Tax competition

In the tax competition game, strategies are tax rates. Each jurisdiction chooses its tax rate according to the exogenous decision rule, taking as given the tax rate of the other jurisdiction and anticipating correctly the effect of migrations on its transfer level. The budget balance requirement and equilibrium migrations determine an implicit relationship between transfers and taxes, that is $B(T, T^*)$ and $B^*(T, T^*)$. From the payoff functions, it is easily seen that for each pair (T, T^*) and for $i = 1, 2$, there exists $x_i(T, T^*) \in [0, 1]$ such that all individuals in class i with preference $x \leq x_i(T, T^*)$ join the domestic jurisdiction and all other individuals in class i join the foreign jurisdiction. Since x is uniformly distributed, we have that $x_i(T, T^*)$ is the proportion of individuals in class i who locate in the

[9] The majority rule in tax competition game implies that the tax rates chosen by jurisdictions depend on who they attract and who they attract depends on the tax rates chosen. Building on this fundamental interaction, we find that a jurisdiction where the poor are in a majority may choose a tax rate on the downward sloping side of its Laffer curve. The reason is that a tax reduction would attract the rich and undermine the political influence of the poor.

domestic jurisdiction. Therefore, letting $\rho = \frac{n_2}{n_1}$, the balanced budget requirement implies,

$$B(T, T^*) = T\rho \frac{x_2(T, T^*)}{x_1(T, T^*)} \tag{1}$$

$$B^*(T, T^*) = T^*\rho \frac{1 - x_2(T, T^*)}{1 - x_1(T, T^*)}. \tag{2}$$

We have a two-stage game to solve. In the first stage jurisdictions simultaneously make their policy choices. Then, in the second stage, individuals make their location decisions. Each jurisdiction will calculate the migration consequences of its policy choice and work backward to the policy decision stage. Accordingly, we begin with the final stage (location decision) and then go on to the policy choice stage. We first determine the equilibrium migration of the rich. Since we shall focus on symmetric equilibria, we can abstract from the tedious complications of corner migrations (in which all individuals locate in the same jurisdiction).

For each pair (T, T^*), the (interior) equilibrium migration of the rich is characterized by the marginal individual $x = x_2(T, T^*)$ who is indifferent between the two jurisdictions, where $x = x_2(T, T^*)$ solves

$$(1 - T) - d_2 x = (1 - T^*) - d_2(1 - x) \tag{3}$$

Hence, the migration response of the rich to a domestic tax change is

$$\frac{\partial x_2(T, T^*)}{\partial T} = -\frac{1}{2d_2} \tag{4}$$

which is decreasing in their degree of attachment to home, d_2.

For each pair (T, T^*), the (interior) equilibrium migration of the poor is characterized by the marginal individual $x = x_1(T, T^*)$ who is indifferent between the two jurisdictions. Using (1) and (2), $x = x_1(T, T^*)$ solves

$$T\rho \frac{x_2(T, T^*)}{x} - d_1 x = T^*\rho \frac{1 - x_2(T, T^*)}{1 - x} - d_1(1 - x) \tag{5}$$

Applying the implicit function theorem, using symmetry and (4), one obtains[10]

$$\left[\frac{\mathrm{d}x_1}{\mathrm{d}T}\right]_{T=T^*} = \frac{\left(1 - \frac{2T}{d_2}\right)\rho}{2d_1 + 4T\rho} \tag{6}$$

[10] The symmetry of the model implies that $x_1(T, T^*) = x_2(T, T^*) = 1/2$ for $T = T^*$.

Notice that (6) has a negative sign for $T > d_2/2$. This means that a tax decrease may attract the poor! This is because the poor find profitable to accompany the rich in a low tax jurisdiction to benefit from the improved tax base.

From these equilibrium migrations, we can determine the effect of a tax change on the transfer level. Differentiating $B(T, T^*)$ with respect to T, around $T = T^*$, using symmetry, and substituting for (4) and (6), it is readily seen that

$$\left[\frac{\partial B(T, T^*)}{\partial T}\right]_{T=T^*} = \rho + \frac{T\rho}{x_1(T, T^*)}\left[\frac{\partial x_2(T, T^*)}{\partial T}\right]_{T=T^*} - \frac{T\rho}{x_1(T, T^*)}\left[\frac{\partial x_1(T, T^*)}{\partial T}\right]_{T=T^*}$$
$$= \rho + \frac{T\rho}{x_1(T, T^*)}\left(\frac{-1}{2d_2}\right) - \frac{T\rho}{x_1(T, T^*)}\left(\frac{1 - \frac{2T}{d_2}}{4T + 2d_1/\rho}\right)$$
$$= \left(1 - \frac{T}{d_2} - \frac{T - \frac{2T^2}{d_2}}{2T + d_1/\rho}\right)\rho. \qquad (7)$$

Inspection of this equation reveals that $B(T, T^*)$ is concave in T around $T = T^*$. Turning to the policy decision stage, the domestic jurisdiction chooses its tax rate so as to maximize the weighted sum of incomes among its residents, taking as given the tax rate of the other jurisdiction and anticipating correctly the effect of its tax choice on the transfer level. Thus, T solves

$$\underset{T\in[0,1]}{\text{Max}}\ B(T, T^*) + \alpha(1 - T)$$

subject to

$$B(T, T^*) \leq 1 - T.$$

Given the concavity of $B(T, T^*)$, the necessary and sufficient first-order condition for the unconstrained optimization around $T = T^*$ is

$$\left[\frac{\partial B(T, T^*)}{\partial T}\right]_{T=T^*} - \alpha = 0.$$

Using (7), the unconstrained optimal tax rate is thus

$$T = \frac{(\rho - \alpha)d_2}{\rho - (\rho - 2\alpha)\rho d},$$

where $d \equiv \frac{d_2}{d_1}$. On the other hand, using (1), it is easily seen that the constraint is binding at $T = T^* = \frac{1}{1+\rho}$. Given these two facts, the solution to the optimization problem is

$$\bar{T} = \text{Min}\left\{\frac{(\rho-\alpha)d_2}{\rho-(\rho-2\alpha)\rho d}; \frac{1}{1+\rho}\right\}.$$

Note that the equilibrium tax rate is negative when $\rho - \alpha < 0$. This is because in a symmetric equilibrium when each rich individual transfers T, each poor individual receives ρT so that the social gain of taxation is in fact $\rho - \alpha$. So to motivate redistribution from the rich to the poor we must have that $\rho - \alpha > 0$. This is what we shall assume in the sequel. Our first Proposition follows immediately.

Proposition 1. *Suppose that each jurisdiction seeks to redistribute income among its residents (that is, $\rho - \alpha > 0$). Then there exists a (pure strategy) symmetric Nash equilibrium in the tax competition game. It has the feature,*

$$\bar{T} = \bar{T}^* = \frac{(\rho-\alpha)d_2}{\rho-(\rho-2\alpha)\rho d} \geq 0 \quad \textit{for} \quad d_2 \leq \frac{1}{(\rho-\alpha)\left(\frac{1+\rho}{\rho}\right) + \frac{\rho-2\alpha}{d_1}}$$

$$\bar{T} = \bar{T}^* = \frac{1}{1+\rho} \quad \textit{otherwise}.$$

This Proposition reveals that the equilibrium tax rate depends on the degree of mobility of each income group (d_1, d_2), the preference for redistribution (α) and the dependency ratio ($1/\rho$). A first observation is that when d_2 is small enough (i.e. the rich are sufficiently mobile) the equilibrium tax rate is too low to eliminate income inequality. Thus, the mobility of the rich effectively limits the capacity of each jurisdiction to equalize incomes. At the limit if $d_2 = 0$ the rich are perfectly mobile and the tax base is infinitely elastic so that the equilibrium tax rate is zero. On the other hand, if d_2 is sufficiently high, each jurisdiction is able to equalize incomes among its residents, $\bar{T} = \frac{1}{1+\rho}$. The most relevant case is probably when jurisdictions do tax in equilibrium (i.e. $d_2 > 0$), but not enough to equalize incomes. In that case the equilibrium tax rate is given by,

$$\bar{T} = \frac{(\rho-\alpha)d_2}{\rho-(\rho-2\alpha)\rho d} \tag{8}$$

It is easily seen that this tax rate is decreasing in α and increasing in ρ. This comes as no surprise since a lower α means a greater preference for redistribution and a higher ρ reduces the cost to the rich of a marginal increase in B (it costs B/ρ to each rich individual to transfer B to each poor individual). A more surprising implication of the equilibrium is that a greater mobility of the poor is beneficial to redistribution when jurisdictions have a sufficiently strong preference for redistribution (i.e. $\alpha < \rho/2$). To see this formally, recall that a higher mobility of the poor is akin to a lower d_1 and thus to a higher $d = d_2/d_1$. Inspection of (8) then shows that taxes are increasing in d if $\alpha < \rho/2$, which means that the mobility of the poor leads to higher taxes. The reason for this result is best seen from the first-order condition above, that is, $\frac{\partial B(T, T^*)}{\partial T} = \alpha$. Given this condition, high preferences for redistribution (i.e. low α) lead to push tax rates to a point where the marginal benefit of taxation is small. Hence, increasing tax has a small effect on the transfer level but the resulting out-migration of the rich increases the transfer level in the other jurisdiction and leads the poor to move there. Since the poor chase the rich, a greater mobility of the poor counter-balances the adverse effect of the mobility of the rich and leads to higher taxes. On the other hand, when $\alpha > \rho/2$ a tax increase attracts the poor since $\frac{\partial B(T, T^*)}{\partial T} = \alpha$ is now high enough to outweigh the induced transfer increase in the other jurisdiction. Therefore, the rich and the poor migrate in opposite directions and a greater mobility of the poor results in lower taxes. (Each jurisdiction has now a lower incentive to increase taxes because this would attract the poor and depress the transfer level.) A crucial element behind all these results is that each jurisdiction takes as given the tax rate of the other and conjectures that an increase in its tax rate will induce the other jurisdiction to raise its transfer level in response to the resulting migrations. However, if one believes that the other jurisdiction will instead reduce its tax rate in response to the migration, then as we are going to show now the equilibrium and its comparative static properties will change drastically.

4. Transfer competition

In the transfer competition game, strategies are transfer levels. Each jurisdiction chooses its transfer level, taking as given the transfer of the other jurisdiction and anticipating correctly the effect of migrations on the tax rate required to finance its transfer level. The budget balance requirement together with equilibrium migrations determine a functional relationship in both jurisdictions between taxes and transfers, $T(B, B^*)$ and $T^*(B, B^*)$. So, $T(B, B^*)$ is the tax required to finance a transfer level B when the other jurisdiction's transfer level is B^*. By analogy with the preceding section and abusing notation, we have that for each pair (B, B^*), there exists $x_i(B, B^*) \in [0, 1]$(with $i = 1, 2$) such that all individuals in class i with preference $x \leq x_i(T, T^*)$ join the domestic jurisdiction and all other individuals in class i join the foreign jurisdiction.[11] Therefore, since x is uniformly distributed on [0, 1], budget-balance in each jurisdiction implies

$$T(B, B^*) = \frac{x_1(B, B^*)}{\rho x_2(B, B^*)} B \tag{9}$$

$$T^*(B, B^*) = \frac{(1 - x_1(B, B^*))}{\rho(1 - x_2(B, B^*))} B^* \tag{10}$$

We now calculate the equilibrium migration responses to a change in the domestic transfer level.

For each pair (B, B^*), the equilibrium (interior) migration of the poor is characterized by the marginal individual $x = x_1(B, B^*)$ who is indifferent between the two jurisdictions. Thus $x = x_1(B, B^*)$ solves

$$B - d_1 x = B^* - d_1(1 - x) \tag{11}$$

This yields

$$x_1(B, B^*) = \frac{1}{2} + \frac{B - B^*}{2d_1}, \tag{12}$$

and the migration response of the poor to a transfer change is

$$\frac{\partial x_1(B, B^*)}{\partial B} = \frac{1}{2d_1} \tag{13}$$

Turning to the migration response of the rich, for any pair (B, B^*), the equilibrium (interior) migration of the rich is characterized by the marginal individual $x = x_2(B, B^*)$who is indifferent between the two jurisdictions. Using (9) and (10), $x = x_2(B, B^*)$ solves

$$1 - \frac{x_1(B, B^*)}{\rho x} B - d_2 x = 1 - \frac{(1 - x_1(B, B^*))}{\rho\,(1 - x)} B^* - d_2(1 - x) \tag{14}$$

Applying the implicit function theorem, using symmetry and (13) yields

$$\left[\frac{\mathrm{d}x_2}{\mathrm{d}B}\right]_{B=B^*} = \frac{-\left(1 + \frac{2B}{d_1}\right)}{2\rho d_2 - 4B} \tag{15}$$

Given these migration responses, we can now derive the tax change required to finance an increase in the transfer level. Differentiating $T(B, B^*)$ with respect to B, around $B = B^*$, using symmetry together with (13) and (15), one obtains

[11] The abuse of notation means that we use the same functional expression for $x_i(T, T^*)$ and $x_i(B, B^*)$.

$$\left[\frac{\partial T(B,B^*)}{\partial B}\right]_{B=B^*} = \frac{1}{\rho} + \frac{B}{\rho x_2(B,B^*)}\left[\frac{\partial x_1(B,B^*)}{\partial B}\right]_{B=B^*} - \frac{B}{\rho x_2(B,B^*)}\left[\frac{\partial x_2(B,B^*)}{\partial B}\right]_{B=B^*} = \frac{1}{\rho}\left(1+\frac{B}{d_1}+\frac{B+\frac{2B^2}{d_1}}{\rho d_2-2B}\right). \tag{16}$$

Proceeding backward, we now determine the optimal policy choice. Anticipating the effect of migrations on its tax rate, the domestic jurisdiction chooses its transfer level so as to maximize the weighted sum of incomes among its residents, taking as given the transfer level in the foreign jurisdiction. Thus, B solves

$$\underset{B}{\text{Max}}\ B+\alpha(1-T(B,B^*))$$

subject to

$$B \leq 1-T(B,B^*).$$

Solving this problem around $B=B^*$, using (16) and noting that in a symmetric equilibrium $B=\rho T$ and thus the constraint is binding for $B \geq \frac{\rho}{1+\rho}$, one obtains

$$\hat{B} = \text{Min}\left\{\frac{(\rho-\alpha)d_2\rho}{2\rho-\alpha+\alpha\rho d}; \frac{\rho}{1+\rho}\right\}.$$

Using again the fact that in a symmetric equilibrium $B=\rho T$, we have

Proposition 2. *Suppose that each jurisdiction seeks to redistribute income among its residents (i.e. $\rho-\alpha>0$). Then there exists a (pure strategy) symmetric Nash equilibrium in the transfer competition game. It has the feature,*

$$\hat{T}=\hat{T}^*=\frac{(\rho-\alpha)d_2}{2\rho-\alpha+\alpha\rho d} \quad \textit{for} \quad d_2 \leq \frac{2\rho-\alpha}{(\rho-\alpha)(1+\rho)-\frac{\alpha\rho}{d_1}}$$

$$\hat{T}=\hat{T}^*=\frac{1}{1+\rho} \qquad \textit{otherwise}.$$

So, as for tax competition the equilibrium involves zero taxation if the rich are perfectly mobile ($d_2=0$); and at the other extreme income equalization is possible if the the rich are not mobile enough (i.e. d_2 is sufficiently high). Ignoring these extreme cases, Proposition 2 suggests that a greater mobility of the poor is always detrimental to redistribution and that competition in transfers involves less redistribution than competition in taxes (which is reminiscent of Wildasin

(1988)).[12] The reason is that a transfer increase in one jurisdiction attracts the poor, enabling the other jurisdiction to lower its tax rate and thereby to attract rich individuals. The fact that the poor and the rich move in opposite directions under transfer competition, exacerbates the fiscal competition and explains the lower level of redistribution in equilibrium. A greater mobility of the poor reduces the incentive to increase transfers and leads to lower taxes. This finding confirms (in a different context) Wildasin's result that transfer competition is tougher than tax competition, but more importantly it shows that the mobility of the poor may have a very different effect on redistribution depending on whether jurisdictions compete in taxes or in transfers. The key difference between the two is the conjecture that each jurisdiction forms about the response of the other to its policy change. Under tax competition, each jurisdiction anticipates that the other will respond to a tax increase by raising its transfer level; while under transfer competition each jurisdiction anticipates that the other will respond (more aggressively) to a transfer increase by reducing its tax rate. These can be regarded as positive and negative conjectural variations, respectively. It remains to derive the equilibrium for zero conjectural variations. That is, each jurisdiction conjectures that the other will not modify its policy in response to the policy change.

5. Tax-transfer competition

Under tax-transfer competition, each jurisdiction takes the tax-transfer policy of the other jurisdiction as given in determining its own policy. In equilibrium each jurisdiction has a budget balanced tax-transfer policy.

For each z, z^*, the (interior) equilibrium migration of the rich is characterized by the marginal individual $x = x_2(z, z^*)$ who is indifferent between the two jurisdictions, where $x = x_2(z, z^*)$ solves

$$(1 - T) - d_2 x = (1 - T^*) - d_2(1 - x) \tag{17}$$

Hence, the migration response of the rich to a domestic tax change (taking $z^* = (T^*, B^*)$ as given) is

$$\frac{\partial x_2(z, z^*)}{\partial T} = -\frac{1}{2d_2} \tag{18}$$

For each z, z^*, the (interior) equilibrium migration of the poor is characterized by the marginal individual $x = x_1(z, z^*)$ who is indifferent between the two jurisdictions. Thus, $x = x_1(z, z^*)$ solves

[12] To see this last point, note first that transfer competition involves lower taxes than tax competition if $2\rho - \alpha + \alpha\rho d \geq \rho - (\rho - 2\alpha)\rho d$. Then check that this condition reduces to $(1 + \rho d)(\rho - \alpha) \geq 0$. The conclusion then follows from the fact that $\rho - \alpha > 0$.

$$T\rho \frac{x_2(z, z^*)}{x} - d_1 x = B^* - d_1(1-x) \tag{19}$$

where from the balanced budget requirement $B = T\rho((x_2(z, z^*))/(x_1(z, z^*)))$

Applying the implicit function theorem, taking z^* as given and using symmetry together with (18), we obtain

$$\left[\frac{\mathrm{d}x_1(Z, Z^*)}{\mathrm{d}T}\right]_{z=z^*} = \frac{\left(1 - \frac{T}{d_2}\right)\rho}{2d_1 + 2T\rho} \tag{20}$$

Since $z^* = (T^*, B^*)$ is taken as given, it follows from (19) and (20) that[13]

$$\left[\frac{\mathrm{d}B}{\mathrm{d}T}\right]_{z=z^*} = 2d_1\left[\frac{\mathrm{d}x_1(Z, Z^*)}{\mathrm{d}T}\right]_{z=z^*} = 2d_1\rho\left(\frac{1 - \frac{T}{d_2}}{2d_1 + 2T\rho}\right). \tag{21}$$

Each jurisdiction calculates the migration consequences of its policy choice and works backward to choose its balanced tax-transfer policy according to the exogenous decision rule, taking as given the tax-transfer policy of the other jurisdiction. Solving this problem around $z = z^*$, using (21) and taking account that incomes are equalized if $T \geq \frac{1}{1+\rho}$, one obtains

$$\tilde{T} = \mathrm{Min}\left\{\frac{(\rho - \alpha)d_2}{\rho + \alpha\rho d}; \frac{1}{1+\rho}\right\}.$$

Thus we have,

Proposition 3. *Suppose that each jurisdiction seeks to redistribute income among its residents (i.e. $\rho - \alpha > 0$). Then there exists a (pure strategy) symmetric Nash equilibrium in the tax-transfer competition game. It has the feature,*

$$\tilde{T} = \tilde{T}^* = \frac{(\rho - \alpha)d_2}{\rho + \alpha\rho d} \quad \textit{for} \quad d_2 \leq \frac{\rho}{(\rho - \alpha)(1+\rho) - \frac{\alpha\rho}{d_1}}$$

$$\tilde{T} = \tilde{T}^* = \frac{1}{1+\rho} \quad \textit{otherwise}.$$

Again this equilibrium involves zero taxation if $d_2 = 0$ (perfect mobility of the rich). Otherwise, this equilibrium leads to *more* redistribution than transfer competition. This is because each jurisdiction conjectures that the other will not respond aggressively to its policy change by reducing its tax rate. However,

[13] Rearranging (19) yields $B = B^* + d_1 - 2d_1x_1(z, z^*)$.

tax-transfer competition involves *less* redistribution than tax competition because each jurisdiction conjectures also that choosing a more redistributive policy will not lead the other jurisdiction to raise its transfer level. As for transfer competition, the mobility of the poor is always detrimental to redistribution. The reason is that a tax increase attracts the poor (this is readily seen by substituting T for its optimal value in (20)). Lastly, for the same reasons as in the tax or transfer competition game, an increase in ρ increases taxes (lower dependency ratio) while an increase in α reduces taxes (lower preference for redistribution).

6. Summary and extensions

Before dealing with the extensions, let us summarize our main results. Tax competition leads to less redistribution than transfer competition. This is because under tax competition each jurisdiction anticipates that the other will respond (more friendly) to a tax increase by increasing its transfer level (i.e. positive conjectural variation), while under transfer competition each jurisdiction anticipates that the other will respond (more aggressively) to a transfer increase by reducing its tax rate (negative conjectural variation). Since tax-transfer competition involves zero conjectural variation, it obviously leads to an intermediate level of redistribution. For each of the three approaches, we find that equilibrium taxes are increasing with the preference for redistribution, α and the relative number of rich individuals, ρ. This is because these two variables influence in the same way the marginal social benefit of taxation. We also find that the mobility of the rich reduces equilibrium taxes whatever the approach adopted. This is not surprising as a greater mobility of the rich implies a greater elasticity of the tax base. More surprising is the ambivalent effect of the mobility of the poor. Intuition would suggest that a greater mobility of the poor undermines the capacity to redistribute income. This is in fact what we find generally excepted under tax competition when the social benefit of taxation is high enough. Indeed, in this case, it turns out that the mobility of the poor is beneficial to redistribution. The intuition is that when the benefit of taxation is high, all jurisdictions push their tax rate to the point where the effect on the transfer level of a tax increase is small, leading the poor to chase the rich in the jurisdiction with a lower tax rate.

To obtain these results, we have used a highly stylized model. Our purpose is now to show that these results are not an artefact of the assumptions we have made, but are very robust features of the strategic interactions with which we are concerned. When dealing with extensions, we shall proceed to change several of these assumptions in turn and examine how the results are affected. We shall consider the following extensions (in that order): (i) arbitrary number of jurisdictions, (ii) general distribution of preferences for jurisdiction, (iii) distortionary taxation.

6.1. Arbitrary number of jurisdiction ($n > 2$)

The most convenient manner to extend our model to $n > 2$ jurisdictions is to consider a circular spatial model as in Salop (1979) so that jurisdictions are kept in symmetric positions (i.e. each jurisdiction has two nearest competitors). Individuals are uniformly distributed on a circle with perimeter equal to one. Jurisdictions ($j = 1, \ldots, n$) are located symmetrically around this circle so that the distance between any two jurisdictions is equal to $\frac{1}{n}$. Focusing on symmetric Nash equilibria, it can be shown that the resulting equilibria are obtained from previous equilibria by replacing both d_1 and d_2 by d_1/n and d_2/n, respectively.[14] It follows that more jurisdictions intensifies competition (by reducing the degree of attachment of each income group) and leads to lower taxes for any fiscal game. Note however that the number of jurisdictions does not affect our previous qualitative results.

6.2. General distribution of preferences for jurisdiction

As before suppose that x is uniformly distributed on [0, 1] among the poor, but that x is distributed among the rich according to a symmetric cumulative distribution function. Let $F_2(x)$ denote this c.d.f and let $f_2 > 0$ be the density of rich individuals with preference $x = 1/2$. We first consider the case of tax competition and continue to focus on symmetric Nash equilibria. As before, let $x_i(T, T^*)$ denote the (cutoff) preference of an individual in group i ($i = 1, 2$) who is indifferent between the two jurisdictions. Using symmetry (that is, $F_2(x_2(T, T^*)) = x_1(T, T^*) = 1/2$ for $T = T^*$), simple calculation gives

$$\left[\frac{\partial F_2(x_2(T, T^*))}{\partial T}\right]_{T=T^*} = -\frac{1}{2d_2/f_2}$$

$$\left[\frac{\partial x_1(T, T^*)}{\partial T}\right]_{T=T^*} = \frac{\left(1 - \frac{2T}{d_2/f_2}\right)\rho}{2d_1 + 4T\rho} \tag{22}$$

$$\left[\frac{\partial B(T, T^*)}{\partial T}\right]_{T=T} = \left(1 - \frac{T}{d_2/f_2} - \frac{T - \frac{2T^2}{d_2/f_2}}{2T + d_1/\rho}\right)\rho.$$

Comparing (22) with (7) reveals that the effect of introducing a general (symmetric) distribution of preference in group 2 is simply to divide d_2 by f_2 (the density of rich individuals with preference $x = 1/2$). It follows then immediately from Proposition 1 that the interior equilibrium tax rate is

[14]The proof is available upon request.

$$\overline{T} = \frac{(\rho - \alpha)d_2/f_2}{\rho - (\rho - 2\alpha)\rho d/f_2}.$$

and similarly one can obtain the (symmetric) equilibrium tax rates under transfer competition and tax-transfer competition by substituting d_2/f_2 for d_2 in Propositions 2 and 3, respectively. Hence, all previous results are unaffected by introducing a general distribution of preferences among the rich. Moreover, we obtain a new comparative static result which is that equilibrium tax rates in the three approaches are decreasing in f_2. This is not surprising as a higher f_2 means a greater density of rich individuals with small attachment and thus a higher elasticity of the tax base.

6.3. Distortionary taxation

A very simple manner to introduce distortionary taxation is to suppose that when each rich individual transfers T, each poor individual receives $(1 - \lambda)\rho$ in a symmetric equilibrium, where $\lambda \in (0, 1)$ is a deadweight loss parameter which measures the importance of economic distortions of any other kind than migrations (e.g. compliance costs and standard incentive effects of tax-transfer policies). Like an increase in the relative number of the poor $(1/\rho)$ the deadweight loss raises the cost to the rich of providing a transfer B to each poor. It is therefore not difficult to see that the deadweight loss will reduce the tax rates in our three fiscal games. Formally, one can obtain the equilibrium tax rates with distortionary taxation in replacing ρ by $(1 - \lambda)\rho$ in Propositions 1, 2 and 3. So, again our main comparative results are unaffected by introducing distortionary taxation.

7. Conclusion

In a fiscal competition model where local jurisdictions redistribute income from their rich residents to their poor residents and both the rich and the poor are (imperfectly) mobile, we have shown that the non-cooperative equilibrium level of redistribution depends crucially on whether jurisdictions compete in taxes or transfers. Tax competition involves much more redistribution than transfer competition. Transfer competition is tougher because an increase in the transfer level attracts the poor which enables the other jurisdiction to reduce its tax rate and thus attract the rich. Not surprisingly a greater mobility of the rich is in either case detrimental to redistribution. However, we also find that a greater mobility of the poor may have opposite effect in either case. This result has an important implication: if one believes that tax competition is the most relevant game, then the mobility of the poor may be beneficial to redistribution and one should promote such a mobility; if one believes that transfer competition is more relevant, then it makes sense to restrict the mobility of the poor in order to improve redistribution. Lastly, when jurisdictions compete in both taxes and transfers, the equilibrium level of redistribution is lower than tax competition but higher than transfer competition, and the mobility of the poor reduces the level of redistribution.

Both tax competition and transfer competition are defensible theoretically and thus the consequences of labour mobility for redistribution will depend on which one is more often observed, and therefore more realistic. The answer to this question will determine whether we should promote or restrict the mobility of the poor if we want to improve the capacity to redistribute income at the local level.

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