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Interjurisdictional Competition and Location Decisions of Firms

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Abstract

We examine the welfare properties of alternative regimes of interjurisdictional competition for heterogenous mobile firms. Firms differ not only in terms of the degree of mobility across jurisdictions but also in terms of productivity. Alternative taxation regimes represent restraints on the discretionary powers of taxation of local governments.

We find that average welfare is higher under discretionary and more efficient taxation regimes (in the sense of minimizing deadweight losses from distortionary taxation) when firms are highly mobile. In this situation, further limiting competition by imposing a system of non-discretionary instruments can reduce average welfare by reducing the efficiency of the local governments at raising and allocating public funds.

When firms face high moving costs, on the other hand, switching to a non-discretionary and less efficient taxation regime may increase welfare by preventing local governments from engaging in excessive redistribution of resources.

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1 Introduction

The extent and shape of competition among states and local governments to attract businesses (in an attempt to foster economic development) has evolved greatly in recent years. Today, almost every state and local government in the United States operates development agencies that design incentive programs to attract and retain businesses. Such programs usually include tax abatements, direct subsidies, loans, and public funding of employees' training. Businesses, on the other hand, hire the services of consulting companies for advise on the process of facility location; this, in turn, involves the evaluation of various criteria such as costs of operation, access to public services and to facilities for education of the work force, and incentive packages offered by state and local governments.

Traditionally, the competition process occurs amidst heated public discussions about (1) the possibility that any potential benefits from competition might be outweighed by the distorting consequences of the discretion with which some of the benefits are granted, and (2) the legal and political implications on interstate trade of affecting the location decisions of businesses. For example, Burstein and Rolnick (1994) (also Rolnick, 1992) proposed that the use of discretionary incentive programs should be discouraged by the federal government. They argued that competition through uniform taxation and spending policies may lead to a more efficient allocation of resources for the provision of public and private goods.[1] In the international arena, there has also been a concern among supranational entities about the potentially harmful effects of preferential tax regimes that offer advantageous treatment to internationally mobile firms. For example, both the Organization for Economic Co-operation and Development (OECD, 1998) and the European Union (EU, 1998) have adopted standards for the good behavior of member states with regard to international taxation to prevent the erosion of national tax revenues.

The Burstein-Rolnick proposal essentially calls for limiting the discretionary powers of state and local governments in the design of tax policies. Their notion of the negative effects of the use of discretionary incentives is based on arguments of optimal taxation: they find no reason for applying discretion in incentive packages between incumbent in-state and new out-of-state firms,

[1] Inspired by the work of Burstein and Rolnick (1994), a bill referred to as the "Distorting Subsidies Limitation Act of 1999," proposing to limit the discretionary application of benefits, was submitted by Rep. David Minge to the US Congress on March 1999. This bill proposed to partially tax away, with rates comparable to income taxation, any benefits received by firms from local or state economic development programs that are targeted to specific businesses.

and thus favor a uniform taxation system. However, the authors considered discretion to be based solely on the degree of mobility of firms (or their location status), without allowing for discretion in other dimension, for example, productivity. Their proposal can been analyzed formally by evaluating the welfare implications of competition among jurisdictions under alternative taxation systems that differ in the degree of discretion that local governments are allowed to exert. For example, Holmes (1995), formalizing the arguments of Burstein and Rolnick (1994), found that the use of discretionary taxation, in terms of the mobility of businesses, results in a lower average measure of aggregate welfare, when compared with a uniform taxation regimem, because it prevents governments from applying different tax rates to agents, which are essentially of the same type, in different locations.

Similarly, the literature on international tax competition has analyzed the conditions under which bans on preferential tax regimes decrease or increase domestic tax revenues (see, for example, Janeba and Peters, 1999; Keen, 2001; Janeba and Smart, 2003; Haupt and Peters, 2005, among others). More recently, Gaigné and Wooton (2011) have also analyzed the impact on national tax revenues of extending the competition game between countries to the choice of discriminatory or uniform tax regimes.

The present paper continues with this line of research and examines the possibility that discrimination in terms of incentive packages can be carried out not only on the basis of the degree of mobility of business but also with respect to heterogeneity in the productivity of businesses.

In our model, local governments, concerned with the welfare of resident immobile agents, engage in competition for mobile entrepreneurs who provide benefits to the community in which they settle. We find that the degree of mobility of entrepreneurs determines the extent to which local governments can direct redistribution of local resources—between mobile and immobile agents—and argue that a federal authority concerned with aggregate efficiency and the design of rules of competition among jurisdictions should take into account the effects of the degree of locational attachment of businesses, when considering restricting the powers of state and local governments.

In contrast with proponents of the elimination of discretionary incentives, we find that average welfare is higher under regimes which allow for the use of more discretionary instruments when entrepreneurs are highly mobile, which is thought to be the empirically relevant case by advocates of constitutional constraints. Imposing non-discretion, in this case, impacts the efficiency of local

governments at raising and allocating public funds.

Our analysis encompasses several issues in the public finance literature regarding the behavior of governments and the evaluation of the properties of alternative taxation systems in a framework of interjurisdictional competition. Competition among jurisdictions has been traditionally examined in the literature on tax competition. In these models (Wilson, 1999; Wilson and Wildasin, 2004, are excellent surveys), governments compete for a mobile resource (usually capital) to enlarge the local tax base to finance a local public good. These studies evaluate the efficiency of the decentralized allocations resulting from competition among jurisdictions and find that competition has distorting effects because there is a fiscal externality associated with the mobility of the tax base. Issues of competition for businesses to improve local development and explicit location decisions of firms are not, however, traditionally considered (some exceptions include Richter (1994) and Wellisch (1995)).

When authors have found potential welfare-improving effects of competition among jurisdictions, the reason is that local governments behave non-benevolently and competition imposes limits on the non-benevolent behavior. Competition, for example, may reduce the taxation powers of governments that are partially interested in maximizing the size of the public sector or in capturing rents (see for example Brennan and Buchanan, 1980; Rauscher, 2000).

The degree of mobility of different tax bases, has also been found to restrict the self-serving behavior of governments. For example, Wrede (1998) noted that perfect household mobility, in a framework of interstate competition, forces governments to use taxation instruments efficiently.

Regarding international tax competition, the models of Janeba and Peters (1999) and Keen (2001) evaluate the merits of discretionary versus uniform taxation regimes, based on different assumptions about the degree of mobility of different tax bases (local firms and foreign firms), and reach opposite conclusions. Janeba and Peters (1999), assuming that local firms are immobile and foreign firms are perfectly mobile, favor a uniform tax regime, because it enables governments to raise the revenues from the mobile tax bases. Keen (2001), on the other hand, considering two imperfectly mobile tax bases and one immobile, argues that restricting preferential tax regimes may reduce revenues in both countries. Janeba and Smart (2003) reconciles the opposing views of Janeba and Peters (1999) and Keen (2001) and argue that the desirability of tax discrimination depends on the relative elasticity of the tax bases.

In our analysis, we also highlight the relevance of the degree of mobility of businesses as a source of restraint in the taxation powers of governments, and we examine whether imposing additional artificial restrictions on the taxation powers of governments reduces their efficiency, when firms differ also in terms of productivity.

Models which explicitly compare alternative taxation regimes to evaluate restricting the taxation powers of governments include those of Becker and Mulligan (2003) and Lee and Snow (1997). Becker and Mulligan examine the properties of alternative tax systems in a redistribution framework; they find that *more efficient* (in a Ramsey (1927) sense) tax systems are associated with larger governments and, under certain conditions, with increased total deadweight loss of government activity. Lee and Snow study optimal taxation rules in environments in which the government's objective function imperfectly represents social benefits from government activity; they find that restrains on taxation powers are "optimal for governments that create more than a critical level of distortion in evaluating the marginal social costs and benefits of taxation and spending."

Our results suggest that if we view the problem of evaluating alternative competition rules as a problem of constitution design, a federal authority could design rules as a menu of policy instruments in which the restrictions on the discretionary powers of governments depend on the degree of mobility of the targeted firms. Discretion in the choice of policies could be allowed when targeting highly mobile firms, and banned for relatively less mobile ones.

In section 2 we present the model of competition among jurisdictions for heterogeneous mobile firms. Our goal is to examine the welfare implications of competing under alternative regimes which differ in the restrictions on the use of discretionary taxation instruments. In section 3 we outline the alternative systems of competition. We then discuss the results in section 4, and conclude in section 5.

2 The Model

Jurisdictions

There are 2 identical jurisdictions. Each is populated by a large number of immobile and

homogeneous workers with preferences over (net) wage *income*, $\overline{w}$, and labor effort, l^w, given by:

$$U^w(\overline{w}, l^w) = \overline{w} - \frac{(l^w)^2}{2}. \tag{2.1}$$

Social preferences over a local public good

We assume that immobile members of the jurisdiction, as a whole, have social preferences over a local public good, g, given by $v(g)$. Producing one unit of the local public good requires one unit of the private consumption good.

Mobile agents

Entrepreneurs are partially mobile agents associated with a machine of two possible productivity levels, y_L and y_H, with $y_L < y_H$. We focus on the location decisions of entrepreneurs abstaining from considerations of entry, as is traditional in models of tax competition, and posit that there is a fixed total number of entrepreneurs of each type in the 2-community economy equal to $2n_L$ and $2n_H$. We assume that in an initial configuration, each location hosts half of each type, i.e., n_L and n_H.

Entrepreneurs can hire 1 worker and produce the economy-wide homogenous good according to the following relation:

$$Y_i = y_i(\alpha l_i^f + \beta l_i^w), \tag{2.2}$$

for $i = L, H$,[2] and where l^f and l^w represent entrepreneurial effort and the worker's labor, and $\alpha, \beta > 0$. We refer to the productive pair of a worker and an entrepreneur as a job. Abusing language, henceforth, we refer to entrepreneurs indistinctly as *firms*.

For the determination of wages and profits (gross of taxation) we assume a constant output share splitting rule: $w_i = \phi Y_i$ and $\pi_i = (1-\phi)Y_i$ for $i = L, H$, and $\phi \in (0,1)$.[3] We assume that the number of workers in each local economy is sufficiently large as to prevent that in an equilibrium (to be defined later) there are firms left without a matching worker.[4,5]

[2] To avoid repetition, we use the subscript i throughout to indicate low (L) and high (H) productivity types.

[3] This rule can be motivated as the solution to a bargaining game between the worker and the entrepreneur.

[4] This assumption generates a simple mechanism by which locations derive benefits from attracting firms. It is not the objective of this study to produce a theory of development or firm migration to rationalize why states compete, but rather to evaluate alternative rules of competition given that it takes place. Holmes (1999) and Owens and Sarte (2002) develop reasons why firm migration might be induced.

[5] Resident workers who remain unemployed will receive in this case a normalized reservation utility from private

Entrepreneurs have the following preferences over (net) profits, $\overline{\pi}^f$, and effort (which we call indistinctly, *labor*):

$$U_i^f(\overline{\pi}_i^f, l_i^f) = \overline{\pi}_i^f - \frac{1}{\theta_i}\frac{(l_i^f)^2}{2}, \tag{2.3}$$

for $i = L$, H, and $\theta_H > \theta_L > 0$, which implies that high productivity entrepreneurs not only are more productive but they also derive less disutility from effort than low productivity agents. In order to simplify the location decisions of firms, we assume that entrepreneurs derive no utility from the local public good, but this feature is not essential for the results.

Labor choice

Workers and entrepreneurs decide noncooperatively on the amount of effort they bring into the job by maximizing utility, taking as given the effort choice of the other party and the rule for the determination of profits and wages,

$$\begin{aligned} l_i^w &= \arg\max_{l^w} \ \overline{w}_i(l_i^f, l^w) - \frac{(l^w)^2}{2} \\ l_i^f &= \arg\max_{l^f} \ \overline{\pi}(l^f, l_i^w) - \frac{1}{\theta_i}\frac{(l^f)^2}{2}. \end{aligned} \tag{2.4}$$

Location preferences

We assume that entrepreneurs have preferences over locations representing, say, trade knowledge associated with a particular jurisdiction, and we posit that entrepreneurs face a disutility cost of moving away from their initial location. We assume that firms differ in intensity of locational attachment and that the distribution of the moving cost for firms of type $i = L, H$, in either community, is given by $n_i F(c)$. We assume that $F(c)$ is the cumulative distribution function of a uniform random variable over the interval $[0, \delta]$; the parameter δ is thus interpreted as the degree of mobility of firms, with lower values representing higher mobility. In the international tax literature, this attachment to the home location is referred to as *home bias* and is a well-established empirical regularity and reflects the higher information and transaction costs involved in investing abroad (Haupt and Peters, 2005).

consumption and leisure of zero, their utility for the local public good will still be embedded in the function $v(g)$.

2.1 Interjurisdictional Competition

The economic environment just described suggests that jurisdictions may want to reshape local characteristics and implement financial and fiscal policies to lure entrepreneurs to improve the local composition of jobs. As in traditional models of tax competition, we will assume that jurisdictions compete to maximize the welfare of resident workers; however, in contrast with models in which locations compete for *more* firms to expand the local tax base, in our setup where the composition of jobs matters, jurisdictions will compete for *better* firms as well. We assume that local governments compete by offering potentially differentiated tax rates to mobile firms to induce them to locate in their jurisdiction.

The redistribution concerns of local governments in our model can be motivated by thinking that politicians maximize the welfare of immobile residents because they evaluate the long-term benefits of maintained support from the constituency versus the short-term distortions induced by redistribution.

Alternative constitutional regimes

We are concerned with examining competition under alternative constitutional regimes determining the rules of application of benefits: one remige that limits the ability of local governments of differentiating among types of firms when targeting incentive programs, and other regimes that allow for different forms of discrimination.

In the discretionary regimes, locations can discriminate among firms in terms of their productivity levels, or their locational preferences, or both. This feature of our model is crucial, and will allow us to differentiate the implications of banning the discretionary powers of governments depending on the dimensions of heterogeneity they choose to discriminate.

The game between jurisdictions

For each alternative constitutional regime, we model interjurisdictional competition as a two-stage game between the local governments.

Definition 1 *The following describes the two-stage game between jurisdictions: i) in the first stage, local governments announce their incentive programs (given by tax rates for entrepreneurs and local workers), and ii) in the second stage entrepreneurs make location decisions by comparing utility differentials against moving costs.*

In order to formalize the game we need to establish the objective function of the local governments in terms of the local incentives programs and the (re)location decisions of firms that, for given announced packages in both communities, determine the number of firms that prevails in each community. With this in mind we define our notion of equilibrium:

Definition 2 *An equilibrium of the competition process between jurisdictions is given by a set of tax rates on mobile entrepreneurs and resident workers in each jurisdiction that constitutes a symmetric subgame perfect Nash equilibrium of the two-stage game described above.*

The Nash equilibrium of the game is obtained by backward induction. In the second stage, given announced policies in both communities, mobile entrepreneurs make optimal location choices comparing utility differentials across locations net of moving costs; these decisions define rules that determine the number of each type of firms that choose to locate in each community. In the first stage, local governments take into account these decision rules and choose policies to maximize the welfare of resident workers, taking as given the policy choices of the other community. We argue that focusing on the symmetric Nash equilibria of the games is appropriate; first, because jurisdictions are symmetric, and second, because we want to stress the comparison of welfare measures across regimes. By looking only at the symmetric equilibria, the different sources of inefficiency can be more readily identifiable, even though some of the games analyzed may admit asymmetric equilibria.

2.2 Benchmark welfare criterion

Our task is to evaluate the welfare properties of the outcomes of competition between the local governments under different sets of rules. The different outcomes cannot be ranked according to the Pareto criterion—which requires an alternative situation to be preferred unanimously to the status quo to be consider *better*—because changing taxation regimes may have different impact on the welfare of different groups in society. Instead, we calculate the sum of utilities of all agents in the economy (workers and entrepreneurs) to evaluate the outcomes that obtain under different regimes.

This criterion can be motivated by interpreting the objective function of the local governments as a form of *non-benevolence*, once we define a *benevolent* government as that which maximizes the welfare of all resident agents, including entrepreneurs—as if they were all immobile. We can then,

for each outcome, compute the implied measure of welfare and interpret the comparison among regimes, as deviations from the solution of the benevolent government.

Consider the case of discrimination in terms of productivities only. If benevolent local governments only have access to non-distortionary tax instruments, their problem is to determine taxes t^w, t_L^f, and t_H^f, and level of public good, g, to maximize the sum of welfare for all agents in their location:

$$\begin{aligned} W_{\text{bench}} = \max_{t^w, t_L^f, t_H^f, g} \quad & (U_L^w + U_L^f) n_L + (U_H^w + U_H^f) n_H + v(g) \\ \text{s.t.} \quad & g = G + t^w (w_L n_L + w_H n_H) + t_L^f \pi_L n_L + t_H^f \pi_H n_H \\ & U_i^w = (1 - t^w) w_i - \frac{(l_i^w)^2}{2} \\ & U_i^f = (1 - t_i^f) \pi_i - \frac{(l_i^f)^2}{2\theta_i} \\ & (1 - t^w) w_i \geq 0, \, (1 - t_i^f) \pi_i \geq 0, \, i = L, H. \end{aligned} \tag{2.5}$$

In this situation, discriminating among types of entrepreneurs is optimal since they face different incentives in their effort choices.[6] Comparing measures of welfare of the outcomes of competition under alternative (distortionary) tax regimes is equivalent to evaluating the respective deadweight loss relative to this benchmark case, since the regimes cannot be Pareto-ranked.

3 Alternative Competition Regimes

We restrict the analysis to the cases in which the local governments can identify at most four kinds of firms, corresponding to two productivity levels and two locations of origin; thus we define four alternative regimes of competition:

1. Communities do not discriminate among firm types.
   This is the *uniform* regime (**unif**).

2. Communities discriminate on productivity levels.
   This is the *productivities* regimes (**prod**).

[6] In order to set up an optimal taxation structure, governments would prefer to determine taxes t_L^w and t_H^w to distinguish among workers hired by entrepreneurs of different productivities. In the rest of the paper we assume, for ease of exposition, that governments do not make such a distinction and determine only one tax rate for workers, t^w.

3. Communities discriminate only between local and foreign firms.
   This is the *location status* regime (**loc**).

4. Communities discriminate among all four types.
   This is the *productivities + location status* regime (**prod+loc**).

We now describe competition among jurisdictions when governments only have access to proportional taxes on workers' wages and firms' profits. In this model there are several trade-offs to distort: the labor choice, the provision of the public good, and the location decisions of firms. The last one is particularly relevant since in our symmetric framework any relocation of firms induced by incentives will result in socially wasteful moving costs. Proportional taxes on wages and profits will also distort the labor choices of workers and entrepreneurs and also the provision of the public good. (If local governments could instead use lump-sum transfers with at least one group of agents, the local public good could be provided efficiently, at least in a range of parameter values.)

Additionally, the fact that local governments consider only the welfare of resident workers in their objective function is another source of inefficiency, since we can expect that when the degree of mobility of firms is relative low, local governments will attempt to set higher tax rates on entrepreneurs, relative to the corresponding solution in problem (2.5).

For ease of exposition, we describe only two cases in detail: case 1, in which local governments are prevented from discriminating among types of firms, and case 4, in which local governments are able to discriminate among all four types, including productivities and location preferences of entrepreneurs. (Cases 2 and 3 can be described as subsets of case 4.)

3.1 The uniform taxation regime

In this case, local governments set proportional tax rates, t^f, on firms' profits and on workers' wage income, t^w. Net income from profits and wages is given in this case by:

$$\begin{aligned} \overline{\pi}_i = &\quad (1-t^f)\pi_i = (1-t^f)(1-\phi)Y_i(l_i^f, l_i^w) \\ \overline{w}_i = &\quad (1-t^w)w_i = (1-t^w)\phi Y_i(l_i^f, l_i^w). \end{aligned} \tag{3.1}$$

Effort choices of workers and entrepreneurs are obtained noncooperatively from the individual problem in (2.4): each member of the productive pair takes as given the choice of effort of the other

party when deciding upon their own:

$$\begin{aligned} l_i^f &= \arg\max_{l^f} \quad \overline{\pi}_i(l^f, l_i^w) - \frac{(l^f)^2}{2\theta_i} = (1-t^f)(1-\phi)\alpha y_i \theta_i \\ l_i^w &= \arg\max_{l^w} \quad \overline{w}_i(l_i^f, l^w) - \frac{(l^w)^2}{2} = (1-t^w)\phi\beta y_i. \end{aligned} \tag{3.2}$$

Location decision of firms

Given announced policies (t_j^w, t_j^f) in each community $j = 1, 2$, entrepreneurs compare implied utility of incentive programs $U_i^f(t_j^w, t_j^f)$; then, they decide to locate in the community where utility net of moving costs is maximized. The number of firms of each type $i = L, H$ that decide to locate in community 1 is given by:

$$\begin{aligned} N_i(t_1^w, t_1^f; t_2^w, t_2^f) = n_i \Big\{ & 1 - F\left[U_i^f(t_2^w, t_2^f) - U_i^f(t_1^w, t_1^f)\right] \\ & + F\left[U_i^f(t_1^w, t_1^f) - U_i^f(t_2^w, t_2^f)\right] \Big\}. \end{aligned} \tag{3.3}$$

This expression represents:

1. The number of local firms that are retained because they face high moving costs, i.e., firms which decide to remain in community 1 because $U_i^f(t_2^w, t_2^f) - U_i^f(t_1^w, t_1^f) < c$:

   $$n_i \left\{ 1 - F\left[U_i^f(t_2^w, t_2^f) - U_i^f(t_1^w, t_1^f)\right] \right\}.$$

2. The number of foreign firms that are attracted because they face low moving costs, i.e., firms that decide to move to community 1 because $U_i^f(t_1^w, t_1^f) - U_i^f(t_2^w, t_2^f) > c$:

   $$n_i F\left[U_i^f(t_2^w, t_2^f) - U_i^f(t_1^w, t_1^f)\right].$$

Depending on whether $U_i^f(t_2^w, t_2^f) - U_i^f(t_1^w, t_1^f) \gtrless 0$, we can have situations in which no foreign firms are attracted and some local firms are retained, or in which all local firms are retained and some foreign firms are attracted.

The game between locations

Ex-ante, workers are homogeneous, but in equilibrium they will be employed by different types of firms, and ex-post they will receive differentiated wage payments; thus there will be as many types of (employed) workers as those of entrepreneurs.

The following budget constraint has to be satisfied in each community:

$$g = G + t^w(w_L N_L + w_H N_H) + t^f(\pi_L N_L + \pi_H N_H), \tag{3.4}$$

where π and w represent profits and wages gross of taxation.

Location Equilibrium

As we noted before, the objective of the local governments is to maximize the sum of utilities of the resident workers; because communities are identical, it is enough to examine the problem of location 1. We characterize the symmetric Nash equilibrium of the governments' game by imposing symmetry on the first order conditions of the individual problem.

In the current case, local governments choose the same tax rate for all firm types, taking into account the tax rates chosen by the rival jurisdiction—implied in the determination of the number of firms N_i:

$$\begin{aligned} \max_{t^w, t^f, g} \quad & U_L^w N_L + U_H^w N_H + v(g) \\ \text{s.t.} \quad & g = G + t^w(w_L N_L + w_H N_H) + t^f(\pi_L N_L + \pi_H N_H). \end{aligned} \tag{3.5}$$

The system of first order conditions, after symmetry is imposed is given by:

$$\begin{aligned} t^w: \quad & U_L^w \frac{\partial N_L}{\partial t^w} + \frac{\partial U_L^w}{\partial t^w} N_L + U_H^w \frac{\partial N_H}{\partial t^w} + \frac{\partial U_H^w}{\partial t^w} N_H \\ & + v'(g) \left\{ w_L N_L + w_H N_H + t^w \left[w_L \frac{\partial N_L}{\partial t^w} + \frac{\partial w_L}{\partial t^w} N_L + w_H \frac{\partial N_H}{\partial t^w} + \frac{\partial w_H}{\partial t^w} N_H \right] \right. \\ & \left. + t^f \left[\pi_L \frac{\partial N_L}{\partial t^w} + \frac{\partial \pi_L}{\partial t^w} N_L + \pi_H \frac{\partial N_H}{\partial t^w} + \frac{\partial \pi_H}{\partial t^w} N_H \right] \right\} = 0 \\ t^f: \quad & U_L^w \frac{\partial N_L}{\partial t^f} + \frac{\partial U_L^w}{\partial t^f} N_L + U_H^w \frac{\partial N_H}{\partial t^f} + \frac{\partial U_H^w}{\partial t^f} N_H \\ & + v'(g) \left\{ \pi_L N_L + \pi_H N_H + t^w \left[w_L \frac{\partial N_L}{\partial t^f} + \frac{\partial w_L}{\partial t^f} N_L + w_H \frac{\partial N_H}{\partial t^f} + \frac{\partial w_H}{\partial t^f} N_H \right] \right. \\ & \left. + t^f \left[\pi_L \frac{\partial N_L}{\partial t^f} + \frac{\partial \pi_L}{\partial t^f} N_L + \pi_H \frac{\partial N_H}{\partial t^f} + \frac{\partial \pi_H}{\partial t^f} N_H \right] \right\} = 0. \end{aligned} \tag{3.6}$$

Unfortunately, a closed-form expression for the equilibrium cannot be obtained because of the nonlinearity of the problem.[7] These conditions represent the trade-offs for a given community of

[7]Since the location decisions of firms have a cut-off level form, the objective function of the local governments need not be globally concave. However, we verified numerically that the solution to the system of first order conditions is a local maximizer of the individual problem. The symmetric equilibria we found appear to be unique. Even though

setting the fiscal programs. The solution requires the balance between the effects of tax policies on workers' utility—directly, through the effects on labor choices and income, and indirectly, through the effects in location decisions of mobile agents—and the effects on the provision of the public good; attracting firms improves employment conditions and enlarges the tax base, but it requires improving on the fiscal packages of the rival jurisdiction. It is apparent that the application of proportional taxes distorts the labor choices of agents and prevents the efficient provision of the public good.

In the symmetric equilibrium there is no relocation of firms: $N_L = n_L$ and $N_H = n_H$. The effects of tax policies on the determination of the number of firms is given by:

$$\begin{aligned} \frac{\partial N_i}{\partial t^f} &= n_i \frac{1}{\delta} \frac{\partial U_i^f}{\partial t^f} \\ \frac{\partial N_i}{\partial t^w} &= n_i \frac{1}{\delta} \frac{\partial U_i^f}{\partial t^w}, \end{aligned} \tag{3.7}$$

where,

$$\begin{aligned} \frac{\partial U_i^f}{\partial t^f} &= -\pi_i \\ \frac{\partial U_i^w}{\partial t^w} &= -w_i, \end{aligned} \tag{3.8}$$

and therefore, there are pressures to lower taxes relative to the rival's policies; when the degree of mobility is low (δ is high), however, these pressures are lessened. In our environment, competition induces restrictions on the level of tax rates that communities can impose on mobile agents; precisely because they are mobile.

Welfare

As noted above, for this regime, the welfare measure, according to the chosen criterion, is obtained by computing:

$$W_{\text{unif}} = \Sigma_{i=L,H}(U_i^w(t^w, t^f) + U_i^f(t^w, t^f))N_i + v(g_{\text{unif}}), \tag{3.9}$$

where g_{unif} represents the level of the public good attained in the solution to (3.6).

there could be asymmetric equilibria in some of the environments in which governments exercise some degree of discrimination, the issue was not explored further.

3.2 Discrimination in location preferences and productivity levels

In this regime, local governments can identify and discriminate over all four types of firms: two productivity levels and the location status of firms, and can thus offer four different tax rates on firms' profits. With the ability to set different tax rates based on productivity levels, local governments have the possibility of reducing the distortions involved in collecting or redistributing resources and therefore the deadweight loss of taxation.

We anticipate that more favorable incentives in the form of lower tax rates will be offered to the high productivity type. In contrast with models of homogeneous agents, the current setup allows us to provide an intuitive content to the expression *better jobs*.

However, in the symmetric equilibrium, governments are likely to offer more attractive incentives to foreign firms than to local ones to entice them to move, because they have to be compensated for the moving costs they have to incur to relocate. Therefore we can expect some degree of inefficient relocation induced by equilibrium policies that are more beneficial to foreign firms. Therefore, the welfare properties of the equilibrium outcome depend on the balance of the relocation inefficiency and the potential benefits of utilizing discretionary tax instruments.

Local governments offer policies $(t^{fL}, t^{fL*}, t^{H}, t^{H*})$, where the asterisk $(^*)$ refers to policies for foreign firms. In location 1, the resulting utility levels for local entrepreneurs is given, as before, by:

$$U_i^f = (1 - t_1^{fi})(1 - \phi)Y_i - \frac{1}{\theta_i}\frac{(l^{fi})^2}{2}. \tag{3.10}$$

The expression for the corresponding utility for foreign entrepreneurs, gross of moving costs, is obtained analogously: U_{i*}^f.

The number of local (N_i) and foreign (N_{i*}) firms that choose to reside in location 1, given announced policies in both communities, is determined from comparing utility differences with the moving costs:

$$\begin{aligned} N_i(t_1^w, t_1^{fi}; t_2^w, t_2^{fi*}) &= n_i \left\{1 - F\left[U_{i*}^f(t_2^w, t_2^{fi*}) - U_i^f(t_1^w, t_1^{fi})\right]\right\} \\ N_{i*}(t_1^w, t_1^{fi}; t_2^w, t_2^{fi*}) &= n_i F\left[U_{i*}^f(t_1^w, t_1^{fi*}) - U_i^f(t_2^w, t_2^{fi})\right]. \end{aligned} \tag{3.11}$$

We can now state the problem of the local government in location 1:

$$\begin{aligned} \max_{t^w, t^{fL}, t^{fL*}, t^{fH}, t^{fH*}, g} \quad & U_L^w N_L + U_{L*}^w N_{L*} + U_H^w N_H + U_{H*}^w N_{H*} + v(g) \\ \text{s.t.} \quad & g = G + t^w(w_L N_L + w_{L*} N_{L*} + w_H N_H + w_{H*} N_{H*}) \\ & + t^{fL} \pi_L N_L + t^{fL*} \pi_{L*} N_{L*} + t^{fH} \pi_H N_H + t^{fH*} \pi_{H*} N_{H*}. \end{aligned} \tag{3.12}$$

The symmetric equilibrium in this case will be a set of policies $(t^w, t^{fL}, t^{fL*}, t^H, t^{H*})$ that solve the following first order conditions (once symmetry is imposed).

$$\begin{aligned} t^w: \; & \frac{\partial}{\partial t^w}\left(U_L^w N_L + U_{L*}^w N_{L*} + U_H^w N_H + U_{H*}^w N_{H*}\right) \\ & + v'(g)\Big\{ w_L N_L + w_{L*} N_{L*} + w_H N_H + w_{H*} N_{H*} \\ & + t^w \frac{\partial}{\partial t^w}\left(w_L N_L + w_{L*} N_{L*} + w_H N_H + w_{H*} N_{H*}\right) + t^{fL} \frac{\partial}{\partial t^w}\left(\pi_L N_L\right) \\ & + t^{fL*} \frac{\partial}{\partial t^w}\left(\pi_{L*} N_{L*}\right) + t^{fH} \frac{\partial}{\partial t^w}\left(\pi_H N_H\right) + t^{fH*} \frac{\partial}{\partial t^w}\left(\pi_{H*} N_{H*}\right) \Big\} = 0 \end{aligned} \tag{3.13}$$

and for $i = L, H$:

$$\begin{aligned} t^{fi}: \; & \frac{\partial}{\partial t^{fi}}\left(U_i^w N_i\right) + v'(g)\left\{ \pi_i N_i + t^w \frac{\partial}{\partial t^{fi}}\left(w_i N_i\right) + t^{fi} \frac{\partial}{\partial t^{fi}}\left(\pi_i N_i\right) \right\} = 0 \\ t^{fi*}: \; & \frac{\partial}{\partial t^{fi*}}\left(U_{i*}^w N_{i*}\right) + v'(g)\left\{ \pi_{i*} N_{i*} + t^w \frac{\partial}{\partial t^{fi*}}\left(w_{i*} N_{i*}\right) + t^{fi*} \frac{\partial}{\partial t^{fi*}}\left(\pi_{i*} N_{i*}\right) \right\} = 0. \end{aligned} \tag{3.14}$$

In a situation in which foreign firms are offered more attractive packages, $t^{fi*} < t^{fi}$, entrepreneurs with low moving costs will shift locations in such a way that in equilibrium, the same number of firms leaving one community will be attracted by the rival location; the number of firms of each productivity type will be given by: $N_i + N_{i*} = n_i$, the same as in the initial configuration. The welfare measure in this case has to account for the total switching costs incurred by relocating firms, $m_{\text{prod+loc}}$:

$$\begin{aligned} W_{\text{prod+loc}} = \sum_{i=L,H} \Big\{ & \Big(U_i^w(t^w, t^{fi}, t^{fi*}) + U_i^f(t^w, t^{fi}, t^{fi*}) \Big) N_i \\ & + \Big(U_{i*}^w(t^w, t^{fi}, t^{f*}) + U_{i*}^f(t^w, t^{fi}, t^{fi*}) \Big) N_{i*} \Big\} + v(g_{\text{prod+loc}}) - m_{\text{prod+loc}}, \end{aligned} \tag{3.15}$$

where for $U_{i*}^f > U_i^f$, we have:

$$\begin{aligned} m_{\text{prod+loc}} &= n_L \int_0^{U_{L*}^f - U_L^f} \frac{c}{\delta} dc + n_H \int_0^{U_{H*}^f - U_H^f} \frac{c}{\delta} dc \\ &= n_L \frac{\left(U_{L*}^f - U_L^f\right)^2}{2\delta} + n_H \frac{\left(U_{H*}^f - U_H^f\right)^2}{2\delta}. \end{aligned} \tag{3.16}$$

4 Results

The purpose of the analysis is to compare the welfare characteristics of interjurisdictional competition under alternative tax systems—or alternative rules of competition.

Because it was not possible to obtain closed-form expressions for the characterization of the equilibrium, we have resorted to numerical computations to identify the patterns of behavior of the model in a range of parameter values that produced an interior symmetric equilibrium. Some of the intuition for our results, however, follows from a simpler model of competition with non-distortionary instruments, for which closed-form solutions can be obtained.[8]

Clearly, when lump-sum taxes are available, the provision of the public good and the labor choices are free of distortions, and as long as there is no relocation of firms, the welfare outcomes will be the same as the benchmark criterion. The only potential source of distortions in these cases is the inefficient relocation of firms induced when governments are able to differentiate firms in terms of location status. A regime that bans this sort of discretion in general improves welfare. Nevertheless, if the empirically relevant case is that firms are highly mobile, as it has been argued elsewhere, then such a policy may be unnecessary; since the mobility of firms by itself imposes constraints on the ability of local governments to differentiate among firm types.

In a situation in which tax instruments are lump-sum and do not distort labor or effort choices, banning discrimination on productivity types has no effects. Nonetheless, there are differences in the payoffs of low and high type agents, since in the discretionary taxation regime, low types face higher taxes than in the uniform system. If we were to include distributional concerns in the evaluation of a proposal to eliminate discriminatory application of benefits, this would have to be taken into account. If, on the other hand, we concern ourselves only with average welfare, no discrimination or discrimination in productivities turn out to be equivalent.

[8] The derivations of the simpler model are available from the author on request.

4.1 Evaluation of Alternative Taxation Regimes

In the cases in which local governments only have access to distortionary taxation instruments, the relative efficiency of the different systems of taxation, in terms of distortions in the labor choices, becomes relevant for the analysis. Consider the classical taxation problem in which revenue requirements are fixed. We can measure the relative efficiency of alternative sets of instruments in terms of the deadweight costs involved in the collection process. This is the well known Ramsey (1927) problem, in which the objective is to minimize the deadweight loss of taxation. In our framework we have heterogeneous agents which respond differently to a distortionary policy, in particular, high productivity agents are more responsive to policies, whereas low productivity agents are less sensitive.

Traditional analysis would suggest that, for a fixed revenue requirement, high productivity agents should face a lower tax rate than low productivity ones. In our environment, however, revenue requirements are not fixed, since for varying degrees of mobility of firms, the levels of provision of the public good and the possibilities of redistribution between entrepreneurs and resident workers change. In our analysis, therefore, it is not easy to identify the relative efficiency of the different taxation systems we consider. We try to disentangle the different sources of inefficiencies at play in each regime. Thus, abusing notation, we label *more efficient* those regimes that would cause fewer distortions in terms of the decisions they would affect in the fixed-revenue requirement case. For example, if we compare the uniform regime to discrimination of productivity levels, we say that the latter is more efficient than the former. With this in mind, we summarize our results:

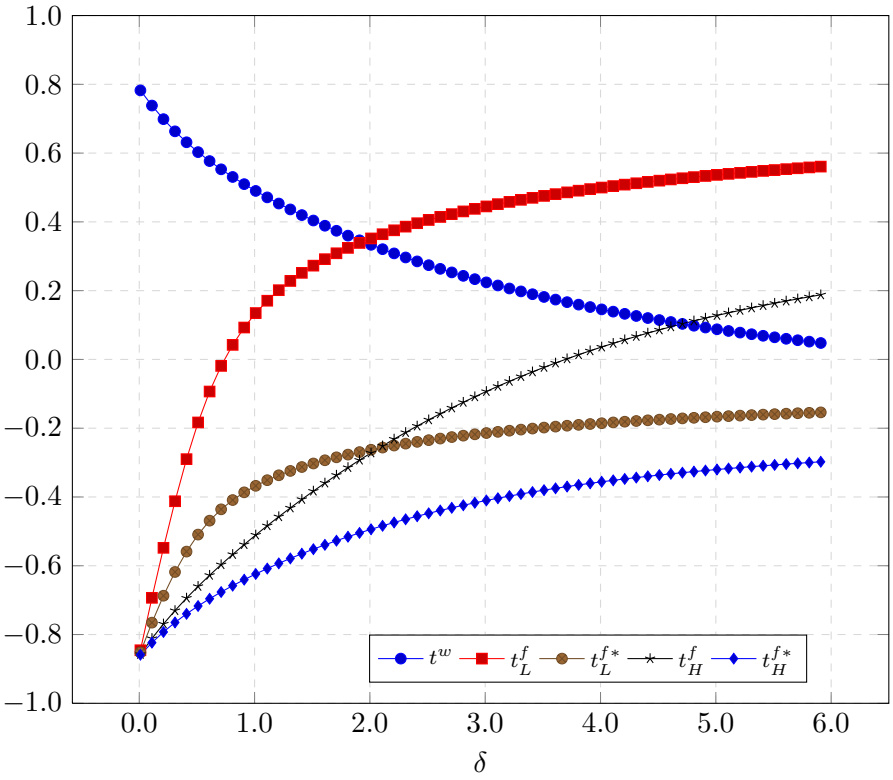
Result 1. In the discretionary regimes, high productivity firms are offered lower tax rates than low productivity types and therefore, corresponding profits, wages and utility levels are higher.

Result 2. In the case in which local governments discriminate also in terms of location preferences, foreign firms receive additional benefits compared to their local counterparts, inducing inefficient relocation of firms across locations.

For an illustration of these situations see Figure 1.

Result 3. In situations in which firms are highly mobile, taxation regimes with more efficient instruments result in a higher welfare measure. When the degree of mobility of firms is low,

Figure 1: Tax rates. Discretion in productivity and location status
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = 1, y_H = 2$, $\theta_L = 1, \theta_H = \frac{3}{2}$.



regimes with less efficient instruments result in higher welfare.

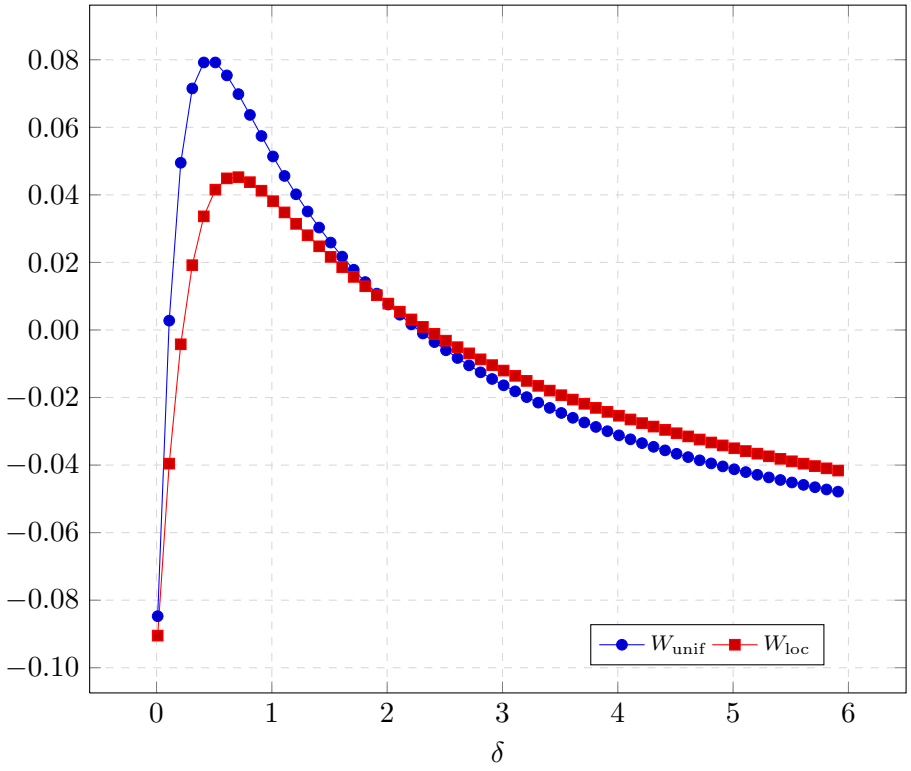
See for example, Figure 2 for the case of homogeneous entrepreneurs.

Result 4. Tax revenues from firms and levels of public good are lower in the regimes in which discrimination in terms of location preferences is allowed. See Figure 3.

Result 5. In terms of the evaluation of the proposal of banning all sorts of discretion, the uniform regime is *not* in general superior, in welfare terms, to the discriminatory regimes. In particular, for relatively low switching costs of entrepreneurs, the regimes that discriminate in terms of productivities, cases 2 and 4, may improve upon the uniform case. See for example, Figure 4.

Result 6. In general, allowing discretion in terms of location status has adverse welfare consequences. See Figures 5 and 6.

Figure 2: Welfare Comparision. Homogeneous firms.
Discretion in location status and uniform taxation.
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = y_H = \theta_L = \theta_H = 1$.



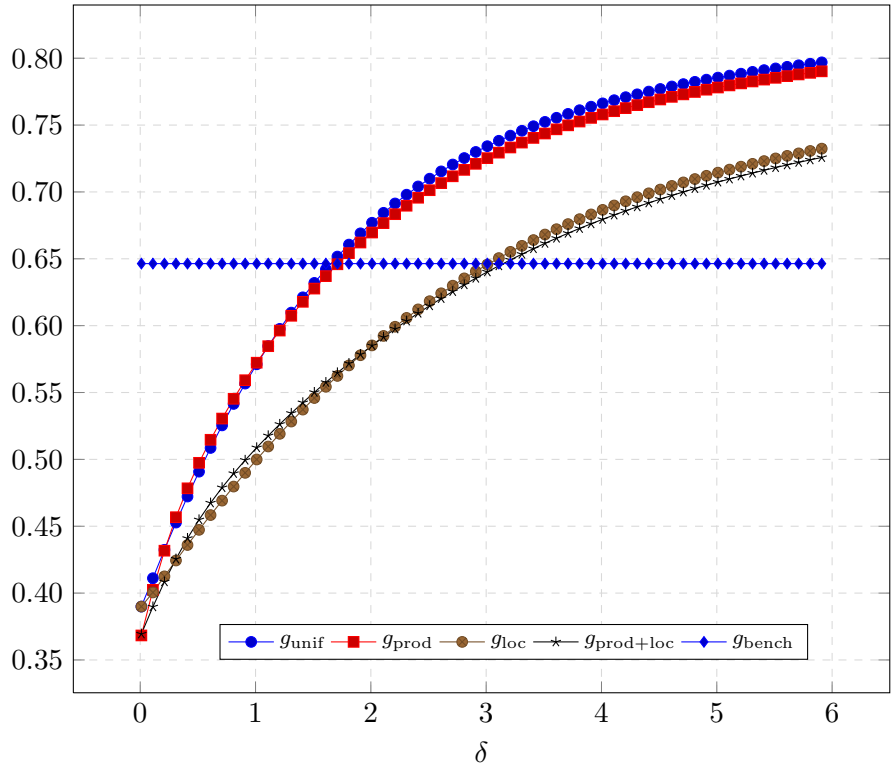
With distortionary instruments there are several effects at play. The different distortions present are:

- The use of distortionary instruments that affects the choices of entrepreneurial effort and labor choice of resident workers.
- The use of discrimination in terms of location status that induces inefficient relocation of firms and causes firms to incur socially wasteful moving costs.
- The objective function of local governments, which disregards the utility of mobile agents.

In our model, entrepreneurs differ in productivity levels, and therefore in the incentives relevant to their choices of effort. From an optimal taxation perspective, it may be advantageous to have different agents face different tax rates, if these are set according to productivities.

The mobility of entrepreneurs imposes constraints on the competition process among local

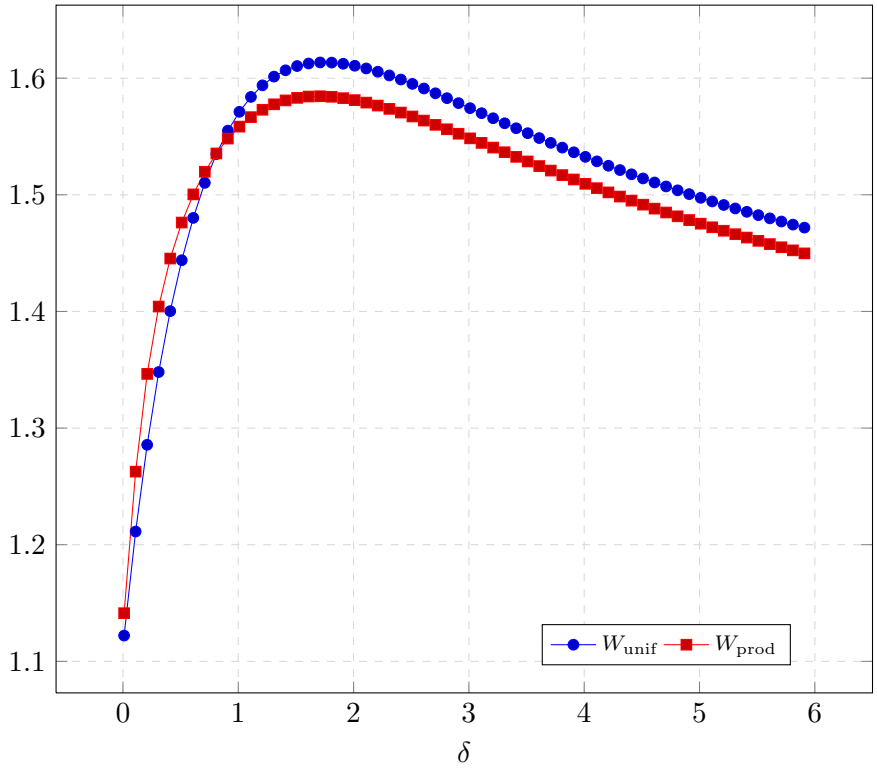
Figure 3: Public good provision. All cases.
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = 1, y_H = 2$, $\theta_L = 1, \theta_H = \frac{3}{2}$.



governments: in particular, on the power of setting tax rates on firms in order to benefit resident workers—an inefficiency resulting from the objective function of the communities. When firms are relative immobile, policies are set as to direct redistribution of resources from the entrepreneurs toward the resident workers—causing more distortions from government activity—to the point of subsidizing workers' labor income. See Figure 1 for an illustration of how tax rates for workers and entrepreneurs respond to changes in the degree of mobility of the latter. The distribution of welfare among workers and entrepreneurs changes according to the degree to which governments can engage in redistribution. See Figure 7 for an illustration of how, when firms are more attached to a location, the governments are able to improve the workers' welfare in detriment of the entrepreneurs'.

Intuitively, the trade-offs that local governments face, concerning the fiscal requirements for the provision of the public good and attempts of redistribution in favor of local workers, are associated to the mobility of firms: as firms become more footloose, governments are forced to reduce fiscal pressure on them. Higher productivity firms also require more incentives to be retained or attracted

Figure 4: Welfare Comparision. Heterogeneous firms.
Discretion in productivities and uniform taxation.
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = 1, y_H = 2$, $\theta_L = 1, \theta_H = \frac{3}{2}$.

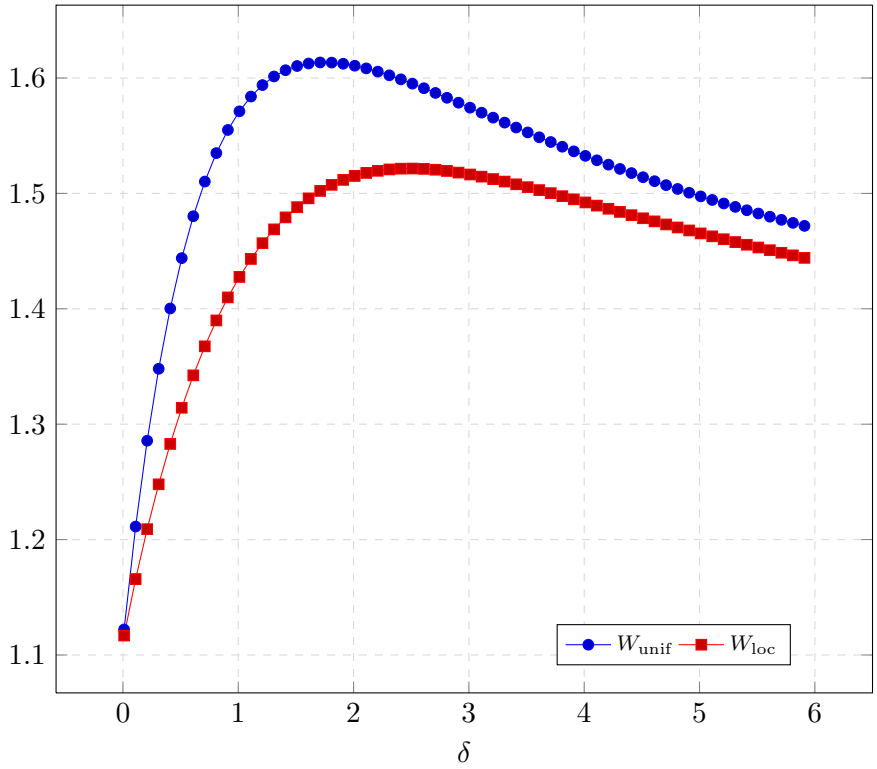


into the community than lower productivity firms.

In a similar framework, Holmes (1995) finds that with homogeneous firms (in his model there are no differences in productivities, but firms still differ in preferred location), in a situation of high degree of mobility, a uniform regime (the same tax rate is imposed on all firms) improves upon a discriminatory regime that allows governments to differentiate in terms of location preferences. His result can be analyzed in the light of ours: in his framework, the uniform tax system constitutes the *efficient regime*, as we have defined it above, and discrimination in terms of location would be the *inefficient system*. His result is then consistent with our view that with high mobility, efficient regimes result in higher welfare. Holmes acknowledges that in his exercise he found that for situations of low degree of mobility, the discriminatory regime could improve upon the uniform tax rule. These results are illustrated in Figure 2.

In our model, discrimination in terms of productivities (with no induced relocation) constitute the *efficient regime*, because the differences in productivities can be exploited to reduce the dead-

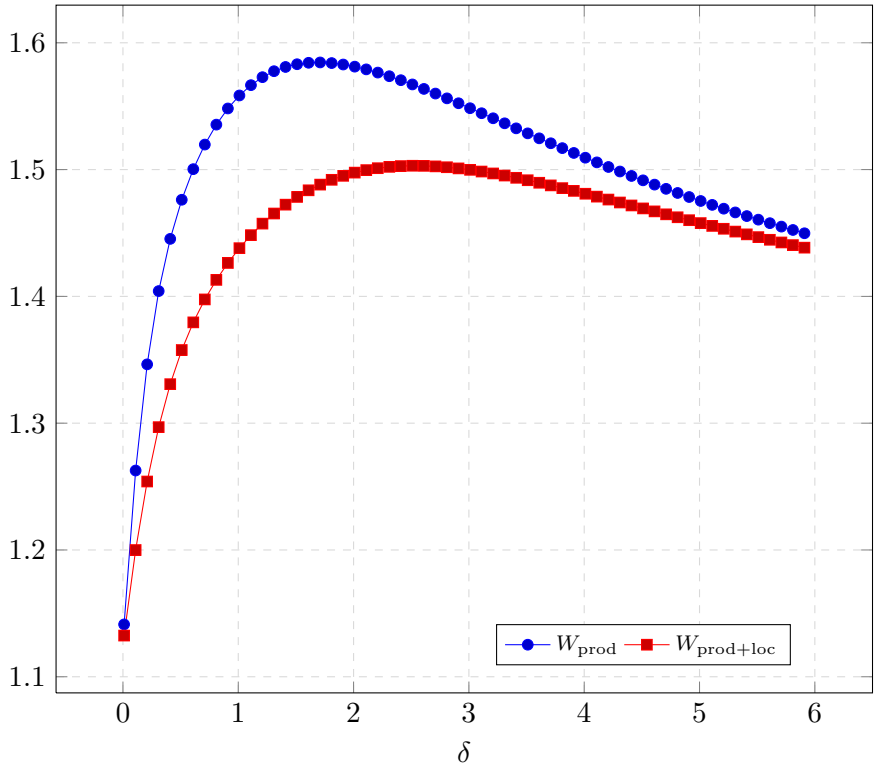
Figure 5: Welfare Comparision. Heterogeneous firms.
Discretion in location status and uniform taxation.
$v(g)\ln(g)$, $\alpha=\beta=1$, $\phi=G=n_L=n_H=\frac{1}{2}$, $y_L=1, y_H=2$, $\theta_L=1, \theta_H=\frac{3}{2}$.



weight costs of revenue collection. The uniform tax rate regime would represent a less efficient system for the same reason. Other regimes in which relocation of firms is induced are more difficult to rank, but the fact that revenue collection and public good provision are lower in these cases (3 and 4) than in the other regimes (1 and 2), as can be seen in Figure 3, indicates that such regimes are more *inefficient*.

The above results suggest that a proposal to reduce the ability of governments to differentiate among firms would be welfare-improving in some cases, particularly if it could be verified that it is a common practice for local governments to differentiate between local and foreign firms, even when businesses might be comparable in productivity levels. We identify this form of discrimination to be the most potentially damaging, in particular when local governments only have access to distortionary fiscal instruments, because it is under this sort of rules that the negative effects of competition among jurisdictions discussed in the introduction are magnified. On the other hand, our results also suggest that potential welfare improvements of reducing discrimination might not

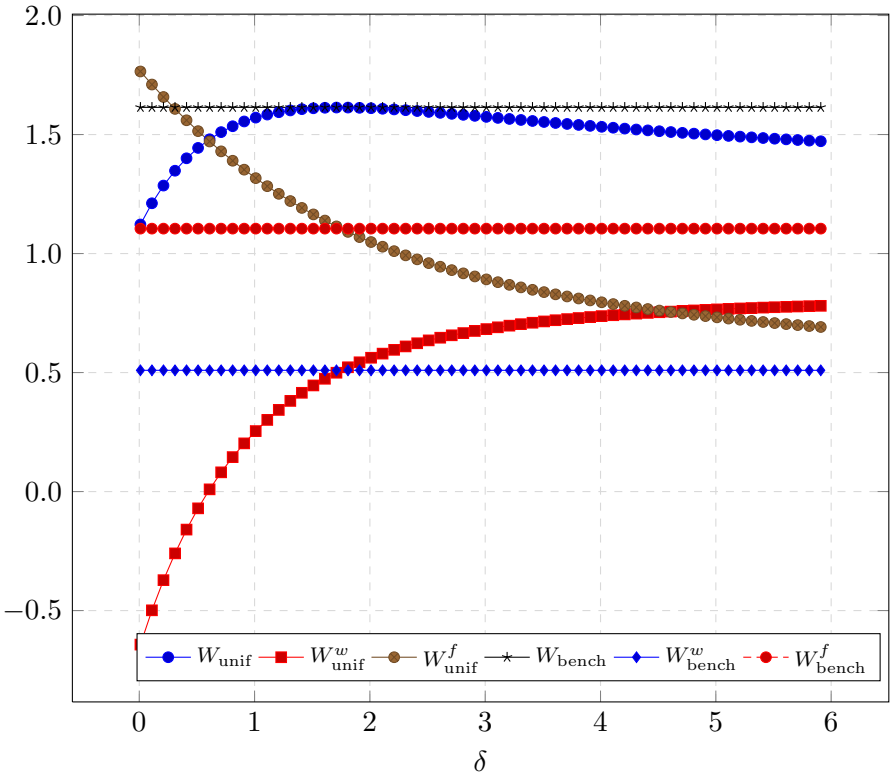
Figure 6: Welfare Comparision. Heterogeneous firms.
Discretion in productivities and in productivities and location.
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = 1, y_H = 2$, $\theta_L = 1, \theta_H = \frac{3}{2}$.



be too large if firms happen to be very responsive to policy differentials across locations—in the sense that in such cases, the high mobility of firms acts as a regulatory mechanism. Limiting the access of local governments to certain tax instruments may, on the other hand, increase welfare if the degree of mobility is very low, since in this case the use of less efficient instruments, may prevent local governments from exercising excessive–with respect to the benchmark formulation–powers of taxation upon firms in order to redistribute resources in benefit of workers. This feature is a result of the interaction between the mobility of firms and the objective of maximizing the welfare of local workers. Notice that if the switching cost of firms is relatively high, firms are, for all practical purposes, residents in their location of origin, since it is very costly to move out. In this case, the objective of maximizing the welfare of only the worker agents can be considered a source of inefficiency.[9]

[9]Mansoorian and Myers (1997) examine the effects of assuming different objective functions for the local governments, in a framework of interjurisdictional competition with mobile population. They identify situations in which the inefficiency of the outcome can be linked to the objective function of the governments.

Figure 7: Welfare Distribution. Uniform regime v. Benchmark.
$v(g) = \ln(g)$, $\alpha = \beta = 1$, $\phi = G = n_L = n_H = \frac{1}{2}$, $y_L = 1, y_H = 2$, $\theta_L = 1, \theta_H = \frac{3}{2}$.



5 Conclusion

Our results complement the view of Holmes (1995) and Burstein and Rolnick (1994), in the sense that limiting the discretionary application of benefits in the competition among states and local governments might be a welfare-improving policy if it could be verified that the common practice is to discriminate between local and foreign firms. Nevertheless, the extent of the social gains that could be obtained would depend on the actual degree of mobility of firms. Our work suggests that the degree of mobility of firms acts as a regulatory mechanism on the power of local governments, and additional measures to regulate the rules of competition among jurisdictions may undermine this feature. If the goal is to restrain the abusive powers of state and local governments, a benevolent federal authority could design rules of competition as a menu of policy instruments in which the restrictions on the discretionary powers of governments—and thus on their ability to engage in inefficient redistribution activities—depended on the degree of mobility of the targeted

firms. In practice, however, it may be difficult to implement such constitutional restrictions on the powers of state and local governments because of the problems involved in obtaining accurate assessments on the degree of attachment of businesses.

In our symmetric environment, it is relatively easy to isolate sources of inefficiencies and distinguish those related to the kind of fiscal instruments that are used by local governments and those associated with the competition process itself. We were able to characterize situations in which a limited degree of discrimination actually improves social welfare relative to a uniform taxation regime; for this we required no inefficient relocation of firms in the equilibrium. Local governments only had access to distortionary fiscal instruments and policy discrimination allowed them to reduce the tax burden of distortionary taxation.

Our model presents several simplifying assumptions, in particular the mechanism generating benefits from firms location through the reduction of unemployment. In an environment where firms faced an upward-sloping labor supply, firms' migration would induce upward pressures on wages and employment, and the benefits of attracting firms would be similar; however, the mechanism would be more complicated because the incentives to migrate would depend on the configuration of firms across locations. Intuitively, upward pressures on wages because of increased labor demand would reduce individual firm profits as the number of relocating firms increased; thus, incentives to migrate, based on comparing profit differentials across locations, would tend to stabilize. In our approach, incentives to migrate depend solely on policy differentials induced by competition.

In our model there is a fixed number of entrepreneurs. Presumably, in a framework with endogenous determination of the number of firms, the inefficiency derived from the fiscal externality discussed above would still be important. Entrepreneurs also display attachment to locations, and therefore, as long as the entry of new firms is accompanied by similar attachment characteristics, the main conclusions of our model would carry through, in particular with respect to the incentives of local governments toward redistribution.

A more complex theory of firm migration, desirably in a dynamic framework, would allow us to compare short and long run distortions, for example with respect to costs of mobility in the short term and dynamic efficiency of the rate of migration in the long run.

We found that higher mobility of entrepreneurs restrained the incentives of redistribution in favor of resident workers. Allowing for workers' mobility across locations would not eliminate the

fundamental fiscal externality, but it would affect the redistribution incentives of local governments which maximize the welfare of residents. It would be interesting to evaluate alternative taxation systems under different degrees of mobility for workers and entrepreneurs. Presumably, the same qualitative results would hold as long as entrepreneurs were relative more mobile than workers.

Finally, competition among governments may also induce inefficiencies that might not be readily identifiable if the local governments' objective function featured more complex forms of non-benevolent behavior, such as reelection concerns or the possibility of capturing informational rents.

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