

Inter-jurisdiction Subsidy Competition for a New Production Plant: What is the Central Government Optimal Policy?

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Abstract

This paper models inter-jurisdiction competition for foreign direct investment and optimal government policy intervention to protect the national interest. The inter-jurisdiction competition for a multinational has the potential of favouring the multinational and of becoming detrimental for the host country. The central government wants to limit such competition but it cannot tax-discriminate between different types of multinationals. We find that the central government would use tax policy to create asymmetries even when the underlying structure is symmetrical. This offers a novel explanation for the creation of ‘Special Economic Zones’ in many countries, which are well known to be aimed at the attraction of foreign direct investment.

1 Introduction

It is well known that, in order to take advantage of positive externalities, local jurisdictions are willing to offer subsidies with the aim of attracting new production plants to their site. This results in multinational corporations (MNCs) holding simultaneous negotiations with different local jurisdictions’ authorities within a given country to find out which one offers the most profitable conditions for the installation of a new production plant.¹

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¹A similar situation could be found in the new economic blocs like the EU, NAFTA, or Mercosur, where the jurisdictions are the countries that form the blocs.

There is substantial evidence of this kind of subsidy competition. For example, in 1993 the state of Indiana packaged a \$300 million deal to attract a United Airlines maintenance facility expected to create 6,300 jobs, while Kentucky issued \$140 million in potential tax credits to attract 400 steel jobs (Wall Street Journal, July 6, 1993). A survey of regional incentives programs implemented in other OECD countries can be found in Chandler and Trebilcock (1986). There is also evidence that this inter-jurisdictional competition is quite common between municipalities, which enter ‘bidding wars’ using firm-specific agreements to attract plants (King, et al., 1993).

There is also an existing literature that, using different set-ups, models the subsidy competition to attract MNCs to particular locations. For example, Bond and Samuelson (1986) and Doyle and van Wijnbergen (1984) model the fact that the tax competition between countries takes the form of a tax holiday. King and Welling (1992) examine a two-period model in which two regions compete simultaneously in each period. Barros and Cabral (2000) analyze “subsidy games” between countries in order to attract foreign direct investment (FDI) from a third country. This paper does welfare comparisons between the equilibria achieved by competitive subsidy, zero subsidy, and first-best subsidy. Finally, Han and Leach (2006) develop a general equilibrium model in which there is a bidding war among jurisdictions for a continuum of firms. They look at the optimality of the public goods provision as well as at the allocation of firms. They show that in the equilibrium this allocation must be efficient.

In the present paper we are interested in the particular case where the central government of the country intervenes in this competition process in order to protect the national interest. To highlight the importance of this matter we quote the following paragraph taken from the web page of the Ministry of Commerce, Industry and Energy of South Korea.

Lawmakers yesterday criticized the Ministry of Commerce, Industry and Energy for lacking an efficient policy for attracting foreign direct investment in a more systematic manner.

”It’s true that foreign direct investment has been on the rise due to the recently launched series of government policies, but the ministry has failed to coordinate its different divisions and the provincial governments,” Kim Tae-Hong of the ruling Uri Party during the National Assembly’s audit of the ministry.

According to Kim, divisions under the Commerce Ministry seem to be competing for foreign direct investment, while the government is failing to join hands with provincial authorities, MOCIE Related News (OCT. - 13 - 2004).

Moreover, according to the UNCTAD 2001 (page 34) recommendations, at the time of promoting FDI

[there is] the need to coordinate policies across various administrative levels within a country. If that is not done, there is a risk

that competition among regions within a country may lead to "fiscal wars" and result in waste as far as the welfare of the country as a whole is concerned ... This challenge is of particular importance in large countries.

Indeed, tax competition among the US states has reached such a level as to provoke calls to limit their fiscal autonomy. According to one commentator:

The accelerating use of state tax incentives to attract and retain businesses provides a vivid case study of the contemporary dangers of too much state autonomy. In recent years, the states have enacted a vast array of tax provisions that are designed to lure businesses to locate their facilities in the state, and interstate "bidding wars" offering tax breaks for major new facilities have become commonplace Location incentives have become a ubiquitous feature of the state tax scene, and businesses have come to expect them as a standard part of their setting decisions.²

The central government intervention in this regional competition process is a well-known fact. Indeed, it is puzzling that central governments frequently favor some locations and not others even when they are similar in terms of, say, level of development and strategic location. They do that by tax/subsidy incentives, regulation, as well as the construction of infrastructure.

In the words of Easson, A. 2001 (page 10)

Many countries around the world provide tax incentives to establish investments in particular locations or regions within the country – from the coastal cities and special economic zones in China to the enterprise zones and renaissance zones of the United Kingdom and the United States.

As it is clear in the previous quotation, this asymmetric treatment usually takes the form of "special economic zones" (SEZs),³ which have been widely used by many countries in order to both attract FDI and promote exports.⁴ The privileges that these SEZs enjoy give them significant competitive advantages relative to other non-favored locations of a particular country.

The best example of this particular asymmetric treatment can be found in China, where at the beginning of the 1980's the central government gave special economic privileges to three cities in Guangdong, one in Fujian, and none in Guangxi (see Litwack and Qian, 1998). In this case the asymmetric treatment

²Enrichy, P.D. (1996) at 380, 384.

³In our paper the term "special economic zones" will refer to a concept that has taken different names in different parts of the world such as Free Trade Zones, Industrial Free Zones, Export Processing Zones, Maquiladoras (Mexico), Special Economic Zones (China) etc. There could be some differences between them, but not substantial ones. According to the ILO database (2003) there are now more than 1000, what they call Export Processing Zones, spread around more than 100 countries and employing more 40 million people.

⁴See ILO: Labour Law and Labour Relations Branch and UNCTAD (2005).

was applied even though there was no apparent difference between the three regions in terms of development or strategic location.

Among the wide variety of privileges enjoyed by firms located in SEZs are: reduction in revenue and/or corporate taxes; tax and duty free importation of merchandise, raw materials, supplies, equipment, machinery and spare parts; reimbursement of central sales tax paid on domestic purchases; tax credit and/or increased rates of depreciation on capital equipment; the provision of permanent resident status for foreign investors; permission or facilitation of employment of foreign nationals; lessening of labour and/or remittance of earnings regulations; preferential interest rates, and the construction of excellent infrastructure by the central government.

SEZs vary considerably in area. On the one hand, Egypt's SEZs, for example, are relatively small (mostly about 400 to 600 hectares). On the other hand, some SEZs in China, Russia, Brazil, India, Kazakhstan, Kyrgyzstan and The Philippines cover much greater areas and in many cases are as large as some countries (see WEPZA Table of Zone Countries).

It is usually the case that SEZs enjoy some autonomy and so in higher or lower degree can be considered as some kind of "jurisdictions" by themselves.⁵ One contributing factor to this autonomy is that SEZs provide access to all sorts of infrastructures⁶ and services required in the MNCs production process, such as: serviced plots, factories, warehouses, transport infrastructure, housing, financial and postal services, telecommunications, power plants, private security services, transport and insurance agencies, as well as recruiting and training agencies. Indeed, some SEZs are organized along the lines of an autonomous province or state and have both legislative and executive functions. An example of the latter are some of the SEZs in China, which occasionally also have their own customs service, tax collection system, and even department of foreign affairs (see Haywood 2000).

Most importantly, it is evident that the autonomy enjoyed by the SEZs gives them a high degree of discretion at the time of setting the price to be paid by, as well as the services to be provided to, the MNCs in order for them to build a production plant in their zone. Indeed, in the cases where autonomy enjoyed by the SEZs is high, like in some Chinese, Russian and Indian ones, they can also set the level of local taxes (subsidies) to be paid by the MNCs.

Thus, two questions arise from the previous evidence: Knowing that a symmetric treatment of similar locations would be desirable in terms of a more even spatial development, why an asymmetric policy is chosen instead? Can such a policy be justified on welfare grounds?

The main purpose of the present paper is to show that, under certain circumstances, an asymmetric tax policy is the best policy that a central government interested in maximizing national welfare may choose. The reason for this is as follows. The advantage of the asymmetric tax treatment of iden-

⁵This is even the case when the SEZs are administrated by private developers. Developer is the usual term used to refer to the administrator of a SEZ, which could be the government (central, regional or municipal) or a private corporation.

⁶In the majority of the cases this infrastructure has been built by the central government.

tical jurisdictions over the symmetric one is that, by eliminating the subsidy competition between them, the former allows ‘aggregate tax’⁷ discrimination between the different types of MNCs when, because of incomplete information or non-verifiability, the central government of the country cannot discriminate in a direct way.

There is already some literature looking at the issue of lessening the adverse effect from inter-jurisdictional competition for MNCs and two approaches have been used. Either a central government intervenes into the inter-jurisdictional competition or the jurisdictions involved coordinate their taxes. Adams and Regibeau (1998) is an example of the first approach. In a context of the ‘tariff-jumping argument for FDI’ and the possibility that the local authorities offer subsidies to attract MNCs, they look at what the optimal import tariff is.

An example of the second approach is the paper by Haufler and Wooton (2001). They analyze the effects of a regionally coordinated corporate income tax in a model with three active countries, one of which is not part of the union,⁸ and a globally mobile firm (MNC). Their model is more general than ours in the fact that when the MNC is attracted to the union it generates externalities not only to the winning country but also, in some degree, to the losing one. For the case where this last externality is substantially low their and our model give an equivalent result. That is, for investments that would take place in the union in the absence of coordination, a coordinated tax increase can raise the share of the "location rents" appropriated by the union. The only, non-substantial, difference is that in our paper this result is obtained by the central government setting taxes on the MNCs in each of the jurisdictions and not by the inter-jurisdictional tax coordination. Moreover, the issue of symmetric versus asymmetric treatment of identical jurisdictions does not arise in their paper.

The structure of the paper is as follows. The basic model is presented in section 2; a simple bargaining framework developed by Bolton and Whinston (1993) is used to model the negotiation between the MNC and the country’s jurisdictions. Section 3 shows the same result in a substantially more general negotiation framework. Section 4 concludes.

2 The basic model

Our goal is to develop a simple framework in order to find out whether the optimal central government policy towards jurisdictions is a symmetric or an asymmetric one. Thus, we propose a two-stage game involving the central government, two jurisdictions (i.e. 1 and 2) and an MNC. In the second stage, the MNC bargains with the two jurisdictions on the level of the lump sum subsidies to be paid by the winning jurisdiction.⁹ For simplicity, we initially assume that

⁷Defined as the addition of the central government tax plus the winning jurisdiction tax.

⁸The union and countries in their paper are respectively equivalent to the country and the jurisdictions in ours.

⁹Bargaining is an appropriate framework to analyze this kind of problem because this is the most common way the MNCs induce different jurisdictions to compete for their production

the MNC makes no gross profit and so it only generates positive externalities to the host jurisdiction. Each jurisdiction maximizes its own payoff, which is equal to the externality produced by the MNC minus the subsidy.

In the first stage, the central government determines the lump sum tax to be imposed ‘on’ the MNC in **each** of the jurisdictions in order to maximize the country’s expected welfare,¹⁰ which is equal to the winning jurisdiction’s payoff plus the central government tax.¹¹

The choice of this particular setting is based on the fact that it is more common to observe jurisdictions, rather than central governments, negotiating with the MNCs. Some evidence of this can be found in Chandler and Trebilcock (1986) and Krause (1998). Furthermore, the central government pre-commitment to taxes is sometimes originated in tax treaties signed well in advance.¹²

All players have complete information. This means that the externality produced by the MNC in each jurisdiction, the taxes imposed by the central government in the first stage of the game, and the payoff that the MNC obtains if it does not invest in the country are common knowledge. For simplicity, the later is normalized to zero.

In what follows we describe how our model works in a simple negotiation framework. In particular, we use a version of the non-cooperative bargaining approach developed by Bolton and Whinston (1993). In our context, this is an alternating-offers framework where the MNC alternates in making offers to the two jurisdictions. When it is the MNC’s turn to make an offer, it can demand either a particular subsidy from one of the jurisdictions or it can make no demand. When it is the jurisdictions’ turn to make an offer, they simultaneously bid the subsidy they are willing to pay. Before identifying the result of this bargaining framework let us make the following two definitions

Definition 1 *The "location rent" in a jurisdiction is defined as the addition of*

plants. Most of the literature uses an auction framework, which is less obviously applicable.

¹⁰We assume here that the jurisdictions cannot pre-commit to subsidies (or taxes) as the central government does it and so they have to bargain with the MNC. The main justification for this assumption is the fact that an MNC would more easily accept a pre-commitment if it is imposed by a third party (in this case the central government) than if it is imposed by the jurisdiction itself. Thus, we could say that the central government is a very good commitment tool for the local jurisdictions. However, we recognize that it could be worth investigating the effects that the introduction of some jurisdictional pre-commitment power has on the model’s results.

¹¹We are assuming that the jurisdictions do not consider the central government tax revenue in their own payoff functions. Obviously, this is not necessarily a realistic assumption if the way the central government expends this tax revenue result in higher benefits for the competing jurisdictions. However, one justification for assuming that can be the existence of a large number of jurisdictions in the country. In this case, each jurisdiction will get negligible benefits from this central government tax revenue. Indeed, the central government can expend this tax revenue in a way that only increases the welfare of the jurisdictions that are not participating in the competition for the MNC.

¹²For simplicity we assume that the central government cannot prevent the jurisdictional subsidies. The main justification for this is that the subsidies can take different forms like infrastructure or other concessions to the MNC, which sometimes are very difficult to be identified as subsidies.

the MNC gross profit and the externality to the jurisdiction which are generated in the case the MNC locates in its site.¹³

Definition 2 *The "after-tax location rent" in a jurisdiction is defined as its location rent minus the central government tax in this jurisdiction.*

Thus, the result of Bolton and Whinston bargaining framework is stated in the following lemma.

Lemma 1 *Agreement is immediate and the MNC's payoff is the maximum between:*

- 1) *half of the after-tax location rent it produces in the winning jurisdiction; and*
- 2) *the value of its outside option, which is the after-tax location rent it produces in the other jurisdiction.*

Proof. See Bolton and Whinston 1993. ■

In other words, the MNC gets half of the winning jurisdiction's after-tax location rent when the outside option is not binding and the value of the outside option when it is binding.

Case A: two identical jurisdictions and one MNC type

The simplest case is when there is only one type of MNC and both jurisdictions are identical. Hence, the externality produced by the MNC is the same in both jurisdictions. Recall that in this section we assume that the MNC gets no gross profit.

On the one hand, in the absence of central government intervention, the competition between jurisdictions induces them to offer a subsidy equal to the entire externality produced by the MNC. Thus, the MNC obtains a benefit equal to the total externality and each jurisdiction gets a payoff of zero. The country's welfare is also zero.

On the other hand, in the presence of central government intervention, it is optimal for it to eliminate one jurisdiction from the competition (by setting a very high tax in this jurisdiction) and to charge the MNC a tax equal to the externality it produces in the other jurisdiction. Then, under this "asymmetric tax policy", the location rent produced by the attraction of the MNC is entirely appropriated by the country. However, the same result can be obtained by a "symmetric tax policy" which consists in charging the same tax in each jurisdiction, which must be equal to the externality produced by the MNC. Thus, the symmetric tax policy is not dominated by the asymmetric one.

¹³However, in the present section we are assuming that the gross profit is equal to zero. The existence of MNC's gross profit will be introduced in section 3.

Case B: two identical jurisdictions and two MNC types

In the previous case there was only one type of MNC. However, it is usually the case that a variety of MNCs are involved in negotiations with the different jurisdictions of a country. Then, industrial, technological, as well as financial characteristics may produce differences in the externalities created by each particular MNC.

To consider this we allow the existence of two types of MNCs (i.e. h or l), which can produce different externalities, but the jurisdictions are still identical. Indeed, we assume that an MNC of type h shows up with probability p and an MNC of type l does it with probability $1-p$. Furthermore, since the taxes are set in advance, the central government cannot ‘tax discriminate’ between the two types of MNCs. This can be justified by two alternative but equally plausible reasons. First, the MNC’s type is only known by the local jurisdictions and the MNCs themselves, while the central government only knows the probability distribution of types, but not its realization. Second, the MNC’s type is non-verifiable. This ultimately means that a tax scheme conditional on types is unfeasible because it cannot be enforced in a court of law. Consequently, the central government can only set taxes conditional on the jurisdiction the MNC builds the new plant, but not on the MNC type.

On the one hand, it is straightforward to see that in the decentralized solution (the one without central government intervention), the inter-jurisdictional competition allows the MNC, whatever its type, to get a subsidy equal to the externality produced. Thus, there is no country’s welfare derived from the new production plant.

On the other hand, when the central government intervention is considered the complexity of the present case needs a clearer specification of what the jurisdictional payoff and the country’s expected welfare are and that requires the following definition. When an MNC of type $i \in (h, l)$ shows up in the second stage of the game, we define a jurisdiction 1 as ‘superior’ if the after-tax location rent in this jurisdiction is higher or equal than the one in jurisdiction 2 (i.e. $e_{i1} - g_1 \geq e_{i2} - g_2$).¹⁴ In addition, if this after-tax location rent is higher or equal than the location rent abroad (i.e., $e_{i1} \geq g_1$), this jurisdiction would be the ‘winner’ of the MNC of type i . Then, in the second stage of the game and by using the Bolton and Whinston (1993) bargaining result stated in lemma 1 we get that the superior jurisdiction’s equilibrium payoff when an MNC of type i shows up is

$$\Pi_{i1}^r = \begin{cases} \min \left[\frac{e_{i1} - g_1}{2}; e_{i1} - g_1 - (e_{i2} - g_2) \right] & \text{if } e_{i1} \geq g_1 \\ 0 & \text{otherwise.} \end{cases} \quad (1)$$

In the first stage the central government’s aim is to maximize the expected country’s welfare. Then, given that the ex-post country’s welfare produced by each particular type of MNC that builds a plant in the country is equal to the

¹⁴Where g_1 is the central government tax in jurisdiction 1. For simplicity we assume that if the previous weak inequality is satisfied with an equal sign, jurisdiction 1 is the superior one.

central government's tax plus the winning jurisdiction's equilibrium payoff, the expected country's welfare is

$$w = \left\{ \begin{array}{l} (g_1 + \min(\frac{e_{h1}-g_1}{2}; e_{h1} - g_1 - (e_{h2} - g_2))) p \text{ if } e_{h1} \geq g_1 \\ 0 \text{ otherwise} \end{array} \right\} \quad (2)$$

$$+ \left\{ \begin{array}{l} (g_1 + \min(\frac{e_{l1}-g_1}{2}; e_{l1} - g_1 - (e_{l2} - g_2))) (1-p) \text{ if } e_{l1} \geq g_1 \\ 0 \text{ otherwise.} \end{array} \right\}$$

Arguably, it is natural to conjecture that, given that both jurisdictions are identical, a central government symmetric tax policy would not be a dominated one. Still, in order to see whether or not this is the case we use the following two numerical examples. In both of them the MNCs of type h and l generate externalities of 40 and 20 respectively and both get zero gross profits.

Example 1 *In this first example we additionally assume that the probability of an MNC of type h showing up is high (say $p = 0.8$), in a way that it pays for the country to get the entire externality from the MNC of type h ; even though this is done at the cost of not attracting the MNC of type l . Thus, it is obvious that the optimal central government tax in each jurisdiction (in the case of the symmetric tax policy), or in the non-eliminated jurisdiction (in the case of the asymmetrical one), is equal to the externality produced by the MNC of type h (40). Now, the MNC of type l does not come to the country under any of the tax policies, but the country appropriates type h MNC's entire externality. Then, both symmetric and asymmetric tax policies are equally optimal for the country.*

However, a different result is obtained in the next example.

Example 2 *In this second example we assume a low enough p (say $p = 0.2$) as to make it optimal for the country to attract both types of MNCs. Let us first obtain the country's welfare under the asymmetric tax policy. In this case, the central government eliminates one jurisdiction from the competition (say jurisdiction 2) and it charges a tax equal to the externality produced by the MNC of type l (20) in the remaining one. When the MNC of type l shows up it has to pay the central government tax of 20 and the bargaining with the winning jurisdiction results in a subsidy of 20. As a consequence, the central government (and the country) appropriates the entire externality produced by an MNC of type l . On the contrary, when an MNC of type h shows up both the jurisdiction 1 and the MNC get half of the after-tax location rent, $\frac{e_{h1}-g_1}{2} = 10$, and so the subsidy is equal to 10. Hence the country's ex-post welfare is 30 ($= g_1 + \frac{e_{h1}-g_1}{2}$) when an MNC of type h shows up and 20 ($= g_1 + \frac{e_{l1}-g_1}{2}$) when an MNC of type l does it.*

Let us now obtain the country's welfare under the symmetric tax policy. In this case, the optimal central government tax in each jurisdiction is equal to the externality produced by an MNC of type l , 20. Then, when the MNC of type l shows up it is straightforward to see that, as in the asymmetric policy, the central government appropriates the entire externality produced. However, in the case that an MNC of type h shows up, the competition between the jurisdictions

results in a subsidy of 20 for the MNC, which is more than the one under the asymmetric policy. Thus, the country's welfare is equal to 20 whichever type of MNC shows up and the symmetric tax policy is dominated by the asymmetric one.

Thus, the following proposition applies.

Proposition 1 *When there are two identical jurisdictions, two types of MNCs that produce different externalities and it is optimal to attract both types of MNC, an asymmetric tax treatment of similar jurisdictions is the only optimal tax policy.*

Proof. See appendix. ■

In order to interpret the previous proposition's result let us define the 'aggregate tax' as the addition of the central government tax plus the winning jurisdiction tax. Then, we can say that the advantage of the asymmetric treatment over the symmetric one is that by eliminating competition it allows 'aggregate tax' discrimination between the two MNC types, which results in a higher country's welfare.

Let us take a closer look at this interpretation with the help of the numerical example 2 and verify the existence of both the 'aggregate tax' discrimination as well as the welfare result. The 'aggregate tax' discrimination is evident because the low type MNC pays zero aggregate tax (a central government tax of 20 and a jurisdictional subsidy of 20) while the high type MNC pays an aggregate tax of -10 (a central government tax of 20 and a jurisdictional subsidy of 30). The importance of the 'aggregate tax' discrimination as a cause for the superiority of the asymmetric policy must be highlighted. For, as we have seen in the numerical example 1, when there is only one type of MNC (and so no place for tax discrimination) the sole elimination of competition does not give any advantage to the asymmetric policy over the symmetric one.

3 A general negotiation framework

The main aim of the present section is to prove that the previous proposition also applies in a more general framework. In particular, we generalize it for the case where: **a)** the MNC not only produces externalities to the winning jurisdiction, but it also gets gross profits for itself; **b)** there is a continuum of MNC types and not just two; **c)** there are n identical jurisdictions; and **d)** a more general negotiation process between the jurisdictions and the MNC is allowed and not just the Bolton and Whinston one.

Given that the addition of MNCs profits makes the model a more general one without increasing its complexity, hereafter we will do so. Then, the location rent that an MNC of type i produces in jurisdiction j , r_{ij} , is equal to the sum of its profit, π_{ij} , and the externality, e_{ij} . However, because we will only consider ex-ante identical jurisdictions we will use r_i , π_i , and e_i respectively. Moreover, we assume now the existence of a continuous atomless distribution of types

producing different location rents, with density function $f(r_i) > 0$ everywhere on the interval $[\underline{r}, \bar{r}]$.

The extension to n jurisdictions does not affect the fact that an MNC can build only one plant. Hence, there will be at most one winning jurisdiction and $n - 1$ losing ones.¹⁵ To further simplify notation, we define the after-tax location rent produced by an MNC of type i in jurisdiction j as $r_{ij}^{at} = r_i - g_j$, where the upper-script 'at' stands for 'after-central-government-tax'. For expositional purposes the central government taxes will be $g_1 \leq g_2 \leq \dots \leq g_n$, which result in the following after-tax location rents: $r_{i1}^{at} \geq r_{i2}^{at} \geq \dots \geq r_{in}^{at}$. Moreover, we adopt the convention that whenever an MNC is indifferent between two or more jurisdictions, and given $r_1 - g_1 \geq 0$, it goes to jurisdiction 1.

Let us now move on to describe the more general negotiation process to be allowed between the jurisdictions and the MNC. Define the payoff of a type i 's MNC located into the country (i.e., $r_i \geq g_1$) as Π_{i1}^m and recall that the MNC gets a payoff of zero by going abroad. Then, this negotiation process' outcome is characterized by the following three properties:

Property 1 (efficiency): The negotiation process' outcome is efficient and the MNC always locates in the jurisdiction in which the after-tax location rent is largest.

The efficiency of the negotiation process' outcome implies that the addition of the MNC payoff, the winning jurisdiction payoff and all the losing jurisdictions payoffs is equal to the winning jurisdiction after-tax location rent, $\Pi_{i1}^m + \Pi_{i1}^r + \sum_{k=2}^n \Pi_{ik}^r = r_i - g_1$.

Property 2 (MNC's bargaining power):

$$0 \leq \Pi_{i1}^m(g_1, g_2, g_3, \dots, g_n) < \Pi_{i1}^m(g_1, g_1, g_3, \dots, g_n) \leq r_{i1}^{at}, \quad (3)$$

$$\forall r_i \geq g_1, g_1 < g_2 \leq g_3 \leq \dots \leq g_n.$$

First, the first weak inequality (\leq) in expression 3 implies that, given that $r_i \geq g_1$, the negotiation process is such that the participation constraint for the type i 's MNC is satisfied. Second, the fact that the second weak inequality (\leq) in expression 3 is not an equality makes the negotiation process a more general one. For, it contemplates the possibility that the MNC does not have all the bargaining power, even in the case where all the jurisdictions are identical. Third, the strict inequality outside the bracket ($<$) in expression 3 means that, at the point where the two jurisdictions are identical, the MNC's bargaining power falls with the reduction in the after-tax location rent of at least the losing jurisdiction with 'highest-after-tax location rent', r_{i2}^{at} .

Property 3: $\frac{\partial \Pi_{i1}^m}{\partial g_j} \leq 0$ for $j \neq 1$.

¹⁵It should be noticed that a losing jurisdiction could get a positive payoff. For instance, as it is shown in appendix B, this would be the case if the negotiation process between an MNC and the jurisdictions was the "Shapley Value".

It is clear that these three properties are satisfied by the Bolton and Whinston bargaining procedure as well as the Shapley Value (see appendix B).

Let us now move on to find out whether or not the asymmetric policy dominates the symmetric one. With this aim in mind we use, as in the previous section, a two-stage game involving the central government, the jurisdictions, and an MNC.

Second stage of the game: In the second stage, the MNC negotiates with the jurisdictions on the level of the lump sum subsidies to be paid by the winning jurisdiction (jurisdiction 1). Recall that the negotiation process' outcome, which satisfies properties 1 to 3, is such that the MNC's equilibrium payoff is Π_{i1}^m when it locates into the country and zero otherwise. Then, it is obvious that the subsidy that winning jurisdiction must pay to an MNC of type i is such that the MNC gets this payoff. Thus, this equilibrium subsidy is

$$d_{i1}^m = \begin{cases} \Pi_{i1}^m - (\pi_i - g_1) & \text{if } r_i \geq g_1 \\ 0 & \text{otherwise.} \end{cases} \quad (4)$$

The first line of expression 4 can be interpreted as if the winning jurisdiction takes the full after-tax profit from the MNC, $\pi_i - g_1$, but then it compensates the MNC by giving back Π_{i1}^m . This guarantees that the MNC just gets its equilibrium payoff, Π_{i1}^m . It is obvious that the subsidy in 4 can be a negative one (i.e., a local tax) and this will be often the case.¹⁶

In addition, let us assume that the winning jurisdiction pays a subsidy to each of the losing jurisdictions (lr)¹⁷. The aggregate value of these subsidies is

$$d_1^{lr} = \begin{cases} \sum_{k=2}^n \Pi_{ik}^r & \text{if } r_i \geq g_1 \\ 0 & \text{otherwise.} \end{cases} \quad (5)$$

Then, by subtracting the subsidies to be paid to the MNC and to the other jurisdictions from the after-tax location rent in the winning jurisdiction (i.e. $r_i - g_1$) we get this jurisdiction's equilibrium payoff when an MNC of type i shows up,

$$\Pi_{i1}^r = \begin{cases} r_i - g_1 - \Pi_{i1}^m - \sum_{k=2}^n \Pi_{ik}^r & \text{if } r_i \geq g_1 \\ 0 & \text{otherwise.} \end{cases} \quad (6)$$

First stage of the game: We have already determined all the important analytical expressions of the second stage of the game. In the first stage, the central government determines the lump sum taxes to be imposed **'on'** the MNC in **each** of the jurisdictions in order to maximize the country's expected welfare.

¹⁶As an example, think of the case where there is no outside option, no central government tax, and no externality (the surplus is just equal to the MNC's gross profit). Then, for the jurisdiction to get half of this surplus, it has to set a tax on the MNC.

¹⁷As we have mentioned in footnote 15 under some negotiation processes, such as the "Shapley Value", the losing jurisdictions get a positive payoff. It does not make any difference whether the MNC or the winning jurisdiction makes these payoffs and so we are assuming that they are done by the latter.

Knowing that the ex-post country's welfare produced by each particular type of MNC that builds a plant in the country is equal to the central government tax paid by the MNC in the winning jurisdiction plus the equilibrium payoffs in all the jurisdictions, the expected country's welfare is¹⁸

$$w = \int_{g_1}^{\bar{r}} (r_i - \Pi_{i1}^m) f(r_i) dr_i. \quad (7)$$

Then, the following proposition applies.

Proposition 2 *When **a**) there are n identical jurisdictions, **b**) there is a continuous atomless distribution of MNC types producing different location rents with density function $f(r_i) > 0$ everywhere on the interval $[\underline{r}, \bar{r}]$, and **c**) the outcome of the negotiation process between the jurisdictions and the MNC satisfies properties 1 to 3, then the lowest central government tax, g_1 , must be strictly less than the ones set in any other jurisdiction, if the central government's policy is optimal.*

Proof. We already mentioned that the distribution function $f(r_i)$ is continuous and has no atom at the top. Then, from properties 1 to 3 and using 7 we can be certain that the central government's optimum can always be achieved by a policy for which $g_2, g_3, \dots, g_n \geq \bar{r}$ and $g_1 < \bar{r}$. ■

Using 7, we obtain that the optimal tax in jurisdiction 1 under the asymmetric policy, g_1^* , is the result of the following maximization problem

$$w^* = \max_{g_1} \int_{g_1}^{\bar{r}} (r_i - \Pi_{i1}^m) f(r_i) dr_i. \quad (8)$$

As we already mentioned after proposition 1, the advantage of the asymmetric treatment over the symmetric one is that the former allows 'aggregate tax' discrimination between the different types of MNCs, while the symmetric one does not. The same interpretation applies in this more general case.

Contrast the previous result with a situation where the central government can tax-discriminate between the different MNC types. It is evident that in this last case, setting a different tax for each type, $g_i = r_i$, but identical in all jurisdictions (i.e., a symmetric tax policy), would allow the central government (and the country) to appropriate the entire location rent whichever is the MNC type. Thus, a symmetric tax policy would be as optimal as an asymmetric one.

Let us now show that the central government optimal tax in the winning jurisdiction must be a positive one. It is obvious in 7 that an increase of g_1 above zero would prevent some types of MNCs from coming to the country, and so negatively affect the country's welfare. However, it is also clear that, for all $r_i \geq g_1$ and given properties 1 and 3, the country's welfare produced by a type i MNC is increasing in g_1 . Thus, the central government optimal tax in the winning jurisdiction is a positive one, $g_1^* > 0$.

¹⁸Clearly, any optimal central government policy would set $g_1 \geq \underline{r}$.

However, at first glance all the privileges that the central governments give to MNCs in particular locations, which have been mentioned in the introduction, seem to be subsidies and not taxes as our model predicts. For instance, the "reduction in revenue and/or corporate taxes" and "tax credit and/or increased rates of depreciation on capital equipment". It is apparent that the particular form taken by these privileges is largely the result of the central government's willingness to charge higher tax rates to the less mobile local firms and lower ones to the more "foot loose" MNCs. We should bear in mind, though, that the reduction in some of the duties is not equivalent to their entire elimination. That is, any MNC coming to the country would still have to pay these reduced central government taxes as well as other taxes and duties which are not reduced. Hence, our prediction that the central government optimal tax on MNCs is positive is consistent with what it is observed.

A final point is the fact that this section's model seems to predict that the central government of a country should only favor one jurisdiction. However, recall that in the introduction we have mentioned that it is not uncommon that countries favor more than one jurisdiction (i.e. they create more than one SEZ). This stylized fact can be captured if we look at our model as a simplified version considering only one industry, which can be straightforwardly extended to account for more than one.

Without going into great detail, assume that there are only two identical jurisdictions $j \in (1, 2)$ and two industries $\iota \in (a, b)$. Moreover, for each of the industries there is the same continuous atomless distribution of MNC types producing location rents with density function $f(r_i) > 0$ everywhere on the interval $[\underline{r}, \bar{r}]$. As before we assume that the central government cannot tax discriminate between different types, in this case within each industry. Then, the central government will be setting taxes which vary both between jurisdictions and industries. That is, $g_{i,j}$ will be the central government tax to be paid by an MNC belonging to industry ι when locating in jurisdiction j – all the other assumptions of this section's model apply.

This last setting is exactly the same as the one described at the beginning of this section, but with two industries instead of one. Similarly to what was the case then, the optimal tax policy for the central government is clearly an asymmetric one, where one of the jurisdictions is eliminated from the competition, in this case for the attraction of an MNC of a particular industry. Likewise, the other jurisdiction is eliminated from the competition for an MNC belonging to the other industry. For instance, an asymmetric tax policy creating two hubs, specializing in different industries, would be one where the central government sets high enough taxes g_{a1} and g_{b2} such that jurisdiction 1 (2) does not become a viable outside option for an MNC belonging to industry a (b). Simultaneously it should set the optimal level of taxes, g_{a1} and g_{b2} , for which jurisdiction 1 (2) is the winner of an MNC belonging to industry a (b).

It is clear that the previous bidirectional asymmetric tax policy would allow a country to create two SEZs which are specialized in different industries. It is also clear that this outcome can be enhanced by the additional provision of different types of infrastructure and/or regulation in the two jurisdictions.

For instance, by providing infrastructure and/or regulation, which boosts the productivity of industry a (b) in jurisdiction 2 (1). Finally, we recognize that it is not uncommon for different jurisdictions to already possess relative innate advantages in particular industries. However, even in this case a bidirectional asymmetric tax policy would both allow each jurisdiction to exploit its relative advantage as well as to reduce competition from the other jurisdiction.

4 Conclusion

It is well known that the creation of location rents to the host site induces the local jurisdictions to compete in subsidies to attract MNCs' production plants. This competition favors the MNCs and reduces the winning jurisdiction's payoff and consequently the expected country's welfare.

It is natural to think that the reduction in the country's welfare gives space for the central government's involvement. Indeed, one interesting stylized fact is that central governments not only intervene in this competition process but also give special benefits in selected jurisdictions, which make their sites more attractive for the location of MNCs' production plants. Knowing that a symmetric treatment of similar locations would be desirable in terms of a more even spatial development it may seem puzzling that an asymmetric policy is chosen instead.

To explain this stylized fact, we have developed a simple model where an MNC bargains with local jurisdictions to decide the location of its new production plant and the central government intervenes by setting taxes on the MNC conditional on the jurisdiction it chooses. Moreover, our model shows that the fact that the asymmetric policy dominates the symmetric one is a quite general result because it applies for any negotiation procedure - between the MNC and the jurisdictions - satisfying three very plausible properties.

The advantage of the asymmetric treatment over the symmetric one in our model is that, by reducing the subsidy competition between jurisdictions, the former allows 'aggregate tax' discrimination between the different types of MNCs when, because of lack of information or verifiability, the central government of the country cannot discriminate in a direct way.

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Appendix A

The proof is as follows: a symmetric tax policy consists in setting the same tax in both jurisdictions: either $g = e_l$ (which from expression 2 gives an ex-

pected country's welfare $w = e_l$) or $g = e_h$ (yielding $w = pe_h$).¹⁹ From a welfare comparison it is obvious that among the two asymmetric policies the first one is optimal when $p \leq \frac{e_l}{e_h}$ while the second one is optimal when $p \geq \frac{e_l}{e_h}$.

There are two non-dominated asymmetric policies. In both cases the tax in one of the jurisdictions, say jurisdiction 2, is $g > e_h$ and the tax in jurisdiction 1 is either $g = e_l$ (yielding $w = e_l + p\frac{e_h - e_l}{2}$) or $g = e_h$ (yielding $w = pe_h$).²⁰ From a welfare comparison it is clear that among the two asymmetric policies the first one is optimal if $p \leq \frac{2}{1 + \frac{e_h}{e_l}}$ while the second one is optimal when $p \geq \frac{2}{1 + \frac{e_h}{e_l}}$.

Putting the above preliminary results together and noting that $\frac{2}{1 + \frac{e_h}{e_l}} > \frac{e_l}{e_h}$ one can conclude that the optimal asymmetric tax policy generates a higher expected country's welfare than the optimal symmetric one when $p < \frac{2}{1 + \frac{e_h}{e_l}}$ (i.e., when to attract both types of MNC is the optimal asymmetric policy) and that the two are equivalent when $p \geq \frac{2}{1 + \frac{e_h}{e_l}}$ (i.e., when to only attract the type h 's MNC is the optimal policy under both the symmetric and asymmetric tax policies).

Appendix B: The Shapley Value

In this appendix we show that another bargaining solution satisfying properties 1 and 2 is the well known concept of Shapley Value.

Definition 3 *The Shapley Value of a player is defined as her expected contribution to all the possible (and equally likely) coalitions she can join.*

To calculate the Shapley Value for our game let us consider the simplest case and assume one type of MNC, no central government, and only two jurisdictions with location rents r_1 and r_2 for jurisdictions 1 and 2 respectively, where $r_1 > r_2$. Hence, the location rents produced by each of the possible coalitions are: $r(\{1\}) = r(\{2\}) = r(\{MNC\}) = 0$, $r(\{1, MNC\}) = r_1$, $r(\{2, MNC\}) = r_2$, $r(\{1, 2\}) = 0$, and $r(\{1, 2, MNC\}) = r_1$.

In the last three columns of table 1 we show each player's payoff in each of the coalitions. Then, using definition 3 the shapley value for each player is calculated at the bottom of each column.

¹⁹Setting $e_b < g < e_a$ is always a dominated strategy.

²⁰Again, setting $e_b < g < e_a$ in jurisdiction 2 is always a dominated strategy.

Table 1
The Shapley Value

Coalition order	Players' payoffs in each coalition		
	jurisdiction 1	jurisdiction 2	MNC
$\{1, 2, MNC\}$	0	0	r_1
$\{1, MNC, 2\}$	0	0	r_1
$\{2, 1, MNC\}$	0	0	r_1
$\{2, MNC, 1\}$	$r_1 - r_2$	0	r_2
$\{MNC, 1, 2\}$	r_1	0	0
$\{MNC, 2, 1\}$	$r_1 - r_2$	r_2	0
Shapley Value	$\frac{1}{6}(3r_1 - 2r_2)$	$\frac{1}{6}(r_2)$	$\frac{1}{6}(3r_1 - r_2)$

In table 1 it is clear that if the MNC's payoff is given by its Shapley Value, $\frac{1}{6}(3r_1 + r_2)$, it is an increasing function of the location rent it generates in the inferior jurisdiction 2 and it is always lower than r_1 . Then, we can be certain that property 2 is satisfied. Moreover, given that the addition of the Shapley Values obtained by all the players is equal to the location rent produced by the grand coalition, the Shapley Value is an efficient mechanism and so property 1 is satisfied as well.

Thus, we have shown that, for the case of two jurisdictions, the Shapley Value also satisfies the two properties. The extension to the case where there are more than two jurisdictions is straightforward.

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