State Tax Competition for Foreign Direct Investment:

A Winnable War?

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Abstract: When a multinational firm invests in a country, potential host states compete for the firm by offering firm-specific tax reductions. Critics blast such incentives as a prisoner's dilemma that transfers rents to the firm without affecting the investment decision. In fact, these incentives are tied to the firm's use of domestic inputs indicating that incentives affect output decisions. If there exist positive interstate spillovers, a federal subsidy is necessary to reach the national optimum without tax competition. Competition reduces state taxes and thus the need for federal subsidies. Also, under competition, the firm locates in the nation's preferred location. Therefore, tax competition offers two means of increasing national welfare, indicating that it is not a simple prisoner's dilemma.

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1. Introduction

When a multinational enterprise (MNE) undertakes foreign direct investment (FDI), it does so through a two stage process. First, the MNE researches several possible locations and narrows its focus to a handful of potential sites. Then these potential locations bid against one another by offering firm-specific tax reductions and other incentives to the firm to ensure that they become the host. This competition takes place between countries as well as between locations within a federation (such as between U.S. states). As shown in Table 1, incentives offered by states are both large and common. One example is the package Kentucky offered to the Toyota Motor Corporation in 1985. The state offered free land, $47 million in new roads, and $65 million in employee training programs to ensure that it hosted the new plant (Jackson, 1987). The use of such incentives has increased dramatically. According to Chi (1989), by 1988 tax incentives for job creation were used by thirty-five states, a 30 percent increase from 1984. Presently, all states offer some form of incentives (Site Selection, 2000).

This tax competition between locations within a federation is strongly criticized. Since the firm has already announced its intention to invest in the country even without enticement, incentives are said to merely transfer rents to the firm. Of particular concern is the possibility of a prisoner's dilemma in which the host state may offer such large incentives that the net gain from FDI for the host and the nation is zero. In this sense, the host may win the battle by securing the investment, but the country can lose the war since it gains nothing from doing so. This idea was succinctly stated by a protest organizer who complained that Toyota had "played [then Kentucky governor] Martha Layne for a sucker... they're taking our tax dollars to help cut their operating cost" (United Press International, 1986). This concern is supported by the empirical evidence and simulation results of Head, Ries, and Swenson (1995), who find that the subsidies needed to win a firm may offset any gains the state receives. A recent article in *The Economist* (2000) also suggests that tax competition prevents local governments from pursuing their constituents' desired tax policies. In response to such criticisms, a number of authors including Graham

and Krugman (1993) and Glickman and Woodward (1989) have recommended that tax competition between states be banned. These arguments assume, however, that states would set nationally optimal tax rates in the absence of competition. This paper shows that if there exist positive interstate spillovers from FDI, individually optimal state taxes will exceed the nationally optimal tax. This distorts the firm's production and location decisions relative to the national optimum. Since competition lowers state taxes, allowing states to compete can enhance national welfare rather than reduce it.

When setting taxes, it is natural to expect states to consider the impact of policies on their own residents while ignoring the effects on other states' residents. Thus, if FDI creates interstate spillovers, a state's optimal tax differs from the nation's optimal tax. In this paper, I analyze one such spillover: the effect of taxation on the price of the MNE's good. [1,2] If a higher state tax reduces MNE output, this translates into higher prices for all states. In effect, because the firm translates the increased taxes into higher prices, the host state can extract surplus for itself from across the country. This motive is well-known in the literature on optimal taxation of international trade in commodities (see Chapter 12 of Bhagwati, Panagariya, and Srinivasan, 1998). Since the taxing state ignores the impact of its tax on the consumers of other states, this leads it to set a tax which is too high relative to the national optimum. These same high taxes in one state, however, can drive the firm to another. As a result, states compete for the firm by lowering their taxes, indicating that tax competition can help to alleviate the inefficiencies

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[1] Other spillovers between states can certainly be envisioned. A wealth of literature, summarized by Blomström and Kokko (1998), provides evidence for nationwide technological spillovers. DePater and Myers (1994) discuss a model in which taxation in one state affects returns on investment elsewhere. Another possible spillover is when the MNE employs workers who reside in non-host states. Since these benefits accrue to non-host labor, again the host ignores their gains from FDI.

[2] Because taxation affects other states through the MNE's price, there is a link between my results and those for commodity tax competition including Gordon (1983), Mintz and Tulkens (1986), de Crombrugghe and Tulkens (1990), and Kanbur and Keen (1993). These models feature jurisdictions that compete for mobile consumers by taxing a consumption good and predict similar tax competition effects as the WZM models. A key difference between this work and mine is that whereas they have production of the good in each state and competition over mobile consumers, I have production in one state and competition over a mobile producer.

caused by decentralized decision-making. Stated differently, when a state does not face competition for the ability to host the firm, it uses its monopoly power in the "hosting" market to capture rents for itself while creating inefficiencies in the market. Therefore, just as with product markets, introducing competition into the "hosting" market can reduce such welfare losses.

Although this benefit from tax competition has yet to be recognized, other examples of beneficial tax competition exist. In the Leviathan models of Brennan and Buchanan (1980), Edwards and Keen (1996), and Wilson (2000), some part of public funds are "wasted" by the self-serving politicians. Since tax competition leads to lower taxes, waste is reduced and welfare rises. Bond and Samuelson (1986) find that tax competition improves welfare when locations have private information about their costs. Jurisdictions can signal this information to the firm by offering tax holidays, leading the firm to choose the most efficient location. Alternatively, Black and Hoyt (1989) model subsidy competition between states for a firm under perfect information. They find that, since subsidies can induce labor migration and lower the average cost of providing a public good, tax competition results in welfare improvements.

Similarly, there is a large literature on how the taxation of mobile capital in one location can affect the welfare other locations (see Wilson, 1999, for an excellent survey). In this literature, pioneered by Wilson (1986) and Zodrow and Mieszkowski (1986) (WZM), locations tax mobile capital in order to provide a public good. By lowering its own tax, a state can attract capital from elsewhere. This creates a negative "fiscal externality" that reduces other states' tax bases. In equilibrium, there is a "race to the bottom" in taxes making all states are worse off due to underprovision of the public good. My analysis differs from the WZM models in four key ways. First, the standard treatment models the government's policy instrument as a profit tax that applies to all firms or a tax on all mobile capital. However, locales rarely alter their income taxes to attract a single firm. Instead, as Table 1 shows, the tax breaks are generally firm-specific reductions in the taxes associated with the firm's domestic inputs. Even those U.S. states that do offer corporate income tax credits almost always link them to employment levels or

employee salaries. [3] Overall, Chi (1989) reports that the three most common incentives were tax

exemptions for inventories, tax exemptions on raw materials used in manufacturing, and subsidies for job

creation. Second, rather than modeling the MNE's location problem as a one in which the firm decides

how to split its activities up across all of the jurisdictions, I consider one in which the MNE chooses a

discrete, single location. This is the framework used by Black and Hoyt (1989), King and Welling

(1992), and King, McAfee, and Welling (1993). Devereux, Lockwood, and Redoano (2001) find that

data from the OECD is consistent with governments competing for discrete firms. Third, the MNE's

profits do not enter national welfare. In the standard models, the MNE calls one of the federation's

members home. This does not, however, mirror the primary criticism of tax subsidies for FDI since an

inbound MNE can repatriate its profits to a location outside the federation. As Glickman and Woodward

(1989) show, the packages offered to foreign MNEs are comparable to those offered to mobile domestic

firms. For example, Tennessee offered General Motors more than $70 million in incentives for the plant

established there in 1990. This amounted to $23,333 per worker, a figure not out of line with those

reported in Table 1. Despite this, incentives offered to foreign MNEs receive far more criticism than

incentives to domestic firms precisely because these incentives accrue to non-U.S. individuals. This is

also precisely the concern of the Kentucky protestor, since it is the impact of the subsidies on the foreign

firm's "bottom line" that provoked such rancor. It is also inherent to the critique of Spencer and Steckler

(2002) who suggest promoting local firms over foreign firms because "they recirculate money in the

community rather than exporting it to far-off locations" (pg. 4B). Finally, my focus is not on public good

provision. Since the incentives in Table 1 are those offered to a single firm and do not affect the taxation

of other firms by any of the states, the case can be made that the fiscal externality from this type of

competition is minimal. Instead, I focus on how tax competition affects the output of the firm. According

to Head, Ries, and Swenson (1999) employment in Japanese MNEs increases by two to four employees

for every worker paid for by a state, providing some evidence of a tax effect on employment of domestic

[3]See Site Selection (2000, pp. 1003-1005) for detailed examples.

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factors. While I do discuss public goods in an extension, I feel that the lessons learned from the WZM models are well-known and therefore focus on what my analysis adds to the debate.

Recently, Haufler and Wooton (1999) have made steps towards this approach. They examine profit tax competition between two nations when there exist barriers to trade. They find that, given transport costs between the nations, both nations offer subsidies to a firm which locates in only one of the two countries. In equilibrium, the firm locates in the larger country due to its larger domestic market. However, they do not consider the aggregate welfare of the two nations, nor do they allow for any production cost differences between the countries. Survey evidence by Glickman and Woodward (1989) shows that labor costs are the dominant factor in location decisions by foreign MNE's in the U.S., with 76 percent of the firms agreeing or strongly agreeing that the cost of labor is an important factor in location decisions. Tax incentives, however, are the least important factor, with only 43 percent of firms indicating that they are important in location decisions. Since production cost differentials appear to dominate tax considerations, they will play a central role in my model of the MNE's location decision.

The remainder of the paper proceeds as follows. The next section lays out the structure of the model. It also presents the solution to the firm's problem and compares the locally and nationally optimal taxes. The following two sections analyze the equilibria without and with state tax competition. Section 5 extends the model in several ways, including public goods, national minimum taxes, tax harmonization, mobile labor, and additional domestic factors. Section 6 concludes.

2. The Model

Consider a country with I states. Each state i has L^i immobile consumers, each of whom is endowed with 1 unit of labor. States are numbered such that $L^1 \$ L^2 \$ ... \$ L^I$, i.e. state I is relatively most abundant in labor. A more general interpretation of L^i is as the state's endowment of those immobile domestic factors used by the MNE including labor, land, and local intermediate inputs. Consumers derive utility from the consumption of two goods, A and B, both of which are private goods. While I can also

include a third, publicly-provided good, with unconstrained head taxes, this does not change the results at all and only adds notation. Therefore, I set aside public goods for now and discuss them in Section 5.4. Preferences are homothetic and identical across all consumers. This preference structure is chosen because it permits me to ignore the distribution of income for both state and national welfare, allowing me to focus on the benefits of tax competition. [4] Good A is produced in each state using a common technology $g(L^i)$, which has a positive but diminishing marginal productivity of labor. This implies that with competitive factor markets, prior to any FDI, the state which is relatively abundant in the MNE's domestic factor also has the lowest marginal opportunity cost for that factor. Note that this is relative abundance, thus with additional factors used in production of A, the state with the most labor need not have the lowest wage. I deal with this alternative in Section 5.3. Good A is then sold competitively on the world market, where it has a constant price normalized to unity. [5] Good B is produced by a monopolistic MNE, which will locate in some state i, using labor hired in the state in which it locates, denoted l^i. [6] The production function for B is $f(l^i)$ which exhibits non-increasing returns to scale. Additional factors imported by the MNE such as foreign capital and technology can be embedded into this production function. These additional factors, however, do not affect the MNE's marginal cost of labor in the host state and therefore have no bearing on the equilibrium. Thus, for simplicity, I omit these additional factors. [7] Good B is sold according to the downward-sloping inverse demand $p(f(l^i))$. For

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[4] With non-homothetic preferences, the federal government may desire to use the lump sum transfers to affect income distributions across and within states. Since this added complication does not alter the intuition for the benefits of tax competition I discuss, I omit it from the present analysis and instead make this expanded case available upon request.

[5] Note that all other prices and incomes are normalized such that they are relative to the price of good A.

[6] As summarized by Caves (1996), a necessary condition for a multinational firm is that it must maintain control over a proprietary asset, removing it from a perfectly competitive market. To simplify the analysis, I momentarily assume away competition in the market for the MNE's good and return to this issue in Section 5.5.

[7] An expanded version of model including these factors is available upon request.

simplicity, I assume that demand in the country is met entirely by domestic production and that there are no exports by the MNE. At the end of Section 5.5, I discuss the implications of introducing imports and additional *B* producers. With no barriers to interstate trade, the price *p* is the national relative price of *B*.

The timing of the model is that the federal government chooses the labor tax rate it applies to the MNE, τ, and a set of lump-sum transfers to each of the states $T = \{T^1, ..., T^I\}$. [8] Following this, each state *i* chooses a firm-specific labor tax rate that is applied to the MNE if it locates in their state. Since these taxes are only paid by the MNE, they are also the differential between the MNE's tax and the tax rates for domestic producers (which are normalized to zero). Under tax competition, states use their labor taxes to bid for the firm. After these taxes are set, the MNE chooses where to locate and how much labor to hire. Since the solution technique is subgame perfection, I begin with the MNE and work backwards.

2.1 The Multinational Firm

The MNE maximizes its global profits through its choice of location and labor. Although the firm considers itself a monopolist in its final good, it takes the cost of labor as given. Per unit labor costs in a particular state are the sum of the wage in state *i* (w^i), the labor tax in state *i* (t^i), and the federal labor tax (τ). The firm's profit if it locates in state *i* is then given by:

$$\pi^i = p(f(l^i))f(l^i) - (w^i + t^i + \tau)l^i - \kappa \tag{1}$$

where κ is the fixed cost of setting up the MNE's local affiliate. This fixed cost is large enough so that it is only profitable to set up one plant. Since the wage rate is determined competitively and the domestic producers' taxes are normalized to zero, in equilibrium $w^i = g_l(L^i - l^i)$. This yields the MNE's equilibrium labor decision (suppressing the arguments of functions):

$$(p_f f + p)f_l = g_l + t^i + \tau \tag{2}$$

The comparative statics for the MNE's labor choice is then:

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[8] One example of a federal tax incentive is the Job Training Partnership Act, which provides federal U.S. funds for job training.

$$\frac{dl^i}{dt^i} = \frac{dl^i}{d\tau} = \frac{1}{g_{ll}}\frac{dl^i}{dL^i} = \left(\left(p_{ff}f + 2p_f\right)f_l^2 + \left(p_f f + p\right)f_{ll} + g_{ll}\right)^{-1} < 0. \tag{3}$$

Note that this implies that increases in either state or federal taxes lead to identical reductions in the

MNE's employment of domestic factors. Finally, depending on the shape of p, due to the fixed cost there

can exist a cost of labor large enough so that the firm does not produce at all.

2.2 States

States choose taxes to maximize the welfare of their citizens. Identical, homothetic preferences

imply that indirect utility is a linear function of income and a declining function of prices. Thus, I can

write the welfare function for state i of $U^i = \gamma(p)Y^i$, where Y^i is the income in state i where $\gamma(p)$ is

decreasing in the price. [9] State i's income is:

$$Y^i = \begin{cases} g(L^i - l^i) + (g_l(L^i - l^i) + t^i)l^i + T^i & \text{if i hosts the MNE} \\ g(L^i) + T^i & \text{otherwise.} \end{cases} \tag{4}$$

Note that the MNE's profits are not included in state income. This is done to reflect the oft-voiced

concern that tax subsidies and profits are simply repatriated to the MNE's home country and do not

benefit the host. If some portion of MNE profits appear in the host state's income, then similar benefits

from tax competition are found, although naturally the details change. [10] Using (4), state i's welfare is:

$$U^i = \begin{cases} \gamma(p(f(k^i,l^i)))\cdot(g(L^i - l^i) + (g_l(L^i - l^i) + t^i)l^i + T^i) & \text{if i hosts the MNE} \\ \gamma(p(f(k^j,l^j)))\cdot(g(L^i) + T^i) & \text{otherwise.} \end{cases} \tag{5}$$

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[9]I could allow additional sources of state income without affecting the tax competition
equilibrium. However, since these add nothing except for notation, I ignore them.

[10] In this case, state and federal incentives to tax the MNE are smaller because higher taxes mean
lower profits. Nevertheless, unless all of the profits enter Y^i, the host state will still tax in a manner
similar to that presented. Additionally, even if profits fully enter Y^i, the host state will still not use its tax
to induce the efficient output of good B since it prefers to extract income from other states through
monopoly pricing. The federal government, however, would use its tax for this purpose. Thus, since in
the absence of federal intervention host taxes are too high, tax competition provides similar benefits to the
presented case.

If the firm locates in state i, for a given federal tax and transfer, the state's optimal tax rate, $t^{i*}(\tau, T^i)$, is such that:

$$\left(\gamma_p Y^i p_f f_l + \gamma\left(t^{i*} - g_{ll}l^i\right)\right)dl^i\Big/_{dt^i} + \gamma\lambda^i = 0. \tag{6}$$

It is important to recognize that $t^{i*}(\tau, T^i)$ may be positive or negative. A large price effect (the first term in equation (6)) or a highly elastic wage rate leads the state to subsidize the MNE's production, thus, depending on the parameterization of the model, the state may lower the MNE's price of labor below the market price. To simplify the following presentation, I discuss the case where $t^{i*}(\tau, T^i)\,\$0$ for all i, however this is purely for exposition and does not affect my results. Note that since welfare depends on the price, if a state does not host the MNE, its welfare is strictly decreasing in the host tax. This is the source of the negative spillovers from state taxation. If, however, output is unaffected by the tax rate, no spillovers exist. The employment effects estimated by Head, Ries, and Swenson (1999) provide some evidence that the derived tax effect on output mirrors that in practice.

2.3 Federal Government

The federal government chooses its tax rate and lump-sum transfers to maximize national welfare. Given the preference structure, the federal government's objective function when the firm locates in state i is $U^{iN} = \gamma(p)Y^N$, where $Y^N = \sum_{i=1}^{I} Y^i$ is national income. The federal government is constrained to a balanced budget, yielding the equilibrium national welfare function:

$$U^{iN} = \gamma(p(f(l^i)))\cdot\left(\sum_{j\neq i}g(L^j) + g(L^i - l^i) + (g_l(L^i - l^i) + t^i + \tau)l^i\right). \tag{7}$$

Under identical, homothetic preferences the distribution of income across states is irrelevant for national welfare excepting how it affects states' taxes. Given that the MNE locates in state i, the nationally optimal total tax burden, t^{iN}, is the one that sets

$$\left(\gamma_p Y^N p_f f_l + \gamma\left(t^{iN} - g_{ll}l^i\right)\right)dl^i\Big/_{d\tau} + \gamma\lambda^i = 0. \tag{8}$$

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As with a state's optimal tax, the nationally optimal tax burden may be negative. Also, since the federal government is indifferent between combinations of the state and federal tax, it is only concerned with the total tax burden. Thus, the government chooses its tax rate such that $\tau + t^i(\tau, T^i)$ is as close to t^{iN} as possible. Note that the federal tax affects non-host states by influencing the equilibrium price.

It is important to recognize the different implications of a labor tax and a profit tax for national welfare. A pure profit tax does not affect the firm's first order condition and would therefore not affect the firm's hiring or output decisions in a given state. The same holds for the lump sum taxes of Black and Hoyt (1989) and King, McAfee, and Welling (1993). A labor tax, however, can affect these choices even if it does not affect the firm's location. This distinction between the effects of a profit tax and a labor tax is critical in determining the implications of tax competition. A reduction in labor taxes is associated with an increase in hiring and output, both of which can be beneficial to the host and the nation. A reduction in a profit tax, however, simply transfers more rents to the firm and reduces national welfare. This distinction highlights the importance of appropriately modeling the policy instruments used to attract investment since the criticisms of tax competition may be on target for profit taxes but not for other tax instruments.

With the model laid out, I now derive the equilibria both without and with state tax competition.

3. No State Tax Competition

In order to judge the welfare implications of tax competition, it is necessary to examine a baseline case. Since both Graham and Krugman (1993) and Glickman and Woodward (1989) suggest banning tax competition, I first consider a situation without competition, that is, in which states assume that they will host the firm with some exogenous probability. Compare this to the competition case below in which this probability is a function of all the state tax rates, giving rise to strategic tax setting. Two alternative baseline cases are a minimum permissible tax imposed by the federal government and tax harmonization

in which all states must set the same tax rate. These alternatives are straightforward once the main results have been derived. Therefore, I defer them to Section 5.1.

Recall that the tax rates are firm specific. As such, a state's tax rate only has welfare effects if it actually hosts the firm. Therefore, each state simply chooses its optimal tax as given by (6). Since each state's tax is independent of its perceived probability of winning, I can consider any set of exogenous perceived probabilities, including those that do not sum to one. In this section, I analyze the firm's location decision and the welfare aspects of state taxation without tax competition.

Lemma 1: *When the federal tax rate and all transfers are zero, the tax rate in any winning state is greater than the nationally optimal state tax.*

Proof: The tax set by the winning state i, is $t^{i*}(0,0)$. Plugging the result from equation (6) into the federal government's first order condition yields:

$$\gamma_p p_f \left(f_k \frac{dk}{dt^i} + f_l \frac{dl^i}{dt^i} \right) \sum_{j \neq i} Y^j < 0.$$

$$(9)$$

Thus without federal intervention, state i's optimal tax rate is greater than the nationally optimal tax burden when the firm locates in state i.

When a single state chooses its tax, it ignores the impact this has on the other states. Since the tax burden is borne by the consumers in all states, without federal intervention the host taxes its labor too heavily from the national perspective. Some federations, such as the European Union, lack an overarching federal tax authority with the power to correct this problem. In other federations, such as the United States, the federal government can take an active role and affect the host state's tax rate. Since the federal government acts as a Stackelberg leader, it chooses τ such that the total tax burden $\tau + t^{i*}(\tau, T^i)$ is as

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close to t^{iN} as possible. If the federal government is unconstrained in its tax, it will always be able to choose a tax rate such that the nationally optimal tax burden is obtained. [11]

Lemma 2: *When the MNE locates in state i without tax competition, for a given set of lump sum transfers*

T, the nationally optimal federal tax rate is $\tau^{i* \, no \, comp} = \frac{-\gamma_p p_f}{\gamma} \sum_{j \neq i} Y^j$.

Proof: This follows from combining equations (6) and (8), such that $\tau^{i* \, no \, comp} = t^{iN} - t^{i*}(\tau^{i* \, no \, comp}, T^i)$.

One trivial method of reaching this national optimum is to set $T^j = -g(L^j)$ for all $j \ldots i$, $T^i = \sum_{j \neq i} T^j$,

and $\tau^{i* \, no \, comp} = 0$. This transfers all income to state i, leading it to choose the nationally optimal tax rate without any need for a federal tax rate. In practice, such a solution would clearly be difficult to implement. Therefore, for the remainder of the paper, I assume that the states' shares of federal tax revenues are constrained, as would occur if the federal government made equal transfers to each consumer. [12] This leaves the federal government with only its tax rate τ to influence state taxes. As long as the non-host states enjoy positive income, Lemma 2 implies that the federal government needs to subsidize the host state's labor if it is to reach the national optimum. Since this amounts to forcing non-host states to subsidize the host's labor, this too may be politically difficult to implement. If the federal government is constrained to a non-negative tax rate and the non-winning states have a positive total income, the national optimum is unattainable. Figure 1 illustrates the results of these two lemmas.

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[11] This is comparable to Walz and Wellisch (1996) who consider competition in expenditures for a mobile, oligopolistic firm. They too find that although competition may be inefficient, its problems can be corrected by allowing the federal government to intervene using the same tool available to the states.

[12] Recall that under identical, homothetic preferences, the distribution of income across states is irrelevant for national welfare.

This says nothing about which state hosts the MNE without competition, which is in general impossible to determine. State *1* is relatively abundant in labor, and thus has the lowest pre-tax cost of labor. This large population also gives it an incentive to keep prices (and taxes) low, however, if the elasticity of wages is small, it may set a tax rate high enough that the firm may prefer to locate elsewhere. A similar ambiguity under tax competition is found in Hwang and Choe (1995). For them, however, it is the income effect on public good provision that leads to this ambiguity rather than movements in wages. Despite these limitations on determining who hosts the MNE without competition, I can determine the nationally optimal firm location.

Lemma 3: *At the nationally optimal tax burden, national welfare is highest when the firm locates in the state which is most abundant in the MNE's domestic factor.*

Proof: Suppose that the firm is located in some state $j \ne 1$ where the total tax burden is t^j. There exists a tax burden t^1 such that the cost of labor is the same in states *1* and *j*, making the firm indifferent between these two locations. This yields the same labor demand *l* and the same price *p* in both states. Comparing national welfare when the firm locates in state *1* with national welfare when it locates in state *j* yields:

$$U^{1N} - U^{jN} = \gamma(p)[g(L^j) - g(L^j - l) - (g(L^1) - g(L^1 - l))].$$

(10)

By the concavity of *g*, $U^{1N} - U^{jN} \ge 0$, with a strict inequality if and only if $L^1 > L^j$. Thus, keeping output the same but shifting production from a high-cost to the low-cost state improves national welfare. Finally, since by definition national welfare is higher at t^{1N} than at this cost-equivalent t^1, moving to the nationally optimal tax rate when the firm locates in state *1* provides an additional improvement in national welfare.

Locating the firm in the lowest-wage state is nationally optimal because the low-cost state also presents the greatest opportunity for the firm to generate surplus, a portion of which can be extracted by

the nation through the labor taxes. As shown in Section 5.3, with additional domestic factors of production, this optimal location will not always be the "largest" or most populous state. Nevertheless, the nationally optimal location is still the one that generates the greatest surplus from investment and thus the greatest opportunity to collect tax revenues. Combining Lemma 3 with the ambiguity over firm location without competition indicates that even if the federal government is unconstrained in its taxation, the non-competitive setting may be sub-optimal since the firm may locate in a high-cost state. Under competition, both of these concerns evaporate.

4. State Tax Competition

States compete in their tax packages by lowering their taxes just enough so that the firm prefers to locate in their state rather than any other, i.e. states engage in Bertrand competition in their labor markets. This is equivalent to endogenizing the perceived probability of state i winning the firm such that this probability is zero if there exists a lower cost location and is one if state i is the lowest cost location. An alternative way of looking at the competition is a second price auction, that is the state that bids the most (i.e. offers the lowest labor cost) wins the firm but only must pay the second highest bid (i.e. can set its labor cost equal to the second-cheapest state). Unlike competition in profit taxes or lump-sum subsidies, competition in taxes on domestic inputs affects the firm's output as well as its equilibrium location. The equilibrium of this bidding war is stated in my first proposition.

Proposition 1: The state which is most abundant in the MNE's domestic factor will host the MNE in the tax competition equilibrium.

Proof: Consider two states i and j where $L^i \gtrless L^j$. By the nature of Bertrand competition, this implies that the cost of labor in each state will be equal:

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$$t^i + g_l(L^i - l^i) + \tau = t^j + g_l(L^j - l^j) + \tau \quad. \tag{11}$$

With equal costs, an equal amount of labor is hired in either location. Thus, $l^i = l^j = l$. Furthermore, p is the same. This implies that the value a state gets from hosting the firm is entirely due to the change in its income, not the price. As is well known in the theory on second price auctions, to find the winner of the auction, one must find the bidder who gains the greatest value from the object. In this context, this is the state whose income rises the most when it hosts the firm and the MNE hires l workers. For state i, this is given by $g(L^i - l) + (g_l(L^i - l) + t^i)l - g(L^i)$ with an analogous difference for j. By the concavity of g:

$$g(L^i) - g(L^j) \le g(L^i - l) - g(L^j - l) \tag{12}$$

which, when combined with (11), implies that:

$$g(L^i - l) + (g_l(L^i - l) + t^i)l - g(L^i) \ge g(L^j - l) + (g_l(L^j - l) + t^j)l - g(L^j), \tag{13}$$

that is, the relatively large state i will win the firm. By induction, state 1, the state with the greatest supply of the MNE's domestic input, will always win the MNE under tax competition. Since state 2 gains the second most from the MNE, it is indifferent between winning and losing, implying that its tax rate is:

$$t^2 = \frac{g(L^2) - g(L^2 - l)}{l} - g_l(L^2 - l) < 0 \tag{14}$$

where l is the demand for labor at this state tax as determined by (2). By (11), this reveals that in equilibrium:

$$\underline{t}^1(\tau, T^1) = \frac{g(L^2) - g(L^2 - l)}{l} - g_l(L^1 - l) \le t^1(\tau, T^1) \tag{15}$$

which, since l depends on the federal tax τ, varies with the federal tax. If, when t^2 is given by (14) state 1 must lower its tax to win the firm, then (15) holds with strict inequality.

This equilibrium is exactly that derived by Black and Hoyt (1989) and King, McAfee, and Welling (1993) in which the state that generates the largest surplus from investment wins the investment.

Here, the state with the largest endowment of the MNE's domestic factor generates the largest increase in surplus when the firm hires its labor because it has the relatively lowest marginal productivity of labor in the *A* sector. Since this state gains the most from the firm, it is willing to offer the most generous incentives, translating into an equilibrium in which the low-cost state undercuts its high-cost competitors. Therefore, regardless of the tax policy chosen by the federal government, the same state hosts the MNE under tax competition. Since this is the state that generates the greatest surplus from the MNE, it is no surprise that this is also the nationally optimal location as discussed in Lemma 3. Although the firm is indifferent between locating in states *1* and *2* in this equilibrium, it is not unreasonable to expect it to locate in the nation's preferred state. As Glickman and Woodward (1989) point out, foreign firms in the U.S. go to great lengths to secure goodwill, so I assume that if the firm is indifferent between locations, it locates in the nation's preferred state. Thus, similar to Bond and Samuelson (1986) but for very different reasons, tax competition results in the efficient firm location. Furthermore, if any other state would desire to bid away the firm (i.e. true tax competition exists), then state *1* must curb its taxation in order to host the MNE. The implications of these changes on national welfare are summarized in my final two propositions.

Proposition 2: *If non-negative federal taxes are permitted, national welfare cannot be lower under tax competition than in its absence.*

Proof: When the firm locates in state *1*, the nationally optimal tax burden is t^{1N} from equation (8). Since $\underline{t}^{1}(\tau,T^{1}) \neq t^{1}(\tau,T^{1})$ for all τ, this leads the federal government to choose

$$\tau^{1*comp} = t^{1N} - \underline{t}^{1}(\tau^{1*comp},T^{1}) \quad \$\tau^{*\,no\,comp} = t^{1N} - t^{1}(\tau^{1*\,no\,comp},T^{1}). \tag{16}$$

As shown in Figure 1, depending on the shape of $\underline{t}^{1}(\tau,T^{1})$, τ^{1*comp} may be positive. Therefore, national welfare is at least as large under competition as it is when state *1* hosts the MNE without competition. Furthermore, by Lemma 3, welfare is at least as large at the nationally optimal tax rate when state *1* hosts

the MNE as when any other state hosts the MNE. Therefore national welfare cannot fall under tax competition.

Thus, the nation cannot be made worse off by tax competition. My final proposition states sufficient conditions for competition to improve national welfare.

Proposition 3: *If any state with $L < L^1$ hosts the MNE without competition, national welfare rises under tax competition. Also, if τ is restricted to non-negative values and $\underline{t}^1(\tau, T^1) < t^1(\tau, T^1)$ for all T^1 and τ for which the MNE produces, then national welfare rises under tax competition. Further, if $\underline{t}^1(0, T^1) \# t^{1N}$ then the nationally optimum can be obtained.*

Proof: If any state other than the lowest-cost one hosts the MNE without competition, tax competition ensures that the firm will locate in the most beneficial place. Following Lemma 3, this improves national welfare.

Now consider cases where the federal government can only set non-negative federal taxes. As discussed above, this indicates that the national optimum is unattainable without competition. When $\underline{t}^1(\tau, T^1) < t^1(\tau, T^1)$ for all T^1 and τ that support positive production, as shown in Figure 1, then the national government will always be able to choose some $\tau \$ 0$ that brings the total tax burden $\tau + \underline{t}^1(\tau, T^1)$ closer to t^{1N} than was obtainable without tax competition. Finally, if $\underline{t}^1(0, T^1) \# t^{1N}$, then there will always exist a $\tau^{**} = t^{1N} - \underline{t}^1(\tau^{**}, T^1) > 0$ which yields the nationally optimal tax burden. Again, if a state with a labor endowment less than that in state *1* host the MNE without competition, then competition provides a second boost to national welfare since the firm will locate in state *1* under competition.

Note that these are sufficient, not necessary conditions. Thus, even in those situations in which

the stringent conditions on $\underline{t}^l(\tau,T^l)$ do not hold, depending on the functional forms and endowments,

welfare improvements or even the national optimum can be found through tax competition. This is

because tax competition reduces the harmful rent-seeking associated with being a monopolist in the

"hosting" market. It is important to recognize the role of the federal tax rate in achieving the optimum. If

the federal tax rate is constrained to zero, forbidding tax competition is inefficient as shown in Lemma 1.

Under tax competition, state l will set a lower tax than it would without competition, however, depending

on the parameters chosen, the equilibrium state tax may be too low from the national perspective. If

$t^l(0,T^l) > \underline{t}^l(0,T^l) \, \$ \, t^{lN}$, then tax competition still improves national welfare when state l hosts the FDI

without competition. If not, then tax competition may reduce national welfare. Additionally, while

Lemma 3 holds only for nationally optimal taxes, there is still a potential gain from ensuring the firm

locates in the low-cost state. Finally, this result does not imply that state l prefers competition to

unconstrained taxation. For a given transfer from the federal government, state l would prefer to

eliminate competition if it hosts the MNE without competition. Thus, it is still possible that the host

state's welfare falls from competition as its host rents are bid away, however since the host gains at the

expense of the other states, the nation overall can benefit.

5. Extensions

In this section I discuss the implications of several alternative assumptions for my results.

5.1 Minimum Taxes and Tax Harmonization

Here, I consider two alternative baselines besides that in which states assume that they win the

firm with an exogenous probability. First, suppose there is a federally imposed minimum tax such that no

state can set its tax rate below this level. This puts a lower bound on the equilibrium tax of the winning

state. If this constraint is non-binding, then this offers no advantages over unrestricted competition. In

particular, if the equilibrium state tax under competition is greater than t^{lN}, a federal subsidy will still be

necessary to achieve the national optimum. If the constraint is binding, this merely reduces the necessary corrective federal tax. Note that if the minimum is set higher than t^{IN}, this will necessitate a federal subsidy.

Alternatively, consider tax harmonization in which all states choose identical tax rates. Here, the low-cost state will host the FDI since pre-tax costs will have the same ordering as post-tax costs. If the states are constrained to choose t^{IN}, then the nationally optimal tax rate is obtainable without federal intervention. However, if federal taxes are unconstrained then harmonization offers no additional benefits. Thus, even with alternative baseline cases, tax competition need not harm the federation.

5.2 Mobile Labor

Although labor is generally immobile in models of tax competition, it is interesting to consider how allowing workers to migrate between states impacts my results. Prior to FDI, all states are identical, each having the same number of workers all of whom receive the same wage. When the firm enters, this increases the wage in the host state. Because of this, workers from non-host states are attracted to the host until the marginal productivity of labor is equalized across states. This implies that the number of workers in the non-host states (L^{lose}) equals the number of workers in the host less the MNE's hiring ($L^{win}-l$). Under this equilibrium symmetry, the equilibrium in tax competition must be such that the host is indifferent between winning the firm and losing. Thus, if state i hosts:

$$g(L^{lose}) + T^i = g(L^{win} - l) + (g_l(L^{win} - l) + t^{win})l + T^i \qquad (17)$$

which implies that the equilibrium state tax is $t^{win} = -g_l(L^{win} - l)$, i.e. the host gains nothing by winning the firm. This also implies that the only labor cost to the firm is the federal tax τ. Therefore, in equilibrium, the federal government will simply set τ equal to the sum of the nationally optimal tax and the wage, yielding comparable results to those above.

5.3 Additional Domestic Factors

One shortcoming of the above model is that it predicts that the most populous state has the lowest wage before investment and will therefore be most successful at attracting foreign firms. The most obvious reason for why even populous states have high wages is the existence of additional factors of production such as land or domestic capital. Therefore, consider a variant in which good *A* is produced in each state using both labor (L^i) and domestic capital (K^i) according to a constant returns to scale production function $g(K^i, L^i)$. As before, in equilibrium, the state who gains the most from a given level of hiring by the MNE will win the firm. Also, taxes will be such that this state sets its costs equal to the cost in the second best state whose tax is derived just as it was in equation (14). Thus, the only issue is ranking the surplus generated by the MNE in the various states. If both domestic capital and labor are used by the MNE, calculation of this depends in a complex on factor intensities of the two industries *A* and *B*, relative factor endowments, and the discrete marginal products of capital and labor. If only labor is hired by the MNE, there exist two situations in which it is straightforward to pin down which state will win. First, if all states have identical capital stocks, then the state with the lowest capital-labor ratio will host the state. This is because it is possible to redefine the labor supply in each state as the effective labor supply, which is a simple reinterpretation of the above model. Second, if all states have identical capital labor ratios, then the state with the largest supply of labor and capital will be the host. This is because, for a given amount of labor hired by the MNE, output falls less in that state than in any other. In any case, the nationally optimal location still hosts the firm under tax competition and tax competition has the same welfare implications as above.

5.4 Public Goods

In many models of tax competition, public good provision is a central focus of the analysis. Typically they find that tax competition is inefficient because the revenue generated from mobile capital is required to provide a public good. As locations compete for continuous levels of investment, taxes are driven down and the public good is underprovided in equilibrium. Since in my model a single location

hosts the firm, this makes the standard modeling of public good provision somewhat awkward. One way around this is to allow states to tax their immobile domestic factors. If this taxation is unconstrained, it is well known that there will be no distortion between public and private good consumption in equilibrium. Therefore, if unrestricted taxation of immobile factors is possible, a model with public goods would reduce to the simple model presented above.

If the taxation of domestic factors is constrained, without federal intervention the public good will by definition be underprovided in the non-host states. Without competition, the host state may suffer underprovision as it seeks to manipulate the firm's hiring decisions. This potential underprovision will be exacerbated by tax competition just as in the standard tax competition models. Since the federal tax does not have the location shifting effect state taxes do, the federal government can mitigate both the price externality and the public good provision problem by taxing the firm and transferring money to the states through the lump sum transfers. If, however, the federal authority does not exist or it is constrained in its taxation, then it will not be able to reach the constrained Pareto frontier. Nevertheless, tax competition will still benefit non-host states because of the lower prices brought about by competition for the firm. In addition, tax competition removes some of the downward pressure on the location-neutral federal tax. Thus, in this case it is no surprise that tax competition has both the positive price effect and the traditional negative underprovision effect, yielding a net ambiguous impact on national welfare. This ambiguity is similar Rauscher's (1995) or Markusen, Morey, and Olewiler's (1995) results, where pollution is the negative effect, and Edwards and Keen (1996), where reduced waste is the positive effect. In any case, since the tax policies I examine are temporary and are only offered to a single firm, one can question the significance of any lasting impact they have on the winning state's government budget. Thus, despite the size of the incentives in Table 1, it is possible to question how important the public good provision problem is for this kind of firm-specific competition.

5.5 Additional Extensions

Finally, I wish to consider three minor variants of the model. First, as in Haufler and Wooton (1999), transport costs between states could be included. If this cost is the same regardless of the destination, this simply increases the likelihood that the firm will locate in the low-cost state without competition since, by virtue of its wealthier market, it now offers an additional cost savings to the firm. This does not affect any of the other results, since state *1* is still the nationally optimal location and, similar to Haufler and Wooton, state *1* will have the greatest desire to host the firm and eliminate transport costs. Second, if transfers are fixed and the federal government chooses its tax at the same time states do, the equilibria with and without competition are the same. Since the federal government is indifferent between federally and locally collected taxes, its Nash best response is to set the federal tax equal to the difference between the host's tax rate and the nationally optimal t^{iN}. Because this is the same optimal federal tax as in the Stackelberg framework, the same equilibria and welfare implications arise. Finally, similar to Walz and Wellisch (1996), I could relax the assumption of a monopolist MNE. Instead, suppose that the demand for the good *B* is met by Cournot competition between the MNE, imports from foreign firms, and immobile domestic firms. In this case, the host state's labor tax will affect the MNE's output as well as domestic output and imports. Since each state ignores the impact of its tax on other states' consumers and firms, in the absence of tax competition, the host state will seek to exploit its market power in the non-competitive "hosting" market, implying that state taxes will again generally differ from the national optimum. Once again, an unrestricted federal government could correct this problem. If, however, a sub-optimal location hosts the firm without competition or the federal tax is constrained, then there are still potential advantages to permitting tax competition.

6. Conclusion

This paper has shown that when FDI benefits states other than its host, this leads to excessive state taxation that can require federal subsidies to correct. Tax competition places additional downward

pressure on state taxation, which can make it easier for the federal government to reach a nationally

optimal tax burden. Competition also ensures that the firm locates in the most beneficial location. This

indicates heretofore unexplored benefits from tax competition. Thus recent criticisms that allowing states

to compete against one another for mobile foreign investment can only hurt the nation need not be true.

In fact, under plausible situations, state tax competition can be welfare improving for the country overall

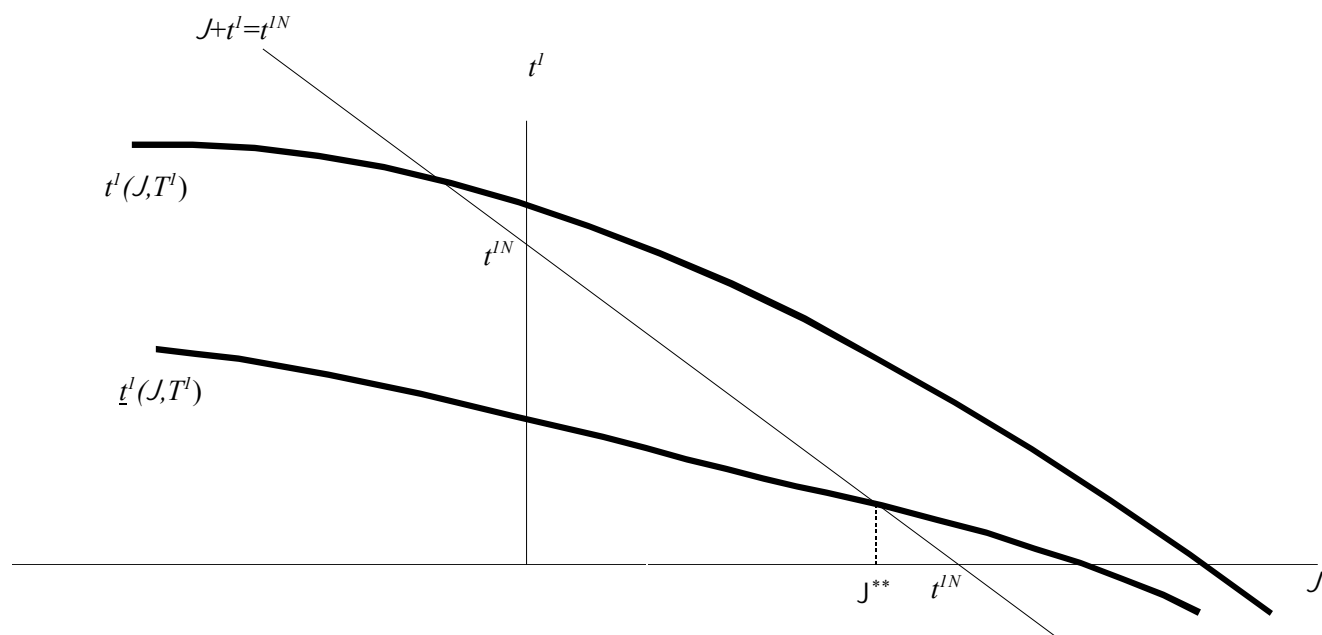even though the winning state may prefer to eliminate competition.

Table 1: Automotive Plant Incentive Packages

Company (Location)	Completion Date	Company's Investment (millions)	Estimated Employment	Incentives	Total Incentives (millions)	Incentive Cost per Job
Motorola[1] (Quebec, Canada)	1999	$300	500	payroll tax credits, low-cost space	$50	$100,000
Toyota[2] (Indiana)	1998	$1200	2300	-	$100	$43,000
Fujitsu[3] (Oregon)	1997	$1300	445	-	$23	$52,000
Mercedes[4] (Alabama)	1993	$250	1400	free land, employee salaries for one year, property tax relief, payroll tax credits, state spending	$300	$160,000
Hyundai[5] (Quebec, Canada)	1989	$215 (Canadian)	1200	-	$110 (Canadian)	$92,000 (Canadian)
Toyota[6] (Kentucky)	1988	$800	3000	Job training; land purchase assistance; site preparation; skills center; highway improvements; educational programs for Japanese employees and families.	$325	$108,333
Diamond-Star[6] (Illinois)	1988	$650	2900	Job training; road, water, sewage installation and improvements; land purchase assistance; property tax abatement.	$118.3	$41,000
Isuzu/Fuji[6] (Indiana)	1988	$500	1700	Job training; road, highway, sewer improvements; land acquisition assistance; $1 million cultural transition fund to aid Japanese workers and families.	$86	$51,000
Mazda[6] (Michigan)	1987	$550	3500	Job training; road, rail, sewer, site improvements; special $500,000 loan; tax abatements.	$52	$15,000
Nissan[6] (Tennessee)	1983	$850	3300	Job training; road, sewer, water, rail improvements; local property tax abatements; company makes payments in lieu of taxes.	$66	$20,000
Honda[6] (Ohio)	1982	$870	4200	Property tax abatement on buildings; previous $16.4 million grant to Honda for adjacent motorcycle factory.	$16.4	$3,904
Volkswagen[6] (Pennsylvania)	1978	$236	2500	Job training; Low-interest loans; rail and highway improvements; local tax abatements; company makes payments in lieu of taxes.	$86	$34,400

Sources: [1] Site Selection (1999) [2] Sword (1998) [3] Scott (1997)   [4] Figlio and Blonigen (2000) [5] The Toronto Star (1989)   [6] Glickman and Woodward (1989)

Figures

Figure 1

The figure shows a graph with vertical axis t^I and horizontal axis J. A line labeled $J+t^I=t^{IN}$ slopes downward from upper left. Two curves are drawn: the upper curve labeled $t^I(J,T^I)$ and the lower curve labeled $\underline{t}^I(J,T^I)$. The vertical axis intersection is marked t^{IN}. On the horizontal axis, points J^{**} and t^{IN} are marked, with a dashed vertical line from J^{**}.

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