The Journal of International Trade & Economic Development, 2013
Vol. 22, No. 3, 351–376, http://dx.doi.org/10.1080/09638199.2011.578751

Developing countries in competition for foreign investment

Goran Vukšić*

Institute of Public Finance, Smičiklasova 21, 10000 Zagreb, Croatia

(*Received 12 February 2010; final version received 1 April 2011*)

This study analyzes the competition for foreign direct investment (FDI) among countries at different stages of development. It is assumed that domestic companies in a more-developed country use more capital in production and that wages in a less-developed country are lower. Countries can compete for FDI by increasing the supply of public inputs in the economy, in addition to (or instead of) offering subsidies or tax reliefs to foreign investors. The results reveal that if governments of competing countries are not allowed to discriminate between domestic and foreign firms, there may be situations in which a less-developed economy will attract FDI depending on the labor cost differential and the responsiveness of foreign investor's and domestic companies' output to changes in the supply of public inputs. If tax discrimination between domestic and foreign firms is permitted, both countries will optimally raise the supply of public inputs, but the more-developed country will always win the foreign investment despite higher labor costs. Thus, governments of less-developed countries may have an incentive to work on an international agreement to disallow tax discrimination.

Keywords: foreign direct investment; economic development; taxation policy; subsidies; public goods

JEL Classifications: F21; O24; H25; H41

1. Introduction

It is a recognized fact that foreign direct investment (FDI) can bring more to host countries than just additional financial capital. FDI inflows are often associated with additional beneficial effects, such as increased employment, enhanced management skills, new technologies, and higher wages. These effects are especially important in the context of economic development and represent a reason why countries, trying to promote economic growth, i.e. increase welfare, engage in competition for FDI. In this context, Blomström and Kokko (2003) speak about the shift of attitude among many of the

*Email: goran.vuksic@ijf.hr

developing countries, which have recognized the potential beneficial effects of FDI.[1]

Competing countries can influence FDI flows up to a certain level by using fiscal policy instruments as strategic tools.[2] For example, governments of competing countries can offer financial subsidies or tax reliefs to foreign investors.[3] However, it has often been stated that financial subsidies and tax reliefs cannot compensate for all the drawbacks of a given competing country. Oman (2000) finds that the competing governments tend to make efforts to modernize the infrastructure, increase local productivity-enhancing human-capital formation, and improve the overall business environment as parts of investment promotion policy. Such policies can be a powerful means of attracting FDI, but also independently of the FDI flows, of promoting economic development, because such measures result in benefits for domestic producers as well. However, empirical findings from Oman (2000) reveal that there might be a trade-off between using public resources for financial and fiscal incentives in competition for FDI and using these resources for other productive purposes aforementioned.

The above observation is at the heart of this article. Competing countries may offer subsidies or tax reliefs to foreign investor and/or may commit to increasing their spending on public inputs, contingent on the foreign investor's decision. While incentives are beneficial only for the foreign company, additional public inputs increase the output of domestic companies as well. Other studies on competition for FDI do not consider the aspect that, apart from tax rates, public inputs may also be important in making a country more attractive to a foreign investor, except in the models in which competing countries are identical (e.g. Dhillon et al. 2007; King et al. 1993; Walz and Wellisch 1996; Zodrow and Mieszkowski 1986). However, considering the aspect of public inputs in an asymmetric setting makes the analysis much more realistic and interesting: since countries are different, their optimal supply of public inputs with and without FDI may also differ, as well as the associated tax rates needed to finance this supply of public inputs. In addition, the profit of the potential foreign investor will not be equally affected by the same marginal increase of public inputs supply in both countries, since a less-developed country may be assumed to start with lower supply of public inputs.

This article presents the model of competition for FDI between asymmetric countries in which governments can use two policy instruments, taxes and public inputs provision, in order to affect foreign investor's location decision. Before discussing the relevant theoretical contributions on asymmetric competition for FDI, some important implications from the models that assume public inputs competition between symmetric countries are shortly reviewed below.

The models of competition for FDI are closely related to (or may be considered a part of) public finance tax competition theory in which regions

or countries mostly compete to attract scarce mobile capital, usually through reductions in tax rates. In these models, indefinitely small capital movements are allowed for, i.e. capital stock is 'continuous' and usually all of it is mobile. The central question tax competition literature addresses is whether and when such competition is either wasteful or welfare-increasing. Zodrow and Mieszkowski (1986) showed in a very influential paper that competition is wasteful if (symmetric) competing countries' only possibility of financing their expenditures is by the taxation of mobile capital. The basic version of their model, in which public goods are consumed by residents, shows that higher taxes increase marginal cost of capital and cause some capital to flow out of the economy. As a consequence of competition, tax rates are set too low, and the public goods are underprovided. They argue that this result extends to the case in which public goods are used as inputs into the production process '... as long as the perceived capital response to changes in property taxation does not fall too drastically as the level of public services increases' (Zodrow and Mieszkowski 1986, 369).[4] However, Noiset (1995) claims that, although higher taxes lead to capital outflows, the tax revenue spent on public inputs may simultaneously work in the opposite direction and attract capital, when public inputs increase its marginal productivity. This may lead to overprovision of public inputs. Similarly, Dhillon et al. (2007) showed that if capital and public inputs are complements, and if the degree of complementarity is sufficiently high, the increase of marginal product of capital (due to higher public inputs supply) is higher than the increase of marginal cost of capital (as a consequence of higher tax rate). This leads to inflow of capital into the economy.

Unlike in the standard public finance models of tax competition, the literature on competition for FDI assumes countries to be competing for lumpy investment, meaning that no indefinite small increments of capital stock are possible. One could think of this as distinguishing between capital and firm mobility.[5] This strain of economic literature reveals additional dimensions of investor's location decisions, other than different tax rates, such as the significance of market size, transportation costs, or production costs. The competing countries engage in 'bidding for firms' in which they also consider the extra benefits (other than an enlargement of the tax base) that a country can receive from foreign investment. Possible subsidies should reflect the value of the investment for the host country. The central question of these models becomes: which country wins the competition and under what conditions? This is especially important in the context of economic development, i.e. competition for FDI between more- and less-developed countries. However, in order to analyze the competition for FDI between countries at different stages of development, some differences between competing countries must be assumed.

Most of the related studies on competition for FDI between asymmetric countries assume that countries differ in size and that there are costs of

trade. This affects the result of the competition for FDI in a way that, other things equal, larger country (i.e. larger market) has an advantage because trade costs create an incentive for a foreign investor to locate in the larger country, in order to maximize profits (Barros and Cabral 2000; Haufler and Wooton 1999). While the country size aspect of a foreign investor's location decision seems sufficiently explored in related studies, some caution is needed in the interpretation of the results in the context of competition between countries at different stages of economic development. Barros and Cabral (2000) used market size as an approximation of centrality, which may be interpreted as assuming that a larger country is a more-developed country. However, Makino et al. (2004) state that access to a market is an important motive for FDI in both groups of countries (developed and less-developed), but while developed countries' markets are usually larger and more competitive, the markets of less-developed countries tend to grow faster and are characterized by relatively weak competition. Bjorvatn and Eckel (2006) analyzed the situation in which competing countries differ in size, and the two markets are not equally competitive. Their results imply that, in some cases, the foreign investor will choose to locate in the smaller but less competitive country. Thus, it cannot be a priori stated that, e.g., highly developed countries' markets are more attractive for each FDI.[6]

In addition to different market size, another assumption that has often been used to create (additional) asymmetry between countries is that there is unemployment, and thus, employment creation due to FDI in only one of the two competing countries. This assumption turns out to be crucial for some results of Barros and Cabral (2000). In their model, the larger country wins the investment if there is no government intervention. Allowing subsidies can change this, since the smaller country gains more from foreign investment because of employment creation, which then justifies higher subsidies that smaller country offers to foreign investor. Haaparanta (1996), on the other hand, assumes that two competing countries differ in market size and wages, but there is unemployment in both countries. He shows that depending on the elasticity of substitution between capital and labor, with subsidies, a high-wage country may be able to attract more foreign capital than a low-wage country if the elasticity of substitution is low. The reason is that, through higher subsidies, high-wage country can compensate for higher costs of foreign investor since additional labor income created by foreign investment in this country is larger due to higher wages.

In the context of competition for FDI between more- and less-developed countries, a glance at the data reveals that the assumption of full employment or smaller unemployment in a more-developed country does not always have to hold, possible examples being some new member states of the EU in eastern Europe, compared to some more-developed old member states.[7] Admittedly, situations in which a more-developed country also has a lower unemployment rate are probably more common, but this

still does not mean that there is no employment creation incurred by FDI in a more-developed country.

Unlike in the most of previous studies, in this article, the asymmetry between competing countries is created by assuming the differences in the availability of domestically owned capital (instead of assuming different market size).[8] Such an assumption reflects indisputable empirical observation, although it may be in contradiction to the predictions of neoclassical models, according to which capital should move to countries where it is scarce. However, such a prediction is not empirically confirmed. The immobility of part of domestic capital from a rich to a poor competing country can be explained by the fact that international investment is usually carried out by large multinational companies and that the capital stock employed in the sector of small enterprises may be internationally immobile.[9] Therefore, this article also provides a new perspective on the issue of why capital does or does not flow to capital-scarce, i.e. less-developed, countries. Also, the model in this article makes similar labor market assumptions to those in Haaparanta (1996): there is unemployment and employment creation due to FDI in both competing countries, and the wages in a less-developed country are lower than in a more-developed country. As discussed above, such assumptions seem to be more realistic for modeling the competition for FDI between countries at different stages of development.

An additional important aspect of this article is that it examines the competition for FDI under the two different tax regimes. In the first one, the so-called non-preferential taxation regime, the governments are not allowed to discriminate between domestic and foreign firms in taxation. This is a common assumption in the standard public finance tax competition models. In the preferential regime, however, governments can give preferential tax treatment to foreign or domestic companies and, for example, tax domestic producers and subsidize a foreign investor in addition to (or instead of) providing (additional) public inputs.[10]

The rest of the article is organized as follows: the outline of the model is given in the next section. Competition for FDI is formally analyzed in the third section, which is divided into two parts. The first part examines the competition for FDI in the non-preferential taxation regime. In the second part, the analysis is repeated for the case in which governments can give preferential tax treatment to foreign or domestic companies. The conclusions are summarized in the last section of the article.

2. The model

This section first describes the structure of competing economies, defines their differences, and determines the optimal policy in the absence of FDI. It then defines the profit function and behavior of a foreign investor, as well as

the benefits for the host economy conditional upon foreign investment actually taking place.

2.1. *Structure of competing economies and the differences*

The world consists of two countries competing for a lumpy foreign investment and a third country, which is the rest of the world, an export market, and the source of the FDI. Markets are assumed to be perfectly integrated with no administrative trade barriers and with tariffs and transportation costs both equal to zero. These assumptions eliminate the size of markets in the competing countries and their proximity to export markets as important determinants in the location decision of the foreign investor. As mentioned earlier, these aspects seem to be sufficiently analyzed in other contributions. The present model also makes some simplifying assumptions regarding the demand for, and prices of, domestic and foreign producers' products. This enables stronger focus on the role of production conditions in potential host economies for location decision of the foreign investor. Competing countries at different stages of economic development have two different instruments for influencing some of the production conditions: provision of public inputs and/or tax reliefs.

There are n identical domestic companies in each competing economy, which produce a homogenous product used as a *numeraire* good. For the simplicity of exposition, n is normalized to 1. The demand function for their product is exogenously given, and the firms are assumed to be price-takers on the world market, which can sell their whole output at some exogenously given world price. Domestic firms in different countries do not compete with the foreign company, which produces a different product.[11] Their technology is described by the production function with three arguments: capital, labor, and public inputs and with the following functional form:

$$F(K_i, L_i, G_i) = g(G_i)\ \min\left[K_i, L_i\right] \tag{1}$$

with $g(0) = 0$, $\partial g/\partial G_i > 0$, $\partial g/\partial G_i|_{G_i=0} = +\infty$ and $\partial^2 g/\partial G_i^2 < 0$. K_i and L_i stand for the capital and labor employed by the single firm, but since n is normalized to 1, they are equal to the overall economy's capital stock and employed labor. G_i denotes the overall supply of public inputs in the economy. Thus, public inputs are used for productive purposes without any rivalry among firms. The subscript $i = H, U$, stands for a highly developed or an underdeveloped country, respectively. The fixed ratio between capital and labor employed in domestically owned firms is assumed in order not to over-complicate the analysis, i.e. to prevent additional supply of public inputs from inducing additional employment in the firm (since capital stock per firm is fixed), although it affects the marginal productivity of labor or capital. Labor is assumed to be in perfectly elastic supply at some

administrative minimum wage, so that capital is the constraint in the production function, i.e. $\min[K_i, L_i] = K_i$.[12] It is further assumed that neither domestically owned capital nor labor is internationally mobile. As in the majority of tax competition models (see e.g. Wilson 1999 or Wilson and Wildasin 2004 for an overview), the only tax instrument considered is capital tax. Thus, government levies capital tax in order to finance the supply of public inputs:

$$K_i T_i = G_i, \text{ with } G_i, T_i \geq 0 \tag{2}$$

where T_i denotes tax rate on domestic capital K_i. Government runs balanced budget and maximizes its residents' real disposable income denoted by W_i.[13] Domestic companies are completely owned by the residents, and their real disposable income is equal to:

$$W_i = F(K_i, L_i, G_i) - K_i T_i = g(G_i)K_i - K_i T_i \tag{3}$$

The optimal policy for the country is to set the capital tax rate at $T_i = \bar{T}_i$ in which income is maximized, i.e. the following condition is fulfilled:

$$(\partial g/\partial G_i)(\partial G_i/\partial T_i) = 1, \text{ or } \partial g/\partial G_i = 1/K_i \tag{4}$$

Since in this simplest case, there is no foreign investment, only domestic capital is being taxed, so that such a policy defines the corresponding maximizing value of $G_i = \bar{G}_i$, the corresponding tax rate $T_i = \bar{T}_i$ and maximized income $W_i = \bar{W}_i$, which will later be referred to as reservation income for the competing country or income without FDI.

As aforementioned, the structure of the competing countries is the same. Difference in the stage of development is introduced by assuming differences in the availability of domestic capital in the competing countries' domestic companies: $K_H > K_U$. It is assumed that labor endowments in the two countries are equal, so that highly developed country has larger capital stock not only in absolute terms but also relative to labor endowment. The assumed properties of domestic firms' production function together with the assumption that $K_H > K_U$ lead to higher employment in a highly developed country: $L_H > L_U$. In addition, wages in an underdeveloped country are assumed to be lower than in a highly developed country, which is an empirically observed fact: $w_H > w_U$. It is easy to verify that the larger capital stock in a highly developed country implies a higher equilibrium supply of public inputs in that country, in the situation without FDI: $\bar{G}_H > \bar{G}_U$. Thus, since the only tax instrument is capital taxation, the highly developed country will have a broader immobile tax base implying a higher optimal supply of public inputs and higher residents' income. Admittedly, the greater capital stock country may be viewed as a larger country in

competition with a smaller one. However, in this interpretation, the difference in size stems from the difference in endowments and has nothing to do with the size of markets as in other related papers.

2.2. *Foreign investor*

The profit of the foreign investor in country i, denoted as Π_i, is given by:

$$\Pi_i = F^m(K^m, L^m, G_i) - L^m w_i - K^m(r + T_i^m) \tag{5}$$

where $F^m(K^m,\ L^m,\ G_i) = h(G_i)\min[K^m,\ L^m] = h(G_i)K^m$ represents the production function of the foreign investor with $h(0) = 0$, $\partial h/\partial G_i > 0$, $\partial h/\partial G_i|_{G_i=0} = +\infty$, and $\partial^2 h/\partial G_i^2 < 0$.

While r represents some exogenous cost of capital for the foreign investor, T_i^m stands for the tax rate on a fixed amount of foreign capital K^m. Thus, government may (be allowed to) discriminate in taxation between domestic and foreign companies. Just like domestic producers, the foreign company is also assumed to be a price-taker on the world market, which can sell the whole output at some exogenously given world price, but it produces a different product.[14] As has been mentioned, there is an infinite supply of labor at the wage rate w_i. L^m denotes the additional employment created by the foreign investor. As in the most of related papers, it is assumed that the foreign investor will always invest in one, and only one, of the two competing countries. It is further assumed that the foreign investor's demand for labor is determined by the characteristics of the investment project and is therefore equal regardless of where it decides to locate (despite the differences in wage rates). This assumption of fixed K^m and L^m is restrictive as compared to other possible approaches. However, this article deals with one specific investment project. In reality, multinational companies usually know exactly what activities they want to undertake in another country and to what extent. Thus, they know how much capital they want (need) to invest, and they know the labor demand for this specific project. Sharing this information with competing countries and inviting them to participate in competition is a necessary first step, because only after having such information can countries decide on their policies.[15] The foreign investor's output is positively related to the supply of public inputs, but in the analysis that follows, it is assumed that $(\partial h/\partial G_i)K^m < 1$ for relevant values of G_i since otherwise the foreign investor would have an incentive to provide public inputs privately.

The foreign investor faces an opportunity cost when investing in one competing country, i.e. the profit that this company could have made by investing in the other country. To avoid unnecessary complications, the situation in which the potential profit of the foreign investor is equal in both countries is neglected: the term $\tilde{\Pi}_i$ is defined as the actual profit the foreign

investor can make elsewhere, plus a small, fixed positive value ε, i.e. the minimum additional profit needed in order for the foreign investor to choose one location over the other. For example, from the perspective of the highly developed country, $\tilde{\Pi}_H = \Pi_U + \varepsilon$. The profit of the foreign investor always depends on the countries' policies. For simplicity, it is assumed that for all relevant policy choices in the analysis that follows, in both competing countries, the profit of the foreign investor is positive. Thus, the foreign investor will choose to invest in the competing economy if $\Pi_i \geq \tilde{\Pi}_i$.

The host economy is assumed to benefit from additional employment income. The residents' income with FDI equals:

$$W_i = F(K_i, L_i, G_i) - K_i T_i + L^m w_i = g(G_i)K_i - K_i T_i + L^m w_i \tag{6}$$

But under the assumption that the foreign investor decides to invest in the competing country, there arises the possibility of taxing or subsidizing the foreign investor. This means that now:

$$K_i T_i + K^m T_i^m = G_i, \text{ with } G_i \geq 0 \tag{7}$$

3. Competition for FDI

Competing countries may offer subsidies or tax reliefs to foreign investor and/or may commit to certain level of spending on public inputs, contingent on the foreign investor's decision. The majority of related models define policy competition for FDI as a situation in which countries may differentiate in taxation between domestic and foreign companies, or may simply give subsidies to the foreign investor. However, as usually assumed in the standard tax competition models, competition is also possible without applying different tax rates for domestic and foreign companies.

3.1. Non-preferential tax regime

In this section, the situation in which a government is not allowed to discriminate in taxation between foreign and domestic producers is analyzed, i.e. there is only one tax rate T_i. First, a government's maximization problem is stated. Then a country's optimal policy with FDI is determined and discussed, neglecting an outside option for the foreign investor (i.e. a possibility that the foreign investor has an alternative location). Afterwards, the impact of an outside option on the optimal policy is examined, and the conditions under which less-developed country can win the investment are discussed. The government's maximization problem is the following:[16]

$$\max_{T_i} W_i = g(G_i)K_i - K_i T_i + L^m w_i \tag{8}$$

such that

$$G_i = (K_i + K^m)T_i \geq 0 \tag{9}$$

$$W_i \geq \bar{W}_i \tag{10}$$

$$\Pi_i \geq \tilde{\Pi}_i \tag{11}$$

First, constraints (10) and (11) are neglected, and their effects are analyzed later. In the situation with a foreign investor, the optimality condition for supply of public inputs is equal to:

$$(\partial g/\partial G_i)(\partial G_i/\partial T_i) = 1, \text{ i.e. } \partial g/\partial G_i = 1/(K_i + K^m) \tag{12}$$

which is not fulfilled at $\bar{G}_i$ any more because of the broader tax base. The optimal supply of public inputs that fulfills the new condition is now higher, $\hat{G}_i > \bar{G}_i$. It should be noted that $\hat{G}_i$ rises with higher K^m and K_i. It also increases, other things equal, with higher responsiveness of domestic output to changes in public inputs supply, i.e. with higher $\partial g/\partial G_i$, for each G_i. Condition (12) defines the optimal tax rate $\hat{T}_i$ and the maximized residents' income $\hat{W}_i$. Comparing residents' income in situations defined by conditions (4) and (12), one obtains:

$$\hat{W}_i - \bar{W}_i = [g(\hat{G}_i)K_i - g(\bar{G}_i)K_i] - (K_i\hat{T}_i - K_i\bar{T}_i) + L^m w_i \tag{13}$$

The expression above is always positive since the term in the first bracket (additional output of domestic companies due to higher supply of public inputs) is always higher than the term in second bracket (possibly higher tax burden). The third term is the additional labor income because of the additional employment created by foreign investment. Therefore, the government will always prefer the situation with FDI in which $T_i = \hat{T}_i$, i.e. $G_i = \hat{G}_i$, to the situation without FDI. Thus, $\hat{W}_i > \bar{W}_i$ and condition (10) is satisfied.

The profit of a foreign investor at $\hat{G}_i$ is denoted with $\hat{\Pi}_i$. However, the impact of constraint (11) has been neglected so far. Unless $\hat{\Pi}_i \geq \tilde{\Pi}_i$, government must do something to increase the investor's potential profit in order to attract the foreign investment. The optimal supply of public inputs from a foreign investor's perspective is obtained by differentiating equation (5) with respect to tax rate and setting the expression equal to zero. This yields the following condition:

$$\partial h/\partial G_i = 1/(K_i + K^m) \tag{14}$$

The optimal supply of public inputs from the foreign investor's perspective is denoted by G_i^* and the corresponding (single) tax rate by

T_i^*. It can be seen from condition (14) that, other things equal, G_i^* rises with higher K_i and K^m. Also, for higher $\partial h/\partial G_i$, i.e. responsiveness of foreign investor's output to changes of public inputs supply, G_i^* increases.

Unless $G_i^* = \widehat{G}_i$, there are ways to increase the potential profit of the foreign investor by deviating from $\widehat{G}_i$. If $G_i^* > \widehat{G}_i$, government can increase the foreign investor's profit by increasing the supply of public inputs beyond $\widehat{G}_i$. The opposite holds good for $G_i^* < \widehat{G}_i$. Once the point G_i^* has been reached, the foreign investor's profit is maximized (investor's profit at G_i^* is denoted by Π_i^*). However, deviating from $\widehat{G}_i$ lowers residents' income. The government is constrained with inequality (10), stating that the residents' income with FDI should never be lower than their income without FDI. Therefore, the foreign investor's profit can only be maximized at Π_i^* if G_i^* is attainable, i.e. if $W_i^* \geq \bar{W}_i$ (where W_i^* denotes residents' income at G_i^*). However, even if G_i^* is not attainable in the above sense, a country may still change the supply of public inputs in order to increase the foreign investor's profit. If $G_i^* > \widehat{G}_i$, it may increase the tax rate and the supply of public inputs up to the point in which $W_i = \bar{W}_i$. This point then defines the maximal attainable supply of public inputs denoted by $G_i^{\max}$ and the corresponding profit of the foreign investor $\Pi_i(G_i^{\max})$. The analogous situation applies to the case in which $G_i^* < \widehat{G}_i$, leading to a minimal attainable amount of public inputs $G_i^{\min}$ and the corresponding profit $\Pi_i(G_i^{\min})$.

Formulating the above situation as a non-cooperative game, countries' strategy spaces can be written as (note that tax rates too can be used as strategic variables instead of public inputs):

$$G_i \in [\widehat{G}_i, \min(G_i^{\max}, G_i^*)], \text{ for each } G_i^* > \widehat{G}_i \tag{15}$$

$$G_i \in [\max(G_i^{\min}, G_i^*), \widehat{G}_i], \text{ for each } G_i^* < \widehat{G}_i \tag{16}$$

In general, the strategy space for both countries is $G_i \in [0, \infty)$, but as shown in the above discussion, it may be restricted without loss of generality. The maximal profit of the foreign investor is obtained at G_i^*, if the latter is attainable, or at $G_i^{\max}$ or $G_i^{\min}$, depending on the relative size of G_i^* and $\widehat{G}_i$. The best response for the competing countries is to choose public input levels, such that the profit of foreign investor in the country exceeds the profit it can make elsewhere:

$$\text{set } G_U(\Pi_H), \text{ such that } \Pi_U(G_U) = \Pi_H(G_H) + \varepsilon \tag{17}$$

$$\text{set } G_H(\Pi_U), \text{ such that } \Pi_H(G_H) = \Pi_U(G_U) + \varepsilon \tag{18}$$

where ε is a positive and small value. Recall from Section 2.2 that, from the perspective of less-developed country, $\Pi_H(G_H) + \varepsilon$ is actually $\tilde{\Pi}_U$ – the profit the foreign investor must be able to make in this country in order to

choose it over highly developed country – for some level of public inputs in highly developed country equal to G_H. Thus, for some G_H, i.e. corresponding Π_H, government in less-developed country will set G_U at the level at which Π_U exceeds Π_H by ε. The same reasoning applies from the perspective of highly developed country. As noted by Barros and Cabral (2000), this game has the nature of Bertrand competition. Following their approach, the problems of equilibrium existence in asymmetric Bertrand games are ignored.[17] Thus, if there exists G_U in the intervals defined by equations (15) and (16), such that $\Pi_U(G_U) > \Pi_H^*$, then the less-developed country receives the investment. Analogously, if there exists G_H in the intervals defined by equations (15) and (16), such that $\Pi_H(G_H) > \Pi_U^*$, then the foreign investor will choose to locate in the highly developed country. If G_i^* is not attainable, then the underdeveloped country wins, if there exists G_U in the intervals defined by equations (15) and (16), such that $\Pi_U(G_U) > \max[\Pi_H(G_H^{\max}), \Pi_H(G_H^{\min})]$. Similarly, the highly developed country wins, if there exists G_H in the intervals defined by equations (15) and (16), such that $\Pi_H(G_H) > \max[\Pi_U(G_U^{\max}), \Pi_U(G_U^{\min})]$.

In the next step, the situation is described in which G_i^* is attainable for both countries by assumption. The difference between the foreign investor's maximal profits in two countries equals:

$$\Pi_H^* - \Pi_U^* = \left[h(G_H^*)K^m - h(G_U^*)K^m\right] - (T_H^*K^m - T_U^*K^m) - (L^m w_H - L^m w_U) \tag{19}$$

The sign of the above expression then determines for which country constraint (11) is satisfied, i.e. which country wins the investment. As discussed above, it does not mean that this country will actually have to raise the supply of public inputs at G_i^*. It is sufficient that it sets the level of public inputs so that the profit of the foreign investor in that country is higher than in the other country. If the equation (19) is positive, the highly developed country will receive the investment because it will be able to offer such conditions to the foreign investor that investor's profit in highly developed country is always higher than the maximal attainable profit it can make in less-developed country.

Proposition 1

In the non-preferential tax regime, when $W_i^* \geq \bar{W}_i$ holds for both countries, and wages are equal in both countries, the highly developed country will always receive the investment. The less-developed country will receive the investment only if the difference in wages between the two countries is sufficiently high, i.e. if:

$$L^m w_H - L^m w_U > \left[h(G_H^*)K^m - h(G_U^*)K^m\right] - (T_H^*K^m - T_U^*K^m) \tag{20}$$

Proof is in the Appendix.

It should be noted that the left-hand side of inequality (20) (difference in total labor costs of the foreign investor) increases with higher L^m, for some given wage differential. This implies that for given amounts of domestic and foreign capital, less-developed countries have better chances of winning the FDI if the foreign investment project is labor intensive, i.e. if L^m is high relative to K^m. If, on the other hand, labor demand by the foreign investor is relatively small, other location determinants gain in relative significance, and the highly developed country is more likely to attract the foreign investor. This result, although intuitive and simple, was not derived in previous models.

Depending on the relative size of domestic capital stock in the two countries, and on the responsiveness of output functions of the foreign and domestic producers to changes in the supply of public inputs, many different situations are possible regarding the relative size of G_i^*, $\widehat{G}_i$, and $\bar{G}_i$ in the two countries. The role of public inputs in the present model is worth comparing to some models from the public finance tax competition literature. Recall that in the version of the model of tax competition by Zodrow and Mieszkowski (1986) in which public goods are used as inputs into the production process, higher taxes increase marginal cost of capital and cause some capital to flow out of the economy, under the assumption that '... the perceived capital response to changes in property taxation does not fall too drastically as the level of public services increases' (Zodrow and Mieszkowski 1986, 369). An additional important assumption for their results is that the marginal cost of an extra unit of tax-financed public inputs always exceeds the associated increase in output due to increased marginal productivity of capital. However, additional insights from the study by Dhillon et al. (2007) showed that if capital and public inputs are complements, and if the degree of complementarity is sufficiently high, the increase of marginal product of capital (due to higher public inputs supply) is higher than the increase of marginal cost of capital (as a consequence of higher tax rate). In other words, higher tax rates and higher supply of public inputs may induce inflows of capital into the economy.

The present analysis investigates the role of public inputs in a set-up that differentiates between the responsiveness of domestic firms' and foreign investor's output to changes in the supply of public inputs, which then determines the resulting levels of public inputs with FDI. It is not the aim of this study to analyze each of the possible situations regarding the relevant properties of domestic and foreign firms' output functions. The important thing is that whatever the size of the expression on the right-hand side of inequality (20), there may always be a difference in labor costs, which is sufficiently high for the underdeveloped country to obtain the investment. However, given some labor cost differential between countries, considering public inputs as a location determinant makes a difference: it is clear from inequality (20) that the responsiveness of the foreign investor's output

function to changes in the supply of public inputs (which determines G_i^*) is important for the outcome of the competition. The properties of the domestic firms' output function, on the other hand, affect the outcome of competition by determining whether the income with FDI is higher than the reservation income.

The above discussion implies that there should be systematic differences between FDI flowing into developed and less-developed countries. Indeed, this is in line with empirical observations. For example, a study by Makino et al. (2004) shows that FDI to less-developed countries are 'labor seeking', while those to developed countries are 'strategic asset seeking'.[18] The latter includes, e.g. product development and planning or R&D activities in general, which may be considered to depend (at least partly) on public expenditures on schooling, universities, and research. In addition, developed countries are characterized by stronger property rights protection and enforcement mechanisms, which may be considered a public good. This may possibly explain the fact that those multinational companies that invest more in R&D and have stronger technological advantages in general tend to invest more in developed countries.

3.2. *Preferential tax regime*

If the government is allowed to set different tax rates for domestic and foreign companies, its general maximization problem is:

$$\max_{T_i, T_i^m} W_i = g(G_i)K_i - K_i T_i + L^m w_i \tag{21}$$

such that

$$G_i = K_i T_i + K^m T_i^m \tag{22}$$

$$\Pi_i \geq \tilde{\Pi}_i \tag{23}$$

$$W_i \geq \bar{W}_i \tag{24}$$

$$K_i T_i + K^m T_i^m \geq 0 \tag{25}$$

First, it should be reminded that the term $\tilde{\Pi}_i$ is defined as the actual profit the foreign investor can make elsewhere, plus a small, fixed positive value, i.e. the minimum additional profit needed in order for the foreign investor to choose one location over the other. It is easy to see that residents' income is not maximized if $\Pi_i > \tilde{\Pi}_i$. Assuming that this is the case, the government could simply increase the tax rate on foreign capital and decrease the tax rate for domestic firms keeping the budget constraint (22) fulfilled for some fixed supply of public inputs. A simple investigation of the objective function (21) shows that this increases residents' income because it

reduces the tax burden on domestic firms for some given supply of public inputs, so that their output is not affected. Therefore, constraint (23) must be effective.

The above problem can be solved using the Kuhn–Tucker theorem in which the following function is defined:

$$L = g(G_i)K_i - K_iT_i + L^m w_i + \lambda_1(\Pi_i - \tilde{\Pi}_i) + \lambda_2(W_i - \bar{W}_i) + \lambda_3(K_iT_i + K^m T_i^m) \tag{26}$$

The equality constraint (22) is plugged into function (26) and the following first-order conditions are obtained:

$$\partial L/\partial T_i = (\partial g/\partial G_i)K_i^2 - K_i + \lambda_1(\partial h/\partial G_i)K^m K_i + \lambda_2 K_i[(\partial g/\partial G_i)K_i - 1] + \lambda_3 K_i = 0 \tag{27}$$

$$\partial L/\partial T_i^m = (\partial g/\partial G_i)K_iK^m + \lambda_1 K^m[(\partial h/\partial G_i)K^m - 1] + \lambda_2(\partial g/\partial G_i)K_iK^m + \lambda_3 K^m = 0 \tag{28}$$

$$\partial L/\partial \lambda_1 = h(G_i)K^m - K^m(T_i^m + r) - L^m w_i - \tilde{\Pi}_i \geq 0, \lambda_1 \geq 0, \lambda_1 \partial L/\partial \lambda_1 = 0 \tag{29}$$

$$\partial L/\partial \lambda_2 = W_i - \bar{W}_i \geq 0, \lambda_2 \geq 0, \lambda_2 \partial L/\partial \lambda_2 = 0 \tag{30}$$

$$\partial L/\partial \lambda_3 = K_iT_i + K^m T_i^m \geq 0, \lambda_3 \geq 0, \lambda_3 \partial L/\partial \lambda_3 = 0 \tag{31}$$

Solving the above problem leads to following result:

Proposition 2

In competition for FDI with tax discrimination, the optimal supply of public inputs in a situation with FDI is determined by the following condition:

$$(\partial g/\partial G_i)K_i + (\partial h/\partial G_i)K^m = 1 \tag{32}$$

and is always higher than in a regime without FDI.

Proof is in the Appendix.

Proposition 2 is an important result with direct policy implications because it states that in competition for FDI with tax discrimination between domestic and foreign companies, each competing country's optimal bid should consist of higher supply of public inputs. This new optimal supply of public inputs (contingent on investment decision) is uniquely defined and denoted with $\hat{G}_i$. It depends (positively) on the responsiveness of the foreign

and domestic firms' output to changes in the supply of public inputs and on the amount of domestic and foreign capital. However, condition (32) does not determine the individual tax rates, i.e. how the tax burden for financing this supply is divided between domestic and foreign firms. In order to define those, the first-order condition (29) is used, evaluated at $\hat{G}_i$. This yields:

$$\hat{T}_i^m = (h(\hat{G}_i)K^m - K^m r - L^m w_i - \tilde{\Pi}_i)/K^m \tag{33}$$

Thus, if $h(\hat{G}_i)K^m - K^m r - L^m w_i > \tilde{\Pi}_i$, the country can tax away part of the foreign investor's profit in amount equal to $\hat{T}_i^m K^m$ and still win the competition. Otherwise, government must pay a subsidy to the foreign investor in order for constraint (23) to hold with equality, i.e. a subsidy equal to $\left|\hat{T}_i^m K^m\right|$. Therefore, for given $\hat{G}_i$ and $\tilde{\Pi}_i$, $\hat{T}_i^m$ is determined, which in return, because of budget constraint (22), defines $\hat{T}_i = (\hat{G}_i - h(\hat{G}_i)K^m + K^m r + L^m w_i + \tilde{\Pi}_i)/K_i$. Unlike the optimal supply of public inputs, the tax rates depend on the profit the foreign investor can make by investing in another country. The value function of the maximization problem using $\hat{T}_i$, $\hat{T}_i^m$, and $\hat{G}_i$ is then:

$$\hat{W}_i = g(\hat{G}_i)K_i - \hat{G}_i + h(\hat{G}_i)K^m - K^m r - \tilde{\Pi}_i \tag{34}$$

Using the envelope theorem for equation (34) leads to the conclusion that the residents' income is negatively related to changes of the profit that a foreign investor can make elsewhere, i.e. $d\hat{W}_i/d\tilde{\Pi}_i = -1$. Also, from the expressions for $\hat{T}_i^m$ and $\hat{T}_i$, it is possible to derive that $dT_i^m/d\tilde{\Pi}_i = -1/K^m$, $dT_i/d\tilde{\Pi}_i = 1/K_i$, and $dT_i/dT_i^m = -K^m/K_i$.

Thus, at the point defined by $\hat{T}_i$, $\hat{T}_i^m$, and $\hat{G}_i$, residents' income is maximized for some profit of foreign investor such that constraint (23) holds with equality, under the assumption that constraint (24) is satisfied. If in this situation, the profit that the foreign investor can make elsewhere rises, because, e.g. another country lowers the tax rate for foreign capital, then a competing country must do something to increase the foreign investor's profit in order for FDI to actually take place. The expressions $dT_i^m/d\tilde{\Pi}_i = -1/K^m$ and $dT_i/d\tilde{\Pi}_i = 1/K_i$ imply that a country should lower T_i^m and increase T_i keeping the supply of public inputs unchanged at $\hat{G}_i$. Since $d\hat{W}_i/d\tilde{\Pi}_i = -1$, this also reduces the residents' income.

At this point, one can define the best response policies for two countries more formally. Their strategic variables are T_i^m, T_i, and G_i, in which any two of the variables define the third one, according to equation (22) and considering the non-negativity restriction for G_i. The strategy spaces are therefore: $T_i, T_i^m \in R$ and $G_i \in [0, \infty)$, such that equation (22) holds. The best response functions are:

$$\text{set } G_U = \hat{G}_U \text{ and set } T_U^m(\Pi_H) = \hat{T}_U^m \text{ such that } \Pi_U(\hat{G}_U, \hat{T}_U^m) = \Pi_H(G_H, T_H^m) + \varepsilon \tag{35}$$

$$\text{set } G_H = \hat{G}_H \text{ and set } T_H^m(\Pi_U) = \hat{T}_H^m \text{ such that } \Pi_H(\hat{G}_H, \hat{T}_H^m) = \Pi_U(G_U, T_U^m) + \varepsilon \tag{36}$$

where ε is a positive and small value. The best response functions are written in terms of T_i^m and G_i, which automatically define T_i. Similarly to the competition in the non-preferential tax regime, competing countries need to offer conditions to foreign investors (by choosing the appropriate tax rates) such that investor's profit in the country exceeds the profit it can make elsewhere by ε. Again, following Barros and Cabral (2000), the problems of equilibrium existence in asymmetric Bertrand games are ignored.[17] However, a competing country can increase T_i and lower T_i^m only as long as constraint (24) is fulfilled because otherwise the government prefers the situation without FDI. Constraint (24) with $G_i = \hat{G}_i$ may generally, for both countries, be rewritten as:

$$g(\hat{G}_i)K_i - \hat{G}_i + T_i^m K^m + L^m w_i \geq g(\bar{G}_i)K_i - \bar{G}_i \tag{37}$$

Rearrangement yields:

$$-T_i^m K^m \leq \Delta F_i - \Delta G_i + L^m w_i \tag{38}$$

in which $\Delta F_i = F(K_i, L_i, \hat{G}_i) - F(K_i, L_i, \bar{G}_i) = g(\hat{G}_i)K_i - g(\bar{G}_i)K_i$ and $\Delta G_i = \hat{G}_i - \bar{G}_i$. Thus, the maximal subsidy that a government can pay to a foreign investor, or the minimal amount that must be taxed away from a foreign investor in order for constraint (24) to hold, equals the expression on the right-hand side of inequality (38). Substituting this right-hand side expression for $-T_i^m K^m$ in equation (5), the maximal profit that a foreign investor may earn in a competing country can be written as:

$$\Pi_i^{\max} = h(\bar{G}_i)K^m + \Delta F_i{}^m + \Delta F_i - \Delta G_i - K^m r \tag{39}$$

in which $\Delta F_i{}^m = F^m(K^m, L^m, \hat{G}_i) - F^m(K^m, L^m, \bar{G}_i) = h(\hat{G}_i)K^m - h(\bar{G}_i)K^m$. Note that the labor costs do not affect the maximal profit of a foreign investor, since labor costs are equal to the gain from additional employment and thus justify a subsidy of equal size. The foreign investor's decision is determined by the sign of the following expression:

$$\begin{aligned}\Pi_H^{\max} - \Pi_U^{\max} &= h(\bar{G}_H)K^m - h(\bar{G}_U)K^m + \Delta F_H^m - \Delta F_U^m + \Delta F_H - \Delta F_U \\ &\quad - (\Delta G_H - \Delta G_U)\end{aligned} \tag{40}$$

If the expression (40) is positive, the highly developed country will receive the investment because it will be able to offer such conditions to the foreign investor that investor's profit in highly developed country is always

higher than the maximal profit it can make in less-developed country, such that constraint (24) is satisfied in both countries. Otherwise, the foreign investor will locate in less-developed country. This does not mean that the highly developed country will actually have to set the tax rates in a way which enables the foreign investor to maximize profit at $\Pi_H^{\max}$. It is sufficient that it sets the tax rates so that the profit of the foreign investor is higher than in less-developed country.

Proposition 3

In competition for FDI with tax discrimination, the highly developed country will always receive the investment.

Proof is in the Appendix.

Proposition 3 demonstrates that in this simple approach, the more-developed country will always attract the FDI if it can discriminate in taxation between domestic and foreign producers. The reason is that under the preferential tax regime, tax rates depend on the wages giving the highly developed country an opportunity for compensating for the difference in labor costs. This is also the case for the study by Haaparanta (1996) in the part in which he assumes a Leontief-type production function. The fact that this article introduces public inputs as an important variable in competition for FDI does not change anything in the outcome of competition in the case of tax discrimination between domestic and foreign producers.

On the other hand, in the case without tax discrimination, a country may not be able to 'transfer' the whole potential gains to the foreign investor and increase the investor's potential profit, because lowering the tax rate necessarily lowers the supply of public inputs. In other words, even if $W_i^* > \bar{W}_i$, a competing country cannot induce any further increase of a foreign investor's potential profit beyond Π_i^*. This implies that, without tax discrimination, a less-developed country may receive the FDI even if its gains from FDI are smaller than in the highly developed country. If G_i^* is attainable for both countries and the labor cost differential is sufficiently high, so that the underdeveloped country wins, then for a w_H sufficiently large as compared to w_U, the gains from FDI in a highly developed country must exceed those in a less-developed country. Since variables other than w_H remain unaffected, an underdeveloped economy still successfully attracts the foreign investment. In such situations, allowing for tax discrimination would reverse this result, and the highly developed country would then be the location for the FDI. For the same reason, if a country sets the tax rate so that its residents' income is maximized at $\widehat{T}_i$, and if at this point it holds that

$\widehat{\Pi}_i > \tilde{\Pi}_i$, a competing country cannot do anything to tax away the extra profit of the foreign investor equal to $\widehat{\Pi}_i > \tilde{\Pi}_i$ without tax discrimination, because increasing the tax rate also increases the tax burden for domestic firms and reduces income.

3.3. *Discussion of cleared labor markets assumption in competing countries*

In this section, the assumption of an exogenously given administrative minimum wage causing unemployment in competing economies is relaxed. Instead, cleared labor markets are a starting point. It is assumed that the labor supply, denoted by L^s, is identical in both countries and upward-sloping in the relevant segment: $L_U^S = L_H^S$, $\partial L_i^S/\partial w_i > 0$, and $\partial^2 L_i^S/\partial w_i{}^2 \leq 0$. The labor market clearing wage rate is then determined by the labor demand. Because of the Leontief production function, with capital being the limiting factor, the availability of capital defines the labor demand. The assumption of lower capital availability in a less-developed country $K_U < K_H$ implies $L_U < L_H$, which, given that $L_U^S = L_H^S$, leads to $w_U < w_H$.

The wages in the two countries increase due to the foreign investor's labor demand L^m, which is identical in both countries and simply added to

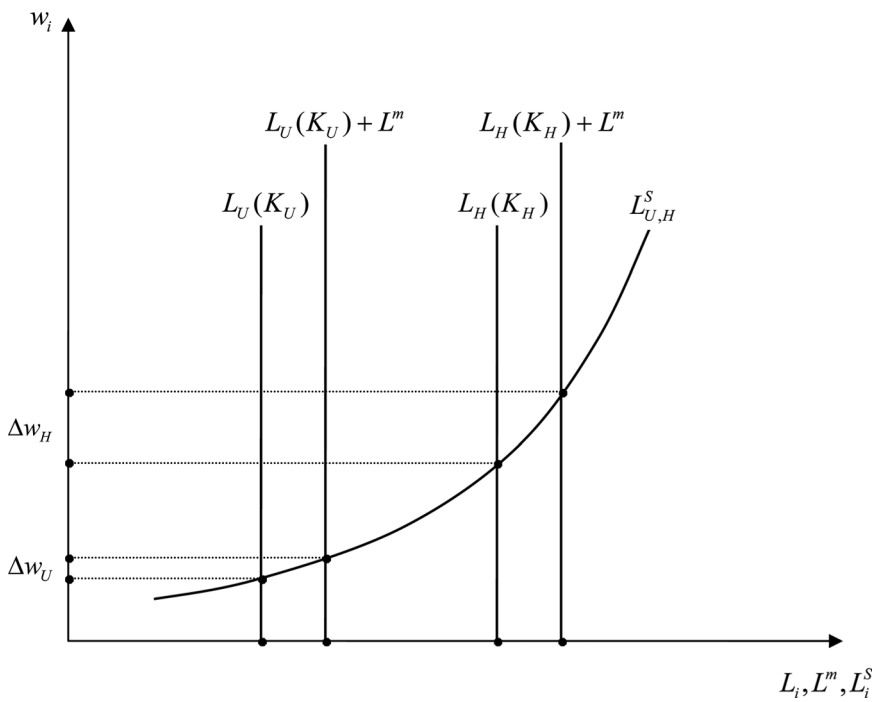

Figure 1. Cleared labor markets.

domestic labor demand L_i (unchanged as compared to the case without foreign investor). This situation is depicted in Figure 1: since $\partial^2 L_i^S/\partial w_i^2 \leq 0$, the corresponding rise in wages in the highly developed country must be at least as strong as in the less-developed country, i.e. $\Delta w_H \geq \Delta w_U$.

The optimal supply of public inputs with and without FDI is unaffected by different assumptions on labor markets. In the case without tax discrimination between domestic and foreign companies, if $\partial^2 L_i^S/\partial w_i^2 < 0$, with attainable G^* for both countries, the left-hand side of the inequality (20) – difference in labor costs – would increase, increasing the chances of the less-developed economy attracting the FDI (when $\partial^2 L_i^S/\partial w_i^2 = 0$, the difference in labor costs does not change).

In the case with tax discrimination between domestic and foreign companies, the results of Proposition 3 remain unchanged, and the highly developed country always gets the FDI. This can be easily seen since the wage rate does not appear in equation (40). This is because the higher labor costs in the highly developed country are equal to higher gains from additional employment due to higher wages in this country, which justifies the sufficiently higher subsidy.

The above discussion assumed that domestic companies are price-takers in the world market and can sell their whole output at an exogenously given world price. Despite the rise in wages, they are still able to sell everything at the world price and make non-negative profit. If this assumption is altered, there may be consequences for the outcome of the competition for FDI. In general, the rise in wages may increase the marginal cost of production for domestic producers above the world price of their product. As a consequence, some domestic companies would have to exit the market, which would reduce the aggregate labor demand and wages to the level at which remaining firms make non-negative profit. It is beyond this model to formally study such cases. Intuitively, one could expect that if this (partial) negative effect was (sufficiently) stronger in a more-developed country, this might reverse the result of the competition in the case with tax discrimination. Also, the chances of the less-developed country winning the FDI in the non-preferential tax regime might increase.

4. Conclusions

The aim of this article was to analyze the competition for FDI between countries at different stages of development. The model assumes different capital availability in local firms of two countries, leading to different optimal supplies of public inputs. There is an employment creation effect in both competing countries as a consequence of FDI, and the empirically observed fact that wages are lower in less-developed countries is also built in the model. However, the main distinctive feature of this article is that the model introduces public inputs as an important determinant of the location

decision of a foreign investor in an asymmetric setting. Competing countries may offer subsidies or tax reliefs to foreign investor and/or may commit to increasing their spending on public inputs, contingent on the foreign investor's decision. While incentives are beneficial only for the foreign company, additional public inputs increase the output of domestic companies as well.

The results reveal that if governments of competing countries are not allowed to discriminate between domestic and foreign firms, there may be situations in which a less-developed economy attracts the FDI, depending on the labor cost differential and on the responsiveness of foreign and domestic companies to changes in the supply of public inputs. A less-developed country has better chances of obtaining the FDI if the investment project is more labor intensive. It can win the investment even in cases when its gains from FDI are smaller than in a highly developed country. If tax discrimination between domestic and foreign firms is permitted, the more-developed country will always attract the foreign investment. The reason is that under the preferential tax regime, tax rates depend on the wages giving the highly developed country an opportunity for compensating for the difference in labor costs. In such a regime, each country's optimal bid for a foreign investor necessarily involves increasing the supply of public inputs. On the other hand, if discrimination is not possible, the optimal supply of public inputs from host countries' perspectives is always higher with FDI. However, this must not be profit-maximizing for the foreign investor, and if countries have to compete for FDI, they may deviate from their optimal supply of public inputs. These conclusions justify and indeed necessitate the inclusion of public inputs as location determinant.

The results of this article imply that governments of less-developed countries may have an incentive to work on an international agreement to disallow tax discrimination, i.e. subsidies, unless they are convinced that there are some beneficial effects from FDI in less-developed countries, which are sufficiently stronger than in highly developed countries, and thus, justify sufficiently higher subsidies (as in some related models). Without asserting any conclusions about the efficiency and overall welfare effects of banning tax discrimination, one should recognize that such a measure is not identical to abolishing tax competition for FDI in general. Even if governments are not allowed to discriminate, they may still deviate from their optimal taxation and supply of public inputs in order to attract FDI as long as the residents' income with FDI exceeds their income without foreign investment.

Final remarks concern the place of the theory on competition for FDI within the broader literature. These models show that public policy matters for the location decision of investors, which is also confirmed empirically. It is, therefore, a large task to include taxation and public-spending aspects in the broader range of models of international trade literature dealing with FDI (see e.g. Helpman 2006, or Markusen 2002). In addition, since this model considers the competition between countries at different levels of

development, it may be considered a contribution to the general discussion as to why capital does not flow to poor countries. The body of literature dealing with this question is large, the most prominent contribution probably being that of Lucas (1990), but again, these studies have mostly neglected the role of fiscal policy, which could have 'kept' more capital in the developed world by using subsidies than the neoclassical theory would predict if fiscal policy were neglected.

Acknowledgements

The author is grateful to Fritz Breuss, Gerhard Clemenz and two anonymous referees for helpful comments.

Notes

1. In the period between 1991 and 2000, around 95% of the 1185 changes of national legislation related to FDI were favorable to foreign investors (UNCTAD 2001).
2. Haaparanta (1996) and Bjorvatn and Eckel (2006) describe some specific cases of countries using incentives in competition for FDI. Extensive overviews are found in Oman (2000) and UNCTAD (1996).
3. Throughout the article, the terms tax relief and subsidies will be used interchangeably. The usual distinction would require tax relief to denote a situation in which a foreign investor pays taxes at lower, but positive, tax rate than domestic producers, while subsidies to foreign investor would mean a negative tax rate for a foreign investor. It is not crucial for the purpose of this analysis to make such a distinction.
4. An important assumption in this version of their model is that the marginal cost of an extra unit of tax-financed public inputs always exceeds the associated increase in output due to increased marginal productivity of capital.
5. Admittedly, this distinction is not always recognized in the literature (e.g. Haaparanta [1996] uses the term FDI to describe perfectly divisible investment).
6. One should also bear in mind that trade costs and, thus, market access do not depend only on country size and geographical position. Other important determinants include international trade liberalization and the availibility and the quality of communication and transportation infrastructure, which may be considered to be (at least partly) public inputs.
7. See e.g. Eurostat database (http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home) for comparison of e.g. Slovenian and German GDP per capita and unemployment rates, or for comparison of Czech Republic with more developed France or Spain, in the period after 2000.
8. Marceau et al. (2010) also use this assumption, though in a set-up without public inputs.
9. The literature on trade and FDI shows that mostly the largest and most productive companies engage in FDI (see Helpman 2006). Thus, domestic companies may be considered to be too small and/or not productive enough (although they still may be able to export – a property that requires smaller size and productivity than those needed in order for a firm to become a multinational enterprise). The assumption that domestic firms are not mobile is quite usual in related models (see e.g. Haaland and Wooton 1999, or Haufler and Wooton 1999), even in the settings with imperfect competition and oligopolistic domestic companies (e.g. Fumagalli 2003). Some studies from the tax competition literature

also acknowledge that tax bases (capital) exhibit different degrees of mobility and are modeled as mobile and immobile capital as noted by Marceau et al. (2010). Their interpretation of this assumption is that some firms may have already sunk investments in some country, which limits their ability to relocate.

10. The consequences of preferential and non-preferential regimes for the outcome of competition for capital have already been studied in some tax competition models. See e.g. Marceau et al. (2010) and references therein. However, assumptions of the models and governments' goals in these studies are significantly different than in the present analysis, which makes the comparison of the results less relevant (e.g. Marceau et al. [2010] assume that governments maximize tax revenue, and neither public inputs nor different wages are considered).
11. In some other related papers (e.g. Bjorvatn and Eckel 2006; Fumagalli 2003; Walz and Wellisch 1996), all the companies produce a homogenous good and compete in quantities (à la Cournot). Barros and Cabral (2000) and Haaparanta (1996), on the other hand, do not model domestic companies at all, and in their papers, the only interaction between host economies is the governments' competition for FDI. Also, Haaparanta (1996) explicitly assumes that there are different markets for products produced in different countries.
12. The alternative assumption of cleared labor markets in competing countries is discussed in a later section.
13. The variables that are maximized by the governments in related models include, e.g. welfare (defined by a utility function or by the producers' and/or consumers' surplus), tax revenue, or residents' income. An example for the latter case is the contribution by Haaparanta (1996) in which governments maximize the net wage income generated by the foreign investment.
14. For the simplicity of exposition, the price of the foreign investor's product is also normalized to 1.
15. The assumption that the characteristics of foreign firm are given and independent of countries' policies and known to competing countries is quite usual in related models (although they do not all explicitly define it by the amount of invested capital or labor demand).
16. It is assumed that the regime with FDI is preferred if $W_i = \bar{W}_i$.
17. As stated by Barros and Cabral (2000), an equilibrium exists, if the strategy values must fall on a small, but positive, grid of width ε, but not otherwise.
18. At the same time, FDI flows to both groups of countries are also found to be 'market seeking'. While developed countries usually have larger markets with higher intensity of competition, less-developed countries' markets are smaller, but with higher growth potential and less competition. As noted earlier, this is another reason why one cannot be sure, in general, which market is more attractive for some specific FDI.

References

Barros, P.P., and L. Cabral. 2000. Competing for foreign direct investment. *Review of International Economics* 8: 360–71.

Bjorvatn, K., and C. Eckel. 2006. Policy competition for foreign direct investment between asymmetric countries. *European Economic Review* 50: 1891–907.

Blomström, M., and A. Kokko. 2003. The economics of foreign direct investment incentives. NBER Working Paper no. 9489.

Dhillon, A., M. Wooders, and B. Zissimos. 2007. Tax competition reconsidered. *Journal of Public Economic Theory* 9: 391–423.

Fumagalli, C. 2003. On the welfare effects of competition for foreign direct investments. *European Economic Review* 47: 963–83.
Haaland, J.I., and I. Wooton. 1999. International competition for multinational investment. *Scandinavian Journal of Economics* 101: 631–49.
Haaparanta, P. 1996. Competition for foreign direct investment. *Journal of Public Economics* 63: 141–53.
Haufler, A., and I. Wooton. 1999. Country size and tax competition for foreign direct investment. *Journal of Public Economics* 71: 121–39.
Helpman, E. 2006. Trade, FDI and organization of firms. *Journal of Economic Literature* 44: 589–630.
King, I.R., R.P. McAfee, and L. Welling. 1993. Industrial blackmail: Dynamic tax competition and public investment. *The Canadian Journal of Economics* 26: 590–608.
Lucas, R.E. 1990. Why doesn't capital flow from rich to poor countries? *American Economic Review* 80: 92–6.
Makino, S., P.W. Beamish, and N. Bin Zhao. 2004. The characteristics and performance of Japanese FDI in less developed and developed countries. *Journal of World Business* 39: 377–92.
Marceau, N., S. Mongrain, and J.D. Wilson. 2010. Why do most countries set high tax rates on capital? *Journal of International Economics* 80: 249–59.
Markusen, J.R. 2002. *Multinational firms and the theory of international trade*. Cambridge, MA: MIT Press.
Noiset, L. 1995. Pigou, Tiebout, property taxation and the underprovision of local public goods: Comment. *Journal of Urban Economics* 38: 312–6.
Oman, C. 2000. *Policy competition for foreign direct investment*. Paris, Development Centre Studies: International Development, OECD.
UNCTAD. 1996. *Incentives and foreign direct investment*. United Nations, New York and Geneva: UNCTAD.
UNCTAD. 2001. *World investment report: Promoting linkages*. United Nations, New York and Geneva: UNCTAD.
Walz, U., and D. Wellisch. 1996. Strategic provision of local public inputs for oligopolic firms in the presence of endogenous location choice. *International Tax and Public Finance* 3: 175–89.
Wilson, J.D. 1999. Theories of tax competition. *National Tax Journal* 52: 269–304.
Wilson, J.D., and D.E. Wildasin. 2004. Capital tax competition: Bane or boon. *Journal of Public Economics* 88: 1065–91.
Zodrow, G.R., and P. Mieszkowski. 1986. Pigou, Tiebout, property taxation and the underprovision of local public goods. *Journal of Urban Economics* 19: 356–70.

Appendix

Proof of Proposition 1

Since $K_U < K_H$, it must always hold that $G_U^* < G_H^*$ (see equation 14 and the explanation thereafter). If $w_H = w_U$ and $T_H^* \leq T_U^*$, it is obvious that expression (19) is positive and that the highly developed country will win the investment. On the other hand, if $w_H = w_U$ and $T_H^* > T_U^*$, then the foreign investor bears a higher tax burden in the highly developed country equal to $K^m(T_H^* - T_U^*)$. From condition (14), it is known that for every $G_H < G_H^*$, it must hold that $\partial h/\partial G_H > 1/(K_H + K^m)$. The difference in public inputs between the two countries is equal to $G_H^* - G_U^* = T_H^*(K_H + K^m) - T_U^*(K_U + K^m)$. Then it must hold that: $h(G_H^*)K^m - h(G_U^*)K^m > [K^m/(K_H + K^m)]\left[T_H^*(K_H + K^m) - T_U^*(K_U + K^m)\right]$, i.e. that $h(G_H^*)K^m - h(G_U^*)K^m > T_H^*K^m - T_U^*K^m \underbrace{[(K_U + K^m)/(K_H + K^m)]}_{<1}$.

Thus, $h(G_H^*)K^m - h(G_U^*)K^m - K^m(T_H^* - T_U^*) > 0$, and the highly developed country will always receive the FDI. That the less-developed country will receive the investment if the difference in wages between two countries is sufficiently high is obvious: wages are exogenously given, and do not depend on public inputs or tax rates. Also, the supply of public inputs and the tax rates are not affected by wages, so that for some given labor demand by foreign investor L^m, there always exists $w_H > w_U$ such that condition (20) is fulfilled.

Proof of Proposition 2

Part 1: Solution of the maximization problem in competition for FDI with tax discrimination.

The equality constraint (22) is plugged into function (26), and the first-order conditions (27)–(31) are obtained. There are eight possible combinations of solutions regarding the effectiveness of constraints (23)–(25).

Case 1: $\lambda_1, \lambda_2, \lambda_3 > 0$. Condition (31) reduces to $K_i T_i = -K^m T_i^m$, implying $G_i = 0$. Condition (30) becomes $-K_i T_i + L^m w_i = \bar{W}_i > 0$, and condition (29) reduces to $-K^m T_i^m - K^m r - L^m w_i = \tilde{\Pi}_i > 0$, i.e. $K_i T_i - K^m r - L^m w_i = \tilde{\Pi}_i > 0$. It can easily be seen that the new system of equations has no solution, and therefore $\lambda_1, \lambda_2, \lambda_3 > 0$ can never hold.

Case 2: $\lambda_3 > 0$, $\lambda_1, \lambda_2 = 0$, Case 3: $\lambda_1, \lambda_3 > 0$, $\lambda_2 = 0$, and Case 4: $\lambda_2, \lambda_3 > 0$, $\lambda_1 = 0$. In all of these cases, condition (31) reduces to $K_i T_i = -K^m T_i^m$, and in a way similar to that of Case 1, it can be shown that there are no solutions in either of these cases. Therefore, constraint (25) can never be binding, and λ_3 is always equal to zero and disappears in all the expressions for the following cases 5–8.

Case 5: $\lambda_1, \lambda_2, \lambda_3 = 0$. Condition (27) yields $\partial g/\partial G_i = 1/K_i$, and condition (28) reduces to $\partial g/\partial G_i = 0$. Thus, there are no solutions in case 5.

Case 6: $\lambda_1 > 0$, $\lambda_2, \lambda_3 = 0$. Rearranging condition (27) yields $\lambda_1 = [1 - (\partial g/\partial G_i) K_i]/[(\partial h/\partial G_i)K^m]$. Substituting this expression for λ_1 in condition (28) yields the condition (32) $(\partial g/\partial G_i)K_i + (\partial h/\partial G_i)K^m = 1$, which defines a unique optimal supply of public inputs denoted with $\hat{G}$.

Case 7: $\lambda_1, \lambda_2 > 0$, $\lambda_3 = 0$. In this case, rearranging condition (27) yields $\lambda_2 = [(\partial g/\partial G_i)K_i - 1 + \lambda_1(\partial h/\partial G_i)K^m]/[1 - (\partial g/\partial G_i)K_i]$. Substituting this expression in condition (28) yields again the condition (32). Thus, $\hat{G}$ is the unique optimal supply of public inputs.

Case 8: $\lambda_2 > 0$, $\lambda_1, \lambda_3 = 0$. In this case, condition (27) yields $\partial g/\partial G_i = 1/K_i$, and condition (28) reduces to $\partial g/\partial G_i = 0$, meaning that there are no solutions.

Part 2: The optimal supply of public inputs in a situation with FDI is always higher than in a regime without FDI.

In a regime without FDI, the optimal supply of public inputs $\bar{G}_i$ is determined by condition (4). However, if evaluated at point $\bar{G}_i$, it must hold that $(\partial g/\partial G_i)|_{\bar{G}_i} K_i + (\partial h/\partial G_i)|_{\bar{G}_i} K^m > 1$, since $(\partial g/\partial G_i)|_{\bar{G}_i} K_i = 1$ and $(\partial h/\partial G_i)K^m > 0$ by assumption. If the supply of public inputs is increased relative to $\bar{G}_i$, the left-hand side of the above inequality decreases. Therefore, at some point $\hat{G}_i > \bar{G}_i$, the inequality turns into equation, i.e. condition (32) holds.

Proof of Proposition 3

First, note that condition (32) implies $\hat{G}_U < \hat{G}_H$. From condition (4), it is known that with every $G_i > \bar{G}_i$, it holds that $\partial g/\partial G_i < 1/K_i$, i.e. $\Delta F_i - \Delta G_i < 0$. Also note that

because of condition (32), with every $G_i < \hat{G}_i$, it holds that $(\partial g/\partial G_i)K_i + (\partial h/\partial G_i)K^m > 1$, i.e. $\Delta F_i + \Delta F_i{}^m - \Delta G_i > 0$. To prove Proposition 3, one needs to distinguish between two cases. In the first case, it is assumed that $\hat{G}_U > \bar{G}_H$. Now, the following intervals are defined: *I*: from $\bar{G}_U$ to $\bar{G}_H$; *II*: from $\bar{G}_H$ to $\hat{G}_U$; *III*: from $\hat{G}_U$ to $\hat{G}_H$.

Using the above definitions, $\Delta^{II}F_i$, for example, stands for the increase in the output of one country due to an increase in the supply of public inputs from $\bar{G}_H$ to $\hat{G}_U$. The expression (40) can also be divided into several segments. Denoting $\Phi = \Pi_H^{\max} - \Pi_U^{\max}$, one can write $\Phi = h(\bar{G}_H)K^m - h(\bar{G}_U)K^m + \Phi^I + \Phi^{II} + \Phi^{III}$, in which $\Phi^I = -(\Delta^I F_U + \Delta^I F_U^m - \Delta^I G_U)$; $\Phi^{II} = \Delta^{II}F_H + \Delta^{II}F_H^m - \Delta^{II}G_H - (\Delta^{II}F_U + \Delta^{II}F_U^m - \Delta^{II}G_U)$; and $\Phi^{III} = \Delta^{III}F_H + \Delta^{III}F_H^m - \Delta^{III}G_H$. If the last two intervals are neglected, it is clear that $\Phi = h(\bar{G}_H)K^m - h(\bar{G}_U)K^m + \Phi^I > 0$. To see this, note that $h(\bar{G}_H)K^m - h(\bar{G}_U)K^m - \Delta^I F_U^m = 0$ and that $\Delta^I F_U - \Delta^I G_U < 0$ because of condition (4). Observing the second interval, one obtains $\Phi^{II} > 0$ because $\Delta^{II}F_H > \Delta^{II}F_U$, $\Delta^{II}F_H^m = \Delta^{II}F_U^m$, and $\Delta^{II}G_H = \Delta^{II}G_U$. Since because of condition (32), it must hold that $\Phi^{III} > 0$, it must also hold that $\Phi = \Pi_H^{\max} - \Pi_U^{\max} > 0$, and the highly developed country always obtains the investment.

In the second case, it is assumed that $\hat{G}_U \leq \bar{G}_H$. This implies that $h(\bar{G}_U)K^m + \Delta F_U^m \leq h(\bar{G}_H)K^m$. In addition, it must hold that $\Delta F_U - \Delta G_U < 0$ because of condition (4) and that $\Delta F_H + \Delta F_H^m - \Delta G_H > 0$ because of condition (32). Collecting terms yields $\Phi = \Pi_H^{\max} - \Pi_U^{\max} > 0$, and the highly developed country will always be the destination of the investment.