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Tax policy as a competitiveness mechanism to attract manufacturing FDI inflows: An application to the Latin-American case*

By

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Abstract

Two possible host countries with different productivity compete for the investment of a transnational enterprise (TE). Once the TE invests, its production will be exported to a third market. The country which is not host of the foreign direct investments (FDI) has the option to export the local production, competing with the TE subsidiary production in the third country. The domestic firm obtains its invest resources in the external financial sector. Governments use tax policy to compete for the FDI flows, and the TE uses that policy as a mechanism of information regarding the countries' productivity. The recent Latin American experience is summarized, and an econometric model is specified and estimated in order to test the main assumptions of the theoretical model.

JEL Classification: F12, F13, F23.

Keywords: Models of Trade with Imperfect Competition and Scale Economies; Commercial Policy, Protection; Promotion; Multinational Firms.

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1 Introduction

Most of the Latin-American governments have introduced economic reforms during the last two decades for easier access to the foreign direct investment flows (FDI), and also as a way of dynamizing the economic growth. There is a consensus among economists that the FDI has positive effects in terms of greater demands of both domestic labour and intermediate goods; involving as well greater tax revenue, the human capital accumulation through technology transference, and the adaptation of modern administrative skills.

As it is well known, subsidiaries of transnational enterprises (TEs) are located in foreign countries only when they are able to reduce their production costs. This is given when subsidiaries can pay workers with lower salaries or purchase cheaper domestic intermediate goods. Besides, there are other FDI determinants such as reduction of transport costs, when target markets are close to the possible host countries. For this reason governments interested in receiving FDI inflows apply policies that are instrumental to reduce the subsidiary production costs.

The incentives of FDI flows searching high rates of returns can be illustrated when TEs try optimizing the production processes allocating the labor-intensive part in low-wage and simultaneously productive economies. Currently, the assembly plants known as “maquiladoras” located in Mexico and the Caribbean region, like in Costa Rica, are vivid examples. Besides, there is the case of TEs looking for input abundance in the possible host economics, in order to avoid the costs of the presence of monopsony in their home land.

Developing Countries have difficulties in attracting FDI as a consequence of an incomplete information problem. Usually TEs do not know which the local production conditions are. So, their governments can attract foreign investors if they succeed in giving more information to TEs about the local productive conditions through some indirect mechanisms, such as: trade, fiscal or labour policies, and also policies of minimum local content require-

ments (LCR) that governments demand to be used by subsidiaries.¹ The main interest of this paper is to analyze the tax policy as an information mechanism to compete for the manufacturing FDI inflows, since tax rates can reveal the actual local production conditions, and this affects directly the profits of the TEs. We focus our analysis on the Latin American tax policy as a possible instrument to compete for the FDI, in spite of the fact that Latin-American tax rates have tended to be unified, specially the profit tax rate.

At present there is a relative broad literature about FDI models in oligopolistic markets. A starting point is the seminal paper by Brander and Spencer (1987), where the level of the unemployment rate may guide governments to offer subsidies or fix lower tariffs to attract the TEs investment.

In Lahiri and Ono (2003) and Lahiri and Mesa (2004) the subsidiary output is export oriented. The first paper analyzes the conflict of interests between a domestic firm producing for the local market and a subsidiary that sells in that local market but it is located abroad, where its government applies LCR policy. The second paper studies the relation between a TEs' decisions and a LCR policy applied by government that faces an exchange rate uncertainty. Qiu and Tao's (2001) paper considers the case of efficiency regarding foreign firms heterogeneity. The latter authors stand out as the less efficient firms can adjust better to the LCR policy than the more efficient ones.

The asymmetric information issue has already been analyzed by the international trade literature. The starting point is the model developed by Spence (1973) about the negotiation between employers and prospective employees, given through the signals that the skilled workers can transmit. In this line Bond and Samuelson (1986) analyze the effects of public policies on a TE's decision, when policies are designed as mechanisms of information.

¹An earlier analytical contribution about this topic is Grossman (1981) who, under a partial equilibrium framework with a competitive firm, finds that the LCR policy raises the price of the domestic input, thus benefiting input suppliers but harming the final-good producers. Later on, Lahiri and Ono (1998) study the FDI social welfare implications in a host country as consequence to fix simultaneously an optimum tax or subsidy rate, and LCR policy. The conclusion of the last paper is that the LCR is low when foreign firms are more efficient than domestic firms, and when domestic industry is highly oligopolistic.

A TE has to make the decision of investing in a foreign country or in its home base in order to supply the foreign market. The assumption is that the decision will depend on the information that the host country may transmit through the tariff policy.

Raff and Srinivasan (1998), as the previous paper, construct a signaling model. Optimal tax and tariff rates are designed to compete for the FDI. Moreover TEs take this policy instruments as signals of a possible host countries' internal productivity conditions. There are other different approaches. In Kolev and Prusa (1999) the tariff rates fixed by a government depend positively on the firm efficiency, but this efficiency is not observed by the government. For this reason foreign firms might give wrong signals in the sense that their productivity is lower than it truly is; so firms may earn bigger profits if the government fixes a lower tariff when firms export their output to that country.

This paper constructs a model about a TE investment when two possible host countries, with different productivities, compete for the FDI using the tax policy. We consider that some percent of labour or intermediate goods demanded by the TEs are acquired in the host country due to their lower prices. We assumed that TEs do not have complete information regarding the countries productivity, but the possible host governments do have it. In this sense the public policy is used as a mechanism of information. In contrast to the Raff and Srinivasan model, ours is focused on a competitive external market, represented by a third country, in an open economic environment, such that governments do not fix tariffs and the ETs output is export oriented.

Our model analyzes the conditions under which the pooling and separating equilibriums are given. If both countries follow the same tax policy, then there is no relevant productivity state information revealed to the TE, therefore the equilibrium is pooling. By contrast, if a country with higher productivity has the capacity to transmit with the tax policy the right information for a TE , the equilibrium is separating.

The Latin-American empirical results tell us that tax rates and the FDI are positively

related, although the high productivity countries tend to set their tax rates lower than their optimum ones. This result is consistent with the theoretical model that shows as these countries set lower tax rates in order to attract greater FDI levels.

This paper is divided in to five sections. The Latin-American FDI behavior and its related policies are described in the next section. The benchmark model and the implications of the different policies options to compete for the FDI are analyzed in section 3. The empirical test for 11 countries is contrasted in section 4. Finally, some concluding remarks are made in section 5.

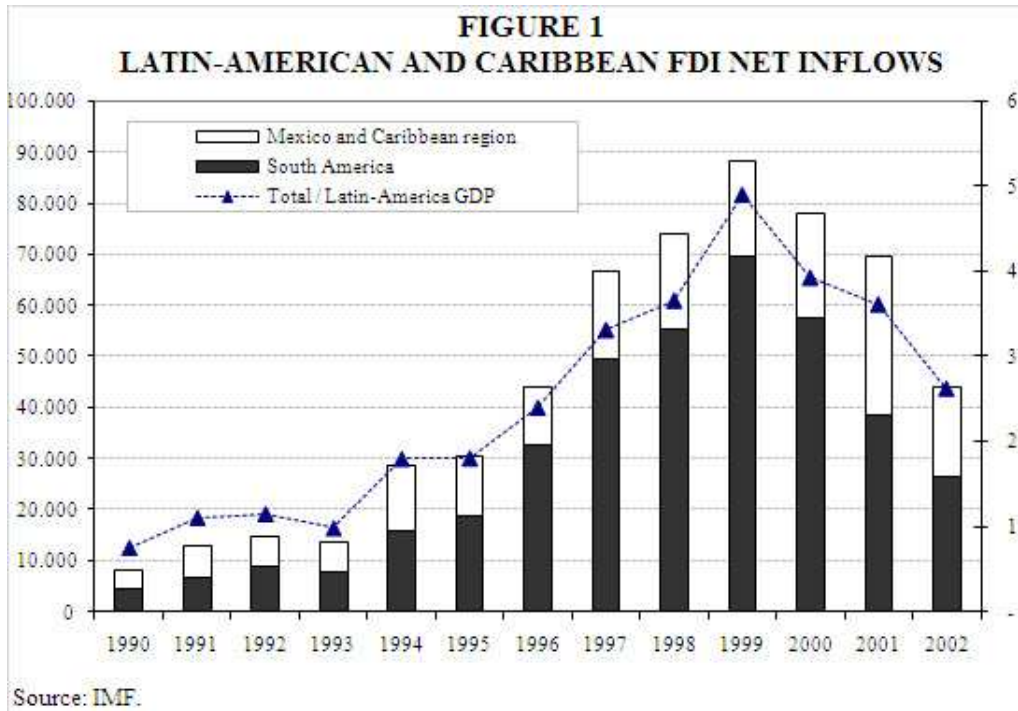
2 FDI inflows, and related policies in Latin-American countries

It is important to understand what accounts for the surge of FDI in Latin America. During the 1990s the world saw an historical shift in this variable. The FDI flows towards Latin-America exploded in that decade, overcoming decades of a lethargic behavior, as it was the case in 1970s and 1980s without a clear trend. This inflow became one of the major source of the region foreign capital at the end of the 1990s, certainly beyond any form of external financing such as bank loans or investment in stocks.

This section is dedicated to interpret this issue and is divided into two subsections. The Latin-American FDI behavior in the 1990s and the first years of the new century is analyzed in the first part. A review of the public policies to attract FDI is presented in the second part. Those policies are: legal FDI enactments, labour and tax policies.

2.1 FDI inflows

The growth of inflow of FDI to Latin-American was remarkable in the 1990s, starting at US\$8.403 and finishing at US\$ 78.358 million. This means that the inflow was multiplied by



more than nine times. In current dollars the yearly average growth of the FDI inflows was 25% in that decade. However, since 1999 these inflows decreased, and in 2002 leveled out at US\$ 44.190. The regional ratio FDI/GDP increased from 0.8% to 4.0% (Figure 1).²

FDI inflows have been concentrated in a few number of countries of the region, mainly Mexico and the major South-American countries in terms of GDP. It is important to note that Mexico has been the main FDI host country in the region. Between 1990 and 2000 the first six FDI host countries accounted for 85.3% of the whole FDI directed towards the region. The ranking was: Mexico (26.4%), Brazil (22%), Argentina (18%), Chile (8%), Venezuela (5.7%) and Colombia (4.9%) (Table 1). After 2000 the Argentina share declines while the Caribbean region share rises.

Recently, FDI inflows have grown stronger in service activities. Between 1996-2003, that sector attracted more than half of the inflows destined for the region (54.3%), followed

²This drop down is mainly explained by domestic and external factors. The first ones are associated to economy instability; the economic crisis in Argentina, Uruguay, and Venezuela; and as well the end of the privatization cycle in the region. The second ones are related to the decrease of the economic growth in Europe and the United States, that are the main FDI investors, and also due to the Asian crisis and a crash of the international stock markets (2000-2002).

TABLE 1
MAIN LATIN-AMERICAN AND CARIBBEAN RECEIVER COUNTRIES OF THE FDI
FDI as a percentage in the whole region in the whole region

Country	1990	2000	1990-2000	2001	2002
Argentina	21,8	13,3	18,3	3,0	4,0
Bolivia	0,3	0,9	0,9	1,0	1,3
Brazil	11,8	41,8	22,0	31,2	30,9
Chile	7,9	6,2	8,0	5,8	4,7
Colombia	5,9	3,1	4,9	3,5	4,0
Caribbean region	12,6	5,2	7,8	6,6	8,6
Ecuador	1,5	0,9	1,4	0,7	1,5
Mexico	31,3	21,0	26,4	41,0	39,3
Paraguay	0,9	0,2	0,5	0,1	0,0
Peru	0,5	1,0	3,8	1,6	4,0
Uruguay	0,1	0,3	0,3	0,4	0,3
Venezuela	5,4	6,0	5,7	5,1	1,5

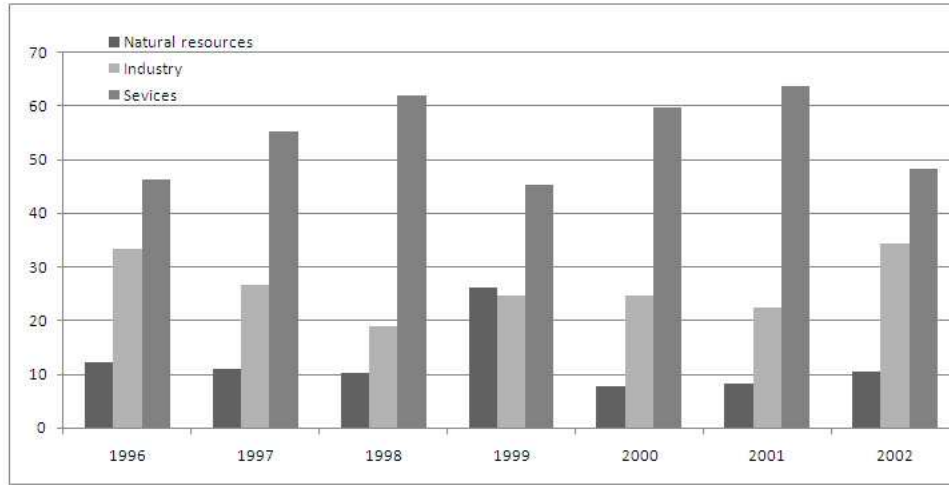
Source: IMF, Balance of Payments data.

by manufacturing (26.4%) and the primary sector (12.2%) (see Figure 2).

Table 2 classifies 11 Latin-American countries in the period 1990-2003 according to three variables, and they are: manufacturing FDI inflows as a percentage of manufacturing GDP (F^f), the manufacturing added value as a proportion of the GDP (P), and the implicit income tax rate (τ), defined as tax levies on the income and capital gains, in terms of the GDP. In keeping with Nicholas Kaldor's laws, the second variable (P) is a reasonable proxy of the total productivity factor (TPF) variable. Kaldor's laws, in particular the Verdoorn law, involves the manufacturing sector as the engine of development, because the dynamics of the economic growth rate are mainly explained through the labour transfers from low productivity sectors to the increasing returns within the scale manufacturing sector. Kaldor argues that there is a virtuous causal relationship among industrial output productivity, good prices, competitiveness, exports, total output; and then again, industrial output.

We find clearly six cases in Table 2 . Chile and Mexico represent countries with F^f , P and τ greater than the median. There is not any country with F^f , P and τ less than the median values. The Brazilian F^f is less than the median, but its P and τ are above it.

FIGURE 2
YEARLY ECONOMIC ACTIVITY COMPOSITION OF THE LATIN-AMERICA FDI INFLOWS
(Percentages)



Note: The results are calculated for the first ten countries that account near to 93% of the Latin-America FDI net inflows. They are: Argentina, Bolivia, Brazil, Chile, Costa Rica, Colombia, Ecuador, Mexico, Peru and Venezuela.
 Sources: UNECLAC. The Bolivia, Costa Rica and Venezuela data are published by UNCTAD, "World Investment Directory" (2004).

Costa Rica and Venezuela show high F^f and P , but low τ . Argentina is the opposite case of the previous two countries. Colombia, Paraguay, and Peru present low F^f and P but high τ . Bolivia and Ecuador are the typical small countries, where high F^f is given with low P and τ . The investments in the two latter countries are probably small but numerous.

The previous result allows to state that the fiscal policy might have played an important role in Latin-America as an instrument of information about the country productivity behavior. Thus, countries attracted more F^f inflows if governments were successful in giving the proper signals to the TEs. Those conditions would be related to both high P and τ .

There are cases where the signal was not the right one. Argentina showed high P but low τ , and its outcomes in terms of F^f might not have been so successful. In contrast, Costa Rica and Venezuela showed the same results like Argentina in terms of P and τ , but they were quite successful to attract manufacturing FDI inflows (F^f). TEs could fetch higher profits through lower τ in Costa Rica and Venezuela, while TEs associated the low τ with low P in Argentina. Colombia, Paraguay and Peru were less successful since they could not

TABLE 2
INDUSTRIAL FDI INFLOWS/INDUSTRIAL GDP; INDUSTRIAL ADDED VALUEs/GDP; AND IMPLICIT INCOME TAX RATES: 1990-2003

	P+, T+	P+,T-	P-,T+	P-,T-
F +	Chile (3.7; 17.6; 3.8)	Costa Rica (9.0;20.9; 2.4)		Bolivia (6.0,15.2, 1.8)
	México (5.9; 18.4; 4.7)	Venezuela (8.8;21.2; 1.9)		Ecuador (23.0, 12.0, 1.6)
	P+, T+	P+,T-	P-,T+	P-,T-
F-			Colombia (3.1; 15.1; 4.4)	
	Brazil (2.9;21.3; 4.5)	Argentina (3.2; 18.9; 1.7)	Paraguay (2.0;16.1; 4.0)	
			Perú (1.5; 12.3; 2.6)	

F = industrial FDI inflows/industrial GDP; P = industrial added value/GDP; T is the implicit tax rate on revenues.

"+" : high; "-" :low; in relation to the medians of the regional variables (the medians are: F=3.7 ; P= -17.6; and T=2.6).

Source: ECLAC and UNTAC for industrial FDI and GDP ; ILPES for tax rates in revenues over the GDP.

transmit the right signal through their high τ .

It is important to note two observations: Firstly, we should not rule out that TEs could have reduced their inflow investments due to by other factors, e.g. the economic and political instability. Secondly, the fiscal policy is not in general oriented to attract FDI; instead this policy is designed normally to reach macroeconomic equilibriums.

2.2 Policies to attract FDI

As a consequence of the Latin-American external debt crisis and also the end of the import substitution process, the governments in these countries decided to change their development strategy toward the improvement of the economic efficiency, reducing the State intervention, and introducing trade liberalization policies. In this economic perspective, the institutional structures were modified; and the FDI, labour and fiscal policies were reformed. A brief review about the last issues are given later on.

2.2.1 FDI statutes

In lesser or higher degree countries in the region have liberalized capital inflows. e.g., the restrictions and regulations about the FDI inflows were removed and as a result countries experienced a significant growth in foreign capital inflows. The advances in the FDI regional legislation are the followings:

i) The previous FDI governmental approval requirements were removed. However, the duty of investment registration in the Central Banks has maintained, only for statistical purposes.

ii) Countries ruled that foreign and domestic investors must have the same legal treatment.

iii) Restrictions on the foreign capital share, both in domestic firms or in previously protected economic sectors, were almost abolished.

In some cases a minimum condition for the duration of investment exist. In Chile the foreign capital must stay for at least a year and in Brazil for six years if it is for privatized enterprises. In addition, countries in the region have removed the restrictions on profits remission.

In general, Chile has the less restricted legislation, while Mexico´s is quite detailed.³ However, in the 1990s both countries recorded striking FDI inflows growth rates as a result of their effort in getting their international insertion through free trade agreements.

Finally, countries have also offered incentives to the FDI through the introduction of mechanism of protection in cases of legal controversies. The last issue has been catered for the signature of international agreements to allow the international arbitration in cases of

³Latin-American countries have kept for the domestic use only the following activities: nuclear energy, military equipment and toxic industries. There are some restrictions for foreign capital in a number of countries regarding: banking, financial and insurance; mining and petroleum; air, maritime, and land transportation; telecommunications and media; electric energy; services and health; fishing; and contracts for public civil works.

lawsuits.⁴

2.2.2 Labour legislation

Less rigid labour legislation has been highly determining ETs' investment decisions. Six countries in the region have approved radical labour reforms. They are: Argentina (1991), Colombia (1991 and 2002), Guatemala (1990), Panama (1995), Peru (1991) and Venezuela (1998) (See Lora, 2001).

For the whole of Latin-American countries this means dismissal cost per worker is nearly 3 months of salary, being in Colombia and Guatemala one month of salary, who hold the lowest costs (Chart 3). Bolivia and Ecuador with more than 4 months of salaries hold the highest costs (Lora, 2000).

Social security contributions in the region add up to 21.3% of the salary. The Caribbean countries, mainly hosts of confection assembly for foreign firms, hold the lowest costs, with less than 13% of the salary. The highest are Argentina, Uruguay, Colombia and Brazil, with more than 30% of the salary (Chart 4). Only Argentina, Colombia, Ecuador, and Peru have guided their reforms in order to facilitate temporal worker employment.

2.2.3 Fiscal policy

Taxes levied on revenues and profits, and also fiscal incentives offered to the FDI are additional instruments besides the FDI legal statute and labour legalization.⁵ The reason is that they affect directly the TEs' investment profitability.

During the 1990s decade nominal tax rates were reduced and taxation bases raised in order to offset the decreasing in tariff revenues due to the introduction of the trade

⁴Among these we have Multilateral Investment Guarantee Agreement (MIGA), and the International Center of Solutions and Disagreements about Investments (CIADI).

⁵Trade policy is also a determinant of the TEs' investment decisions. We should not consider it, since our model is for open economies and the output is export oriented.

TABLE 3
LATIN AMERICAN AND CARIBBEAN NOMINAL TAXES ON THE CORPORATE PROFITS
(Percentages)

	1992		1997		1998		1999 ó 2000		Jun. 2001		Dic. 2002	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Argentina	20	20	33	33	35	35	35	35	35	35	35	35
Bolivia	0	0	25	25	25	25	25	25	25	25	25	25
Brazil	25	40	15	25	15	25	15	15	15 a/	15 a/	15 a/	15 a/
Chile	15	35	15	35	15	35	15	15	15	15	16 b/	16 b/
Colombia	30	30	35	35	35	35	35	35	35 c/	35 c/	35	35
Costa Rica	30	30	30	30	30	30	30	30	30	30	30	30
Ecuador	0	44	25	25	25	25	15	25	25	25	25	25
México	0	35	34	34	34	34	35	35	35	35	32	32
Paraguay	0	30	25	30	25	30	25	30	25	30	25 e/	30 e/
Peru	0	30	30	30	30	30	30	30	20	20	27	27
Venezuela	20	67,7	15	34	15	34	15	34	15 g/	34 g/	15 g/	34 g/
Average	12,7	32,9	25,6	30,5	25,8	30,7	25,0	28,1	25,0	27,2	25,5	27,6
Standar Dev.	12,9	16,4	7,7	4,0	7,9	4,2	8,7	7,4	8,1	7,8	7,5	7,0

a/ There is an additional 10% tax over the profits that exceed the value that result of from multiplication of R\$ 20.000 by the number of months in the respective settlement period.

b/ The public firms must pay an additional 40% tax over their accrued profits.

c/ The tax rate is greater than 2% in the special stability tax system.

e/ The tax rate over the income from agricultural activities are 25%. The maximum tax rate is applied over the rest of commercial, manufacturing and services activities.

g/ These rates are for all societies. There are special rates for non-profit organizations (6% al 34%), and oil and mining exploitations (50% and 60% respectively).

Source: Tanzi (2000) for data from 1992 to 2000, Centro Interamericano de Administraciones Tributarias (CIAT) for data from 2001 to 2002.

liberalization policy.⁶ From 1992 to 2002 the maximum nominal profit tax rate decreased from 32.9% to 27.6%, and simultaneously the gap between the maximum and minimum tax rate dropped from 20.1 to 2.2 percentage points (Table 3). Chile and Brazil, important FDI host countries, are the outstanding cases. Their maximum nominal taxes dramatically dropped from 35% and 40% to 15% and 16%, respectively, in this period. On the other hand, Argentina and Colombia raised their minimum and maximum tax rates (Table 3).

Implicit income and profit tax rates in the main Latin-American countries are presented in Table 4.⁷ The trend of the implicit tax rates are clearly increasing in the period 1990-2003. The average implicit tax rate rose from less than 2.0%, at the beginning of the decade, to nearly 2.7%, at the end. The highest implicit average tax rates were registered in Mexico (4.7%), Brazil (4.46%), Colombia (4.37%) and Chile (3.86%). In contrast, the tax

⁶One of the most important changes, which explains the taxation bases enlargement, was the introduction of the "Added Value Tax" (AVT) in countries. This tax is oriented over the consumption expenses and reduces distorts over the saving and production decisions.

⁷The relation between tax levies on income and profits and GDP are computed in this Table.

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Average
Argentina	0,52	0,77	0,98	1,24	1,55	1,65	1,79	1,86	2,09	2,14	2,43	2,47	1,83	2,81	1,72
Bolivia	0,76	0,92	1,03	1,27	1,17	1,33	1,89	2,17	2,53	2,55	2,63	2,35	2,22	2,03	1,78
Brazil	4,17	3,16	3,49	3,63	3,73	4,41	4,29	4,12	4,87	5,18	5,08	5,39	5,49	5,41	4,46
Chile	2,47	3,89	3,92	3,94	3,80	3,53	3,93	3,75	3,92	3,53	4,07	4,44	4,60	4,29	3,86
Colombia	3,21	4,17	4,39	4,52	4,17	4,02	3,83	4,39	4,35	4,23	4,29	5,32	5,22	5,13	4,37
Costa Rica	1,78	1,66	1,65	1,97	2,10	2,24	2,17	2,22	2,44	2,92	2,71	3,02	3,06	3,34	2,38
Ecuador	1,29	1,43	1,40	1,30	1,51	1,92	1,79	2,03	1,79	0,79	1,84	2,24	2,13	2,07	1,68
Mexico	4,46	4,53	5,15	5,51	5,13	4,01	3,85	4,26	4,41	4,70	4,71	4,91	5,10	5,00	4,70
Paraguay	1,14	1,14	1,37	1,46	2,00	2,26	2,23	2,05	2,02	2,28	1,81	3,78	3,62	3,29	2,17
Peru	0,62	0,94	1,67	2,03	2,56	2,86	3,64	3,63	3,52	2,90	2,75	2,98	3,00	3,73	2,63
Venezuela	1,35	1,26	1,50	2,26	2,22	2,22	1,85	2,11	2,12	1,96	1,65	2,00	2,08	1,97	1,90
Promedio	1,98	2,17	2,41	2,65	2,72	2,77	2,84	2,96	3,10	3,02	3,09	2,77	2,82	2,86	2,70
Note: tax levies on capital profits as proportion of the GDP.															
Source: ILPES.															

rates in Argentina (1.72%), Bolivia (1.78%) and Ecuador (1.68%) were below of the average. An interesting point to highlighter is that high tax rates are related to high FDI flows.

Despite the fact that most of the countries in the region have incorporated the principle of equal tributary treatment in their legislations, some countries still offer fiscal incentives to the FDI. Nevertheless, the most important FDI host countries in the region, Brazil and Mexico, keep incentives through lower tariffs to the foreign firms. The Chilean and Colombian strategy has been to offer a special tributary stability plan for the foreign investors.

3 The formal framework

A model is constructed in this section. This model permits us to determine if a country should export with the FDI or through a local firm. We will also compute the optimum tax rates that countries levy on the foreign firm profits in order to attract manufacturing FDI inflows. After that, the model equilibriums are analyzed.

3.1 Model

Local firms and TE subsidiaries are located in different countries and they compete in an international competitive market.⁸ Countries are divided according to their high (h), or

⁸As it is well known, subsidiaries in Latin America generally export a percent of their output into large international markets.

low (l) productivity. The analysis is focused on the role of the fiscal policy instrument used by countries as a signal to decide if they export through a TE subsidiary or alternatively through a local firm. The second alternative is more costly, as it will be explained thereafter. Countries are characterized by a given rate of unemployment, as it is suggested in Brander and Spencer (1987), and Lahiri and Ono (1998) papers.

As the exported market is competitive, then its price (P) is given. The TE subsidiary profits (π^f) and the local firm profits (π) are:

$$\pi_i^f = (1 - \tau_i) \left(P - a_i^f \left(1 + \frac{2}{3} \left(X_i^f \right)^{\frac{1}{2}} \right) \right) X_i^f - F^f, \quad (1)$$

$$\pi_j = (1 - \tau_j) \left(P - a_j \left(1 + \frac{2}{3} \left(X_j \right)^{\frac{1}{2}} \right) \right) X_j - F, \quad (2)$$

A subsidiary firm located in country i exports X_i^f , and a local firm located in country j exports X_j . The high (h) or low (l) productivities are denominated by the subscript i or j . If $i = h$, then $j = l$, or vice versa. The tax rate on profits is τ . The TE investment in country i is F^f , and the local firm investment in country j is F . The latter is carried out by imported capital goods. This last assumption applies for developing countries, since additional to incurring in external payments for patents, franchises and networks for selling their goods, these countries import a high percent of their capital goods requirements. So we should raise the assumption that:

$$F > F^f. \quad (3)$$

The marginal cost functions in country i translate into:

$$C_i^f = a_i^f \left(1 + \left(X_i^f \right)^{\frac{1}{2}} \right),$$

$$C_i = a_i \left(1 + \left(X_i \right)^{\frac{1}{2}} \right).$$

The increasing marginal costs, such as Kaldor (1934) and Coase (1937) suggest, are explained by information and coordination overheads as consequence of the firm's size. Let

assume that the local firm's marginal cost is greater than the subsidiary TE's at the same export levels in country i . Then:

$$a_i > a_i^f. \quad (4)$$

The lower marginal cost of the subsidiary TE is explained by a better resources management system, a higher efficiency in the production process and more suitable specifications of its imported inputs.⁹ The parameter a_i^f is part of the TE subsidiary's marginal cost in the country i , and is defined as:

$$a_i^f = l_i^f + k, \quad (5)$$

where l_i^f is the local component and k are the imported inputs. We assume that the subsidiary firm demands local inputs in a competitive market, hence they do not affect their prices.¹⁰ Moreover, the local and imported components (l_i and k) are required under a fixed coefficient scheme in order to produce the output X^f . Then, there is the assumption that l_i^f and k are not substitutes, and also that labour costs in the host countries are lower than the ones in the TE home countries.¹¹ This last fact explains why TEs decide to invest abroad.

Between two possible host countries, a TE with complete information invests in the one with the lower marginal cost, given certain exportation level. However, TEs do not have all information that is needed for a risk-free investment decision. So governments in low productivity countries try to reveal better conditions that they actually have. In this model we assume that those governments use tax policy as a instrument to achieve this aim.

If exports are carried out by a TE subsidiary, the social welfare (W_i^f) is understood as the sum of tax levies and labour income, since all profits are remitted. This equation is:

$$W_i^f = \left[\tau_i (P - C_i^f) + l_i \right] X_i^f, \quad (6)$$

⁹It is important to take into account that local firms have overhead when they sell to foreign markets.

¹⁰If the firms demand labour, the wage rate does not change given the presence of unemployment rate.

¹¹As we said before, there are other factors different from reduction of production cost that explain FDI determinants. One is the access to the third markets for the TE. To achieve the last aim, e.g., the transport cost type "iceberg" should be included, such as Brander and Krugman (1983) include it.

If exports are carried out by a local firm, the social welfare (W_i) is the sum of the profits after tax, tax levies, and revenues raise through required inputs; less the investment financed by external debt.¹²

$$W_i = [(1 - \tau_i)(P - C_i) + \tau_i(P - C_i) + C_i] X_i - F.$$

Simplifying the above equation, we get the following expression:

$$W_i = P X_i - F. \quad (7)$$

An important feature in the last expressions is the inclusion of unemployment as it is stated out by Bander and Spencer (1987), and Lahiri and Ono (1998).

The first order conditions for a TE subsidiary and a local firm, obtained from (1) and (2), are:

$$\begin{aligned} X_i^f & : 0 = P - a_i^f \left(1 + X_i^{f\frac{1}{2}}\right), \\ X_i & : 0 = P - a_i \left(1 + X_i^{\frac{1}{2}}\right). \end{aligned} \quad (8)$$

The equilibrium outputs (X_i and X_i^f) are:

$$X_i^f = \left(\frac{P}{a_i^f} - 1\right)^2, \quad X_i = \left(\frac{P}{a_i} - 1\right)^2 \quad (9)$$

Those output exported by a TE subsidiary or by a local firm mainly depend on the profits mark-up. The subsidiary profits in any country must be equal to the profit of some benchmark international activity. The latter is henceforth called reservation profit. Thus, a TE would invest in a other country if and only if $\pi_i^f \geq \bar{\pi}$. Therefore, in equilibrium the TE subsidiary must fetch:

$$\pi_i^f = \bar{\pi} \quad (10)$$

¹²The intermediate goods are not included ($C_i X_i$), because these could be used eventually in other activities.

The optimum tax rate fixed by a government, using condition (10), is:

$$\tau_i^* = 1 - \frac{3(\bar{\pi} + F^f)(a_i^f)^2}{(P - a_i^f)^3}. \quad (11)$$

τ_i^* is negatively related to F^f , and $\bar{\pi}$. On the other hand, τ_i is positively related to the subsidiary mark-up $(P - a_i^f)$. According to (4), the optimum tax rate fixed in a low productivity country ($i = l$) must be smaller than in a high productivity country.

3.2 Equilibriums of the Model

The highest FDI level which a low productivity country may try to attract is obtained in this section. This aim is achieved using the social welfare functions (6, and 7).

3.2.1 The strategies for a low productivity country

A low productivity country ($i = l$) is indifferent between export with FDI or with a local firm if the social welfare is equal under both modalities. There are two alternatives. The first option is followed when a low productivity country applies its own optimum tax policy to attract the foreign investment. That is:

$$W_{l, F^f}|_{\tau=\tau_l} = W|_{l, F}.$$

That previous expression gives the maximum amount of FDI that country l tries to attract, and it is:

$$F^f|_{\tau=\tau_l} = \left(\frac{(P - a_l^f)}{3} + l \right) + F - P \left(\frac{P}{a_l} - 1 \right)^2 - \bar{\pi} > 0, \quad (12)$$

$F^f|_{\tau=\tau_l}$ is positively related to F , and the TE subsidiary mark-up $\left(\frac{P}{a_l^f}\right)$. By contrast, $F^f|_{\tau=\tau_l}$ is negatively related to the local firm's mark-up $\left(\frac{P}{a_l}\right)$ and $\bar{\pi}$. If country l competes

for a greater level of $F^f|_{\tau=\tau_l}$, then this country must cut its τ_l^* , and therefore this situation leads country l to promote its exports with a local firm, since this strategy makes its social welfare better off.

The second option is chosen countries l follow countries h 's fiscal policy, in order to compete for a higher level of F^f . In this sense the social welfare rule is:

$$W_{l, F^f}|_{\tau=\tau_h} = W|_{l, F},$$

Since the country l competes until the following F^f level:

$$F^f|_{\tau=\tau_a} = \left(\frac{1}{3} + \frac{l_l}{P - a_l^f} \right) \frac{(P - a_h^f)^3}{(a_h^f)^2} + \left(F - P \left(\frac{P}{a_l} - 1 \right)^2 \right) \left(\frac{P - a_h^f}{P - a_l^f} \right)^3 \left(\frac{a_l^f}{a_h^f} \right)^2 - \bar{\pi} > 0, \quad (13)$$

Taking into account that $\frac{P - a_h^f}{P - a_l^f} > 1$, then:

$$[F^f]_{\tau=\tau_a} > [F^f]_{\tau=\tau_b} \quad (14)$$

Therefore countries l follows countries h 's fiscal policy if and only if this countries decide to compete for higher F^f .

3.2.2 Separating and pooling equilibriums

Simultaneously governments lay out their fiscal policies at a starting period (τ_i , for $i = h, l$) and then TEs set their *ex-ante* probabilities. A $\Pr(C_h) = \mu_0$ is set by a TE that a country is h , and a probability $\Pr(C_l) = (1 - \mu_0)$ that a country is l . The expected investment profit values set by a TE is $E[\pi_i^f]$. The expression for this is:

$$E[\pi_i^f] = \mu_0 \pi_h^f + (1 - \mu_0) \pi_l^f.$$

Replacing the equilibrium outputs in the previous equations, we get:

$$E[\pi_i^f] = (1 - \tau_p) \Omega - F^f; \quad (15)$$

where

$$\Omega = \mu_0 \frac{(P - a_h^f)^3}{3 (a_h^f)^2} + (1 - \mu_0) \frac{(P - a_l^f)^3}{3 (a_l^f)^2}.$$

τ_p is the expected tax rate that a TE is determined to pay. Once that a TE invests in a country, this observes the country productivity, and then the TE revises their assumptions according to Bayes' rule and re-set their probabilities. These *ex-post* probabilities are:

$$\begin{aligned} P(\tau_h) &= \mu_1 = 1, \\ P(\tau_l) &= (1 - \mu_1) = 0. \end{aligned}$$

The **separating equilibrium** is reached when governments set different tax rates, and then a TE try to invest in countries with τ_h . TEs assume that those are countries h , according to equation (11). Governments in countries h set their tax rates where governments in countries l are indifferent as to compete for FDI or not to do so. In terms of the social welfare, that situation can be expressed as:

$$W_{b, F^f} \Big|_{\tau=\tau_s} = W_{b, F}.$$

That equality allows us to obtain the maximum tax rate that countries h should set. That tax rate is henceforth called separating (τ_s):

$$\tau_s = \frac{3 \left[P \left(\frac{P - a_l}{a_l} \right)^2 - F - l_l \left(\frac{P}{a_l^f} - 1 \right)^2 \right] (a_l^f)^2}{(P - a_l^f)^3}, \quad (16)$$

τ_s is negatively related to F , l_l , and $\left(\frac{P}{a_l^f} - 1 \right)$, and the latter one is the subsidiary firm's mark-up in a country l . When the previous three terms are big enough, we get that $\tau_s < \tau_l$.

In consistence with equation (11) τ_l is written as:

$$\tau_l^* = 1 - \frac{3 (\bar{\pi} + F^f) (a_l^f)^2}{(P - a_l^f)^3}.$$

The **Pooling equilibrium** is given when all governments set the same tax rates and TEs are not able to identify the countries' productivity levels. In this case, both the *ex-ante* and *ex-post* probabilities are equal.

If a country l sets $\tau = \tau_p$ -equilibrium pooling tax rate-, a TE might not identify if a country is l or h . According to equation (15), that tax rate is:

$$\tau_p = 1 - \frac{3 \left(E \left[\pi_i^f \right] + F^f \right)}{\Omega}, \quad (17)$$

such that $E \left[\pi_i^f \right] = \bar{\pi}$. So that:

$$t_l < \tau_p < t_h.$$

The maximum F^f level that a country l tries to obtain competing against a country h is when both countries set $\tau = t_p$. That is:

$$W_{l, F^f} \Big|_{\tau=\tau_p} = W_{l, F}.$$

and that value is:

$$F^f = \left(\frac{1}{3} + l_l \right) \frac{\Omega}{P - a_l^f} + \left(F - P \left(\frac{P}{a_l} - 1 \right)^2 \right) \frac{\left(a_l^f \right)^2 \Omega}{\left(P - a_l^f \right)^3} - \bar{\pi} > 0, \quad (18)$$

Hence the maximum level of F^f that countries l compete for countries h depends on the fixed tax rates, and they are:

$$F^f \Big|_{\tau=\tau_l} < F^f \Big|_{\tau=\tau_p} < F^f \Big|_{\tau=\tau_h}.$$

The pooling equilibrium is an intermediate state, in which countries l compete for certain FDI levels. Since TEs can not identify countries' productivity, then it is convenient

for them to choose countries with $\tau = \tau_p$. TEs will never be absolutely sure that countries with τ_h are the most productivity ones.

Stating the above results formally, we can state the following propositions:

Proposition: *According to F^f levels, the tax policies that countries set are:*

Case i: *if $F^f \leq F^f|_{\tau=\tau_l}$, then both types of countries do not compete for the FDI, and each country sets its optimum tax rate. This equilibrium is separating.*

Case ii: *if $F^f|_{\tau=\tau_l} \leq F^f \leq F^f|_{\tau=\tau_p}$, then it is convenient for both types of governments to set the same tax rate and the equilibrium is pooling (τ_p). That tax rate is the one expected by a TE.*

Case iii: *if $F^f|_{\tau=\tau_p} \leq F^f \leq F^f|_{\tau=\tau_h}$, the higher productivity countries should set the τ_s since this tax rate is lower than the optimum tax rate for the low productivity countries ($\tau_s < \tau_l < \tau_p < \tau_h$). However, that tax rate could be not convenient for the higher productivity countries, since they could give the wrong signal to the TEs. Nevertheless TEs could thus reach greater profits.*

Case iv: *if $F^f \geq F^f|_{\tau=\tau_h}$, the higher productivity countries set their optimum τ_h and the lower productivity countries do not follow them.*

4 Estimates

In this section an econometric model is specified and estimated for the manufacturing FDI behavior received by the main host countries in Latin-America. We shall give endorsement to the following theoretical conclusions by an empirical assessment:

- a) Countries' productivity is positively related to the income tax rate; and
- b) the income tax rate is positively related to the FDI flows, so the productivity affects as well the FDI flows.

The econometric specification is,

$$F_{i,t}^f = \beta_o + \beta_1 \tau_{i,t} + \beta_2 X_{i,t} + u_{i,t}; \quad (19)$$

where the variables $F_{i,t}^f$, $\tau_{i,t}$, and $X_{i,t}$ have the same meaning described in the theoretical section, and $u_{i,t}$ is the random error. The index i is the country, and t the time. The equation (19) is estimated through the panel data technique. According to the previous point (a), the income tax rate (τ) is an endogenous variable. Then, when an explanatory variable is correlated with the random error, the econometric technique used, and which yields consistent estimators is the Instrumental Variables (IV). Thus we use a two-stage least squares (IV) estimation for the panel-data model, where τ is instrumented by the productivity variable (P) and X variable. The first stage is written as,

$$\tau_{i,t} = \lambda_o + \lambda_1 P_{i,t} + \lambda_2 X_{i,t} + e_{i,t}, \quad (20)$$

the random error is $e_{i,t}$. To make equations (19) and (20) empirically feasible, the data is collected from 11 countries in the region, available on a yearly basis during the period 1990-2003.¹³ The total observations are 154. Table 5 gives the meaning of the variables and displays the descriptive statistics: means and standard errors. We observe that both the manufacturing FDI as a percentage of manufacturing GDP (F^f) and the percentage of manufacturing export (X), with means 6.3% and 29.5% respectively, differ markedly across the sample countries.

The estimated results on F^f are shown in Table 6. The individual country effects are captured in the intercept of the regressions through dummy variables, such as it is done by the Fixed Effect (FE) technique. The F^f lag effect is reported in columns (b). Although the theoretical model does not study the dynamic effects of F^f , this case indeed does constitute a relevant empirical question.

¹³The source is the Economic Commission for Latin America and the Caribbean (ECLAC and UNCTAD) of the United Nations. The countries were chosen according to the available data for manufacturing FDI flow.

TABLE 5
VARIABLES DEFINITIONS, MEANS, AND STANDARD ERRORS

Definition	Variable	1990-2003 (11 Countries)		
		Obs.	Mean	Std.Dev.
Manufacturing FDI as percentage of manufacturing GDP	F	139	6.3	12.1
Tax revenue, income tax and capital gains, as percentage of GDP	τ	154	3.0	1.3
Aggregate value of manufacturing activities as percentage of GDP	P	154	17.5	3.7
Percentage of manufacturing exports	x	154	29.5	21.4

Regarding the goodness fit of the models, when the ‘within’ estimated coefficients are used to predict the overall data, we obtain a squared correlation of at least 3% (column 2a). That low percentage reflects a wide scatter of points around the fitted linear relationship estimated between the endogenous variables (τ and F^f) and the regressors. In spite of that shortcoming, the relationships among variables are robust statistically such as it is stated in the theoretical framework. The FE estimation method is statistically valid for all regression stages, excluding the results in column (2.b), such as it is shown by the F test. The Hausman test also shows that the estimated parameters by a two-stage least squares (IV) estimation are better than a regular panel-data model (where the null hypothesis presumes that τ , the potential endogenous variable, is exogenous and rejected at any conventional confidence level). Note, however, that this test assumes that the variable P is actually a valid instrument. This assumption is strong. The implication is that sometimes a failure to reject the null hypothesis, it may be due to invalidity of the instrument, rather than because the variable is in fact exogenous.

The estimated relation between the instrumental productivity variable (P) and the endogenous income tax rate τ , is statistically significant at the 1% level, and has the right sign and value size, both in the static and in the dynamic first stage of the regressions. A country high productivity and lower τ was described theoretically in the separating equilibrium (equation

TABLE 6
FIXED EFFECTS MODEL RESULTS

Dependent variable Regression stage	Income tax		Manufactures FDI inflows as a	
	I		II	
	[1.a]	[1.b]	[2.a]	[2.b]
Lag of the manufactures FDI inflows as a percentage of the manufactures GDP (F_{-1}^f)		0.004 (0.7)		0.862*** (8.43)
Tax revenues, income tax and capital gains, as percentage of total GDP (τ)			26.159*** (3.18)	12.559*** (2.16)
Aggregate value of manufacturing activities as percentage of the GDP (P)	-0.083*** (-3.83)	-0.071*** (-3.05)		
Percentage of manufactured exports (X)	0.028*** (3.71)	0.021*** (3.08)	-0.454 (-1.57)	-0.242 (-1.39)
Constant	3.83*** (8.8)	3.709*** (8.03)	-61.666*** (-3.05)	-30.855*** (-2.08)
Prob>F, fixed effects test	0.00	0.00	0.01	0.99
Prob>chi2, Hausman test			0.02	0.08
R-sq (overall)	0.25	0.20	0.03	0.11
Observations	11	11	11	11

*(**)[***]: statistically significant at the 10% (5%) [1%], t-statistics in parenthesis

16). As an illustration at hand, one additional percent point in P , in the static case, reduces τ in 0.083 percent points.

The export manufacturing capacity (X) and τ are positively related and they are statistically significant at 1% level. In the static case, one additional percent point in X increases τ by 0.023 percent points. On the other hand, there is no empirical evidence that previous F^f affects τ in the region, as stated the first stage regression in the dynamic case, but this variable does affect its future behavior.

The second stage regression results are the empirical backbone to support the theoretical assumptions of the model. Thus, τ and the F^f are positively related, and they are statistically meaningful at the 1% level. In the static case, an additional percent point of τ increases F^f by 26.2 percent points. The instrumental variable X is not statistically significant in the second stages at any conventional level.

5 Conclusions

The theoretical model constructed in this paper allow us to explain how governments can influence the TEs' invest decisions through the tax policy. Two types of economies with different levels of productivity were considered to achieve this policy strategy. The model allows to analyze how low productivity countries can compete with high productivity countries for the manufacturing FDI inflows. An important feature of the model are the export oriented outputs. The analysis states that countries without FDI will have the option to develop their own capacity to export through domestic firms, although their investments and marginal costs will be greater.

The theoretical model predicts that countries h should set higher tax rates than countries l . However, governments in countries l may follow the tax policy of countries h in order to compete for the F^f . By contrast, countries h could apply lower tax rates to differentiate themselves from countries l and so attract greater F^f . Those low tax rates, even lower than the optimum tax rates in countries l , could bring the risk of being identified with countries l . If F^f is large enough, the optimum tax rates in countries h could be so low that countries l would never have the incentives to follow them; or perhaps give the wrong signal to be identified as a country l .

Under static conditions, the relations between τ and P , or τ and F^f were tested econometrically. The second regression stages do verify that the economic openness may explain greater manufacturing FDI inflows. Finally, the empirical test concludes that foreign investments (F^f) display a dynamic behavior in the region, such that an additional percent point in the lag of F^f implies greater future inflows by nearly 0.86 percent points. This last result is due to the incomplete information problem that it is solved once TEs invest in countries.

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