Vying for Foreign Direct Investment: A EU-type Model of Tax Competition*

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Abstract

This paper brings out the special mechanism through which taxes influence bilateral FDI, when investment decisions are two-fold in the presence of fixed setup flows costs. For each pair of source-host countries, there is a set of factors determining whether aggregate FDI flows will occur at all, and a different set of factors determining the volume of FDI flows (provided that they occur). We develop a two-country tax competition model which yield an asymmetric Nash-equilibrium with high corporate tax rate and high level of public good provision in the rich source country for FDI outflows and with low corporate tax rate and low level of public good provision in the poor host country for FDI inflows. This is akin to the asymmetry among the EU 15 and EU 10 in the enlarged European Union, as of 2004. We also demonstrate that the notion that the mere international tax differentials are a key factor behind the direction and magnitude of FDI flows, the traditional race to the bottom argument in tax competition are too simple.

1

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2 Introduction

> "European countries have been steadily slashing corporate-tax rates as they vie for foreign investment, potentially adding to pressure on the U.S. for similar cuts as it weighs a tax overhaul. Following the lead of Ireland, which dropped its rates to 12.5% from 24% between 2000 and 2003, one nation after another has moved toward flatter, lower corporate rates with fewer loopholes" (Wall Street Journal Europe, January 28-30, 2005).[1],[2]

Indeed, the economic literature has extensively dealt with the effects of taxation on investment, going back to the well-known works of Harbeger (1962) and Hall and Jorgenson (1967). Of particular interest in this era of increasing globalization are the effects of international differences in tax rates on foreign direct investment (FDI); see, for instance, Auerbach and Hassett (1993), Hines (1999), Desai and Hines (2001), De Mooij and Ederveen (2001), and Devereux and Hubbard (2003).

In this paper (1) we attempt to provide a new look at the mechanisms through which corporate tax rates influence aggregate FDI flows; (2) we develop and simulate a model of tax competition.

We assume "lumpy" setup costs for new investment. This specification, which has been recently supported empirically by Caballero and Engel (1999, 2000), creates a situation in which FDI decisions are two-fold: whether to export FDI at all, and, if so, how much. These decisions are pair-wise: that is, they are made by each source country with respect to each host country, as the "lumpy" cost is specific for each source-host pair. In this context, the source and host tax rates may have different effects on these two decisions.

We begin with the observation that there are in fact no investment flows for many source-host pair countries, as indeed our lumpy setup cost model suggests. We employ a Heckman estimation approach to ask which source-host pairs have any investment at all and to investigate which are the determinants of these flows in those pairs that have. We employ panel data for OECD countries for the period 1981 to 1998.[3]

The organization of this paper is as follows. Section 2 is an introduction.Section 3 provides a simple conceptual framework for the analysis of the effects of taxation on two-fold FDI decisions. Section 4 presents the data and empirical findings. Section 5 develops a model of tax competition. Section 6 reports on the simulation results. Section 5 concludes.

[1] In fact, Ireland had during the 1990's corporate tax rates of only 10% on certain activities. Under pressure from the EU, it has limited the applicability of this low rate to certain regimes (e.g. the Shanon Free Zone).

[2] The tax rate was 28% in 1999.

[3] For a recent survey of the empirical literature about the determinants (including taxes) of FDI, see Blonigen (2005).

3 Source and Host Taxation

Elsewhere (Razin, Rubinstein and Sadka (2004)) we emphasize the two-fold nature of investment decisions. In the presence of fixed setup costs of new investment, a firm determines how much to invest according to the standard marginal productivity conditions. For this decision, the setup costs play no role. But in the presence of fixed setup costs, the profits, that are generated when the firm carries out the amount of investment called for by marginal productivity conditions, may be negative. Therefore, the firm faces also a decision whether to incur the setup costs and invest at all. Thus, the investment decision of the firm is two-fold: whether to invest at all, and if so, how much to invest. Indeed, in Razin, Rubinstein and Sadka (2004) we provide evidence in support of this two-fold mechanism of investment in the context of foreign direct investment. Looking at aggregate FDI inflows and outflows among all potential source-host pairs of OECD countries, we find a large proportion of such pairs with no FDI flows at all. Following the two-fold decision mechanism, we accordingly estimate jointly a selection equation (whether to invest all) and a flow equation (how much to invest). The estimation results point out to the importance of fixed setup costs of new investments for the determination of aggregate FDI flows.

Consider for concreteness the case of a parent firm that weighs the development of a new product line. We can think of the fixed setup costs as the costs of developing the product line. The firm may choose to make the development at home and then carry the production at a subsidiary abroad. This choice may be determined by some "genuine" economic considerations such as source-host differences in labor costs, in infrastructure, in human capital, etc. But it may also be influenced by tax considerations. Of course, the fixed setup cost is not limited only to R&D, but may include also the cost of orientation in a foreign country - such as learning and adopting a new language, a new judicial system, a set of new political norms and institutions, etc.

In this context of FDI, there arises the issue of double taxation. The income of a foreign affiliate is typically taxed by the host country. If the source country taxes this income too, then the combined (double) tax rate may be very high, and even exceeds 100%[4]. This double taxation is typically relieved at the source country by either exempting foreign-source income altogether or granting tax credits[5]. In the former case, foreign-source income is subject to the tax levied by the host country only. When the source country taxes its resident on their world-wide income and grants full credit for foreign taxes, then in principle the foreign-source income is taxed at the source-country tax rate, so that the host-country tax rate becomes irrelevant for investment decisions in the source country. But, in practice, foreign-source income is far from being taxed at the source country rate. First, there are various reduced tax rates for foreign-source income. Second, foreign-source income is usually taxed only upon repatriation,

[4] For a succinct review of this issue see, for example, Hines(2001).

[5] This is also the recommendation of the OECD model tax treaty (OECD, 1997). A similar recommendation is made also by the United Nations model tax treaty (U.N. 1980).

thereby effectively reducing the present value of the tax.[6] Thus, in practice, the host country tax-rate is much relevant for investment decisions of the parent firm at the source country. The relevance of the host-country tax rate intensifies through transfer pricing.

To highlight the issue of source-host differences in tax rates, suppose that the source country does not tax foreign-source income at all. Denote the fixed cost of development by c. Now, if the host-country tax rate is lower than that of the source country, then the parent firm at the source country attempts to keep this cost at home for tax purposes. (Furthermore, there may exist some jointness to the product which enables the parent firm to produce it in multiple markets, once it is created, so that the source country may be crucial in the development process.) The firm may thus charge its subsidiary artificially low royalties for the right to produce the new product. Thus, this cost remains largely deductible in the high-tax source country. Denote the (maximized) present value of the cash flows arising from the production and sale of the new product by $v(\tau_H)$; as explained above, it depends (negatively) on the corporate tax rate (τ_H) levied by the host country. Thus, the parent firm will indulge into the project if

$$c(1-\tau_S) \leq v(\tau_H),$$

where τ_S is the corporate tax rate in the source country[7].

As is evident from condition (1), the tax rate in the source country, τ_S, affects positively the decision by a parent firm in country S whether to carry a foreign direct investment in country H; whereas the tax rate in the host country, τ_H, has a negative effect on this decision.

The amount of foreign direct investment is determined by the standard marginal productivity conditions derived from the maximization of the present value of the cash flows of the foreign subsidiary, after taxes paid in the host country. Therefore, the tax rate in host country (τ_H) has a negative effect on the flow of FDI from S to H; whereas the tax rate in the source country (τ_S) is irrelevant for the determination of the magnitude of their flows.

4 Empirical Evidence

In the dataset there are H-S pairs for which no FDI flows appear in the data (covering 18 years). This probably indicates that the FDI flows called for by the standard marginal productivity conditions are not large enough to surpass a certain threshold level as the one described in condition (1), rather than that the desired flows, in the absence of a threshold, are actually zero. The traditional Ordinary Least Squares (OLS) methods treat the no-flow observations as

[6] See also Hines and Rice (1994) for a detailed discussion of the benefit of tax deferral.

[7] When the tax-allowed depreciation is close to the true physical (or economic) depreciation, investments are financed primarily by debt, then $v(\tau_H)$ may be approximated by $(1-\tau_H)v_0$, where v_0 is the pre-tax present value of the cash flows of the subsidiary; see, for instance, Auerbach (2002), and Hasset and Hubbard (1996). In this case, condition (1) is approximated by $c[1-(\tau_S-\tau_H)] \leqq v_0$, where we note that $(1-\tau_S)/(1-\tau_H)$ is approximated by $1-(\tau_S-\tau_H)$.

either literally indicating zero flows, and assign a value of zero for the FDI in these observations, or discard these observations altogether. In both cases the estimates are biased.[8]

We employ 3-year averages, so that we have six periods (each consisting of 3 years). The main variables we employ are: (1) standard country characteristics, such as GDP or GDP per-capita, population, educational attainment (as measured by average years of schooling), language, financial risk ratings, etc.; (2) S-H source-host pair, characteristics, such as S-H FDI flows, geographical distance, common language (zero-one variable), S-H flows of goods, bilateral telephone traffic per-capita as a proxy for informational distance, etc.; (3) corporate-tax rates[9]. Table 1 describes the list of the 24 countries in the sample, and whether they are observed in the sample (at least once) as a source or host country (but most source countries do not have positive flows more than with few host countries), and Table 2 describes the data sources.

The data employed in the empirical analysis are drawn from OECD reports (OECD, various years) on a sample of 24 OECD countries, over the period from 1981 to 1998. The FDI data are based on the OECD reports of FDI exports from 17 OECD source countries to 24 OECD host countries[10].

4.1 Baseline Results

Table 1 describes the data sources. Table 2 presents the effects of several potential explanatory variables of the two-fold decisions on FDI flows (baseline estimates). Our focus is on the role of the source and host corporate-tax rates. We analyze country-pair shocks as we use aggregate country-pair data.[11]

But we naturally include in the empirical analysis a host of standard explanatory/control variables that are employed in studies of the determination of FDI flows. We briefly discuss these determinants first. They are analyzed in details in Razin, Rubinstein and Sadka (2004). These variables includes standard "mass" variables (the source and the host population sizes); "distance" variables (physical distance between the source and host countries and whether or not the two countries share a common language); and "economic" variables (source and host GDP per capita, source-host differences in average years of schooling, and source and host financial risk ratings). In addition, we include a dummy variable (previous FDI) to indicate whether or not the source-host pair of countries have already established FDI relations between them in the past;

[8] See Razin, Rubinstein and Sadka (2004) and Razin, Sadka and Tong (2005).

[9] We simply apply the statutory rates, because they are exogenously given. Average effective tax rates, suggested by Deverux and Griffith (2003) as determinants of the location of investments, are endogenous in the sense that they are determined by the amount of investment. To apply econometrically average effective tax rates, there is a need for a good instrument. The statutory rate is the best available instrument.

[10] The OECD reports accurately on *all* rich and poor countries that are a host to OECD FDI exports. But data are missing for non-OECD countries as a source of FDI exports. This is the reason that we restrict our sample to the group of OECD countries, as potential source and host countries, among themselves, with no missing data.

[11] For an analysis of micro-data see, e.g., Devereux and Griffith (1998).

such past relations may have some bearing on the setup costs of establishing a new relation. Also, as in other international cross-section studies as well, there is the issue of endogeneity between some or all of the explanatory variables and the dependent variables. In our case, for example, some weak macroeconomic fundamentals in a host country may lead simultaneously to low FDI flows and tax rates. As finding appropriate instruments may be impossible or certainly hard, we follow the common procedure of handling the endogeneity issue by including country-fixed effects.

As explained in detail in Razin, Rubinstein and Sadka (2004), the OLS estimates of the effects of these variables are biased. This is true for both the OLS-D regression, where the observations with no FDI flows are discarded (leaving only 851 observations out of the 2116 observations in the full sample); and for the OLS-Zero regressions, where the no-flow observations were recorded as having FDI flows of zero[12]. Note that the difference in the coefficients between OLS-D and OLS-Zero indicate that there exist non linear relationships between the dependent variable and the independent variables. The Heckman method is suitable for estimating such non linear relationships. The Heckman joint estimation of the flow and selection equations are presented in the last two columns. We exclude certain variables from the flow equation for identification. The results are more or less in line with findings in Razin, Rubinstein and Sadka (2004). For instance, a high gap in education in favor of the source country reduces the probability of having FDI flows to the host country. This is expected because a gap in years of schooling may be a proxy for a productivity gap; see also Lucas (1990). The host financial risk rating affects positively the flow of FDI, whereas the analogous variable of the source country is negative and significant in the selection equation. Finally, the existence of past FDI relations is positive and significant in the selection equation, as it may help to reduce the setup costs of establishing a new FDI flow.

We turn now to the effect of corporate-tax rates. First, the source corporate-tax rate is positive and significant in the selection equation, as indeed predicted by condition (1) of the preceding section. This rate plays no statistically significant role in the flow equation, again in line with our analysis. The coefficient of the host corporate-tax rate is indeed negative, although insignificant in the selection equation.[13],[14] But it is negative and significant in the flow equation,

[12] More accurately, as we measured FDI by logs, we put a large negative number for these FDI flows.

[13] One may argue that since previous FDI indicates that the fiscal environment was acceptable to the investors before, it may soak up elements of the host's fiscal environment. If host country taxes change only infrequently, the previous FDI variable may pick up the overall attractiveness of the country (taxes included), causing the host tax to appear unimportant, even if it does influence investment selection. This concern was mitigated in the baseline estimation, because we employed previous FDI as a dummy variable rather than a continuos (quantity) variable. Furthermore, country fixed effects, that we employed, soak up the correlation of the host tax rate with the country overall fiscal environment.

[14] To the extent that some source country in the sample do effectively tax foreign source income, granting credits for foreign taxes paid, the host-country tax looses its importance. This may provide an alternative explanation for the absence of a significant effect of the host-country corporate tax rate in the selection equation.

again as predicted by our analysis. Note that it is not merely the source-host tax differential ($\tau_S - \tau_H$) which is the main determinant of FDI flows.

Interestingly, the role of the source and host corporate-tax rates is not properly revealed by the traditional OLS regressions. In the first regression (OLS-D), only the host corporate-tax rate plays a statistically significant role in reducing FDI flows to the host country; whereas in the other regression (OLS-Zero), it is only the source corporate-tax rate which plays a statistically significant role in promoting FDI outflows from the source country. Thus, OLS analysis does not detect a role for both tax rates to play in the determination of FDI.

4.2 Robustness

In this section we perform several robustness tests.

First, other empirical work on FDI has relied on variants of gravity equations, which include the GDP of the host and source countries. Home and host GDP are also key regressors in the FDI estimation framework carried by Carr, Markusen and Maskus (2001), or the slightly modified version proposed by Blonigen, Davies and Head (2003). Since rich and often high tax countries were responsible for much of the FDI activity over the period analyzed here, the positive coefficient on source country taxes may possibly reflect investor size. We therefore replace in Table 3, panel (a) the host and source GDP per capita and population size by the host and source GDP. The effects on FDI of the host and source corporate tax rates are intact: the source tax rate has a positive and significant coefficient in the selection equation, whereas the host tax rate has a negative and significant coefficient in the flow equation. Also, the coefficients of the host and source GDP are insignificant. (The coefficients of the host population, as a size variable, was significant in the baseline estimations - negative in the flow equation and positive in the selection equation.)

The selection equation includes two variables (previous FDI dummy and source country risk rating) that are not included in the flow equation, as a device for identifying the selection equation. Indeed, a lack previous FDI may serve as a proxy for the existence and magnitude of fixed setup costs. We therefore included a dummy for previous FDI flow in the selection equation, but not in the flow equation. As a robustness test, we included also the previous FDI dummy in the flow equation. The results are reported in Table 3, panel (b). Indeed, the coefficient of the previous FDI dummy is insignificant in the flow equation. Our main results concerning the host and source corporate tax rates remain intact.

A further robustness test with respect to the previous FDI as an exclusion restriction variables is reported in Table 3, panel (c). We replace the previous FDI dummy by previous FDI stock. Due to a lack of sufficient data on FDI stocks, the sample size reduces from 2116 to just 1036 observations. Even in this smaller sample (with a different restriction exclusion variable), our main results remain intact: the coefficient of the source tax rate is positive and significant in the selection equation, whereas the host tax rate is negative and significant in the flow equation.

The results of another robustness test are reported in Table 3, panel (d). We added the lagged host and source tax rates to both the flow and selection equations. The lagged tax variables prove to be significant, underscoring the importance of the contemporaneous tax variables; as in the baseline case.

We also include country-pair fixed effects in order to control for selection and time-invariant heterogeneity. The results are reported in Table 3, panel (e). The effects of source and host corporate tax rates remain as in the baseline case: the coefficient of the source tax rate is positive and significant in the selection equation, but much lower and insignificant in the flow equation; whereas the coefficient of the host tax rate is negative and significant in the flow equation, but insignificant in the selection equation.

Table 1: Data Sources

Variables:	**Source:**
Import of Goods	*Direction of Trade Statistics*, IMF
FDI Inflows	*International Direct Investment Database*, OECD
Unit Value of Manufactured Exports	*World Economic Outlook*, IMF
Population	*International Financial Statistics*, IMF
Distance	Shang Jin Wel's Website: www.nber.org/~wei
Bilateral Telephone Traffic	*Direction of Traffic:* *Trends in International Telephone Tariffs*, International Communication Union International Telecommunication Union
Educational Attainment	Barro-Lee Dataset: www.nber.org/N....
ICRG Index of Financially Sound Ratings (inverse of financial risk)	Ashoka Mody, IMF
Corporate Tax Rates	World Tax Database (University of Michigan) http://www.bus.umich.edu/otpr/worldtaxdatabase.htm

Table 2: The Effects of Host and Source Corporate-Tax Rates on FDI: Baseline Estimates

	OLS		Heckman Estimation	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate[1]	1.880 (1.175)	**2.420**** (**0.717**)**	1.168 (1.236)	**5.614**** (**1.821**)**
Host Tax Rate[1]	**−3.461**** (**1.109**)**	−0.683 (0.763)	**−3.636**** (**1.103**)**	2.568 (1.538)
Host Real GDP per Capita[2]	0.088 (0.704)	0.198 (0.463)	−0.046 (0.723)	0.280 (0.889)
Source Real GDP per Capita[2]	0.258 (0.757)	0.311 (0.318)	0.095 (0.774)	−4.697* (2.390)*
Host Population[2]	−4.810* (2.332)*	0.592 (1.641)	**−6.524**** (**2.350**)**	**10.147**** (**2.906**)**
Source Population[2]	0.330 (2.843)	0.973 (1.508)	−0.739 (2.748)	−2.000 (3.732)
Source-Host Difference in Schooling[3]	−0.009 (0.093)	−0.066 (0.056)	0.034 (0.102)	**−0.287**** (**0.107**)**
Common Language[4]	**0.922**** (**0.136**)**	**0.453**** (**0.119**)**	**0.892**** (**0.123**)**	**0.392**** (**0.189**)**
Source-Host Distance[5]	**−0.689**** (**0.087**)**	**−0.389**** (**0.069**)**	**−0.663**** (**0.082**)**	**−0.415**** (**0.099**)**
Host Financial Risk Rating[6]	**0.049**** (**0.017**)**	−0.005 (0.012)	**0.060**** (**0.017**)**	−0.023 (0.026)
Source Financial Risk Rating[6]	**−0.082**** (**0.030**)**	**−0.036**** (**0.011**)**		**−0.138**** (**0.050**)**
Previous FDI[7]	**0.395**** (**0.129**)**	**1.526**** (**0.200**)**		**0.630**** (**0.148**)**
Number of Observations	851	2116	2116	2116

Notes:
(a) All estimations include country and time fixed effects
(b) Robust standard errors appear in parentheses
* Indicates significance at the five percent level;
** Indicates significance at the one percent level;
[1] In fractions
[2] In logs, lagged one period
[3] In average years of schooling, lagged one period
[4] One for common language; zero otherwise
[5] In logs
[6] Lagged one period
[7] One for existence of previous FDI; zero otherwise

Table 3: The Effects of Host and Source Corporate-Tax Rates on FDI: Robustness Tests

(a) GDP as a size variable

	OLS		**Heckman Estimation**	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate	1.970	**2.367**	1.256	**5.360**
	(1.154)	(**0.703**)**	(1.217)	(**1.800**)**
Host Tax Rate	**−3.046**	−0.718	**−3.109**	1.743
	(**1.149**)**	(0.739)	(**1.149**)**	(1.441)
Host Real GDP per capita				
Host Real GDP	0.045	0.199	−0.109	0.363
	(0.7)	(0.462)	(0.722)	(0.894)
Source Real GDP per capita				
Source Real GDP	0.261	0.317	0.075	−4.581
	(0.737)	(0.318)	(0.756)	(2.414)
Host Population				
Source Population				
Source-Host Difference in Schooling	0.031	0.068	−0.012	**0.251**
	(0.089)	(0.056)	(0.098)	(**0.097**)**
Common Language	**0.923**	**0.453**	**0.891**	**0.394**
	(**0.137**)**	(**0.119**)**	(**0.123**)**	(**0.185**)**
Source-Host Distance	**−0.694**	**−0.389**	**−0.667**	**−0.403**
	(**0.087**)**	(**0.069**)**	(**0.083**)**	(**0.098**)**
Host Financial Risk Rating	0.038	−0.004	**0.046**	−0.002
	(0.016)*	(0.011)	(**0.015**)**	(0.025)
Source Financial Risk Rating	**−0.084**	**−0.035**		−0.128
	(**0.030**)**	(**0.010**)**		(0.050)*
Previous FDI (dummy)	**0.386**	**1.527**		0.655
	(**0.130**)**	(**0.199**)**		(0.146)*
Number of Observations	851	2116	2116	2116
*significant at 5%; **significant at 1%				

(b) Lagged FDI dummy included in the flow and selection equations

	OLS		Heckman Estimation	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate	1.880 (1.175)	**2.420** (**0.717**)**	1.489 (1.223)	**5.804** (**1.807**)**
Host Tax Rate	**−3.461** (**1.109**)**	−0.683 (0.763)	**−3.600** (**1.076**)**	2.292 (1.532)
Host Real GDP per capita	0.088 (0.704)	0.198 (0.463)	−0.016 (0.699)	0.510 (0.930)
Host Real GDP Source Real GDP per capita	0.258 (0.757)	0.311 (0.318)	0.199 (0.751)	−4.407 (2.583)
Source Real GDP Host Population	−4.810 (2.332)*	0.592 (1.641)	−5.803 (2.442)*	**10.579** (**2.919**)**
Source Population	0.330 (2.843)	0.973 (1.508)	0.311 (2.748)	−2.327 (3.838)
Source-Host Difference in Schooling	0.009 (0.093)	0.066 (0.056)	-0.016 (0.099)	**0.283** (**0.109**)**
Common Language	**0.922** (**0.136**)**	**0.453** (**0.119**)**	**0.896** (**0.122**)**	0.370 (0.199)
Source-Host Distance	**−0.689** (**0.087**)**	**−0.389** (**0.069**)**	**−0.668** (**0.084**)**	**−0.401** (**0.113**)**
Host Financial Risk Rating	**0.049** (**0.017**)**	−0.005 (0.012)	**0.053** (**0.017**)**	−0.031 (0.027)
Source Financial Risk Rating	**−0.082** (**0.030**)**	**−0.036** (**0.011**)**	−0.069 (0.030)*	−0.114 (0.049)*
Previous FDI (dummy)	**0.395** (**0.129**)**	**1.526** (**0.200**)**	0.296 0.159	**0.571** (**0.157**)**
Number of Observations *significant at 5%; **significant at 1%	851	2116	2116	2116

(c) Lagged FDI flows as an exclusion restriction

	OLS		**Heckman Estimation**	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate	1.085	1.595	0.068	2.964
	(1.468)	(0.768)*	(1.350)	(5.300)
Host Tax Rate	−0.708	−0.589	**−4.003**	7.805
	(1.257)*	(0.753)	(**1.253**)**	(9.984)
Host Real GDP per capita	0.298	0.287	0.131	−0.693
	(0.734)	(0.498)	(0.764)	(5.271)
Host Real GDP				
Source Real GDP per capita	0.019	0.039	−0.470	−9.207
	(0.877)	(0.317)	(0.823)	(6.018)
Source Real GDP				
Host Population	−0.571	2.168	**−6.147**	**11.129**
	(2.384)	(1.615)	(**2.175**)**	(**0.895**)**
Source Population	−2.861	−0.101	−3.272	−6.264
	(2.982)	(1.535)	(2.253)	(5.203)
Source-Host Difference in Schooling	0.064	0.046	-0.038	0.415
	(0.101)	(0.058)	(0.128)	(0.398)
Common Language	**0.491**	**0.200**	**0.816**	0.038
	(**0.092**)**	(**0.070**)**	(**0.125**)**	(0.523)
Source-Host Distance	**−0.378**	**−0.214**	**−0.638**	**0.098**
	(**0.059**)**	(**0.041**)**	(**0.086**)**	(**0.334**)**
Host Financial Risk Rating	**0.016**	−0.006	**0.059**	−0.058
	(**0.016**)**	(0.012)	(**0.018**)**	(0.102)
Source Financial Risk Rating	−0.074	−0.018		−0.107
	(0.036)*	(0.012)		(0.184)
Previous FDI (dummy)				
Previous FDI (flow)	**0.439**	**0.539**		0.303
	(**0.044**)**	(**0.037**)**		(0.160)
Number of Observations	747	2116	834	834
*significant at 5%; **significant at 1%				

(d) Contemporaneous and lagged tax rates

	OLS		Heckman Estimation	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate	2.044 (1.061)	**2.187** (**0.737**)**	1.496 (1.123)	**4.602** (**1.877**)**
Source Tax Rate (lagged)	−0.398 (1.220)	**0.763** (**0.827**)**	−0.833 (1.269)	2.549 (1.514)
Host Tax Rate	**−3.080** (**1.133**)**	−0.480 (0.769)	**−3.257** (**1.124**)**	2.748 (1.618)
Host Tax Rate (lagged)	−1.190 (1.118)	−0.679 (0.741)	−1.126 (1.153)	−0.728 (1.717)
Host Real GDP per capita	0.302 (0.713)	0.309 (0.498)	0.165 (0.729)	0.419 (0.951)
Host Real GDP				
Source Real GDP per capita	0.297 (0.727)	0.182 (0.363)	0.170 (0.748)	−4.852 (2.376)*
Source Real GDP				
Host Population	−4.646 (2.343)*	0.753 (1.670)	**−6.338** (**2.361**)**	**10.430** (**2.971**)**
Source Population	0.189 (2.840)	0.794 (1.536)	−0.936 (2.744)	−2.048 (3.786)
Source-Host Difference in Schooling	0.017 (0.101)	0.086 (0.058)	−0.035 (0.113)	**0.344** (**0.115**)**
Common Language	**0.922** (**0.136**)**	**0.452** (**0.119**)**	**0.892** (**0.122**)**	0.390 (0.190)*
Source-Host Distance	**−0.689** (**0.087**)**	**−0.389** (**0.069**)**	**−0.663** (**0.082**)**	**−0.418** (**0.100**)**
Host Financial Risk Rating	**0.046** (**0.017**)**	−0.007 (0.013)	**0.058** (**0.017**)**	−0.027 (0.027)
Source Financial Risk Rating	**−0.082** (**0.031**)**	**−0.034** (**0.012**)**		−0.135 (0.050)*
Previous FDI (dummy)	**0.395** (**0.128**)**	**1.530** (**0.200**)**		**0.618** (**0.149**)**
Number of Observations	851	2116	2116	2116
*significant at 5%; **significant at 1%				

(e) Country-pair fixed effects

	OLS		Heckman Estimation	
	OLS-D	**OLS-Zero**	**Flow**	**Selection**
Source Tax Rate	1.482 (1.301)	**2.381** (**0.744**)**	1.323 (1.155)	**8.330** (**2.361**)**
Host Tax Rate	**−3.372** (**1.287**)**	−0.747 (0.816)	**−3.344** (**1.122**)**	0.994 (2.584)
Host Real GDP per capita	0.044 (0.832)	0.208 (0.478)	−0.001 (0.729)	1.645 (1.836)
Source Real GDP per capita	0.218 (0.854)	0.384 (0.320)	0.112 (0.756)	−2.606 (2.928)
Host Population	−3.778 (2.679)	1.017 (1.747)	−3.917 (2.255)	**22.683** (**6.239**)**
Source Population	0.431 (3.281)	1.013 (1.611)	−0.982 (2.809)	−1.396 (6.211)
Source-Host Difference in Schooling	0.017 (0.105)	0.083 (0.059)	0.023 (0.091)	0.447 (0.184)*
Common Language	**1.321** (**0.060**)**	**0.162** (**0.030**)**	**0.773** (**0.086**)**	3.193 (.)
Source-Host Distance	**−1.006** (**0.054**)**	**−0.374** (**0.011**)**	**−0.826** (**0.026**)**	−1.359 (.)
Host Financial Risk Rating	0.037 (0.019)	−0.002 (0.013)	**0.045** (**0.017**)**	−0.039 (0.047)
Source Financial Risk Rating	−0.088 (0.034)*	**−0.038** (**0.012**)**		**−0.205** (**0.078**)**
Previous FDI (dummy)	**0.429** (**0.146**)**	**0.969** (**0.221**)**		**−0.676** (**0.231**)**
Number of Observations *significant at 5%; **significant at 1%	851	2116	2116	2116

5 A Source-Host Country Model of Tax Competition

In this section we draw on the preceding sections to shed some light on various aspects of international tax competition concerning the flows of FDI. Specifically, we take another look at the implication of FDI for effects of taxation the tax taxes in a source-host country setup. We analyze in the preceding sections the asymmetric mechanisms trough which source and host taxation affect FDI. Here we analyze this asymmetry to explain the endogenous coexistence of high-tax, high public expenditure source countries and low-tax,low public expenditure host countries. Such differences may be a characteristic in the enlarged European Union between the old members countries and the new accession countries.

5.1 Production

Consider a host country with a continuum of firms, each with a productivity level factor of ε, where $\varepsilon > -1$; the density and the ?? distribution functions

are denoted, respectively, by g and G. We normalize the number of firms to one. Unlike in chapter 3, the productivity factor is not random. It is random to all before any economics decision is made. Firms are then ex ante and ex post different in their productivity levels.

Assume for simplicity that the initial stock of capital of the firm is zero. Firms with a productivity factor ε (an ε-firm) employs a capital stock of K in the first period produces an output of $A_H F(K)(1+\varepsilon)$ in the second period, where F exhibits a ??? marginal product of capital ($F' > 0, F_\text{J} < 0$). As before, there are setup costs of new investment. Therefore, only firms with a productivity factor above some threshold level (ε^0) will make new investments.

That foreign direct investors (from the source country) have a cutting edge advantage over domestic inventors with respect to these setup costs, so that they acquire control over the domestic firms in the host country.

Foreign direct investors compete among themselves for these firms. Therefore, the price they pay for an ε-firm (with $\varepsilon \geq \varepsilon^0$) to the original domestic owners is $V_H(\varepsilon, \tau_H) - c^*(1-\tau_S)$, where $V_H(\varepsilon, \tau_H)$ is defined by:

$$V_H(\varepsilon, \tau_H) = \max_K \left[\frac{A_H F(K)(1+\varepsilon)(1-\tau_H) + \tau_H \delta'_H K + (1-\delta)K}{1+(1-\tau_H)r} - K \right] - c^*, \tag{(1)}$$

where c^* is the setup cost born by the foreign direct investor. As before, this cost is born in the source country and tax-deducted there. The parameters δ and δ'_H denote as before the physical and the tax rate of depreciation, respectively, and τ_i denotes corporate tax rate in country $i = H, S$. as explains in the preceding chapter, the foreign direct investors do not pay any further tax at their home country. We assume that the two countries are open to the world credit market, which fixes the rate of interest at r.

The first order condition for the optimal stock of capital of an ε-firm is given by

$$A_H F'(K)(1+\varepsilon) = r + \delta - \frac{\tau_H}{1-\tau_H}(\delta - \delta'_H) \tag{(2)}$$

for firms with $\varepsilon \geq \varepsilon^0$. This condition defines the optimal stock of capital of a firm as its productivity factor and the host corporate tax rate.

The cutoff level of the productivity factor is a function $\varepsilon_0(\tau_H, \tau_S)$ of τ_H and τ_S, given by:

$$V_H(\varepsilon, \tau_H) - (1-\tau_S)c^* = 0. \tag{(3)}$$

That is, the ε-firm is indifferent between investing and not investing. Note that because of the setup cost advantage of the foreign direct investors, firms that are not purchased by these investors will not invest at all under domestic ownership, and their value is zero. (Recall that the initial stock of capital of the firm is zero.)

As we plausibly assume that the depreciation rate allowed for tax purposes (δ'_H) is below the true physical rate (δ), it follows from equation (2) that τ_H

depresses the stock of capital of each investing firm. It also follows from condition (3) that τ_H reduces the number of investing firms (that is, increases ε^0). Therefore the host corporate tax rate reduces the total stock of capital in the host country. In contrast, it follows from condition (3) that τ_S increases the number of investing firms (that is, lowers ε^0). Therefore, an increase in the source corporate tax rate raises the capital stock in the host country.

As we are only concerned with FDI flows from the source to the host country, we do not need to adopt the same richness of the host productive sector in the source country.[15] We thus model the firms in the source country as homogenous. Output is $A_H F(K)$ for all firms, where the homogenous productivity factor $1+\varepsilon$ is already embodied into A_S. We also ignore setup costs in the source country. The value of the representative firm is

$$V_S(\tau_S) = \underset{K}{\text{Max}} \left[\frac{A_S F(K)(1-\tau_S) + \tau_S S'_S K + (1-\delta)K}{1+(1-\tau_H)r} - K \right] \qquad ((4))$$

The optimal stock of capital in the source country is given by the marginal productivity condition:

$$A_S F'(K) = r + \delta - \frac{\tau_S}{1-\tau_S}(\delta - \delta'_S). \qquad ((5))$$

This equation yields the optimal stock of capital on a decreasing function $K_S(\tau_S)$ of τ_S.

5.2 Private Consumption

A representative consumer in country $i = S, H$ has an initial endowment I_H in the first period and a utility function

$$U\left[V(x_1, x_2), P\right] \qquad ((6))$$

over first-period consumption (x_1), and second-period consumption (x_2), and public expenditures (P). These expenditures can represent public good provision. Weak separability is assumed between (x_1, x_2) and P, so that the provision of the public good does not affect private demands for first and second-period consumption. For simplicity, it is assumed that P i incurred in the first period. Note that we consider purely simplicity, a presentative consumer model, it is straightforward to extend the public expenditures can reflect redistributive transfers. The tax rate τ_i applies also to the interest income of the consumers, both at home and abroad.[16] Note that we assume identical preferences in the two countries; that is the same U and V for the two countries. However, the identical preferences assumption does not mean that the two countries have a

[15] For instance, the heterogeneity of firms in the host country was needed in order for τ_S to play a role in the extensive margin of FDI. Specifically, with homogeneous firms, ε^0 does not generally change when τ_S changes.

[16] Note that we assume that corporate income is taxed only home - at the corporate level. Each country takes individuals and corporations at the same rate.

demand for the same quality of the public good (P). This is because they do not have the same income. We assume that I_S is significantly higher than I_H. That is, the source country is rich and the host country is poor. Assuming plausibly, that the public good is a normal good, the rich-source country will have a greater demand for the public good (namely, for tax revenues) than the poor-host country. We employ this specification in order to single out the cross-country income gap as the driving force for the ensuing cross-country differences in tax policy in the tax competition equilibrium. (For this reason we also specified the same production function F for the two countries.)

Utility maximization yields the individual consumption demands for the first and the second periods:

$$X_j X_i \left[W_i, r(1-\tau_i)\right] \qquad j=1,2;\ i=H,S \tag{(7)}$$

where W_i is the income of a representative consumer in country i. Note that the demand functions are two identical for the two countries, as we assumed identical preferences for private goods.

The income of a representative consumer in the host country consists of the initial endowment, plus the proceeds from the sales of the domestic firms (with productivity factors above ε^0) to the foreign direct inventors. That is, is given by:

$$W_H(\tau_H,\tau_S) = I_H + \int_{\varepsilon_0(\tau_H,\tau_S)}^{\infty} V_H(\varepsilon,\tau_H) - (1-\tau_S)C^* \left\{1 - G\left[\varepsilon_0(\tau_H,\tau_S)\right]\right\} \tag{(8)}$$

Note that the number of firms within a productivity factor above ε^0 is $1-G(\varepsilon_0)$.

The income of the representative firms in the source country (retained by the representative consumer) is similarly given by

$$W_S(\tau_S) = I_S + V_S(\tau_S). \tag{(9)}$$

Note that the representative consumer in the source country, who is the foreign direct inventor in the host country, pays for the purchased price that exhausts entirely the profits she gets from them. (This follows from the assumed perfect competition among the foreign direct inventors.

5.3 Government

Each government balances its budget: tax revenues must suffice to finance public expenditures. This is done overtime in present value terms, given the free access to the world credit market. By Walras' law the government's budget constraint can be replaced by an economy-wide resource constraint.

Consider first the host country. The representative consumer sells an ε-firm at price $V_H(\varepsilon,\tau_H) - (1-\tau_S)C^*$. This price reflects the cash flow of the ε-firms, after taxes paid to the host country government. However, note that these taxes

are paid by a firm owned by foreign investors. Hence, from the point of view of the host country, the price paid by the foreign direct investors must include also these taxes (which serve to finance public expenditures). Put differently, the host country extracts from the foreign direct investor the before-tax cash flow of the purchased ε-firm, that is $(1+r)^{-1}\{A_H F[K_H(\varepsilon,\tau_H)](1+\varepsilon)+(1-\delta)K_H(\varepsilon,\tau_H)\}-K_H(\varepsilon,\tau_H)-(1-\tau_S)C^*$. Therefore, the economy wide resource constraint of the host country is

$$I_H+(1+r)^{-1}\int\limits_{\varepsilon_0(\tau_H,\tau_S)}^{\infty}\{A_H F[K_H(\varepsilon,\tau_H)](1+\varepsilon)-(1-\delta)K_H(\varepsilon,\tau_H)\}g(\varepsilon)d\varepsilon \tag{(10)}$$

$$=\int\limits_{\varepsilon_0(\tau_H,\tau_S)}^{\infty}K_H(\varepsilon,\tau_H)g(\varepsilon)d\varepsilon+(1-\tau_S)C^*\left\{1-G\left[\varepsilon_0(\tau_H,\tau_S)\right]\right\}$$
$$P_H+X_1\left[W_H(\tau_H,\tau_S)\right]+(1+r)^{-1}X_2\left[W_H(\tau_H,\tau_S)\right].$$

Note from equation (10) that the source country effectively subsidizes the host country through the tax deductibility of the fixed setup costs.[17] The magnitude of this subsidy is $\tau_S C^*\left\{1-G\left[\varepsilon_0(\tau_H,\tau_S)\right]\right\}$. Similarly, the economy wide resource constraint in source country is given by

$$I_S+(1+r)^{-1}\{F_H[K_S(\tau_S)]+(1-\delta)K_S(\tau_S)\}-\tau_S C^*\left\{1-G\left[\varepsilon_0(\tau_H,\tau_S)\right]\right\} \tag{(11)}$$

$$=P_S+K_S(\tau_S)+X_1\left[W_S(\tau_S),\tau_S\right]+(1+r)^{-1}X_2\left[W_S(\tau_S),\tau_S\right].$$

Note again the the source country subsidizes the host country by the amount of tax deductions allowed for the fixed setup costs.

5.4 Equilibrium

Each government attempts to maximize the welfare of its representative consumer. In doing each government takes the policy of the other government as given. We thus look at a Nash-equilibrium of the two country tax competition game.

Formally, the government of the host country chooses τ_H and P_H so as to maximize

[17] When the source country does mange to tax the (resident) parent company on its income from the FDI subsidiary, then it still loses tax revenues to the host country through the foreign tax credit clause that is usually granted to avoid double taxation.

$$U\left[V\{X_1\left[W_H\left(I_H,\tau_H\right),\tau_H\right],X_2\left[W_H\left(I_H,\tau_H\right),\tau_H\right]\}\right],P_H\right], \qquad ((12))$$

subject to the economy-wide resource constraint (10). The source country rate (τ_S) that appears in the latter constraint is considered by the host government as exogenously given. Similarly, the source government chooses τ_S and P_S so as to maximize

$$U\left[V\{X_1\left[W_S\left(\tau_S\right),\tau_S\right],X_2\left[W_S\left(\tau_S\right),\tau_S\right]\}\right],P_S\right], \qquad ((13))$$

subject to the economy-wide resource constraint (11), where τ_H in the latter constraint is taken as exogenously given.

We denote the equilibrium policy of the host government by (τ_H^*,P_H^*), and the equilibrium policy of the source government by (τ_S^*,P_S^*).

6 Host-Source Asymmetric Policies

We resort to some analytics and numerical simulations in order to characterize the equilibrium and study the effect of the source-host income gap on the divergence or convergence the tax-expenditure policies. The parameter values which we use in the simulations are:

$g\left(\varepsilon\right)=0.5$, $G\left(\varepsilon\right)=0.5+0.5\varepsilon$, $F(K)=K^{\alpha}$, $\alpha\in(0,1)$ and $0\leq\delta_i'<\delta\leq1$.

The government of the host country solves:

$$\max_{\tau_H}\left\{\ln\left(X_{1,H}\left(W_H\left(\tau_S,\tau_H\right)\right)\right)+\beta\ln\left(X_{2,H}\left(W_H\left(\tau_S,\tau_H\right)\right)\right)+\gamma\ln\left(P_H\left(\tau_S,\tau_H\right)\right)\right\} \qquad ((14))$$

where (τ_S) is considered by the host government as exogenously given. The best-response function is given by:

$$\begin{aligned}H\left(\tau_S,\tau_H\right)\equiv\frac{1}{1+\beta}\frac{dW_H\left(\tau_S,\tau_H\right)}{d\tau_H}\left[\frac{1}{X_{1,H}\left(W_H\left(\tau_S,\tau_H\right)\right)}-\frac{\gamma X_{1,H}\left(W_H\left(\tau_S,\tau_H\right)\right)}{P_H\left(\tau_S,\tau_H\right)}\right]+\\ \frac{\beta}{1+\beta}\left[\frac{dW_H(\tau_H,\tau_S)}{d\tau_H}\left(1+(1-\tau_H)r\right)-rW_H(\tau_H,\tau_S)\right]\times\\ \times\left[\frac{\beta}{X_{2,H}\left(W_H(\tau_H,\tau_S)\right)}-\frac{\gamma}{(1+r)\,P_H\left(\tau_S,\tau_H\right)}\right]=0\end{aligned}$$

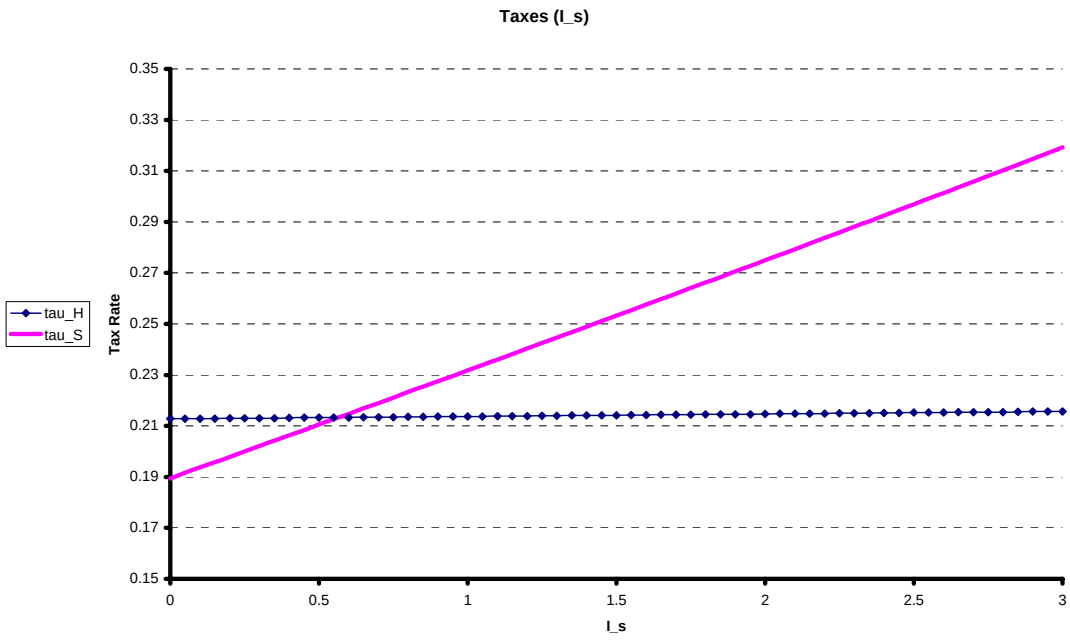
Similarly, the government of the source country solves:

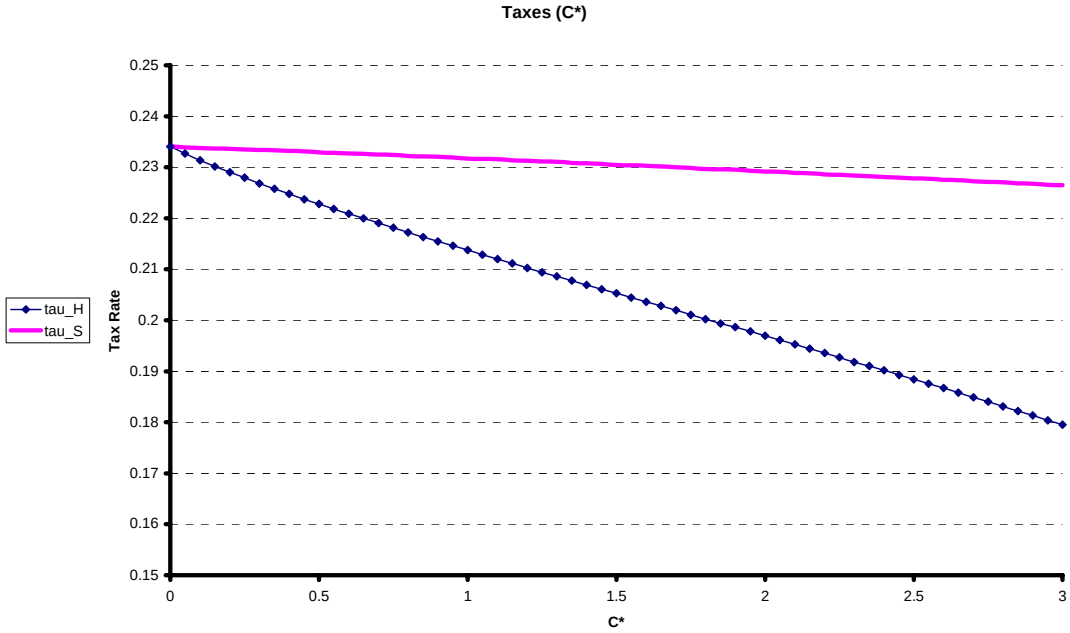
$$\max_{\tau_S}\left\{\ln\left(X_{1,S}W_S(\tau_S)\right)+\beta\ln\left(X_{2,S}W_S(\tau_S)\right)+\gamma\ln\left(P_S\left(\tau_S,\tau_H\right)\right)\right\} \qquad ((15))$$

where τ_H in is taken as exogenously given. The best response function is given by:

$$S(\tau_S, \tau_H) \equiv \frac{1}{1+\beta} \frac{dW_S(\tau_S)}{d\tau_S} \left[\frac{1}{X_{1,S}(W_S(\tau_S))} - \frac{\gamma}{P_S(\tau_S, \tau_H)} \right] \qquad ((16))$$
$$+ \frac{\beta}{1+\beta} \left[\frac{dW_S(\tau_S)}{d\tau_S} (1 + (1-\tau_H)r) - rW_S(\tau_S) \right] \left[\frac{\beta}{X_{2,S}(W_S(\tau_S))} - \frac{\gamma}{(1+r) P_S(\tau_S, \tau_H)} \right]$$
$$- \frac{\gamma}{P_S(\tau_S, \tau_H)} \frac{dh(\tau_S, \tau_H)}{d\tau_S} = 0$$

The simulations yield a unique asymmetric equilibrium: Rich and Source-FDI countries have equilibrium high corporate tax rates and high provision of public goods and services; while Poor and Host-FDI countries have equilibrium low corporate tax ratesand low provision of public goods and services. An increase in the fixed cost tends to lower τ_H and τ_S. An increase in the I_S , keeping I_H constant, tends also to raise τ_H and τ_S.





7 Conclusion

Indeed, the 2004 enlargement of the EU with ten new countries provides a stylized analogue of the predictions of the model. Table 4 describes the corporate tax rates in the 25 EU countries in 2003 in anticipation for the actual enlargement. It reveals a marked gap between the original EU-15 countries and the 10 accession countries. The latter have significantly lower rates. Estonia, for instance, has no corporate tax; the rates in Cyprus and Lithuania are 15%; and in Latvia, Poland, and Slovakia, 19%. In contrast, the rates in Belgium, France, Germany, Greece, Italy, and the Netherlands range from 33% to 40%.

Table 4 Statutory Corporate Tax Rates in the Enlarged EU, 2003.

Country	Tax Rate (%)
Austria	34
Belgium	34
Cyprus*	15
Czech Republic*	31
Denmark	30
Estonia*	0
Finland	29
France	33.3
Germany	40
Greece	35
Hungary*	18
Ireland	12.5
Italy	34
Latvia	19
Lithuania*	15
Luxembourg	22
Malta*	35
The Netherlands	34.5
Poland*	27
Portugal	30
Slovakia*	25
Slovenia*	25
Spain	35
Sweden	28
United Kingdom	30

Note: * Denotes a new entrant.

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