Applied Economics, 2009, **41**, 2691–2703

Routledge
Taylor & Francis Group

Do low corporate income tax rates attract FDI? – Evidence from Central- and East European countries

Christian Bellak* and Markus Leibrecht

University of Economics and B. A., Augasse 2-6, A-1090 Vienna, Austria

Fifty six bilateral country relationships combining 7 home countries from the EU and the US, and 8 Central and East European host countries (CEECs) of foreign direct investment (FDI) from 1995-2003 are used in a panel gravity-model setting to estimate the role of taxation as a determinant of FDI. While gravity variables explain most of the variation of FDI inflows, the bilateral effective average tax rate (beatr) is roughly equally important to other cost-related factors. The semi-elasticity of FDI with respect to taxes is about -4.3. This value is above those of earlier studies in absolute terms and can partly be attributed to using the beatr instead of the statutory tax rate. Our results indicate that tax-lowering strategies of CEEC governments seem to have an important impact on foreign firms location decisions.

I. Introduction

Foreign Direct Investment (FDI) is carried out by Multinational Enterprises (MNEs) in order to earn profits. The profitability of FDI is expected to decrease with increases in energy prices, taxes, labour costs etc. Concerning taxation, the negative relationship between tax burden and FDI inflows is basically confirmed by the empirical evidence for OECD countries. (e.g. DeMooij and Ederveen, 2003, 2005) However, the empirical evidence concerning FDI and taxation in the Central- and East European Countries (CEECs) has consistently not found evidence that taxes matter for location decisions (see below).

We suggest that one possible reason for this somewhat unexpected evidence for the CEECs in the empirical FDI-taxation literature is due to the use of a flawed indicator of tax burden. These flaws, we argue, can be remedied.

The present article differs from previous studies by including a theoretically well-founded measure of the tax burden, namely forward-looking effective tax rates derived by Devereux and Griffith (1999), rather than the statutory tax rate, which has various shortcomings in explaining FDI.

In this article we examine first of all whether there is any substance in the belief that corporate tax rates are an important location factor for FDI from seven home countries to eight CEECs.[1] Secondly, we investigate whether, and to what extent, the choice of measure of the tax burden affects the tax elasticity of FDI. This is mainly motivated by the fact that there has been a gap between the conceptually ideal measure of the tax burden and its operational counterpart in empirical models in earlier studies.

*Corresponding author. E-mail: christian.bellak@wu-wien.ac.at

[1] The home countries are Austria, France, Germany, Italy, The Netherlands, The United Kingdom and The United States. The host countries are Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia (CEEC-8).

Applied Economics ISSN 0003–6846 print/ISSN 1466–4283 online © 2009 Taylor & Francis
http://www.informaworld.com
DOI: 10.1080/00036840701320217

Thirdly, we compare the role of the corporate tax burden to that of other location determinants.

Our empirical results show that the semi-elasticity of FDI with respect to taxation is about −4.3. This is above those of earlier studies in absolute terms and can partly be attributed to using a superior measure of the corporate tax burden than the statutory tax rate. The results indicate that tax-lowering strategies of CEEC governments seem to have an important impact on foreign firms' location decisions.

The remainder of the article is structured as follows. Section II provides some conceptual background and a review of previous studies. Section III describes our data set and the variables used. Section IV describes the empirical specification and methodology used in the estimation. Section V presents the estimation results and discusses their significance in relation to earlier studies. Section VI provides a summary of our main findings.

II. Some Conceptual Considerations and a Review of Previous Studies

The question why a particular country succeeds in competing for inward FDI can be answered by reference to the eclectic paradigm (Dunning 1988; Markusen 1995). With reference to various theories (e.g. Trade Theory, Theory of the Firm and Theory of Industrial Organization) the eclectic paradigm avers that FDI emerges if a firm has an Ownership-advantage (e.g. a patent) combined with a Location-advantage (e.g. low production costs; large market size) and an Internalization-advantage (e.g. economies of interdependent activities).

The particular location factors considered by the firm in choosing between different *foreign* markets have to be valid proxies for host-country Location-advantages. The eclectic paradigm incorporates all possible location factors which attract FDI *conditional* on a firm's decision to undertake FDI. This poses a problem as it neither attributes weights to single location factors like taxation, nor does it assess their relative weights. Hence, empirical applications based upon the eclectic paradigm have to rely on more or less *ad hoc* specifications.

Recently gravity models have been used to explain not only bilateral trade flows but also bilateral FDI flows (e.g. Brainard, 1997). These models can easily be combined with the eclectic paradigm. Empirical models explaining bilateral FDI flows should be based on a panel-gravity setting.

Location-advantages can be classified in terms of factors which are efficiency- or market-related, supply and demand based (e.g. Mold, 2003) or transition specific (Carstensen and Toubal, 2004). Our variable of main interest, the corporate income tax burden, clearly falls into the efficiency and supply related categories.

As the tax burden is a factor which reduces profitability in the host country, it should be negatively related to the inflow of FDI.[2] In general, few studies have dealt with taxes as drivers of FDI to the CEECs. Recently, Bellak *et al.* (2007) surveyed eight papers, which dealt explicitly with FDI to the CEECs, in order to ascertain their tax-rate elasticities. The outcome suggests a median tax-rate elasticity of around −1.45 (semi-elasticity). This result implies that a one percentage point decrease in the tax rate will increase FDI inflows by 1.45%. As almost all of the studies surveyed used statutory tax rates as a measure of the corporate tax burden, the result is in line with the tax-rate elasticities found by DeMooij and Ederveen (2003, 2005), i.e. −1.2 and −2.05, respectively.

However, we question this low tax-rate elasticity. The statutory tax rate is not an appropriate indicator of the tax burden, especially in the case of FDI, because it does not include all relevant tax codes. From a conceptual and empirical point of view, bilateral forward-looking effective average tax rates (*beatrs*) should be used (Devereux and Griffith, 1999, 2002). Hence, the estimated tax-rate elasticities from statutory tax rates are probably flawed. In our study, we follow Devereux and Griffith (1999) and use *beatrs*. We expect a higher tax-rate elasticity than the one based on statutory tax rates as the meta-analyses by DeMooij and Ederveen (2003, 2005) show tax-rate elasticities of −9.3 and −5.9 respectively, when effective average tax rates are used.

In addition, the negative but low median semi-elasticity derived by Bellak *et al.* (2007) may also be explained *inter alia* by the following facts, which are partly transition specific. First, since relatively little

[2] Having described the general relationship between FDI and lower taxes, the story could, however, be different on a more disaggregated level. We are grateful to the referee for raising this problem. First, footloose manufacturing sectors may react differently to service sectors. Second, different tax incentives etc. may apply on the sectoral level. Recently this issue was analysed empirically by Stöwhase (2005). He shows that the tax sensitivity of FDI depends crucially on the sector receiving the capital flow. This raises the possibility of an over- or underestimation of sectoral tax elasticities on the aggregate level. Given the difficulties of obtaining appropriate data at a reasonable scale at present, we have not followed this strategy. As more data will become available in the future, sectoral analyses will show the size of the bias incurred.

FDI is efficiency oriented but most is horizontal FDI other location factors are believed to be important, too. In the case of the CEECs, location factors specific to the transition process such as hyper-inflation, privatization, recession, etc. may play an important role. Second, the more varied the mix of location factors in competing host countries, the smaller should be the influence of a single factor such as taxation. It follows that the tax burden should be more important the more similar potential host countries are with respect to other location factors, *ceteris paribus*. Third, MNEs may avoid taxes via profit shifting. Fourth, insofar as FDI flows contribute to expansionary investment in the existing capital stock, it may react less than in the case of new investment and Greenfield investment in particular.

III. Data and Variables

Dependent variable

The bilateral net-FDI-outflow in millions of euro from home country (*i*) to host country (*j*) for the years 1995–2003 (*t*), is used as the dependent variable (*fdi*). Data are mainly taken from the 'OECD International Direct Investment Statistics Yearbook' and the 'OECD Foreign Direct Investment' database. Missing values are substituted by information from Eurostat's 'New Cronos' database and from National Statistical Offices.

The fact that we use net-FDI-outflows in our study requires some explanation, as criticism has frequently been directed at this measure. In particular, some authors argue that FDI flows reflect financial flows only and not necessarily real capital formation in the host country (see Devereux and Griffith, 2002, p. 84f.). These authors conclude that there is a superior measure, namely plant, property and equipment (PPE), which reflects real capital (fixed assets).

In our view net-FDI-outflows indeed represent the annual decisions of MNEs, either to invest Greenfield or to acquire a foreign firm directly or to expand an existing affiliate or to divest in the CEECs. Net-FDI-outflows include (i) equity of the parent company in the subsidiary, (ii) net loans between parent and affiliate, as well as (iii) reinvested earnings. In addition, local financing in the form of raising new capital, or taking loans, contributes to the affiliate's capital (iv). Empirically, using FDI flows as the dependent variable may thus over- or underestimate 'real investment'. *Over*estimation may result from the fact that financial flows, which are unrelated to investment activities of the affiliate, may enter the components (i), (ii) or (iii). For example, transfer pricing via overvaluing services or goods by the affiliate inflates reinvested earnings. Another source of overestimation is the capital provided by the parent company to cover losses of the affiliate abroad. *Under*estimation of real capital formation results from the fact that the local financing (component iv) is excluded from FDI-flow figures.

In the case of the CEECs, over- and underestimation effects of real capital by FDI flows tend to exist but should be rather small. Profit shifting via transfer pricing might play a certain role, as the CEECs are low-tax countries in general, but underestimation due to local new equity financing is probably of minor importance.[3]

Thus, we are left with 'local loans' as the most serious remaining source of underestimating real capital. Falcetti *et al*. (2003) reported that the ratio of total domestic credit to annual GDP was only 43.2% in Central and Eastern Europe and the Baltic States, while it was 108.8% in the Euro Area on average. Still in 2005, the EBRD's Transition Report concludes on 'financial sector vulnerabilities in Hungary', one of the most advanced countries of the CEEC-8.

In summary, we are convinced that, due to the minor importance of local financing, net-FDI-outflow to the CEECs is a reasonable proxy for the annual real capital formation of affiliates abroad.

Independent variables

The independent variables have to be valid proxies for host country-related Location-advantages. We base our choice of independent variables on the findings of some recent and widely cited studies which, however, use a somewhat different operationalization. We group the Location-advantages as follows:

- market-related location factor: host market size
- efficiency-related location factors: unit labour costs, effective tax rate, distance, common border
- transition-specific location factors: inflation, privatization, political risk.

[3] Rather, in many cases it is the other way round, i.e. a listed acquired firm is de-listed from the stock exchange after the acquisition by a foreign MNE, in order to gain 100% ownership.

Moreover, as we use a gravity setting we also include home country size as another market-related variable.

The larger a home country, the greater the potential for FDI outflows *ceteris paribus*, which suggests a positive coefficient on home country size (*gdphome*). With a larger market, there is a greater likelihood that MNEs will be able to recoup the costs of their FDI (Barba Navaretti and Venables, 2004). We therefore expect a positive sign of the estimated coefficient of host market size (*gdphost*).

While a larger distance (*dist*) between home and host country may encourage FDI due to an Internalization-advantage it may also discourage FDI due to the lack of market know-how, higher communication and information costs and differences in culture and institutions (Buch and Lipponer, 2004). Hence, from a theoretical point of view the sign on the distance coefficient is ambiguous *a priori* (Markusen and Maskus 2002). Here, we expect a negative sign as intra-firm trade flows between parent and affiliate tend to be high in the case of vertical FDI (VFDI) where the costs of re-exporting are an important determinant of overall cost. Secondly, large distance will impact negatively even on horizontal FDI (HFDI). If affiliates are relatively new, as is often the case in the CEECs they typically depend on headquarter services and intermediate inputs supplied by the parent. Thirdly, the negative impact of distance on FDI has been shown by many empirical studies, notably by Markusen and Maskus (2002), who discriminate between various theories of FDI.

As outlined above the average tax rate is the relevant measure of tax burden for *discrete* choices like the location decision of MNEs. Moreover, for international investment decisions *beatrs* are the relevant location factors. As taxes are a cost we expect a negative sign on the estimated coefficients.

Privatization revenues on an annual basis (*privrev*) are used to reflect progress in privatization. We expect a positive sign on the estimated coefficient, as a higher degree of privatization implies more investment opportunities for foreign investors arising from first-mover advantages, competition effects etc. In our view this variable is a better measure of privatization progress than the index of the private-sector's share in the total economy, as published by the EBRD, which is sometimes used. This index exhibits little variation over time as it varies, if at all, only in steps of five percentage points, so that it may underestimate the actual progress of privatization.

Following Bellak *et al*. (2008) our labour cost variable is a measure of real unit labour costs in a common currency (*ulc*). According to public opinion, low labour costs are among the most important determinants of inward FDI in the CEEC-8. This reasoning is in line with evidence reported in Hunya (2004), who suggests that after the first wave of VFDI in the CEECs, FDI has shifted 'further East' within and across the CEECs due to increasing labour costs. In general, high labour costs in the host country should exert a negative impact on FDI.[4]

In countries in transition, property rights may be insecure and political stability may be low. Hence, political *risk* may play a role as a determinant of FDI. As Barba Navaretti and Venables (2004, p. 6) argue 'political risk and instability seems to be an important deterrent to inward FDI'. Political instability could seriously deteriorate the investment climate of a CEEC and thus cause losses for foreign investors. We expect a negative relationship between political risk and FDI but a *positive* coefficient due to the measurement of political risk ranging from 0 (highest risk) to 25 (lowest risk).

Inflation (*pp*) is included as a proxy for macroeconomic instability, which may occur especially in transition countries (Buch and Lipponer, 2004). We expect a negative sign on the estimated coefficients.

A common-border dummy variable is considered in addition to *dist*, as centre-to-centre distance may overstate the effective distance between home and host countries (Head, 2003). We expect a positive sign on the estimated coefficient.

Tariffs (*tar*) are defined as the ratio of tariff revenues over imports of goods and services. From a theoretical point of view the sign of the coefficient on this variable is ambiguous *a priori* depending on the underlying motive for FDI. If the observed FDI is mainly HFDI, the market imperfection theory of FDI suggests a positive sign. In this case HFDI is observed due to an Internalization-advantage ('tariff-jumping' FDI). If, on the other hand, FDI is mainly VFDI, theory suggests a negative sign (e.g. Barba Navaretti and Venables, 2004). In the case of VFDI high trade costs can be seen as a Location-disadvantage, which deters FDI.

Table 1 summarizes the discussion of individual location factors.

Descriptive data analysis

Our data set constitutes a balanced panel of bilateral net-FDI-outflows for seven home countries (*i*), eight

[4] Should the coefficient carry a positive sign, this could be an indication of an omitted variable problem, as in this case labour costs may capture effects of an increasing level of skill in the host country.

Table 1. Independent variables

	Source	Variable	Expected sign
Market-related variables			
(a) $gdphome_{it}$[a]	Eurostat: New Cronos database	Home country size measured as GDP home country in €m.	+
(b) $gdphost_{jt}$[a]	Eurostat: New Cronos database	Host market size measured as GDP host country in €m.	+
Efficiency-related variables			
(c) $dist_{ij}$Sádhaná[a]	http://www.wcrl.ars.usda.gov/cec/java/lat-long.htm	Distance in kilometres	–
(i) $combord_{ij}$	Maps	Common border; Dummy variable: 1 if common border	+
(d) $beatr_{ijt}$	Our own calculations based on Devereux and Griffith 1999; assumptions follow Devereux and Griffith except that we give investment in inventory less (10%) and investment in buildings more weight, as data for the CEECs show that investment in inventories is of minor importance; a pre-tax financial return of 20% is assumed; only corporate income taxes are considered; raw tax data are taken from the European Tax Handbook and KPMG's Corporate Tax Rate Surveys	Bilateral effective average tax rate; measured in per cent	–
(e) ulc_{jt}	Own calculations based on van Ark and Monnikhof (2000); data are taken from the AMECO database and the WIIW database	Real unit labour costs in common currency (Euro); measured in per cent	–
Transition-specific variables			
(f) $privrev_{jt}$	Own calculations; EBRD: Transition Report	Annual privatization revenues in €m.	+
(g) $risk_{jt}$	Euromoney	Political Risk; index ranging from 0 to 25	+
(h) pp_{jt}	EBRD: Transition Report	Inflation measured as the percentage increase in producer prices.	–
(i) tar_{jt}	Own calculations; ratio of taxes and duties on imports excluding VAT over imports of goods and services; Eurostat: New Cronos database; EBRD: Transition Report	Percentage tariffs on imports. Tariff revenues in percent of imports.	?

Note: [a]These variables are the 'core' gravity variables.

Table 2. Descriptive statistics

Variable		Mean	SD	Min	Max	Observations
lnfdi	Overall	4.02	1.75	−0.43	7.81	$N=449$
	Between		1.39	1.66	7.19	$n=56$
	Within		1.11	0.60	7.94	$T=8.02$
lngdphome	Overall	13.90	1.10	12.11	16.24	$N=449$
	Between		1.12	12.20	16.09	$n=56$
	Within		0.14	13.43	14.24	$T=8.02$
lngdphost	Overall	10.40	0.76	8.96	12.24	$N=449$
	Between		0.75	9.38	11.94	$n=56$
	Within		0.21	9.93	10.88	$T=8.02$
lndist	Overall	6.99	0.98	4.03	9.15	$N=449$
	Between		0.99	4.03	9.15	$n=56$
	Within		0.00	6.99	6.99	$T=8.02$
beatr	Overall	34.79	7.43	16.11	55.92	$N=449$
	Between		5.37	24.07	48.07	$n=56$
	Within		5.08	17.52	47.06	$T=8.02$
ulc	Overall	25.42	9.23	11.00	50.00	$N=449$
	Between		8.77	15.43	46.14	$n=56$
	Within		2.89	15.42	33.22	$T=8.02$
privrev	Overall	1223.80	1157.48	58.16	4570.03	$N=449$
	Between		908.25	93.03	2712.47	$n=56$
	Within		739.74	−19.38	4375.46	$T=8.02$
pp	Overall	28.08	112.81	−1.20	901.80	$N=449$
	Between		43.94	1.92	154.04	$n=56$
	Within		104.10	−122.55	803.66	$T=8.02$
risk	Overall	13.88	3.32	5.32	19.82	$N=449$
	Between		2.90	9.59	17.48	$n=56$
	Within		1.64	7.73	17.39	$T=8.02$
tar	Overall	4.34	3.83	0.50	18.45	$N=449$
	Between		3.07	0.95	11.71	$n=56$
	Within		2.28	−0.17	13.43	$T=8.02$
combord	Overall	0.31	0.33	0.00	1.00	$N=449$
	Between		0.33	0.00	1.00	$n=56$
	Within		0.00	0.13	0.13	$T=8.02$

host countries (CEEC-8) (j) and 9 years (t), resulting in 504 observations. However, as bilateral net-FDI-outflows can be negative or zero, and the log of FDI is used as the dependent variable, we are obliged to drop 45 observations (about 9% of our data set). The search for unsystematic outliers[5] in the dependent and independent variables via box-plots and added variable plots pinpoints four data points as potential outliers which are also dropped from the analysis. Table 2 shows the descriptive statistics for our dataset and reveals that the *between* variability is higher than the *within* variability. Our variable of interest, the *beatr*, has an overall mean of 34.8% and ranges between 16% (Austria – Bulgaria in 2002) and 56% (Italy – Czech Republic in 1995). The broad range is not only due to large differences in the statutory tax rates of the home and the host countries but also due to large differences in the withholding tax rates on dividends and interests as well as in allowances. This again is a strong hint of the importance to exploit the considerable heterogeneity across host countries and in bilateral relationships to their home countries.

Table 3 shows the correlation matrix of the various location factors used in the empirical study. No correlation coefficient is above 0.8 in absolute value, which is often used as a threshold value. As low pairwise correlation coefficients are not sufficient for concluding that the variables are not highly multicollinear we provide further evidence using

[5] We define unsystematic outliers as data points which do not represent heterogeneity between the host countries. For example, using box plots the *ulc* for Slovenia are shown to be extreme values throughout the sample period. Hence, these data represent heterogeneity between the host countries which we exploit in our analysis.

Table 3. Correlation matrix

	lngdphome	*lngdphost*	*lndist*	*combord*	*beatr*	*privrev*	*pp*	*risk*	*ulc*	*tar*
lngdphome	1.00									
lngdphost	0.03	1.00								
lndist	0.75	−0.02	1.00							
combord	−0.29	0.10	−0.59	1.00						
beatr	0.03	−0.01	0.01	0.04	1.00					
privrev	0.02	0.69	−0.03	0.06	−0.05	1.00				
pp	−0.02	−0.23	0.09	−0.07	0.14	−0.10	1.00			
risk	0.03	0.52	−0.18	0.27	−0.21	0.39	−0.27	1.00		
ulc	0.02	0.07	−0.10	0.18	−0.38	−0.10	−0.25	0.45	1.00	
tar	−0.05	−0.59	0.14	−0.18	0.09	−0.32	0.30	−0.67	−0.29	1.00

variance inflation factors in the empirical analysis (e.g. Kennedy, 2003).

IV. Empirical Specification and Methodology

The basic panel-gravity model includes the logarithm of home country and host market size, distance, country-pair-specific effects as well as time dummies (Egger and Pfaffermayr, 2003).[6] The model applied is a generalized panel-gravity model with various location factors added. It is shown in Equation 1.

$$\ln FDI_{ijt} = b_1 \ln Y_{it} + b_2 \ln Y_{jt} + b_3 \ln DIST_{ij} + b_4 X_{ijt} + b_5 Z_{ij} + b_6 W_{jt} + \gamma_t + \alpha_{ij} + e_{ijt} \quad (1)$$

where:

$lnFDI_{ijt}$ is the log of net-FDI-outflow from home country i to host country j at time t (*lnfdi*);

lnY_{it} is the log of GDP in country i at time t and the same for $\ln Y_{jt}$ for country j (*lngdphome* and *lngdphost*);

$lnDIST_{ij}$ is the log of the distance between countries i and j (*lndist*);

X_{ijt} are location factors which vary between country-pairs and over time (e.g. *beatr*);

Z_{ij} are location factors which vary over country-pairs only (i.e. *combord*);

W_{jt} are location factors which vary over time and over host countries (e.g. *pp*);

γ_t are time dummies (*TD*);

α_{ij} are country-pair-specific effects;

e_{ijt} is the remainder error term.

We regard the country-pair-specific effects as random for two reasons. First, Hausman-tests[7] on fixed vs. random effects show that the random effects assumptions cannot be rejected. Hence, using the random effects estimator results in more efficient estimates than the fixed effects estimator, which can be highly inefficient if the cross-section dimension is large relative to the time dimension (Pesaran *et al.*, 1998). Using the random effects approach is in line with several recent studies dealing with FDI, trade or capital flows to CEECs (e.g. Clausing and Dorobantu, 2005; Dawson and Hubbard, 2004; Bevan and Estrin, 2004; Gibson and Tsakalotos, 2004) and it allows estimating the impact of time fixed variables (i.e. *dist* and *combord*) on FDI flows. Second, from a more substantive point of view, the random effects approach is relevant here as we are concerned with the decision of MNEs between various host countries. In this decision, differences between *country-pairs* matter, which are exploited by the random effects estimator. Concerning time effects we consider these to be fixed as they are likely to be correlated with *gdphome* and *gdphost* as time dummies account *inter alia* for the business cycle and for common shocks (Egger and Pfaffermayr, 2003).

Our estimation strategy is based on a general to specific approach. We start with the most general

[6] These variables may be called 'gravity specific'.
[7] We perform two types of Hausman-tests. First, if no serial correlation and heteroskedasticity seem to be present and if the other requirements of the original Hausman-test are fulfilled (e.g. the difference between fixed effects and random effects variance matrices is invertible) we use the original Hausman-test. Second, in case of non-spherical errors or a nonpositive definite difference in the fixed effects and random effects variance matrices we perform a regression based Hausman-test with cluster robust SE (Wooldridge, 2002).

model (1) and test down until a specification is reached with only (at conventional levels) significant variables included. This procedure should reduce the probability of an omitted variable bias and it provides information about the robustness of the tax-rate elasticity.[8] An additional robustness and stability analysis (see below) is carried out via the jackknife procedure with respect to host countries included. Furthermore we explore the stability of the coefficient on *beatr*, *ulc* and *privrev* over time. We always test for the presence of serial correlation in linear panel data models ('Wooldridge-test', Wooldridge, 2002) and heteroskedasticity (LM-test, Verbeek, 2004) in the remainder error term. In all cases the Wooldridge-test does not reject the null hypothesis. In cases heteroscedasticity is implied by the LM-test heteroscedasticity-robust SE are used.

V. Results

Table 4 shows the results of our estimation strategy. Model 1 is our most general model including all location factors as well as time dummies. All coefficients carry the expected sign. The core gravity variables as well as *beatr*, *privrev* and *ulc* are highly statistically significant. *Combord* and *pp* are marginally insignificant at the 10% significance level (p-values of 0.102 and 0.11, respectively) using two-sided t-tests. Applying one-sided tests with the alternative hypothesis specified according to the expected sign of the coefficient (Table 1) these two variables are significant at the 10% level. *Risk* and *tar* are highly insignificant even in the case of a one-sided test.

Dropping these two highly insignificant variables step-by-step beginning with the most insignificant variable (*tar*) we finally end up with model 2. This includes the gravity-specific variables as well as *beatr*, *ulc, combord* (efficiency related), *privrev* and *pp* (transition specific). *pp* is again marginally insignificant at the 10% significance level, but due to its p-value of 0.102, which implies statistical significance in case of a one-sided test, we decide to keep this variable in our preferred specification.[9]

The Hausman–Wooldridge-test implies that the random effects specification cannot be rejected. Further tests suggest that model 2 has satisfactory properties from a statistical point of view. Studentized residuals do not show the presence of outliers using a cut-off level of +/− 3.5 (Egger and Pfaffermayr, 2003), the highest variance inflation factor (VIF) of 5.40 implies that multicollinearity should not be a problem in model 2 and a Reset-test suggests that our linear specification is sufficient. Finally, a regression based Hausman-test for endogeneity of *privrev* in model 2, using the EBRD's index of the private-sector share in the total economy as well as dummies for the method of privatization as instruments (see Carstensen and Toubal, 2004 and below) does not reject the null hypothesis of exogeneity.

The magnitudes of the coefficients on distance and host-market size are reasonable as they are in line with the theoretical prediction of the gravity model and with empirical evidence for gravity models explaining international trade flows (Leamer and Levinsohn, 1995; Head, 2003). The comparably low coefficient on home-country size is not unexpected as relatively small countries (Austria and The Netherlands) are among the main source countries of FDI to CEECs. Moreover, the coefficient on *combord* of about 0.68 implies that sharing a border increases net-FDI-outflows by about 97%, a value in line with those usually found for gravity models explaining international trade flows (Head 2003).

The coefficient on *beatr* is statistically significant and negative. The estimate of −4.30 signals a substantially larger impact of corporate income taxes on FDI than earlier studies imply. For example, a median semi-elasticity of about −1.6 can be deduced from the study by Carstensen and Toubal (2004), which partly covers the same countries as well as a similar time period. This estimate is thus substantially lower than ours in absolute value. However, it must be kept in mind, that besides other differences to our study Carstensen and Toubal base their analysis on statutory tax rates.

The tax-rate elasticity of −4.30 implies that a one percentage-point decrease in the effective tax rate increases net-FDI-outflows *ceteris paribus* by about 4.30%. Evaluated at the mean net-FDI-outflow of € 193.5 m. this amounts to € 8.3 m. on average. Thus, in the past, tax-lowering strategies of governments in the CEECs had an important effect on the allocation of FDI among the CEEC-8.

Model 2 shows that a one percentage-point increase in *ulc* reduces net-FDI-outflows by about 3.30%. Comparing this estimate with other studies is notoriously difficult, as almost every study uses an alternative definition of labour costs. Lansbury *et al.*

[8] We also used a specific to general approach to asses the robustness of the tax-rate elasticity with respect to single location factors additionally included in the empirical model. The results show the robustness of our estimate in this respect but are not reported here. For details see Bellak and Leibrecht (2005).
[9] Dropping *pp* does not change the results of our analysis. Details can be found in Bellak and Leibrecht (2005).

Table 4. Estimation results

	Model 1		Model 2	
lngdphome	0.25*	(1.70)	0.26*	(1.76)
lngdphost	0.98***	(5.50)	0.96***	(6.21)
lndist	−0.46**	(−2.35)	−0.46**	(−2.39)
combord	0.66[a]	(1.63)	0.68*	(1.72)
beatr	−4.29***	(−3.42)	−4.27***	(−3.41)
privrev	0.028***	(3.51)	0.030***	(3.93)
pp	−0.084[a]	(−1.59)	−0.090[a]	(−1.61)
ulc	−3.40***	(−2.95)	−3.30***	(−2.88)
risk	2.80	(0.91)		
tar	2.20	(0.68)		
cons	−4.86**	(−2.16)	−4.29**	(−2.04)
N	449		449	
R^2 within	0.33		0.33	
R^2 between	0.66		0.67	
R^2 overall	0.52		0.52	
AR(1): χ^2_1	0.97		1.21	
Het.:	χ^2_{18}: 34.15**		χ^2_{16}: 23.78*	
TD: χ^2_8	29.44***		28.34***	
Hausman:	χ^2_8: 11.48		χ^2_6: 9.31	
BP: χ^2_1	165.02***		171.20***	
Wald:	χ^2_{18}: 325.04***		χ^2_{16}: 316.15***	
sigma_u	0.70		0.70	
sigma_e	0.98		0.99	
Reset: χ^2_3			3.54	
stud. res > |3.5|:			0.00	
Highest VIF:			5.40	
Hausman-test for endogeneity of privrev				
1st stage *F*-value on joint significance of instruments:			10.95	
2nd stage *p*-value on statistical significance of 1st stage residuals			0.31	

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.10$.
[a]Significant at 10% level in case of one-sided test.
t-values in parenthesis.stud.res: studentized residuals. VIF: variance inflation factor. Het: LM-test for heteroskedasticity in fixed effects model. TD: time dummies. BP: Breusch–Pagan-test for random individual effects. Hausman: Hausman-test or Hausman–Wooldridge-test for fixed vs. random effects. AR(1): Wooldridge-test for serial correlation in linear panel data models. Reset: Ramsey-functional-form-test. Wald: model-test; groups = number of cross-sections. sigma_u = SD of cross-section-specific residual. sigma_e = SD of remainder error term. Theta = weight on cross-section specific-mean in random effects model.

(1994) use unit labour costs in a host country relative to other potential hosts in Central Europe and find that labour costs have a significant and negative impact on FDI. Inclusion of relative wage and relative productivity measures as in Holland and Pain (1998) appears to leave only the relative wage variable significant, while productivity differentials across host countries are not significant. According to the authors this implies ‘that considerations of comparative factor costs across countries influence some investment decisions’ (p. 16). Clausing and Dorobantu (2005) measure labour costs by the average compensation rate in the host country and also find a negative effect throughout. Some studies (e.g. Bénassy-Quéré *et al.* 2005, p. 590) even find a *positive* relationship between FDI and labour costs, which is most likely attributable to an omitted variable problem. The authors themselves state, that ‘unit labour costs are positively related to the quality of labour.’ (ibidem, p. 589) Hence, labour costs may account for the impact of skill differentials across host countries.

Concerning the privatization process, our analysis shows a significant and positive impact of *privrev*. At first sight, the coefficient on *privrev*, although significant and with the correct sign seems very low: *ceteris paribus*, net-FDI-outflows increase by about 0.03% if privatization revenues increase by one million euro. Yet, given that foreign MNEs have been active in the CEEC-8 for some time now and that privatization programmes are far advanced, the share of FDI unrelated to privatization processes *per se* should have increased.

Other studies including the privatization process as a determinant of FDI use the EBRD’s private-sector share in total economy (Lansbury *et al.*, 1996; Holland and Pain, 1998; Carstensen and Toubal, 2004) and/or the method of privatisation (Holland and Pain, 1998;

Carstensen and Toubal, 2004). Using the private sector share often results in insignificant coefficients, partly because the share variable does not vary much over time. In Carstensen and Toubal (2004) and Holland and Pain (1998) the 'method of privatization' (i.e. vouchers vs. other methods) turns out to have a significant effect on FDI inflows. Holland and Pain conclude that 'countries with a program of direct privatisation through cash sales have attracted relatively higher inward investment than those countries using voucher privatisation' (p. 16). Clearly, the studies quoted here cover earlier time periods.

The marginally insignificant coefficient on inflation points to the fact that inflation has decreased considerably in the CEEC-8 compared to earlier periods of transition. Studies including earlier years and countries in macroeconomic turbulence (e.g. Edmiston *et al.*, 2003) reveal significant negative effects of inflation on FDI flows.

Finally, the analysis implies that political instability (*risk*) does not seem to be a relevant location factor within the CEEC-8. This is in marked contrast to studies using data from the beginning of the transformation process till the end of the 1990s (e.g. Carstensen and Toubal, 2004). Finally, the insignificance of *tar* is plausible as tariffs were brought down considerably during the 1990s and, hence, are of minor importance throughout our sample period (see Table 4).

Relative importance of effective tax rates as a location factor

Table 5 shows the beta coefficients corresponding to model 2. Host-market size and distance are the most important determinants of net-FDI-outflows. This result is in line with many other studies (e.g. Mold, 2003). Taxation, privatization and unit labour costs are almost equally important as location factors. *Inter alia* these results imply that the role of taxes should not be overemphasized relative to that of other location determinants.

An alternative measure of the corporate income tax burden

In order to show that using statutory tax rates instead of the conceptually superior effective tax rates may lead to an underestimation of the tax-rate sensitivity of FDI we replace the *beatr* by the statutory tax rate (*statrate*) in model 2. Results for model 3 (reported in Table 5) show the expected substantial drop of the semi-elasticity to about −1.9.

Table 5. Beta coefficients and statutory tax rate

	Beta coeff.	Model 3	
lngdphome	0.16	0.19	(1.15)
lngdphost	0.42	0.94***	(5.34)
lndist	−0.26	−0.41*	(1.84)
beatr	−0.18	statrate − 1.90[a]	(−1.59)
privrev	0.20	0.029***	(4.12)
ulc	−0.17	−2.70**	(−2.30)
pp	−0.05	−0.094*	(−1.84)
combord	–	0.66[a]	(1.41)
cons	–	−4.36*	(−1.83)
N	449	449	
R^2 within		0.33	
R^2 between		0.61	
R^2 overall		0.49	
AR(1): χ^2_1		1.20	
Het.: χ^2_{16}		22.87	
TD: χ^2_8		36.32***	
Hausman: χ^2_{14}		16.08	
BP: χ^2_1		257.13***	
Wald: χ^2_{16}		267.83***	
sigma_u		0.81	
sigma_e		0.99	

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.10$.
[a] Significant at 10% level in case of one-sided test.
z-values in parenthesis. Het: LM-test for heteroskedasticity in fixed effects model. TD: time dummies. BP: Breusch–Pagan-test for random individual effects. Hausman: Hausman-test or Hausman–Wooldridge-test for fixed vs. random effects. AR(1): Wooldridge-test for serial correlation in linear panel data models. Wald: model-test.-groups = number of cross-sections. sigma_u = SD of cross-section-specific effects. sigma_e = SD of remainder error term. Theta = weight on cross-section-specific mean in random effects model. SD used to calculate beta coefficients are taken from Table 2; *combord* is a dichotomous variable, hence calculation of a beta coefficient is inadmissible.

This estimate also falls marginally short of statistical significance at the 10% significance level (two-sided test). This should be considered as an indication that the relatively low value of the median semi-elasticity derived by Bellat *et al.* (2007) is partly due to the use of statutory tax rates. This result is also important with regard to evaluating the effectiveness of governments' tax cuts, which might have had a larger effect on inward FDI than earlier studies have revealed.

Robustness and stability analysis

We check the robustness of our preferred specification in model 2 against the impact of possible cross-section outliers by dropping host countries stepwise (e.g. Winner, 2005). Thereby we focus on those variables which are relevant from a policy

Table 6. Jackknife analysis

	Minimum (in absolute value)		Host country excluded	Estimate	Maximum (in absolute value)		Host country excluded
beatr	−2.95**	(−2.24)	Czech Republic	−4.27***	−5.91***	(−4.34)	Croatia
ulc	−1.23	(−0.59)	Slovenia	−3.30***	−4.28***	(−3.36)	Romania
privrev	0.023**	(2.65)	Hungary	0.03***	0.032***	(3.63)	Poland

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. z-values in parenthesis.

Table 7. Stability analysis

	Model 4		Model 5		Model 6	
lngdphome	0.26*	(1.84)	0.27*	(1.83)	0.26*	(1.73)
lngdphost	0.97***	(6.34)	0.93***	(5.96)	0.96***	(6.05)
lndist	−0.46**	(−2.45)	−0.49**	(−2.49)	−0.46**	(−2.31)
combord	0.68*	(1.73)	0.63[a]	(1.55)	0.68*	(1.65)
pp	−0.09*	(−1.65)	−0.07[a]	(−1.36)	−0.09*	(−1.70)
beatr	−4.50***	(−3.40)	−3.80***	(−3.08)	−4.40***	(−3.44)
dummy_beatr	0.22	(0.13)				
privrev	0.03***	(4.24)	0.044***	(5.39)	0.03***	(4.37)
dummy_privrev			**−0.03** ***	(−3.12)		
ulc	−3.30***	(−3.03)	−2.80**	(−2.52)	−3.40***	(−2.92)
dummy_ulc					**0.46**	(0.38)
cons	−4.35**	(−2.10)	−4.03*	(−1.90)	−4.34**	(−2.01)
N	449		449		449	

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.10$. z-values in parenthesis.
[a]Significant at 10% level in case of one-sided test.

perspective (*beatr, ulc, privrev*). Table 6 reports the resulting minimum and maximum values of the coefficient estimates and the coefficient derived from model 2 as well as the country excluded. The results are robust with respect to dropping countries as no coefficient changes sign and all but one remain highly significant. The coefficient on *ulc* gets insignificant when Slovenia is excluded. This is plausible as Slovenia received low FDI and has comparably high unit labour costs when compared to other host countries in our sample.

The stability of the coefficients on *beatr*, *ulc* and *privrev* is checked by combining these variables with a dummy variable for the years 2000–2003. The year 2000 has been chosen as some host countries (notably Romania and the Slovak Republic) started to reduce their *beatr since* 2000. Table 7 (models 4–6) shows that the semi-elasticities for *beatr* and *ulc* for the period 2000 to 2003 are not significantly different from that of previous years, but that the importance of privatization as a driver of FDI is significantly lower from 2000 onwards. This last result seems to be plausible as the privatization process levelled off in many CEECs around 2000 (EBRD transition report, various issues).

VI. Summary

The aim of this article was to test the hypothesis that a high corporate tax burden acts as a deterrent to FDI flows in the CEECs, since it exerts a negative effect on the profitability of investments. We suggest that using the statutory tax rate in previous studies might blur the effects of the tax burden on FDI and lead to questionable results. Therefore, we use the bilateral effective average tax rates to explaining net-FDI-outflows from the seven most important home countries to the CEEC-8. Referring to the eclectic paradigm as a conceptual basis, we find in a panel-gravity setting that FDI is positively related to both source country and host-market size as well as to progress in privatization. Also, FDI is inversely related to the distance between home and host countries, to the corporate tax burden and to unit labour costs. We also find weak evidence for the negative impact of macro-economic risk on FDI. Concerning the role of taxes three points are worth noting:

First, the derived tax-elasticity is robust across various specifications and is greater in absolute value than those reported in earlier studies on the CEECs, pointing to a greater importance of tax policy for company location decisions than previously acknowledged.

Second, the differences in the absolute value of the semi-elasticities when compared to earlier studies are clearly partly due to the use of *beatrs*. The derived semi-elasticity after replacing the *beatr* by *statrate* in our study is, indeed, substantially lower.

Third, the relative importance of the corporate tax rate as a determinant of FDI must not be overemphasized as our results (beta coefficients) reveal that at least during the period 1995 to 2003 the tax burden had no exceptional influence on net-FDI-outflows to the CEEC-8 when compared to other determinants.

While this study is a step towards a better understanding of the determinants of FDI flows to the CEECs, there are several limitations to our analysis. In particular, we are conscious of the exclusion of location factors such as the quantity and quality of production related (public) infrastructure. This omission is due to the lack of meaningful data. Moreover, special investment incentives (e.g. regional, R&D) are not included, as many different incentives have been granted by CEEC governments throughout the sample period of nine years. The choice of incentives to be included in the *beatr* would be arbitrary. Moreover, many CEECs have reduced their special investment incentives to MNEs during our survey period in accordance with the *aquis communautaire* of the EU. For example, Boudier-Bensebaa (2005) reported that, in Hungary, special tax incentives for MNEs have increasingly been phased out, or that domestic and foreign firms are now treated equally. Finally, as data on the sectoral level become available differences in tax-rate elasticities between sectors should provide a more detailed picture on the tax-rate sensitivity of FDI.

Acknowledgement

We are grateful to the Austrian Science Fund for providing financial support by grant F 2008.

References

Bellak, C. and Leibrecht, M. (2005) Do low corporate income tax rates attract FDI? - Evidence from Eight Central- and East European Countries, GEP Discussion Paper, No. 2005/43.

Bellak, C., Leibrecht, M. and Römisch, R. (2007) On the appropriate measure of tax burden on Foreign Direct Investment to the CEECs, *Applied Economics Letters*, **14**, 603–6.

Bellak, C., Leibrecht, M. and Riedl, A. (2008) Labour costs and FDI flows to the CEECs: a Survey of the Literature and Some empirical *Evidence, Economic Dynamics and Structural Change*, forthcoming.

Barba Navaretti, G. and Venables, A. J. (Eds) (2004) *Multinational Firms in the World Economy*, Princeton University Press, Princeton, N.J.

Bénassy-Quéré, A., Fontagne, L. and Lahrèche-Révil, A. (2005) How does FDI react to corporate taxation?, *International Tax and Public Finance*, **12**, 583–603.

Bevan, A. A. and Estrin, S. (2004) The determinants of foreign direct investment into European Transition Economies, *Journal of Comparative Economics*, **32**, 775–87.

Boudier-Bensebaa, F. (2005) Agglomeration economies and location choice: Foreign Direct Investment in Hungary, *Economics of Transition*, **13**, 605–28.

Brainard, S. L. (1997) An empirical assessment of the proximity–concentration trade–off between multinational sales and trade, *The American Economic Review*, **87**, 520–44.

Buch, C. and Lipponer, A. (2004) Clustering or competition? The foreign investment behaviour of German banks, Deutsche Bundesbank Discussion Paper Series 1: Studies of the Economic Research Centre No. 06.

Carstensen, K. and Toubal, F. (2004) Foreign direct investment in Central and Eastern European countries: a dynamic panel analysis, *Journal of Comparative Economics*, **3**, 3–22.

Clausing, K. A. and Dorobantu, C. L. (2005) Re-entering Europe: does European Union candidacy boost foreign direct investment?, *Economics of Transition*, **13**, 77–103.

Dawson, P. J. and Hubbard, L. J. (2004) Exports and economic growth in Central and East European countries during transition, *Applied Economics*, **36**, 1819–24.

DeMooij, R. A. and Ederveen, S. (2003) Taxation and foreign direct investment: a synthesis of empirical research, *International Tax and Public Finance*, **10**, 673–93.

DeMooij, R. A. and Ederveen, S. (2005) How does foreign direct investment respond to taxes? A meta analysis, Paper presented at the Workshop on FDI and Taxation, GEP Nottingham, October.

Devereux, M. P. and Griffith, R. (1999) The taxation of discrete investment choices, IFS Working Paper Series No. W98/16.

Devereux, M. P. and Griffith, R. (2002) The impact of corporate taxation on the location of capital: a review, *Swedish Economic Policy Review*, **9**, 79–102.

Dunning, J. H. (1988) *Explaining International Production*, Unwin Hyman, London.

European Bank for Reconstruction and Development (EBRD) *Transition Report*, various issues, London.

Edmiston, K., Mudd, S. and Valev, N. (2003) Tax structure and FDI: the deterrent effects of complexity and uncertainty, *Fiscal Studies*, **24**, 341–59.

Egger, P. and Pfaffermayr, M. (2003) The proper panel econometric specification of the gravity equation: a three-way model with bilateral interaction effects, *Empirical Economics*, **28**, 571–80.

Falcetti, E., Sanfey, P. and Taci, A. (2003) Bridging the gap? Private sector development, capital flows and the investment climate in south-eastern Europe, EBRD Working Paper No. 80.

Gibson, H. D. and Tsakalotos, E. (2004) Capital flows and speculative attacks in prospective EU member states, *Economics of Transition*, **12**, 559–86.

Head, K. (2003) Gravity for beginners, Web Download.

Holland, D. and Pain, N. (1998) The diffusion of innovations in Central and Eastern Europe: a study of the determinants and impact of Foreign Direct Investment, National Institute of Economic and Social Research Discussion Paper No. 137.

Hunya, G. (2004) Manufacturing FDI in New EU Member States - Foreign Penetration and Location Shifts between 1998 and 2002, WIIW Working Paper No. 311.

Kennedy, P. (2003) *A Guide to Econometrics,* , 5th edn, Blackwell Publishing, Oxford.

Lansbury, M., Pain, N. and Smidkova, K. (1996) Foreign Direct Investment in Central Europe since 1990: an econometric study, *National Institute Economic Review*, **156**, 104–14.

Leamer, E. E. and Levinson, J. (1995) International trade theory: the evidence, *Handbook of International Economics*, Vol. 3, Elsevier Science, Oxford, pp. 1339–94.

Markusen, J. R. (1995) The boundaries of multinational enterprises and the theory of international trade, *Journal of Economic Perspectives*, **9**, 169–289.

Markusen, J. R. and Maskus, K. E. (2002) Discriminating among alternative theories of the multinational enterprise, *Review of International Economics*, **10**, 694–707.

Mold, A. (2003) The impact of the single market programme on the locational determinants of US manufacturing affiliates: an econometric analysis, *Journal of Common Market Studies*, **41**, 37–62.

Pesaran, M. H., Shin, Y. and Smith, R. P. (1998) Pooled mean group estimation of dynamic heterogeneous panels, Cambridge Working Papers in Economics 9721.

Stöwhase, S. (2005) Tax-rate differentials and sector-specific Foreign Direct Investment: empirical evidence from the EU, *Finanzarchiv*, **61**, 535–58.

Van Ark, B. and Monnikhof, E. (2000) Productivity and unit labour cost comparisons: a database, International Labour Organisation Employment Paper No. 5, Geneva.

Verbeek, M. (2004) *A Guide to Modern Econometrics*, Wiley & Sons, Chichester.

Winner, H. (2005) Has Tax competition emerged in OECD countries? Evidence from panel data, *International Tax and Public Finance*, **12**, 667–87.

Wooldridge, J. M. (2002) *Econometric Analysis of Cross Section and Panel Data*, MIT-Press, Cambridge.