II. AKTUALNE TEME

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1. PANEL ANALYSIS OF FDI DETERMINANTS IN EUROPEAN TRANSITION COUNTRIES***

ABSTRACT

This paper focuses on defining determinants of FDI flows from the perspective of a host country by creating a balanced panel of 12 countries from the CEEC and Baltic region. We find FDI flows to move, on average, to stable exchange rate environments, countries with low sovereign risk, and countries with high GDP per capita. In addition, we find also that agglomeration of FDI seems to be an important determinant of current FDI flows. We do not find any support in the data for trade openness to be neither a robust nor a significant explanatory variable of current FDI flows.

1 INTRODUCTION

Intensive growth of international financial flows occurred in the late 1980s and in 1990s for several reasons. *Firstly*, the development of portfolio theory and institutional investors in U.S. in late 1970s and in 1980s (money market mutual funds, investment funds, pension funds) emerged as an answer to stiff regulation in the U.S. banking sector. *Secondly*, amplified interrelations of global markets and globalisation,

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due to improvements in telecommunications and information technologies, enabled greater movement of funds across markets. *Thirdly*, the liberalisation and deregulation of financial markets in mid-1980s, especially in European countries, encouraged the development of financial institutions, markets and instruments in Europe.

By the end of the 1990s it seems that flows of international financing have surpassed the flows of international trade and become independent.

Table 1
TOTAL NET PRIVATE CAPITAL FLOWS TO DEVELOPING COUNTRIES 1990-99. (in bil. USD)

	1990	1991	1992	1993	1994
Total private net capital flows	42.6	61.6	99.7	165.8	174.5
Debt	15.7	18.8	38.1	48.8	50.5
Commercial bank credit	3.2	5.0	16.4	3.5	8.8
Bonds	1.2	10.9	11.1	36.6	38.2
Other	11.3	2.8	10.7	8.7	3.5
Portfolio investment	2.8	7.6	14.1	51.0	35.2
Foreign direct investment (FDI)	24.1	35.3	47.5	66.0	88.8
as a percentage of total flows (%)	56.6	57.3	47.6	39.8	50.9

	1995	1996	1997	1998	1999
Total private net capital flows	203.3	282.1	303.9	267.7	238.7
Debt	62.2	102.1	103.4	81.2	19.1
Commercial bank credit	30.4	37.5	51.6	44.6	-11.4
Bonds	30.8	62.4	48.9	39.7	25.0
Other	1.0	2.2	3.0	-3.1	5.5
Portfolio investment	36.1	49.2	30.2	15.6	27.6
Foreign direct investment (FDI)	105.0	130.8	170.3	170.9	192.0
as a percentage of total flows (%)	51.6	46.4	56.0	63.8	80.4

Source: World Bank (2000), p. 36.

The break-down of the socialist-planning concept of managing an economy, as well as the beginning of transition in most of the former socialist countries towards market economy, brought additional interest in FDI as a way to increase efficiency of the existing socially- (or state)-owned-enterprises (SOEs), narrow the technological gap vis-a-vis the western-European countries and introduce new skills and new ways of doing business.

Table 2

FDI FLOWS IN BULGARIA (BUL), CROATIA (CRO), CZECH REPUBLIC (CZK), ESTONIA (EST), HUNGARY (HUN), LATVIA (LAT), LITHUANIA (LIT), MACEDONIA (MAK), POLAND (POL), ROMANIA (ROM), SLOVAKIA (SKA) AND SLOVENIA (SLO) 1990-2000. (in mil. USD)

	BUL	CRO	CZK	EST	HUN	LAT
1990	4.0	NA	NA	NA	NA	NA
1991	55.9	NA	NA	NA	1462.1	NA
1992	41.5	NA	NA	82.3	1479.2	29.4
1993	40.0	120.3	654.3	162.2	2349.7	45.1
1994	105.4	116.9	878.2	214.4	1144.1	214.5
1995	90.4	115.1	2567.6	201.5	4518.6	179.6
1996	109.0	506.0	1435.3	150.2	2274.1	381.7
1997	504.8	529.6	1286.5	266.2	2167.0	521.1
1998	537.2	932.3	2734.3	580.5	2037.1	356.9
1999	806.1	1479.2	5093.3	305.2	1950.5	347.6
2000	NA	851.7	NA	NA	NA	407.0

	LIT	MAK	POL	ROM	SKA	SLO
1990	NA	NA	89.0	NA	NA	NA
1991	NA	NA	291.0	40.0	NA	NA
1992	NA	NA	678.0	77.0	NA	111.0
1993	30.2	NA	1715.0	94.0	198.8	112.6
1994	31.3	24.0	1875.0	341.0	269.9	128.1
1995	72.6	10.0	3659.0	419.0	236.1	177.4
1996	152.4	11.2	4498.0	263.0	350.8	194.0
1997	354.5	15.7	4908.0	1215.0	173.8	375.2
1998	925.5	117.7	6365.0	2031.0	562.1	247.9
1999	486.5	30.1	7270.0	1041.0	354.3	181.2
2000	378.9	NA	NA	NA	NA	181.0

Source: IFS (2001).

Among the CEEC countries Poland, Hungary and the Czech Republic received the lion's part of FDI flows. Focusing on the CEEC and Baltic transition countries, our goal is to identify the factors, which attract FDIs. This should answer the question why some of the countries in transition received more FDI flows compared to others. So far, according to our knowledge, nobody has undertaken an analysis including all CEEC countries for the period 1993 -1999.

The paper is, thus, divided into five parts. In the first section we give a brief background description, then we proceed by specifying the problem and explaining the utilised variables. Section 4 contains descriptions of the proxies we applied to model the defined variables. In Section 5 we interpret the obtained empirical results and compare them with the results from other papers. We conclude that FDIs are attracted by a stable exchange rate environment, higher per capita income, agglomeration of foreign direct investment flows and low sovereign risk. We do not find support for trade openness to be significant in explaining FDI flows.

2 BACKGROUND

Foreign direct investments (FDIs)[1] can be divided into two main categories (Julius, 1991): FDIs that produce new assets and a whole new operation ("greenfield investment"), and merger and acquisition FDIs ("brownfield investment") that aim to improve the efficiency of acquired unit - where most of the privatisation deals can be classified.

As in every market, we can also define supply and demand side in the market for FDI. Supply side of the FDI market consists of multinational corporations (MNCs) that have incentives to invest in a specific country (host country). To understand the supply side, then, we have to be able to understand those motives: why MNCs invest in a particular country,

[1] By the "Balance of Payments Manual" (IMF, 1993) definition, every foreign investment in equity that exceeds 10 percent of voting power in an enterprise is considered as a foreign direct investment.

why in a particular industry, why in the form of FDI and not in the form of portfolio investment or credit, etc. Demand side of the FDI market consists of national governments and other economic units in the host country that will be sublimed under the national government.[2] The demand side story can be understood, if we are able to discover the motives of national governments to attract FDI versus portfolio investment or ordinary credit.

Some studies of motives of MNCs for FDI stress technological externalities, i.e. MNC can lower average fixed costs of capital intensive industries (an of R&D) by expanding the production via FDI. Imperfections on the production factors markets can also play a role. Also, strategic reasons and industrial organisation can provide motives for FDI - entrance in the foreign market, closeness to the selling market, surpassing obstacles to foreign trade, etc. All of those partial reasons have been summarised in the OLI theory of motives for FDI (Dunning, 1988). According to that theory, MNCs will engage in FDI if three prerequisites are fulfilled: ownership advantages (O), locational advantages (L), and potential benefits from internalisation (I). Ownership advantages represent all the advantages of owning a producing unit in a host country versus selling the goods and services in the market or selling the license to some economic unit in the host country. Locational advantages represent specifics regarding inputs that exist in a host country (natural resources, infrastructure, abundance and low price of labour and other inputs, availability of skilled labour, etc.), transport costs, access to the market, as well as various forms of administrative specifics (taxes, tariffs, quotas, incentives for FDI etc.). Internalisation advantages represent the improvements of efficiency, as well the reduction of costs, when transactions (e.g. common financial planning, internal credits etc.) are done internally between parent MNC and the FDI outlet, versus those transactions done through markets (either in the home country of the MNC or host country).

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[2] Which would be the same as to suppose that government in its pursuit of maximizing social welfare function takes into account the specific interest of potential FDI deals.

Summary of the motives for the host country to attract FDIs can be in creating social benefits like: creating jobs, transfer of the technology and other skills, improving the human capital, broadening of the tax base, boosting the economic activity, boosting of exports, better integration to the world markets, realisation of comparative and competitive advantages, realisation of the scale and scope economies, etc. There are also potential costs associated with FDIs (Graham and Krugman, 1995): reduction of "good" jobs and increase of "bad" jobs (due to labour market imperfections, increases of imports and import dependence - due to imports of new technology), take-over of strategic industries by foreigners, influence of big MNCs on policy in a small country, monopolisation of the industry after the entrance of FDI. Host countries should try to keep social benefits above social costs. Another motive for the host country to attract FDIs lays in the fact that FDI are not debt-creating flows, and a host country can use external financing through FDI without a fear of growing unsustainable foreign debt (that logic was behind the debt-equity swap strategies of debt reduction in the aftermath of debt crisis in the 1980s).

3 PROBLEM SPECIFICATION

In order to define our model we use the Dunning's eclectic OLI model applying it to total FDI flows to CEEC countries. The concept of "O"wnership advantages gives rises to the question which reasons lie behind the company's investment abroad. In this context the distinction can be made between specific qualities a firm contains representing entry barriers for other companies (technology, managerial techniques, company size, monopoly power). The concept of "I"nternalisation advantages attempts to answer the question why a specific firm prefers to invest abroad rather than being involved in licensing, franchising or some other way of delegating the production other than founding its own company. Analysing total FDI flows one is facing the fact that a company has already decided to invest abroad. The interesting question remains, however, about the main determinants influencing the choice of location, i.e. "L"ocational advantages of a home country.

Our model takes into account five broad segments (see equation 1) of the local (home) country attempting to describe its "L"ocational advantages.

(1) FDI = f (agglomeration of FDI, macroeconomic stability, market size/market purchasing power, market trade openness, and economic and political risk)

- Agglomeration of FDI

The idea of the agglomeration hypothesis is based upon the cluster effect (Bellack, 1998) caused by FDIs and could also be explained by the bandwagon effect in the shape of oligopolistic reaction (Vidas-Bubanja, 1998). One could imagine that in not well-established economies, as the emerging or rather transition economies are, where the economic environment is rapidly changing, recent history matters compared to the accumulated effect (in this case cumulative flows of FDI). We expect a positive sign in front of the flow/stock FDI coefficient.

- Macroeconomic stability

We define macroeconomic stability as price stability in a broad sense. It can be perceived as a measure of investment value volatility or risk. The higher the volatility, the higher the investment risk. We also calculate the nominal exchange rate volatility (as the price of the local currency with respect to the USD - Barell and Pain,1997) as deviations from the average exchange rate over the whole period and, alternatively, as the standard deviations of the currency among quarters in a given year. The same standard deviation approach we apply to the inflation volatility variable. In addition, level of prices in the economy, which is perceived as a determinant of the locational advantage, is also tested. In both cases, one would expect negative signs in front of the coefficients, denoting that the higher volatility is, the less attractive is the investment environment.

- *Market size*

The market size hypothesis can be viewed from different perspectives. FDI flows could be seen as a consequence of domestic demand deficiencies and hence undertaken for broadening the demand basis. In that sense, firms producing tradable goods may invest abroad to improve market access by offering improved customer support (instead of being involved in licensing). In that sense absolute market size (population or GDP) and actual demand or purchasing power (per capita GDP) matters. On the other hand market size may be looked at as describing the dynamic development of market purchasing strength (growth rates of GDP or per capita GDP). We expect for any of the market size measures to be positively correlated with FDI inflows.

- *Market trade openness*

Market trade openness or trade intensity ratio can be seen as an indicator of the country's trade policy, although it has some shortcomings. Large countries perform more intraregional trade compared to the small open economies, which are forced to engage more in international trade. In our case we deal with CEEC countries, which can be treated as small open economies. It has been shown that the level of technology in a country (through FDI) positively depends upon the degree of integration into world trade. However, there is also evidence of FDI flows into markets which are highly protected, and where such firms take usually a monopolistic position[3], or engage in "tariff jumping". In this case either sign could be expected.

[3] A good example is the free oil trade between Croatia and Macedonia. After selling the publicly owned oil refinery OKTA to the Greek company Helenic Petroleum, Macedonian oil imports from Croatia were cut and OKTA repositioned itself as the only price setter on the market.

- *Sovereign risk*

Credit rating is used to measure investor's perception of country specific risk. This variable incorporates three factors, which can cause country risk - political events, economic factors and social factors.[4] Since there is a wide variety of elements, which help define the rating index, we do not think that collinearity in model with the macrostability variables represents a problem. Bevan and Estrin (2000) find that credit rating is significantly and positively correlated with FDI inflows. One would expect that credit ratings are positively related to FDI inflows.

4 DATA DESCRIPTION AND REGRESSION MODEL

In the presented analysis we do not focus on identified flows (home country p invests in host county q) as it is undertaken in several other papers (see e.g. Bevan and Estrin, 2000; Resmini, 2000), but rather take into account total FDI flows to transition countries. Furthermore, panel comprises 12 countries, including CEEC and Baltic countries for which data is available on an annual frequency from 1990 to 1999. The latter represents the reason underlying the exclusion of Albania and Bosnia and Herzegovina. The panel definition embodies one of the differences between our paper and the recently published work by Bevan and Estrin (2000) since they excluded Croatia and Macedonia from the estimates, claiming that their "conditions render them special cases which require country-specific explanations". We disagree with this statement, especially in the light of Croatia's entry of EU accession negotiations. Thus, we have included in our panel regression the following countries: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovak Republic and Slovenia.

Also, we were inclined to use same data sources bearing in mind different methodologies and vast differences, one faces, when comparing

[4] See, for example, Euromoney -"County risk analysis" (2000).

databases of different institutions. The choice of the database was based on the explanatory variable - FDI flows to countries from the panel, which includes equity capital, reinvested earnings, other capital and financial derivatives associated with various intercompany transactions between affiliated enterprises, however without items of exceptional financing such as debt-equity swaps. Having compared the data provided by the IMF, UNCTAD, WIIW and EBRD, we have decided that the IMF database offers the best alternative, since EBRD data diverge significantly from other aforementioned sources, whereas WIIW data is not unified among countries. Therefore, we only used the infrastructure proxy form the EBRD "Transition update report 2000".

We proceed in the following way - first we estimate the basic unbalanced panel model (equation 2). The estimated basic model containing 12 countries is presented in three ways, employing OLS estimators, applying cross section weights (CSW), i.e. GLS using the estimated cross section residual variance and utilising seemingly unrelated regression (SUR), i.e. GLS using the estimated cross-section residual covariance matrix. We then continue by splitting the country sample into CEEC 6 countries (Hungary, Poland, Czech Republic, Slovakia, Slovenia and Croatia) and other six EEC and Baltic countries (Bulgaria, Romania, Macedonia, Estonia, Lithuania and Latvia). The sample is segregated in order to analyse whether different country characteristics are reflected in different results with respect to FDI determinants.

$$(2)\quad \log(FDI_t) = C + \log(FDI_{t-1}) + \log(FXV3_t) + \log(PCGDP_t) + \log(RAT2_t) + \log(OPN_t) + u_t$$

To compute nominal exchange rate volatility (FXV3) we use the standard deviation inside the annual period of the local currency per USD. Per capita GDP is calculated by dividing GDP with the population size (PCGDP). Trade openness (OPN) represents the trade ratio to GDP (all in nominal terms) and includes exports and imports of goods as well as services, since banking and insurance FDI account for a significant amount of foreign investment in the CEEC. The credit rating variable (RAT2) is defined according to S&P indexes. We take a cardinal

measure from 1 to 4 to account for different categories which exist, 1 denoting no rating at all, 2 being speculative investment at the lower band (e.g. BB), 3 speculative investment at the higher band bordering with lower investment grade (e.g. BBB-), whereas 4 stands for a high investment grade. Hence, according to the definition, one would expect a positive relationship between ratings and FDI inflows.

In our analysis we use fixed effects or country-specific effects,[5] and by doing so, we make the plausible assumption of heterogeneity across countries. Our analysis does not include random effects.

5 EMPIRICAL RESULTS

The results we obtain in our basic model (Table 3.)[6] coincide with our expectations. Current flows of FDI show a positive relationship to one period lagged FDI flows, indicating that agglomeration does exist in the area of foreign direct investment. The volatility of nominal exchange rates exhibits a negative relationship with current FDI flows.[7] The coefficient is robust and significant once we account for heteroskedasticity and contemporaneous correlation in the panel, using SUR. Per capita GDP seems to be robust and positively related to FDI flows. Trade openness is also positively related in our basic model to FDI flows - however, it has very low significance. Ratings, on average, are robust and positively related to FDI, and significant when SUR is applied. This implies, according to the definition of rating variable, that better ratings attract more FDIs.

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[5] A brief overview of the panel data models can be found in the Appendix.

[6] Table 3 represents summary of the results. Detailed results can be found in Tables A1 to A3 in the Appendix.

[7] We have also tried standard deviation of price level measured by CPI as a measure of price level stability, but this proxy has proven to behave worse than exchange rate stability. One possible explanation is that foreign investors are primarily concerned with their return in foreign currency terms, and all those countries had reasonably low inflation.

We restrain from interpreting the single elasticities from the estimates due to the small finite sample properties we are facing, since it might be the case that the value of coefficients does not converge towards their true value.

Table 3
EMPIRICAL RESULTS FOR PANEL OF 12 COUNTRIES
(standard errors in parenthesis)

	OLS	GLS (CSW)	SUR
log FDI (-1)	0.44	0.40	0.49
	(0.11)	(0.10)	(0.05)
log FXV3	-0.01	-0.05	-0.02
	(0.04)	(0.02)	(0.01)
log PCGDP	0.62	0.60	0.44
	(0.45)	(0.34)	(0.15)
log OPN	0.52	0.22	0.37
	(0.59)	(0.48)	(0.23)
log RAT2	0.22	0.21	0.23
	(0.23)	(0.15)	(0.04)
BUL_C	-1.24	-1.06	-0.22
CRO_C	-1.69	-1.39	-0.47
CZK_C	-1.23	-0.71	0.00
EST_C	-2.01	-1.54	-0.79
HUN_C	-0.93	-0.42	0.23
LAT_C	-1.61	-1.44	-0.55
LIT_C	-1.83	-1.86	-0.80
MAK_C	-2.82	-2.58	-1.60
POL_C	-0.11	0.13	0.88
ROM_C	-0.66	-0.20	0.39
SKA_C	-2.10	-1.64	-0.86
SLO_C	-2.87	-2.37	-1.42
N (unbalanced obs.)	80	80	80
R-squared	0.88	0.88	0.88
Adj. R-squared	0.85	0.85	0.85
F-statistic	116.21		

After obtaining the results from the whole panel, we split the panel into two subpanels.

Table 4
EMPIRICAL RESULTS FOR CEE6 COUNTRIES
(standard errors in parenthesis)

	OLS	GLS (CSW)	SUR
log FDI (-1)	0.30	0.20	0.34
	(0.18)	(0.13)	(0.10)
log FXV3	-0.04	-0.08	-0.06
	(0.06)	(0.03)	(0.02)
log PCGDP	1.60	1.50	1.24
	(0.86)	(0.64)	(0.39)
log OPN	-0.33	-0.08	-0.29
	(0.81)	(0.72)	(0.56)
log RAT2	0.10	0.13	0.1
	(0.27)	(0.20)	(0.12)
CRO_C	-9.18	-7.79	-6.38
CZK_C	-8.35	-6.79	-5.52
HUN_C	-8.14	-6.36	-5.31
POL_C	-7.45	-5.74	-4.81
SKA_C	-8.99	-7.68	-6.26
SLO_C	-10.83	-9.32	-7.67
N (unbalanced obs.)	41	41	41
R-squared	0.90	0.89	0.89
Adj. R-squared	0.86	0.86	0.86
F-statistic	64.05		

The results for CEEC6 are very similar to those obtained for the whole panel, except for ratings that seem to be less important for attracting FDI into these countries (that are considered more advanced transition countries than others). The reason lies in the fact that the aforementioned countries experienced high levels of FDIs during the period they did not have assigned ratings (e.g. case of Hungary, Poland and Czech Republic).

Table 5
EMPIRICAL RESULTS FOR OTHER SIX COUNTRIES
(standard errors in parenthesis)

	OLS	GLS (CSW)	SUR
log FDI (-1)	0.47	0.51	0.54
	(0.16)	(0.15)	(0.13)
log FXV3	-0.02	-0.05	-0.05
	(0.06)	(0.05)	(0.03)
log PCGDP	0.39	0.06	0.08
	(0.68)	(0.51)	(0.34)
log OPN	0.96	0.47	1.38
	(1.07)	(1.03)	(0.58)
log RAT2	0.37	0.46	0.37
	(0.42)	(0.33)	(0.18)
BUL_C	0.15	2.22	1.92
EST_C	-0.70	1.88	1.16
LAT_C	-0.23	1.92	1.58
LIT_C	-0.48	1.57	1.24
MAK_C	-1.14	1.25	1.12
ROM_C	1.02	3.15	3.28
N (unbalanced obs.)	39	39	39
R-squared	0.78	0.78	0.78
Adj. R-squared	0.71	0.70	0.70
F-statistic	25.78		

The results for the other subsumple show again similarities with the initial results, except that the issue of ratings seems to be more important as well as trade openness.

How do our results compare with similar work in the field? Bevan and Estrin (2000) estimated a significant positive relationship between ratings and direct investment, which coincides with our results. Hence, sovereign risk, or rather perceived country risk matters. Also, in the same paper openness seems negatively related with foreign direct investment flows, although highly insignificant. Olofsdotter (1998) obtained also a negative relation between openness and FDIs, again insignificant. Our results regarding openness of markets are mixed and

therefore inconclusive. Furthermore, the market size measure in Bevan and Estrin (2000) shows a strong positive relation to FDI the same way our results seem to indicate.

6 SUMMARY AND CONCLUDING REMARKS

This study tried to identify determinants of foreign direct investment in CEEC and Baltic countries. An unbalanced panel analysis was applied to 12 countries for which data is available from 1990 to 1999. The results seem to indicate that foreign investors, on average, do prefer a stable exchange rate environment. Also, market size matters implying that the larger the country (the larger the purchasing power), the more attractive it is for foreign investors. Sovereign risk is significant in explaining FDI flows, emphasising the importance of the risk premia that investors consider. Trade openness did not play a significant role in our model, and was not robust. So, we do not find, on average, a straightforward, positive relationship between trade openness and FDI flows. The results were confirmed on more homogeneous subpanels - CEEC 6 (Hungary, Poland, Czech Republic, Slovakia, Slovenia and Croatia) and other six EEC and Baltic countries (Bulgaria, Romania, Macedonia, Estonia, Lithuania, Latvia). For CEEC6 countries it seems to be the case that ratings play a less important role compared to the other six EEC countries.

There are several paths one could take in improving the specification of the model and, hopefully, receive answers with better statistical properties. One of the possibilities to improve the model is to introduce quarterly data. This would mean that asymptotic properties would apply, improving the quality of the estimates. Also, some type of index should be developed, or a proxy to measure the level of administration corruption, which should be tested in a transition environment. In order to improve the statistical properties one could attempt to estimate the regression using the IV approach, either by taking first differences or levels as instruments, or the 3SLS approach, and by doing so overcome the problem of the estimators' biasness and inconsistency.

Appendix

PANEL DATA ANALYSIS

Panel data analysis is often used when there exist distinct subgroups within each element of the data set. For instance, when looking at the data set on families with the distinction of siblings within each family, when looking at the data on industries with the distinction of firms within each industry, and especially when looking at the data on countries (cross section data) during some period (time series data) in cross-country comparisons. In all those instances a model has additional indexing:

(A1) $Y_{jt} = a + bX_{jt} + u_{jt}$,

where j goes from 1 to N and represents number of, say, countries, and t goes from 1 to T and represents time; Y is the dependent variable; X is the explanatory variable and u is the error term. Once a panel of data is employed one gains NxT observations, instead of only N (in cross-section analysis), or only T (in time series analysis).

Panel data models can further be distinguished according to the way they can deal with differences that are out of the model (e.g. initial conditions of each country etc.), but should also be controlled for. There are two ways of dealing with these issues, which divides panel data models into two subgroups: fixed effects models and random effects (error components) models.

Fixed effects models assume that there is a difference associated with each country, like in the case of initial conditions, that does not change over time (a specific constant for each country). Thus, a fixed effects panel data model takes the form:

(A2) $Y_{jt} = a_j + bX_{jt} + u_{jt}$,

where a_j represents specific distinctive feature of each country.

Random effects (error components) models assume that there is a random difference associated with each country. Thus, random effects panel data model can be defined as:

(A3) $Y_{jt} = a + bX_{jt} + u_j + u_k + u_{jt}$,

where the random term is divided into u_j or random effects of each country, u_k or random time effects and u_{jt} or random combined country-time effects.

An additional way of differentiating between various types of panel data models is the distinction between a one way error component model and a two way component model. A one way error component model defines the error term as[8]

(A4) $u_{jt} = \mu_j + u_{jt}$,

where μ_j is time invariant and accounts for any individual effect, which is not part of the regression and υ_{jt} denotes the stochastic part of the error term. So, for instance, in the case of an earnings equation apart from explanatory variables such as sex, union membership, education, to mention some, μ_j could be an individual's unobserved ability, e.g. working skills. In an FDI equation μ_j could represent the influence of the unobserved legal framework. By averaging (A2) and (A4) over time and subtracting from (A2) one obtains the so called within estimator, which can be utilised in some cases in order to overcome certain panel problems.

(A4.1) $y_{jt} - y_j = b(x_{jt} - x_j) + (u_{jt} - u_j)$

A two-way error component model contains two-way error components disturbances, which can be shown as:

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[8] We follow here Baltagi (1995).

(A5) $u_{jt} = \mu_j + \lambda_t + \upsilon_{jt}$,

where μ_j represents the time invariant unobservable individual effect and λ_t denotes the individual invariant unobservable time effect accounting for any time-specific effect which is not included in the regression, while υ_{jt} is the stochastic disturbance term. The individual invariant term can account for time effects, which are common to the entire pool such as oil crises or, in an FDI framework for CEEC countries, the change from socialism to capitalism.

As a special case of panel data analysis one could define a dynamic panel data model. The dynamic relationship is characterised by a lagged dependent variable, which enters the regression:

(A6) $Y_{jt} = a + Y_{jt-1} + bX_{jt} + u_{jt}$, $u_{jt} = \mu_j + \upsilon_{jt}$

Assuming that the disturbance term follows a one-way component model and that both terms of the error term are iid and independent of each other, dynamic panel analysis contains some basic problems. Since Y_{jt} is a function of μ_j, Y_{jt-1} is also a function of μ_j. In other words, there exists correlation between Y_{jt-1} and μ_j with the consequence that the OLS estimator is biased and inconsistent. The consistency of the fixed effect within estimator[9] depends upon the time span T being large. The same problem occurs when it is applied to random effects GLS estimators. Solutions can be seen in applying instrumental variables with or without first differencing[10] using within estimators and applying dummies for each state and other possible solutions.

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[9] Obtained by performing the within transformation, eg.: $Y_{jt} = a + bX_{jt} + u_{jt}$, $u_{jt} = \mu_j + \upsilon_{jt}$, then averaging over time, one obtains $Y'_j = a + X'_j + \mu_j + \upsilon'_j$ (loosing the time subscript). By subtracting both equations we obtain: $Y_{jt} - Y'_j = b(X_{jt} - X'_j) + (\upsilon_{jt} - \upsilon'_j)$ - as shown in (A4.1)

[10] For detailed explanations see Baltagi (1995), pp. 125-148.

In the paper we apply cross section weights assuming the presence of cross-section heteroskedasticity. This is undertaken by GLS using estimated cross-section residual variances. Also, if one intends to correct for cross-section heteroskedasticity and contemporaneous correlation, then Parks estimator could be a possible solution, i.e. applying feasible GLS using an estimated cross-section residual covariance matrix.

DATA & RESULTS

TABLE A1. POOL OF 12, OLS

Dependent Variable: LOG(?FDI)
Method: Pooled Least Squares
Date: 07/10/01 Time: 10:13
Sample(adjusted): 1992 1999
Included observations: 8 after adjusting endpoints
Number of cross-sections used: 12
Total panel (unbalanced) observations: 80

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.442360	0.111550	3.965567	0.0002
LOG(?PCGDP)	0.616774	0.445830	1.383430	0.1714
LOG(?FXV3)	-0.008037	0.040101	-0.200424	0.8418
LOG(?RAT2)	0.224571	0.225995	0.993697	0.3242
LOG(?OPN)	0.517425	0.592931	0.872656	0.3862
Fixed Effects				
BUL_--C	-1.236687			
CRO_--C	-1.691926			
CZK_--C	-1.234339			
EST_--C	-2.007609			
HUN_--C	-0.927946			
LAT_--C	-1.608444			
LIT_--C	-1.828835			
MAK_--C	-2.823007			
POL_--C	-0.108894			
ROM_--C	-0.659498			
SKA_--C	-2.102533			
SLO_--C	-2.872652			

R-squared	0.880641	Mean dependent var	6.038389
Adjusted R-squared	0.850328	S.D. dependent var	1.470504
S.E. of regression	0.568901	Sum squared resid	20.38983
F-statistic	116.2052	Durbin-Watson stat	2.369462
Prob(F-statistic)	0.000000		

TABLE A2. POOL OF 12, GLS (CSW)

Dependent Variable: LOG(?FDI)
Method: GLS (Cross Section Weights)
Date: 07/10/01 Time: 10:14
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 12
Total panel (unbalanced) observations: 80

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.397815	0.095788	4.153065	0.0001
LOG(?PCGDP)	0.599971	0.344663	1.740748	0.0866
LOG(?FXV3)	-0.048573	0.024658	-1.969866	0.0533
LOG(?RAT2)	0.214055	0.154541	1.385109	0.1709
LOG(?OPN)	0.219554	0.484993	0.452696	0.6523
Fixed Effects				
BUL_--C	-1.061708			
CRO_--C	-1.388312			
CZK_--C	-0.711524			
EST_--C	-1.538105			
HUN_--C	-0.422936			
LAT_--C	-1.438794			
LIT_--C	-1.860041			
MAK_--C	-2.582582			
POL_--C	0.129040			
ROM_--C	-0.203361			
SKA_--C	-1.639296			
SLO_--C	-2.370089			

Weighted Statistics

R-squared	0.993599	Mean dependent var	8.163428
Adjusted R-squared	0.991973	S.D. dependent var	6.166788
S.E. of regression	0.552508	Sum squared resid	19.23168
F-statistic	2444.666	Durbin-Watson stat	2.381427
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.876806	Mean dependent var	6.038389
Adjusted R-squared	0.845519	S.D. dependent var	1.470504
S.E. of regression	0.577968	Sum squared resid	21.04496
Durbin-Watson stat	2.207359		

TABLE A3. POOL OF 12, SUR

Dependent Variable: LOG(?FDI)
Method: Seemingly Unrelated Regression
Date: 07/10/01 Time: 10:18
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 12
Total panel (unbalanced) observations: 80

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.487813	0.053061	9.193351	0.0000
LOG(?PCGDP)	0.435258	0.146731	2.966368	0.0043
LOG(?FXV3)	-0.022633	0.010731	-2.109259	0.0389
LOG(?RAT2)	0.232854	0.046688	4.987492	0.0000
LOG(?OPN)	0.369996	0.233783	1.582646	0.1185
Fixed Effects				
CZK_--C	-0.004184			
HUN_--C	0.233011			
POL_--C	0.880968			
SKA_--C	-0.856583			
SLO_--C	-1.423189			
CRO_--C	-0.474315			
EST_--C	-0.785223			
LIT_--C	-0.796278			
LAT_--C	-0.547749			
MAK_--C	-1.601849			
BUL_--C	-0.221431			
ROM_--C	0.394173			

Weighted Statistics

Unweighted Statistics

R-squared	0.879937	Mean dependent var	6.038389
Adjusted R-squared	0.849445	S.D. dependent var	1.470504
S.E. of regression	0.570577	Sum squared resid	20.51016
Durbin-Watson stat	2.466832		

TABLE A4. POOL OF CEE6, OLS

Dependent Variable: LOG(?FDI)
Method: Pooled Least Squares
Date: 07/10/01 Time: 10:18
Sample(adjusted): 1992 1999
Included observations: 8 after adjusting endpoints
Number of cross-sections used: 6
Total panel (unbalanced) observations: 41

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.302270	0.184045	1.642372	0.1110
LOG(?FXV3)	-0.035874	0.068290	-0.525327	0.6032
LOG(?RAT2)	0.096173	0.270720	0.355248	0.7249
LOG(?PCGDP)	1.603415	0.863800	1.856233	0.0733
LOG(?OPN)	-0.326690	0.807161	-0.404740	0.6885
Fixed Effects				
CRO_--C	-9.178615			
CZK_--C	-8.349561			
HUN_--C	-8.139733			
POL_--C	-7.446442			
SKA_--C	-8.998175			
SLO_--C	-10.82605			

R-squared	0.895174	Mean dependent var	6.780171
Adjusted R-squared	0.860232	S.D. dependent var	1.268279
S.E. of regression	0.474153	Sum squared resid	6.744631
Log likelihood	-21.17756	F-statistic	64.04717
Durbin-Watson stat	2.457899	Prob(F-statistic)	0.000000

TABLE A5. POOL OF CEE6, GLS (CSW)

Dependent Variable: LOG(?FDI)
Method: GLS (Cross Section Weights)
Date: 07/10/01 Time: 10:19
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 6
Total panel (unbalanced) observations: 41

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.202781	0.130164	1.557890	0.1297
LOG(?FXV3)	-0.079030	0.027572	-2.866272	0.0075
LOG(?RAT2)	0.134286	0.195417	0.687177	0.4972
LOG(?PCGDP)	1.495648	0.638231	2.343429	0.0259
LOG(?OPN)	-0.075255	0.721351	-0.104325	0.9176
Fixed Effects				
CRO_--C	-7.793974			
CZK_--C	-6.794567			
HUN_--C	-6.362050			
POL_--C	-5.741874			
SKA_--C	-7.675781			
SLO_--C	-9.323603			

Weighted Statistics

R-squared	0.998068	Mean dependent var	10.43596
Adjusted R-squared	0.997424	S.D. dependent var	8.936429
S.E. of regression	0.453538	Sum squared resid	6.170902
Log likelihood	-10.71198	F-statistic	3874.903
Durbin-Watson stat	2.470386	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.892729	Mean dependent var	6.780171
Adjusted R-squared	0.856972	S.D. dependent var	1.268279
S.E. of regression	0.479650	Sum squared resid	6.901938
Durbin-Watson stat	2.165445		

TABLE A6. POOL OF CEE6, SUR

Dependent Variable: LOG(?FDI)
Method: Seemingly Unrelated Regression
Date: 07/10/01 Time: 10:19
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 6
Total panel (unbalanced) observations: 41

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.341482	0.095882	3.561487	0.0013
LOG(?FXV3)	-0.059717	0.020488	-2.914760	0.0067
LOG(?RAT2)	0.104470	0.117402	0.889851	0.3806
LOG(?PCGDP)	1.235968	0.391162	3.159731	0.0036
LOG(?OPN)	-0.285745	0.563733	-0.506881	0.6159
Fixed Effects				
CRO_--C	-6.375489			
CZK_--C	-5.516477			
HUN_--C	-5.312864			
POL_--C	-4.809302			
SKA_--C	-6.261323			
SLO_--C	-7.668452			

Weighted Statistics

Unweighted Statistics

R-squared	0.894046	Mean dependent var	6.780171
Adjusted R-squared	0.858728	S.D. dependent var	1.268279
S.E. of regression	0.476697	Sum squared resid	6.817195
Durbin-Watson stat	2.518373		

TABLE A7. POOL OF OTHER SIX, OLS

Dependent Variable: LOG(?FDI)
Method: Pooled Least Squares
Date: 07/10/01 Time: 10:20
Sample(adjusted): 1992 1999
Included observations: 8 after adjusting endpoints
Number of cross-sections used: 6
Total panel (unbalanced) observations: 39

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.470673	0.158285	2.973587	0.0060
LOG(?FXV3)	-0.017560	0.058978	-0.297731	0.7681
LOG(?RAT2)	0.366483	0.422992	0.866405	0.3936
LOG(?PCGDP)	0.393804	0.678701	0.580233	0.5664
LOG(?OPN)	0.962458	1.072138	0.897700	0.3770
Fixed Effects				
LIT_--C	-0.478632			
LAT_--C	-0.229062			
EST_--C	-0.698333			
MAK_--C	-1.140453			
BUL_--C	0.147179			
ROM_--C	1.018811			

R-squared	0.786435	Mean dependent var	5.258568
Adjusted R-squared	0.710161	S.D. dependent var	1.258763
S.E. of regression	0.677676	Sum squared resid	12.85886
Log likelihood	-33.70280	F-statistic	25.77685
Durbin-Watson stat	2.285047	Prob(F-statistic)	0.000000

TABLE A8. POOL OF OTHER SIX, GLS (CSW)

Dependent Variable: LOG(?FDI)
Method: GLS (Cross Section Weights)
Date: 07/10/01 Time: 10:20
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 6
Total panel (unbalanced) observations: 39

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.509363	0.148653	3.426534	0.0019
LOG(?FXV3)	-0.053128	0.049258	-1.078566	0.2900
LOG(?RAT2)	0.454958	0.332392	1.368741	0.1820
LOG(?PCGDP)	0.055223	0.509455	0.108396	0.9145
LOG(?OPN)	0.470046	1.027107	0.457641	0.6507
Fixed Effects				
LIT_--C	1.566593			
LAT_--C	1.923512			
EST_--C	1.882755			
MAK_--C	1.248894			
BUL_--C	2.221348			
ROM_--C	3.152670			

Weighted Statistics

R-squared	0.920851	Mean dependent var	5.919393
Adjusted R-squared	0.892583	S.D. dependent var	2.029182
S.E. of regression	0.665055	Sum squared resid	12.38435
Log likelihood	-29.92685	F-statistic	81.44034
Durbin-Watson stat	2.292448	Prob(F-statistic)	0.000000

Unweighted Statistics

R-squared	0.781153	Mean dependent var	5.258568
Adjusted R-squared	0.702993	S.D. dependent var	1.258763
S.E. of regression	0.686006	Sum squared resid	13.17690
Durbin-Watson stat	2.330853		

TABLE A9. POOL OF OTHER SIX, SUR

Dependent Variable: LOG(?FDI)
Method: Seemingly Unrelated Regression
Date: 07/10/01 Time: 10:21
Sample: 1992 1999
Included observations: 8
Number of cross-sections used: 6
Total panel (unbalanced) observations: 39

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LOG(?FDI(-1))	0.543053	0.124941	4.346488	0.0002
LOG(?FXV3)	-0.048615	0.031019	-1.567260	0.1283
LOG(?RAT2)	0.367126	0.180112	2.038326	0.0511
LOG(?PCGDP)	0.077634	0.344248	0.225518	0.8232
LOG(?OPN)	1.375068	0.578381	2.377442	0.0245
Fixed Effects				
LIT_--C	1.235644			
LAT_--C	1.580940			
EST_--C	1.164402			
MAK_--C	1.120731			
BUL_--C	1.921118			
ROM_--C	3.277356			

Weighted Statistics

Unweighted Statistics

R-squared	0.781503	Mean dependent var	5.258568
Adjusted R-squared	0.703468	S.D. dependent var	1.258763
S.E. of regression	0.685456	Sum squared resid	13.15581
Durbin-Watson stat	2.412116		

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SAŽETAK

PANEL ANALIZA DETERMINANTI IZRAVNIH STRANIH ULAGANJA (FDI) U EUROPSKIM ZEMLJAMA U TRANZICIJI

Ovaj rad analizira odrednice FDI tokova sa stajališta zemlje primatelja, formiranjem panela 12 zemalja Središnje i Istočne Europe, te Baltika. Rezultati analize pokazuju da FDI tokovi, u prosjeku, idu prema stabilnijem tečajnom okruženju, prema zemljama s nižim rizikom, te zemljama s višom razinom BDP-a po stanovniku. Nadalje, čini se da je aglomeracija FDI-a važna odrednica njegovih tekućih tokova. U podacima ne nalazimo potvrdu da je otvorenost zemlje robusna pa ni signifikantna objašnjavajuća varijabla tekućih FDI tokova.