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## FDI in the CEEC's and the theory of real options: An empirical assessment

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An Empirical Assessment**

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# **FDI in the CEEC's and the Theory of Real Options :**

## **An Empirical Assessment**

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### **Abstract**

Building on the empirical evidence resulting from a newly developed database of foreign direct investment (FDI) operations in the countries of Central and Eastern Europe (CEECs), panel data techniques are used to show that, at the sector level, a consistent modelling of FDI flows needs to take into account not only the determinants traditionally considered by the literature, including the recent developments on gravity models, but also variables linked to the institutional environment in which the FDI is undertaken. The inclusion of these variables, affecting the risk and the uncertainty of the FDI operation, is in line with the main findings of the real option theory of investments, whose implications are here empirically tested with success.

JEL classification: C23, D81, F15, F21, P20

Keywords: panel data, real option theory, gravity models, FDI, transition economies

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disclaimer applies. The possibility of exploiting the database PECODB developed by Prof. Alessandrini (Bocconi University) is also gratefully acknowledged.

## 1. Introduction

Over the last years the process of transition to the market undertaken by the formerly socially-planned Central and Eastern European Countries (CEECs), the progressive removal of restrictions to the free circulation of capital and the set up of vast privatisation programs of formerly State-owned enterprises created in principle ideal conditions for the attraction of Multinational Enterprises (MNEs). Those firms were willing to exploit through Foreign Direct Investments (FDI) the potentialities of those markets, or to gain in production efficiency through the relocation of labour intensive lines of production.

However, after almost a decade since the start of the transition, the process of east-west market integration has failed to be as linear and straightforward as the early economic predictions might have implied. The total amount of FDI inflows in the CEECs has been negligible if compared to the one of other developing countries (see Figure 1) and flimsy if compared to the expectations of international observers in the early 90's<sup>1</sup>. In addition, the pattern of the operations undertaken in the CEECs by multinational firms is far from being homogeneous: most of the surveys have, implicitly or explicitly, recognised the heterogeneity of FDI in the regions, in terms of project characteristics and investment determinants at the sectoral and geographical level<sup>2</sup>.

Economic theories have developed in the last decade several pieces of work which attempt to predict these different patterns of FDI in the area<sup>3</sup>, but all of them are clearly put at a strain when confronted to the general empirical evidence arising from the CEECs, being able to explain, if successful, only a part of what remains a complex picture. On the other hand, the performed survey studies, for their very same nature, have not fully developed, neither tested, possible links between their findings and the general economic theory.

The paper is an attempt to develop those links. The methodology used will consist in an econometric estimation of foreign investment determinants embedding, among others, the hypothesis derived from the latest developments of the investment theory literature, as applied to the case of FDI in the CEECs, with a particular focus on sector-specific factors. In particular, Section 2 will present an analysis of the data set used in the study, together with the derivation of some "empirical regularities" the theoretical model should account for. Section 3 briefly summarise the main findings of the FDI literature, merging it with the latest developments in the investment literature (i.e. gravity models and real option theory) applied to the case of international production of goods. Section 4 derives the working hypothesis of the model, consistent with both the empirical regularities arising from the analysis of the data set and the theoretical hypothesis. Section 5 and 6 present respectively, the formal econometric model and its results. Section 7 concludes with a summary of the findings and a brief presentation of some future lines of research.

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<sup>1</sup> It is common today to refer to the FDI inflows to the CEECs as a "trickle".

<sup>2</sup> For a comparison of the results of different surveys on FDI in the CEECs up to 1994 see European Bank for Reconstruction and Development, *Transition Report 1994*, Table 9.4, p.130. For more recent surveys see Meyer (1995), Lankes and Venables (1996) and Konings and Janssens (1996).

## 2. Analysis of the data set

The paper will draw on a recently developed data set including 2,500 investment operations undertaken by European MNEs in Central and Eastern Europe in the period 1989-1996<sup>4</sup>. For each single operation the database records the country of origin and of destination of the investment, the year, the sector (NACE two, three and four digits), and, for most of the operations, the number of employees of the foreign affiliate and the initial and committed value of the investment operation.

An analysis of the data set revealed that, in line with the results of previous survey studies<sup>5</sup>, FDI in Central and Eastern Europe is a complex phenomenon, involving different home and host countries policies and firms' strategies. By and large, one can identify three main "stylised facts" arising from an analysis of the operations of MNEs in the area.

1. Different sectors imply different and peculiar investment strategies by MNEs. Using the Pavitt<sup>6</sup> classification of industrial sectors, the database shows that out of the total FDI undertaken in the CEECs in the manufacturing sector, almost 43 per cent of the operations are undertaken within economies of scale sectors, where the market size component is important as a determinant of FDI flows (market-seeking FDI)<sup>7</sup>. Another 43 per cent of the operations are in traditional sectors, mostly producing consumer goods with a significant labour content. These operations include both market and efficiency-seeking FDI, the last being investments aimed mainly at exploiting local relative advantages in the endowment of factors of production, in particular labour. The remaining 15 per cent of initiatives is undertaken by firms operating in specialised and high-tech sectors. Crossing the de-composition of FDI flows at the sector level with the geographical variable from the host countries point of view, economy of scale investments are more relevant, on a percentage basis, in only two countries, namely Poland (48 per cent) and the Czech Republic (53 per cent), while in Slovenia and Hungary these initiatives are only slightly less numerous than those in traditional sectors. Economy of scale investments tend to imply a high financial commitment by investors as they are generally capital intensive. Hence, the preference for relatively stable countries for this kind of investments. The opposite is true for traditional sector investments that tend to be more relevant in the remaining countries, such as Latvia (80 per cent), Bulgaria (68 per cent), Lithuania (62 per cent) and Romania (50 per cent). The low capital intensity of these operations, unregulated labour markets and a relatively inexpensive work force are conducive to this kind of investments. High-tech and specialised sectors investments are relevant only in the Czech Republic, Hungary and Poland.

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<sup>3</sup> See among others Artisien et al. (1993), Norman and Motta (1993), Vannini (1995).

<sup>4</sup> The database PECODB has been developed by the ISLA Centre of Research of Bocconi University, Milan, under the direction of Professor S. Alessandrini and with the financial assistance of DGIII-Industry of the European Communities. The possibility of exploiting such a database is gratefully acknowledged.

<sup>5</sup> We will draw here on the results of the research "EU Foreign Direct Investments in Central and Eastern Europe", and in particular on Altomonte (1997).

<sup>6</sup> See Pavitt K. (1984) "Sectoral Patterns of Technical Change: towards a Taxonomy and Theory", *Research Policy*, vol. 13, n.6.

<sup>7</sup> For an in depth theoretical analysis of the different MNEs strategies see Dunning (1992).

2. The timing of reforms is important. Poland, Hungary and the Czech Republic account for the majority of FDI inflows in the CEE region. These countries have been widely recognised as the leaders of the liberalising reforms in Central Europe<sup>8</sup> having implemented policies creating a balanced and rather solid macro-economic environment and an extensive deregulation and opening of the economies, which in turn guided reforms of the industrial and financial sectors and of labour markets. The link between economic reforms and FDI inflows is reflected in the timing of foreign direct investment inflows (see Figure 2). In particular, Hungary was the first Comecon country, already in 1972, to allow the foreign participation in joint-ventures. The national policies towards foreign participation during the start of the transition capitalised on this positive and flexible attitude. As a result in Hungary the process of economic transformation started in 1988 moving to a rules-oriented system of FDI, adopted only later, in 1991, by the Czech Republic and Poland. Hence, Hungary attracted up to 110 FDI initiatives until 1990, with only 10 in Poland and only 2 in the Czech Republic (see Figure 2, bottom). Hungary then lost its leadership, respectively, to the Czech Republic in 1993 and Poland in 1995, once the economic reforms in these countries started to be implemented. In the case of Poland, for example, the effects of the Privatisation Law of 1990 were delayed until 1992, when the macro-economic stabilisation programme begun to show results. As a consequence, FDI inflows increased immediately afterwards, recording in 1993 a total number of initiatives greater than Hungary<sup>9</sup>.

3. The geographical proximity matters. The database shows that, in terms of the number of investments, German, Italian and Austrian entrepreneurs have been the most active in supporting the transition of the host economies, followed by France, the United Kingdom, the Netherlands, Sweden, Switzerland and Finland. However, the patterns of these investments are not homogeneous across the recipient countries, since a number of clusters can be identified (see Figure 3), apparently depending on the geographical proximity between the home and the host country. The “north-European” cluster represented by the FDI operations of Sweden, Denmark and Finland in the Baltic States, the concentration of German FDI in the core CEE region or the tendency for Italian FDI to be relatively more concentrated in the Balkan region are clear examples of this trend.

The stylised facts derived from the empirical analysis of the data base should now be put in relation with the different theoretical models developed in the literature for explaining the phenomenon of international production of goods, in order to develop an appropriate link between the two. The next section presents the main economic theories related to the subject.

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<sup>8</sup> See European Bank for Reconstruction and Development, *Transition Report*, various years.

<sup>9</sup> For further empirical evidence on the relationship between timing of reforms and FDI see Altomonte (1996); Lankes and Venables (1996); Brunetti, Kisunko and Weder (1997).

### 3. Theories of foreign direct investment

The theory of international production stems directly from the application of an imperfect competition framework to general neo-classic models of international trade. It is in fact widely acknowledged today that a double market failure (structural and transactional, see below) is at the basis of the existence of Multinational Enterprises<sup>10</sup>. This assumption is based on the analysis of the distinctive peculiarities of MNEs, characterised by the fact that they merge together both the international dimension of their activities and the direct ownership control of those ones. In other words, they not only act as international players, extending their economic activities beyond the national boundaries, but they also retain the physical control of such activities through an extensive network of affiliates located in one or more foreign countries.

The most general model developed within the theory of international production for the analysis of these issues explicitly takes into account this twofold dimension of the activities of MNEs, integrating it into a coherent framework, where different specific contribution are combined: this is the reason why it has become known under the name of eclectic paradigm<sup>11</sup>. The main idea postulated by the model is that a firm undertakes a Foreign Direct Investment only when the following three conditions are matched together:

a) The firm possess specific ownership advantages (O). It is mainly a structural market failure that induces and allows companies to gain an international dimension in the undertaking of their investments. Hymer identified for the first time this market failure<sup>12</sup>, pointing out the fact that firms are normally endowed with what he called ownership advantages, that is a set of specific advantages developed by the firm and mainly related to her intangible assets, such as superior know-how, better management, peculiar marketing skills, wider network of external relations and so on. These advantages allow the firm to exploit a consistent degree of market power, and, being specific of each firm, to obtain monopolistic rents on every market the firm operates, thus pushing the firm to penetrate and exploit foreign markets.

b) For the firm it has to be convenient to exploit factors of production located into a foreign country. In other words, the firm can exploit location advantages (L). In fact, as the neo-classic theory of international trade pointed out, it is the spatial disposition of internationally static factors of production that is in part responsible for the location of production activities.

c) The firm needs to have some internalisation advantages (I). The existence of a transactional market failure, due to the presence of transaction costs allows firms to be created and to grow, up to the extent to which they are able to substitute the (expensive) market transactions with cheaper internal ones. This process comes to an end when the benefits obtained by the overcoming of market failures through the internalisation of transactions are smaller or equal to the costs stemming from the setting up of this structure of exchanges alternative to the market. In terms of Foreign Direct Investment, it is

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<sup>10</sup> For a general reference see Hymer (1960); Buckley and Casson (1976); Dunning (1988).

<sup>11</sup> Dunning (1988, 1992).

<sup>12</sup> Hymer (1960).



therefore the presence of these internalisation advantages that induces firms to retain the control on their assets located abroad, avoiding of passing through the market, i.e. through arm's length transactions or licensing.

The eclectic paradigm, also known as OLI framework, from the initials of the three set of variables it takes into consideration, has been largely employed as a general tool of reference for explaining the FDI patterns of multinational enterprises. However, there is today a growing awareness that FDI operations are driven by determinants not necessarily expressed by the pure, static, economic advantages of the OLI framework<sup>13</sup>.

Among the approaches which try to overcome the drawbacks of the eclectic paradigm, a promising (in terms of theoretical soundness and empirical evidence) line of research which is being explored is the application of the so-called gravity models to the theory of international production, via the inclusion of the OLI set of variables into general equilibrium models of international trade and investment<sup>14</sup>. Gravity models were originally conceived in order to explain bilateral trade flows as dependent, in analogy with the law of gravitation, by the attraction of two countries' "masses" (sizes) weakened by the "distance" (transport costs) between them and enforced by preferential arrangements they eventually belong to. In economic terms, the size of exports flows from country *i* to country *j* is dependent by a) the size of the total potential supply of the exporting country, b) the size of the total potential demand of the importing country and c) factors representing the resistance to a trade flow between the two countries<sup>15</sup>. Adapting these hypothesis to the OLI framework, also in line with the traditional specification of the gravity equation, we can suppose the FDI flows to be dependent from<sup>16</sup>:

1. the size of the market of the host country;
2. the potential demand of the local consumers;
3. the geographical distance among markets.

At a first glance, the hypothesis developed by the gravity models seem to be consistent with the findings of the empirical analysis previously developed, in that they stress the importance of the distance between the host and the home country and they emphasise the market-seeking component of the FDI flows.

Always within the OLI framework, and in line with the neo-classical models of international trade, the literature has explored the issue of relative labour costs, also considered among the

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<sup>13</sup> See for example the seminal paper of Markusen (1995) on international trade and investment and his reinterpretation of the Dunning's OLI model. A more recent critique on the "steadiness" of the OLI framework can be found in Buckley and Casson (1998).

<sup>14</sup> For a general equilibrium model of international trade and investment see Markusen and Venables (1995).

<sup>15</sup> The original gravity model literature originated with Tinbergen (1962) and Linnemann (1966). More recent contributions include Bergstrand (1985, 1989) and Matyas (1997). An application to the case of CEECs has been proposed by Baldwin (1994).

<sup>16</sup> Brainard (1997) and Eaton and Tamura (1996) provide some preliminary application of gravity models to FDI theory. Brenton and Di Mauro (1998) apply this analysis to the case of FDI flows to the CEECs.

potential determinant of foreign investments. Although the literature has found mixed evidence for the significance of labour costs on the distribution of foreign investments<sup>17</sup>, this theoretical hypothesis may be consistent with the finding of a relatively important efficiency-seeking component in the FDI flows directed to the CEECs, as outlined in Section 2. Hence the hypothesis that the FDI is a function of :

4. the relative comparative advantage of a host country in its cost of labour.

Moving away from the determinants derived more or less directly from the eclectic paradigm, it seems also relevant, at least for the case of CEECs, to consider one of the most recent developments of the literature on investment theory, not necessarily applied to the case of foreign investment. The general idea behind the theory of real options is that each investment operation can be assimilated, in its nature, to the purchase by the investor of a financial call option, where the investors pay a premium price in order to get the right to buy an asset for some time at a price (exercise price) predetermined, and eventually different from the spot market price of the asset (strike price). Analogously, the firm, in its investment decision, pays a price (the cost of setting up the project) which gives her the right to use the capital (exercise price), now or in the future, in return for an asset worth a strike price.

Taking into account this approach, the calculus of profitability of each single investment operation cannot be done simply applying the net present value rule to the future expected cash flows of the operation, but has rather to consider the following peculiar characteristics of the investment decision<sup>18</sup>:

5. there is uncertainty over the future rewards from the investment;
6. there is some leeway about the timing of the investment;
7. the investment is partially or completely irreversible.

The first characteristic of the investment decision derives from the fact that investors have no perfect information. As a result they form expectations and beliefs on the future behaviour of the economic variables, which cannot be predicted with certainty. The second characteristic is directly related to the uncertainty: investors might want to postpone their investment from period  $t$  to period  $t+1$  in order to get more information, refine their beliefs and reduce uncertainty. This of course entails an opportunity cost of waiting in terms of possible missed opportunities, should the economic variables in period  $t+1$  be such that the investor would have made profits had the investment been undertaken at time  $t$ . Finally, the investor has to take into account the fact that the initial cost of the investment is at least partially sunk, i.e. he or she cannot recover it all should he

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<sup>17</sup> Kravis and Lipsey (1982) found the labour cost component to be the least important coefficient in their study of the location of production for exports by the affiliates of US MNEs. Yamawaki (1993) found a statistically significant negative correlation between real labour costs and the geographical distribution of Japanese investments in Europe during the '80s, but a positive one on an analogous exercise with a different dataset (Yamawaki and Thiran, 1995).

change his mind after the investment has been undertaken. As a result, the “weight” of the uncertainty in the determination of the net value of the investment is higher the higher is the sunk cost of the investment<sup>19</sup>.

This set of hypothesis, when applied to the case of multinational enterprises in the CEECs, can help in clarifying some of the empirical regularities evidenced in the analysis. In particular, the relationship between timing of reforms and FDI, already outlined in Section 2, is explained by the OLI framework in a rather unsatisfactory or loose way, through the inclusion, among the location advantages, of a general variable measuring the “political stability” of a host country. This approach is directly derived from the theory of transaction costs<sup>20</sup>, according to which the FDI is negatively affected by the risk of expropriation of the investment by the host country government, an effect that is higher the higher is the political instability of the host country and the higher is the sunk cost of the undertaken investment. However, the OLI approach, although taking into account that the behaviour of the host country governments is somehow internalised in the investment’s decision process of the MNE, again fails to formalise this issue in a coherent economic model from which testable hypothesis could be derived.

From the theoretical point of view, this exercise has been undertaken by the new industrial organisation approach, in which a strand of the literature has analysed the effects of the sovereign political risk associated with FDI, mainly within game theoretical models involving a threat of expropriation by the host country governments<sup>21</sup>. On the other hand, however, empirical tests of the influence of the host country political stability over the patterns of FDI failed to give conclusive evidence about the presence and the direction of an eventual causality nexus<sup>22</sup>. The new developments here summarised might help to bridge this missing link between the theoretical analysis and the empirical literature, allowing for a better modelling of FDI flows.

In fact, the theory of real option defines in detail an economic model in which the variables directly affecting the information set of the investor are crucial. When this framework is applied to the internationalisation issue, the crucial variables responsible for the undertaking of a FDI are likely to be those capable of sending a signal from the host economy that reduces both the level of uncertainty of the investor and his asymmetric information set (and, as a consequence, his expected level of risk). Clearly, those variables are not only related to the political stability of the host economy (and the risk of expropriation of the sunk capital), but are part of a more general set that can be identified in the institutional climate dealing in the host country with the regulatory environment of foreign operations,

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<sup>18</sup> Dixit and Pindyck (1994); Abel, Dixit, Eberly and Pindyck (1995); Pennings and Sleuwaegen (1998).

<sup>19</sup> The literature has already explored the issue of sunk costs and investment. See in particular Motta (1992).

<sup>20</sup> As a general reference see Williamson (1985, 1996). See Caves (1996) for the case of MNEs.

<sup>21</sup> See in particular Eaton and Gersovitz (1984), Veugelers (1993) and Thomas and Worral (1994).

<sup>22</sup> See Brunetti and Weder (1997) for a good survey. Very different proxies for “political stability” have been tested in the literature with respect to the patterns of FDI flows, from “number of riots” to “assassinations per thousands of inhabitants”. However, in the absence of a consistent theoretical framework, these exercises were not able to find a clear-cut answer on an eventual causality nexus between a not-too-well defined concept of political stability and FDI flows.

which guarantees the respect of a minimum set of rules in terms of competition, transparency and enforceability of laws<sup>23</sup>.

Applying the framework of the real option theory to the specific case of FDI in the CEECs, one can suppose that the progress in economic reforms is likely to send a signal of “certainty” to the investor. This has two (positive) consequences on the investor’s foreign investment decision: a) he or she will tend to discount his future expected profits at a lower rate, since the signal modifies the investor’s belief on the overall level of risk of the operation; b) within a more certain environment, the opportunity cost of waiting is increased, hence FDI are more likely to be undertaken rather than postponed<sup>24</sup>.

The empirical proof of these issues will be developed in sections 5 and 6. The following section 4 formally derives the working hypothesis of the econometric model, combining the stylised facts derived from the empirical analysis with the theoretical hypothesis presented in this section.

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<sup>23</sup> “Reduction or elimination of unnecessary uncertainty may be the best kind of public policy to stimulate investment”, Dixit and Pindyck (1994), p. 14.

<sup>24</sup> Lankes and Venable (1996) show some explicit evidence of the link between deferral of planned FDI operations and transition progresses.

#### 4. Derivation of working hypothesis

The stylised facts outlined in Section 2, combined together with the theoretical hypothesis previously presented, give some hints on the variables which can be used in the model as determinants of a foreign investment in the considered CEE region.

In particular, it has been stated that the size of the market of the host country and the potential demand of the local consumers play a role in the determination of market-seeking investments, as showed by both the empirical evidence and the recent literature on gravity models. In addition, efficiency-seeking investments can be influenced by a comparative advantage of the host country in its cost and endowment of labour. Finally, the clustering of FDI operations in the CEECs and again the application to the theory of international production of the gravity models of international trade suggest that the distance can also play a role in the determination of FDI flows. Therefore three working hypothesis can be at first included in the general model:

a) theoretical hypothesis # 1 and #2 are able to account for market-seeking FDI: the bigger the size of the market and its potential demand, the higher the probability of attracting a foreign investment;

b) theoretical hypothesis #3 is confirmed by stylised fact #3: the distance between the home and the host country seems to play a role in the determination of FDI flows;

c) theoretical hypothesis #4 is consistent with the presence of efficiency-seeking FDI: labour costs advantages have a positive influence on the determination of FDI flows;

On the other hand, the combination of the theory of real options with the empirical findings previously presented supports the following working hypothesis:

d) theoretical hypothesis #5 and #6 can be linked to stylised fact #2: according to its sector of activity (domestic-oriented vs. export oriented sectors) and the competitive situation, a firm can opt for a “wait and learn” attitude in order to lower its degree of uncertainty relative to its knowledge of the foreign environment, or can be pressed to undertake the investment in order to gain first mover advantages (e.g. secure some distribution chains or acquire a position through the exploitation of the privatisation of formerly State-owned firms). As a result, any progress in the transition, and hence any improvement in the general institutional climate, may act as a signal able to lower the uncertainty of the investors, increasing the opportunity cost of waiting and therefore fostering the undertaking of a foreign direct investment<sup>25</sup>;

e) theoretical hypothesis #7 is consistent with stylised fact #1: different sector of activities are characterised by different degrees of irreversibility of investments, hence they can be partly responsible for different firm strategies in terms of market penetration;

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<sup>25</sup> Since the model is based on sector level data, it considers only potential reductions in what is referred to as “aggregate uncertainty”, without dealing instead with the firm-specific “idiosyncratic uncertainty” (see Dixit and Pyndike, 1994).

Before moving to the econometric estimation of these hypothesis, a few lines of comment on this last set of determinants are worth. In general, transition indicators, such as EBRD or World Bank ones, are strongly significant as predictor of FDI flows<sup>26</sup>. Of course this finding arises some criticism on the effective independence of this measure from other latent variables that might eventually be responsible for the determination of foreign investments. For example, a general and often common criticism points to the fact that transition indicators could simply measure the extent of a privatisation process. That, once coupled with the particular type of business of a MNE, might generate high opportunity cost of waiting, especially if other competitors are already trying to build up first-mover advantages in the area. Hence the high significance of this variable. As a result, in order to control for this problem, the econometric model presented in the next Section will employ suitable measures of transition, in which the degree and extent of the privatisation process is only but one of several components. In addition, these indicators will be matched by additional variables derived from the working hypothesis previously presented.

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<sup>26</sup> The previously quoted studies exploring the link between FDI and the timing of reforms all “suffered” by this excessive weight given to the variables measuring the level of transition.

## 5. The econometric model

The proposed econometric model rests on a panel data set constructed recording the number of investment in each sector  $i$  over host country  $j$  at time  $t$  (cross-sector, time-series model). The observations available on the  $i$ -th sector over time  $t$  are the realisation of the variable over the set of host countries  $j$ . As a result the panel data set is balanced. The dependent variable will be of the form  $\mathbf{INV}_{ijt}$ , measuring the number of investments undertaken by a MNE in sector  $i$  at time  $t$  for each host country  $j$ . In order to emphasise the relevance of the undertaken investments over the maximum possible set of observations, I opted for a binary formulation of the dependent variable. Hence,  $\mathbf{INV}_{ijt}$  takes the following values:

$$\mathbf{INV}_{ijt} = \begin{cases} 1 & \text{if an FDI operation is registered in sector } i \text{ of country } j \text{ in year } t \\ 0 & \text{otherwise} \end{cases}$$

As a result, I will estimate a random-effects probit model on the specified panel. The estimation technique is based on a generalised estimating equations (GEE) approach, applied to a generalised linear model (GLM)<sup>27</sup>. Consider the following GLM:

$$g(E(y_{ijt})) = \mathbf{x}_{ijt} \boldsymbol{\beta}, \quad y \sim F \text{ with parameters } \boldsymbol{\theta}_{ijt}$$

where  $y_{ijt}$  is the dependent variable,  $\mathbf{x}_{ijt}$  the vector of regressors and  $\boldsymbol{\beta}$  the vector of coefficients to be estimated. The function  $g(\cdot)$  is called the *link function*, while  $F$  is the *distributional family* of  $y$ . Given the assumption of the model, the link function is defined as  $\Phi^{-1}(\cdot)$ , i.e. the inverse Gaussian cumulative, while the distributional family  $F$  is assumed to be binomial. In this case, the GLM ends up to the estimation of a standard probit model. As a remark, one can note that the identity link and the Gaussian distributional family would produce a standard OLS-type model. However, with respect to the standard GLM approach, in this case the peculiar (panel) nature of the data set has to be taken into account, via the imposition of a specific structure on the within-groups (sectors, in the case considered) correlation matrix. In other words, one has to drop the standard hypothesis that the correlation of observations within different groups is zero, i.e. the observations are homogeneous (drawn from the same population). Instead, I will impose an exchangeable correlation structure on the within-groups correlation matrix, i.e. a constant correlation of observations within different groups (i.e. sectors in the case considered). As a result, the chosen link function, distribution family and correlation structure yield a random-effects probit regression model, which will be estimated through the maximisation of an appropriate likelihood function.

<sup>27</sup> The GEE approach used follows in particular Liang and Zeger (1986).

In terms of independent variables, according to the working hypothesis listed before, they will be constructed as follows<sup>28</sup>:

a) the market-seeking component of the FDI can be measured through the classic variables entering the gravity models, i.e. the population of the host country over time,  $\mathbf{POP}_{jt}$ , as a proxy for the size of the market of the host country and the per-capita gross domestic product  $\mathbf{GDPPC}_{jt}$ , as a proxy for the potential demand of the local consumers. Both variables should exhibit a positive sign;

b) the geographical distance is measured as the kilometric distance between the capital cities of the host countries and an EU average location, since the model has no home country specification. However, thanks to the detail of the database, the determination of such average European location is weighted for the relevance of each home country in terms of the number of operations undertaken in the CEECs. This data-driven approach seems to be more punctual with respect to a generic “average” European location from which the distance would have been calculated. The variable will be expressed as  $\mathbf{DIST}_j$  and will be measured as the distance in Km. that corresponds to the quickest street link between the two destinations<sup>29</sup>. In other words, it tends to measure highways distances rather than line distances, in order to embed a more realistic measure of transport costs. In terms of the expectations on the sign of the variable, the (controversial) hypothesis of substitution between FDI and trade as alternative modalities of serving a foreign market would imply a positive sign of the variable. On the other hand, given the fact that an higher distance tends in general to embed higher barriers to internationalisation and higher risks for the investor<sup>30</sup>, I would expect a negative relationship. As a result the sign is a priori undetermined;

c) efficiency-seeking considerations could be picked up by the relative comparative advantage of host countries, as measured by the difference between the weighted<sup>31</sup> average of the gross monthly earnings in manufacturing of the European Union<sup>32</sup> and the relative figure for each Central and Eastern European country, on an yearly basis. The variable will be measured as  $\mathbf{\Delta WAGE}_{jt}$  and the expected sign is a positive one (the higher the difference, the higher the convenience of an efficiency-seeking FDI). As it can be seen from Annex 2, the labour costs

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<sup>28</sup> For a matter of homogeneity, all macroeconomic data related to the CEECs are, unless specified, withdrawn from the OECD-CCET (Centre for Cooperation with the Economies in Transition) publication “Short Term Statistics”, various issues.

<sup>29</sup> As derived by standard route mapping computer software.

<sup>30</sup> In terms of the degree of control on the foreign affiliate.

<sup>31</sup> I employed a weighted EU average wage, using the data for each European country, with the same weights used for the distance variable.

<sup>32</sup> The EU data are derived from Eurostat (1998) “Net earnings of employees in manufacturing industry in the EU - Data 1980-1996”, Luxembourg. Both EU and CEECs data are related to the average earnings of skilled and non-skilled workers.



enter into the determination of the ORI index. However, the correlation between this variable and the difference in wages in our data set is negligible (see Table 1);

d) in order to measure the relevance of the opportunity cost of waiting on the level of FDI into the CEECs I will use an index of transition (ORI) which is directly related to the degree to which complex operating conditions affect production and profits earned in the local currency by a foreign firm<sup>33</sup>. In particular this index measures the business operations climate as expressed by two variables: the degree to which nationals are given preferential treatment and the general quality of the business climate, including bureaucratic and political continuity and the degree of enforceability of contracts. As already mentioned, the degree and extent of the privatisation process are but one of several components of this index. This variable varies over each host country over time, i.e. it is expressed as **ORI<sub>jt</sub>**. According to the hypothesis, it should be significant with a positive sign;

e) apart from the measure of transition previously presented, I will control for the uncertainty of the local environment also via the standard deviation of the production indices of the manufacturing sector of each host country over years. In order to take into account structural movements of the index, the yearly standard deviation has been weighted for the total standard deviation of the production index of the country over the time span considered (1990-95). This index will be defined as **PROD<sub>jt</sub>** and, in accordance to the theoretical predictions, it should be significant with a negative sign;

f) the relationship between the undertaking of a foreign investment and its irreversibility can be expressed through an index measuring the level of sunk costs for each sector of activity. I opted for an endogenous measures, as suggested by Davies and Lyons<sup>34</sup>. It consists in a set of four dummies for sectors classified according to their advertising or R&D intensity<sup>35</sup>. For the time being, we will leave aside the exogenous measures suggested in the literature (e.g. Motta, 1992). The dummy variable is **SUNK-n<sub>i</sub>** where  $n = 1, \dots, 4$  measures an increasing degree of irreversibility of the investment (1 being sectors with no R&D and no advertising intensity, 4 being sectors with both, see Annex 1);

g) finally, a control variable has been introduced in order to take into account of the firm-level dimension of the data set, since the model operates at the sector level via the aggregation of single investment operations. Such control variable is given by the average size of the firms in each sector of activity, measured in terms of number of employees. The variable is **SIZE<sub>i</sub>**.

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<sup>33</sup> The index is calculated by BERI S.A, Business Risk Guide. Annex 2 explains the methodology of calculation.

<sup>34</sup> As reported in Davies and Lyons (1996).

<sup>35</sup> Four combinations are considered for the sectors: advertising intensive, R&D intensive, both R&D and advertising intensive, neither R&D nor advertising intensive.

Hence the complete random-effects probit panel model to be estimated is:

$$\begin{aligned}
 \mathbf{INV}_{ijt} = & \beta_{ij} + && \text{random intercept (sector effect)} \\
 & \alpha_1 \mathbf{GDPPC}_{jt} + \alpha_2 \mathbf{POP}_{jt} + \alpha_3 \mathbf{DIST}_j + && \text{“gravity model” variables} \\
 & \alpha_4 \mathbf{\Delta WAGE}_{jt} + && \text{efficiency-seeking FDI} \\
 & \alpha_5 \mathbf{ORI}_{jt} + \alpha_6 \mathbf{PROD}_{jt} + \alpha_7 \mathbf{SUNK-n}_i + && \text{“real option theory” variables} \\
 & \alpha_8 \mathbf{SIZE}_i + && \text{control variable} \\
 & \mathbf{v}_{ijt} && \text{error component}
 \end{aligned}$$

where:  $i = 1, \dots, 39$  NACE 2 and 3-digits sectors (see Annex 1);  
 $j = 1, \dots, 10$  host countries (see Annex 1);  $t = 1990, \dots, 1995$   
 $v_{ijt} \sim i.i.d. (0, \sigma_i^2)$ ;  $\alpha_k$  random coefficients

The intercept  $\beta_{ij}$  captures the sector specific unobserved heterogeneity being composed, according to the standard modelling of random-effects, by an unknown fixed sector-effect and a random sector-specific error component.

The time period considered goes from 1990 to 1995 included, while the host countries are the ten CEECs who have applied for accession to the European Union (see Annex 1). In terms of sector, I used both the NACE 2 and 3-digits classification. In particular, I started with the NACE 3-digits classification as proposed by Davies and Lyons (1996), based on the NACE-1970 revision and which, as stated, classifies one hundred sectors according to the degree of irreversibility of the investment. I have updated the classification to the NACE-1990 revision, aggregating the sectors that with respect to the Davies and Lyons classification are now homogeneous at the NACE 2-digits level, coming up with a total of 39 sectors. For a detailed classification, see Annex 1.

## 6. Econometric results

Table 1 summarises the statistics relative to the variables employed in the model. The levels of correlation between the variable fall within acceptable limits of tolerance. The “suspicious” levels of correlation between the institutional uncertainty (ORI) and the geographic distance (DIST) do not perturbate the stability of the estimation, when tested for separate specifications in order to check for the sensitivity of the model to each different regressor progressively added. In addition, the inclusion of other measures of uncertainty, such as an index measuring the completeness of the legal framework, did not yield substantially different results.

Table 2 presents the results of the regression run using the general panel. Since all is known about the random-effects estimator is its asymptotic properties, rather than reporting an F-statistic for the overall significance of the regressors, the model reports a Chi-squared statistic. For all the specifications of the model, the joint set of coefficients has always been found significant. As a result, the main findings can be summarised as follows:

Gravity model: among the variables derived from the gravity model, the population is, as expected, significant with a positive sign. The market-seeking component seems to be a crucial determinant for the FDI of European firms into the CEECs. The local demand, measured by the levels of per capita GDP, does not seem, instead, to play a major role in the determination of FDI flows. This might be understandable if investors look at the potential growth of the market (measured implicitly by the population) rather than at its actual dimension. The distance enters significantly into the determination of FDI flows with a negative sign: FDI operations of EU firms are positively correlated to the “proximity” of the host country. This finding, in line with the analytical results obtained from the database (see Figure 3), is likely to reflect the relative “naivety” of some of the foreign investments undertaken in the CEECs by Small and Medium-sized European firms, mainly aiming at exploiting cross-border labour costs advantages. The next result will confirm these peculiar firms’ strategies.

Efficiency-seeking FDI: the efficiency-seeking hypothesis is supported by the significance, with the expected positive sign, of the variable ( $\Delta$ wage) measuring the relative comparative advantage of the CEECs in their cost of labour. This finding is also consistent with the negative sign recorded for the variable measuring geographical distance, since it is likely that investments driven mainly by the exploitation of low labour costs aim at minimising as well the transportation costs for re-importing the goods in the home market. It is worth noting that sector-specific effects (unobserved heterogeneity captured by a significant constant  $\beta$ ) arise within the gravity model specification only once the  $\Delta$ wage variable is taken into account. This means that market-seeking strategies as expressed by the gravity model specification seem to be appropriate for explaining the general pattern of FDI into the area (no significant constant with this specification); on the contrary,

once efficiency-seeking strategies are included into the model, these are linked to specific sector effects.

Real option theory: the inclusion of the variables related to the real option theory has yielded extremely promising results. Both variables measuring the institutional and economic uncertainty under which the investment is performed are highly significant, with the expected sign (positive for the variable measuring the business climate (ORI), negative for the variable measuring the economic uncertainty, PROD). In particular, the variable measuring the business climate in which the investment is undertaken displays the highest coefficient recorded among the significant variables<sup>36</sup>. The hypothesis derived from the application of real option theory, i.e. that any progress in the transition (or, better, any signal, economic or institutional, that the transition is under way) reduces the opportunity cost of waiting and fosters the undertaking of FDI is therefore confirmed.

Using the general specification of the model, the hypothesis that different degrees of irreversibility of the investments affect FDI flows does not seem to be confirmed (the dummy variables measuring the irreversibility of the investment were never significant).

However, Table 3 shows the results of the econometric tests on the model sub-specifications obtained using the four panels in which sectors were homogeneous relative to their levels of irreversibility. This exercise has generated a significance of different sets of variables over the different specifications, in line with the theoretical expectations. In particular, coherently with the real option theory predictions, the only variables affecting significantly the foreign investments in sectors characterised by high sunk costs (Table 3, sunk4) are the size of the market as measured by the population (large plants are normally intended to serve market- rather than efficiency-seeking strategies) and the institutional climate (ORI), since, given the large size of the investments, small changes in it can yield great differences in the opportunity cost of waiting. It is interesting to note how in both R&D and advertising-intensive sectors the variable measuring the investment climate (ORI), hence the progress of transition, is not significant, while the variable related to the economic uncertainty (PROD) remains significant. Quite consistently, in R&D-intensive sectors (Table 3, sunk3) labour costs do not seem to play a role in the determination of the FDI flows, while the distance between the home and the host country is relevant. The opposite is true for the advertising intensive sectors (Table 3, sunk2), where the labour costs are a significant FDI determinant, while the distance is not. For both classes of sectors, finally, the size of the market as measured by the population remains conducive to the undertakings of FDI operations.

The results obtained testing a model including only sectors with a low level of sunk costs are quite similar to the general specification presented in Table 2, but for the lack of significance of the variable measuring the geographic distance in the former case. This rather similar pattern between the two specifications is likely due to the fact that the endogenous measures used to highlight sector

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<sup>36</sup> Recall that the value of the coefficients in probit models expresses the impact of changes in the regressors  $\mathbf{x}$  in the probability of the event  $y = 1$  to occur.

effects may be too generic and not able to underpin the differences existing among sectors characterised by low sunk costs. It would be advisable, therefore, to test this model using different sector classifications, e.g. the ones more focused on economies of scale (Pavitt) or on labour skills (OECD). The general overall significance of the constant  $\beta$  measuring sector specific effects supports this line of research.

## 7. Conclusions and future lines of research

In this paper it has been proven that the orthodox neo-classical theories of foreign direct investment, even in their latest formulation (gravity models), are able to predict FDI flows only to a limited extent. On the other side, the theory of real options, when applied to the case of international investments, can be considered a fruitful extension of the current theoretical framework, since it is able to combine consistently the existing interactions between irreversibility, uncertainty and the choice of timing, all peculiar characteristics of an investment decision.

It can therefore be concluded that any new development in the theory of international production has to rest also on a micro-economic approach, a sort of “new agenda” for modelling MNEs stressing dynamic issues such as uncertainty, market volatility and the expectations and beliefs of single investors<sup>37</sup>.

In particular, this is especially the case of the CEECs. It has been proven in fact that in their case the variables related to the general economic and social environment of the host country, guaranteeing the respect of a minimum set of rules in terms of competition, transparency and enforceability of laws, become at least as important in the determination of FDI patterns as the “classic” economic variables, in general related to the macro-economic environment, traditionally indicated by the literature as the main FDI determinants.

One should however be aware that, notwithstanding this refinement, the current theoretical framework cannot be taken as a general tool of interpretation of the extremely complex and multi-faceted phenomenon of FDI. The empirical analysis reveals in fact that a thorough specification of the patterns of FDI flows has to take into account both the host and home country dimension, the sectoral specificity and the peculiar firm-level strategies, considered together as different “layers”, or aspects, of the investors’ final investment decision.

As a result, at the empirical level a further improvement in the model presented here lies in a better specification of the sector, country and firm-specific effects. The endogenous measures used to highlight sectoral effects should be refined using different sectoral classifications, more focused on economies of scale or on labour skills. The issue of country specificity should be taken into account via a formulation of the model that allows for a more thorough measure of the distance between the home and host country. Finally, firm-specific effects, in particular linked to the size of the multinational enterprises, should be taken into consideration. It is in fact likely that the FDI determinants might differ, or have a different weight, in the investments’ decision of large multinationals when compared to small and medium-sized ones.

From the theoretical point of view, the model has proven the significance of the beliefs of economic agents in the determination of their investment decision, in terms of expected levels of risk and uncertainty, and thus the importance of the variables capable of modifying, acting as signals, those beliefs. Clearly, a future line of research in the field of FDI theory is linked to the incorporation of this set of signals in the pay-off function of asymmetrically informed investors,

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<sup>37</sup> See at this purpose the recent articles of Buckley and Casson (1998) and Graham (1998).

within the framework of the real option theory. This could be done through a two-stage game in which at stage one the State sends signals to the investors in order to foster a FDI decision (reduction of aggregate uncertainty), while at stage two the investors endogenously modify their beliefs in order to take into account the signals and eventually undertake the investment decision, according to their firm-specific (idiosyncratic) uncertainty. The new developments of game theoretic models applied to the theory of industrial organisation could be fruitful with this respect.

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**Table 1. Summary statistics and correlation coefficients**Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Unit of meas.
Inv	2340	.2512821	.4338431	0	1	binary variable
Gdppc	2184	2600.036	2002.645	204	9372	M US\$, nominal
$\Delta$ wage	2145	1624.948	258.8819	748.12	2184.731	ECU
Pop	2340	10.556	11.06843	1.5	38.6	millions
Ori	2340	39.48333	4.369349	30	48	index 0-100
Dist	2340	1444.766	376.8767	883.8901	1941.25	Km
Prod	2223	83.62302	66.67861	2.572893	366.9163	standard deviation
Size	2340	333.014	276.631	28	6551	avg. # employees
sunk1	2340	.4358974	.4959798	0	1	dummy variable
sunk2	2340	.1282051	.3343895	0	1	dummy variable
sunk3	2340	.2820513	.4500944	0	1	dummy variable
sunk4	2340	.1538462	.3608783	0	1	dummy variable

Correlation coefficients

Obs. = 2067

	Gdppc	Pop	Dist	$\Delta$ wage	Ori	Prod	Size
Gdppc	1.0000						
Pop	-0.1420	1.0000					
Dist	-0.6032	-0.0321	1.0000				
$\Delta$ wage	-0.2321	-0.0115	0.3307	1.0000			
Ori	0.6829	-0.2423	-0.7685	-0.1555	1.0000		
Prod	-0.4957	0.2392	0.2344	0.0391	-0.3862	1.0000	
Size	0.0010	0.0004	-0.0018	-0.0003	0.0010	0.0004	1.0000

**Table 2. Estimation results**

Convergence achieved after 7 iterations

General estimating equation for panel data    Number of obs = 2067  
Group variable: sector                            Number of groups (sectors) = 39  
Link: probit  
Family: binomial  
Correlation: exchangeable  
chi2(10) = 188.40                                Prob. > chi2 = 0.0000

Inv	Coef.	Std. Err.	Z	P> z
Gdppc	-.0000305	.0000251	-1.213	0.225
Dist	-.0003475	.0001396	-2.489	0.013 **
Pop	.0300838	.003072	9.793	0.000 ***
$\Delta$ wage	.0005675	.0001361	4.170	0.000 ***
Ori	.0455156	.0133438	3.411	0.001 ***
Prod	-.0028087	.0006605	-4.252	0.000 ***
Size	.0001057	.0000628	1.684	0.092
<i>sunk1</i>	.2765182	.2259072	1.224	0.221
<i>sunk2</i>	.2106343	.2860096	0.736	0.461
<i>sunk3</i>	.007195	.2295377	0.031	0.975
$\beta_{ij}$	-3.240131	.7013703	-4.620	0.000 ***

\*\* = significant at the 5 per cent level; \*\*\* = significant at the 1 per cent level

Note: sunk4 dropped due to collinearity

**Table 3. Estimation results according to sectoral specifications**

**Sunk 1 (no R&D no Adv.)**

Number of obs = 901                  Number of groups (sectors) = 17  
 chi2(7) = 72.78                      Prob > chi2 = 0.0000

Inv	Coef.	Std. Err.	Z	P> z
Gdppc	5.11e-06	.0000366	0.140	0.889
Pop	.0262114	.004446	5.895	0.000 ***
Dist	-.0001368	.0002042	-0.670	0.503
$\Delta$ wage	.0006913	.0002003	3.451	0.001 ***
Ori	.0469935	.0194917	2.411	0.016 **
Prod	-.0021184	.0009119	-2.323	0.020 **
Size	.0001882	.0001104	1.705	0.088
$\beta_{ij}$	-3.628874	.9879337	-3.673	0.000 ***

\*\* = significant at the 5 per cent level; \*\*\* = significant at the 1 per cent level

**Sunk 2 (Adv. Intensive)**

Number of obs = 265                  Number of groups (sectors) = 5  
 chi2(7) = 31.60                      Prob > chi2 = 0.0000

Inv	Coef.	Std. Err.	Z	P> z
Gdppc	-.000112	.0000792	-1.415	0.157
Pop	.0374826	.0086787	4.319	0.000 ***
Dist	-.0002462	.0003786	-0.650	0.515
$\Delta$ wage	.0011956	.0003771	3.171	0.002 ***
Ori	.0518983	.0367821	1.411	0.158
Prod	-.0037703	.0018851	-2.000	0.045 **
Size	.0010303	.0009379	1.099	0.272
$\beta_{ij}$	-4.837469	1.977783	-2.446	0.014 **

\*\* = significant at the 5 per cent level; \*\*\* = significant at the 1 per cent level

**Table 3. (cont.d)****Sunk 3 (R&D Intensive)**

Number of obs = 583  
 chi2(7) = 65.31

Number of groups (sectors) = 11  
 Prob > chi2 = 0.0000

Inv	Coef.	Std. Err.	Z	P> z
Gdppc	-.0000358	.00005	-0.715	0.474
Pop	.0319769	.0063694	5.020	0.000 ***
Dist	-.0008506	.0002924	-2.909	0.004 ***
$\Delta$ wage	.0003432	.0002789	1.230	0.219
Ori	.0254225	.0274946	0.925	0.355
Prod	-.0038795	.0014688	-2.641	0.008 ***
Size	-.0000682	.0001554	-0.439	0.661
$\beta_{ij}$	-1.020301	1.376864	-0.741	0.459

\*\* = significant at the 5 per cent level; \*\*\* = significant at the 1 per cent level

**Sunk 4 (Adv. And R&D Intensive)**

Number of obs = 318  
 chi2(7) = 32.49

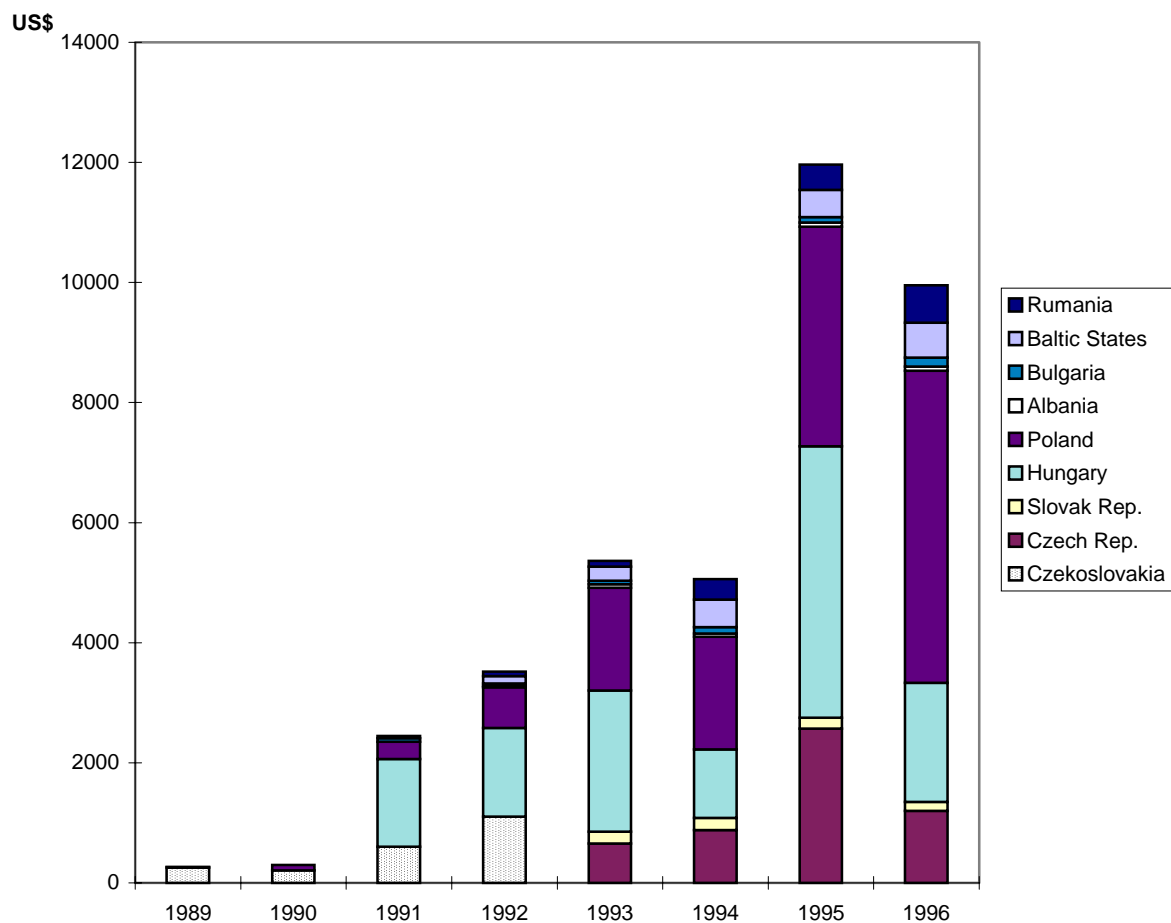
Number of groups (sectors) = 6  
 Prob > chi2 = 0.0000

Inv	Coef.	Std. Err.	Z	P> z
Gdppc	-.00009	.0000699	-1.287	0.198
Pop	.0385991	.0087173	4.428	0.000 ***
Dist	-.0002209	.0003705	-0.596	0.551
$\Delta$ wage	.0001036	.0003699	0.280	0.779
Ori	.0827058	.0364559	2.269	0.023 **
Prod	-.0033288	.0019337	-1.721	0.085
Size	.0000698	.0000846	0.824	0.410
$\beta_{ij}$	-4.039136	1.816171	-2.224	0.026 **

\*\* = significant at the 5 per cent level; \*\*\* = significant at the 1 per cent level

**Figure 1. FDI inflows in the CEECs, 1989-1996**

(Million of US dollars)

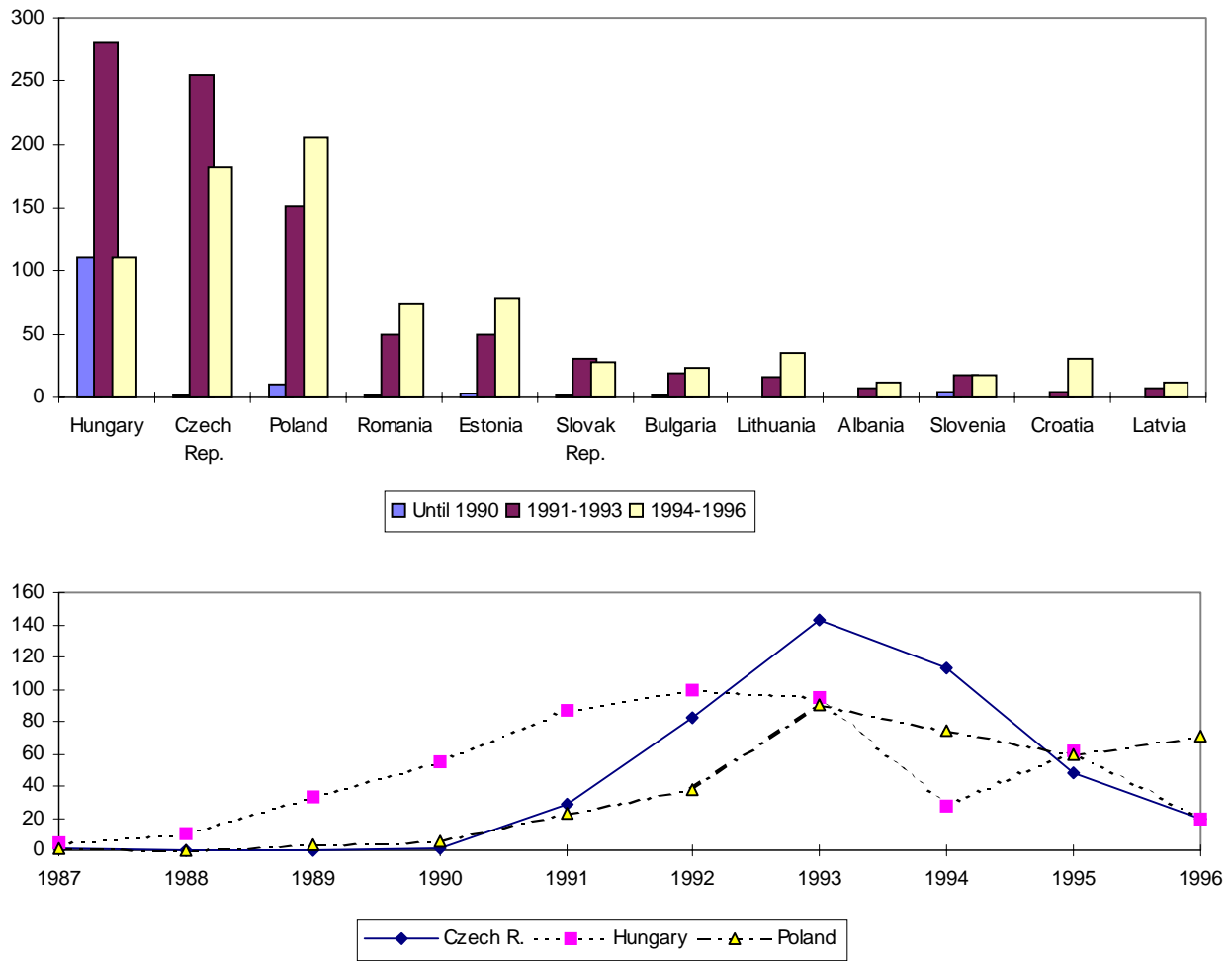


Source: UNCTAD-DTCI, *World Investment Report 1997*, FDI Database, Annex table B.1

Note: Data related to Czechoslovakia are disaggregated in Czech and Slovak Republic starting from 1993. Data related to the Baltic States (Estonia, Lithuania, Latvia) are aggregated for an easier interpretation.

**Figure 2. European initiatives in the CEEC region by host countries and years.**

(total number of FDI operations)

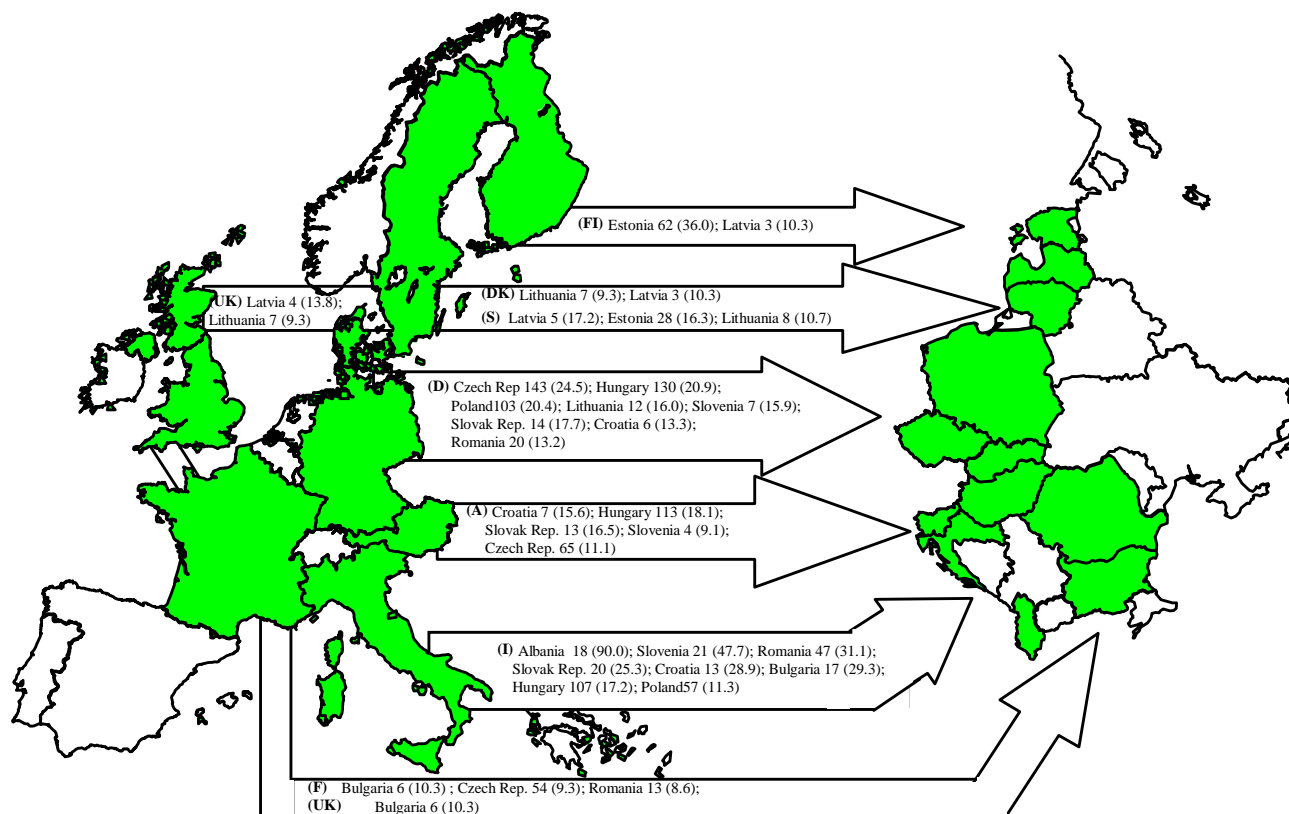


Source: Database PECODB, ISLA-Bocconi



### Figure 3. The clustering of FDI operations in the CEECs<sup>a</sup>

(n. of investments and percentage over total n. of operations in the host country)



Source: Database PECODB, ISLA-Bocconi

<sup>a</sup> The chart considers only flows representing at least 8-10 per cent of the total inward FDI in the host country.

## **Annex 1**

### NACE 2 and 3 digits classification of sunk costs (total: 39 groups)

#### **No Advertising and no R&D - Sunk1**

151 and 152 (production and transformation of meat and fish); 156 (grains); 158 (fabrication of bread, tea, coffee and other alimentary products); 17 (textiles); 18 (clothing); 19 (leather); 20 (wood); 21 (paper and pulp); 22 (publishing and press); 252 and 262 (plastics and ceramics); 26 (other non-metallic products); 27 (metallurgy); 28 (metals); 292 (general machinery); 351 (ship building); 361 and 362 (furniture); 366 (other general manufacturing).

#### **Advertising intensive - Sunk2**

153 and 155 (vegetables, milk and dairy products); 157 (pet food); 159 (drink and beverages); 16 (tobacco); 363 and 365 (musical instruments and toys).

#### **R&D intensive - Sunk3**

241 and 242 (basic chemicals and agro-chemicals); 246 and 247 (other chemical products and synthetic fibres); 251 (rubber products); 291 (mechanical machinery); 294 and 295 (machine tools); 30 (office machines); 31 (electrical appliances, excluding domestic); 321 (electronics); 331 and 332 (medical and precision instruments); 343 (car components); 352 and 354 (railways; motorcycles).

#### **Advertising and R&D intensive - Sunk4**

243 and 245 (paintings; soaps and detergents); 293 (agricultural machines); 297 (domestic appliances); 322 and 323 (telecommunications); 334 and 335 (optics, photography, clocks); 341 (car production).

### Host Countries included in the data set

Bulgaria, Czech Republic, Hungary, Estonia, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia

## Annex 2 (as extracted from “Business Risk Services-BRS Users Guide”)

### OPERATIONS RISK INDEX (ORI)

The objective of ORI is to gauge the business operations climate. There are two variables being measured:

- ❶ the degree to which nationals are given preferential treatment;
- ❷ the general quality of the business climate, including bureaucratic and political continuity.

**Definition of the Index.** A permanent panel of  $\pm 105$  experts around the world rate present conditions for the 15 criteria that measure the country's business environment from 0 (unacceptable conditions) to 4 (superior conditions). The criteria are weighted to emphasise critical success factors, and this expands the 15 to a weighted total of 25. A rating of 4 on each criterion gives a perfect environment of 100. As a result the ORI variables ranges from 0 to 100.

❖ The quality of the panel members is the foundation of the concept. Executives in companies, banks, governments, and institutions volunteer their ratings. All have extensive international experience. Geographic distribution is world wide.

❖ A version of the Delphi method is used. Data are from a permanent panel. The first reply prepared by a panel member requires research and care in matching the rating with the definitions of the criteria. A panelist is supplied with his previous reply and the overall panel average per criterion as input for decisions on current ratings.

**Criteria and Weightings.** The following have been used for over twenty years. ORI ratings are comparable since 1974.

<u>Criteria</u>	<u>Weighting</u>	<u>Criteria</u>	<u>Weighting</u>
Policy Continuity	3	Labour Cost/Productivity	2
Attitude: Foreign Investors and Profits	1.5	Professional Services and Contractors	0.5
Degree of Privatisation	1.5	Communications and Transportation	1
Monetary Inflation	1.5	Local Management and Partners	1
Balance of Payments	1.5	Short-term Credit	2
Bureaucratic Delays	1	Long-term Loans and Venture Capital	2
Economic Growth	2.5		
Currency Convertibility	2.5		
Enforceability of Contracts	1.5		