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The Location of Industrial Activities After EU Enlargement: A Sectoral Approach

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Enlargement of the European Union to 10 new members (NM) (of which 8 countries from Central and Eastern Europe) can be considered to some extent as the end of the transition process. Indeed, during the last fifteen years, these countries experienced widespread transformation of their economies. As a consequence, their international specialisation changed dramatically. New comparative advantages emerged, partly shaped by subcontracting and foreign direct investment (FDI). Between 1990 and 2004, the eight new members received around 190 $ billion of FDI, of which about 80 % came from EU-15 countries. In this context, the enlargement can also be considered as a new phase. From now on, new members benefit from a common legal framework with EU-15 countries. This leads to higher integration in Europe. As a consequence, this could also encourage firms to rethink their location on the continent, as the risk for foreign investors is considerably reduced.

The purpose of this paper is to try to identify the main determinants of foreign investment, in the context of the EU enlargement. Regarding some sectors, as retail trade or financial activities which until now have concentrated a large amount of FDI in the NM, it is clear that the openness of new markets is the main reason to invest in NM. In the manufacturing industries, the decision of location is both more opened and more complex. Economic literature has mainly identified two types of FDI, namely cost saving investments and market seeking investments. We thus concentrate our analysis and calculations on those industries. We try also to assess whether determinants have or not the same influence across sectors. Moreover, as FDI concept can also covered financial activities between the parent company and its affiliates, we prefer to use another set of data which is the turnover of foreign affiliates.

The first section of the paper presents the theoretical background. The econometric model is developed in section 2. In section 3, we present the main results for manufacturing industries as a whole. As those results are obtained using data for the main OECD countries, we conclude this section by presenting some results about the potential of some NM as well as Romania and Bulgaria regarding their attractiveness for foreign investors. Finally, we try to identify some sectoral differentiation[1].

1. The theoretical background

The modern view of FDI is a combination of two approaches. The first one is the classical view, in which FDI is considered to exploit international differences in factor prices. The second one is the industrial organisation view, according to which FDI exploit firm specific assets. The choice of the location of producing activities will be determined by the combination of the advantages of the firm and of the host country. It is thus possible to distinguish to types of FDI (Carr *et Alii*, 2001):

- Vertical FDI: geographically separates the stages of production. The primary motivation is factor savings.

[1] We would like to thank Isabelle Desnoyer-James from OECD for providing us with data.

- Horizontal FDI: replicates activities at home and abroad. The primary motivation is the access to markets.

In those last types of models, the sizes of both investor and host countries are the main determinants. Conversely, vertical FDI is mainly driven by wage cost differential. The geographic distance between the host and investor countries has an ambiguous impact. On the one hand, it can be considered as a proxy of trade barriers, especially when transportation cost is considered. Thus, the closer two countries are, the more they trade. As a consequence, sales of foreign affiliates may have a positive correlation with the distance, as it is suggested in the horizontal model. But distance can have a negative impact on vertical FDI, as the costs generated by the segmentation of the production process increase with the distance. Other variables, like membership to an economic union can also have influences on the location of FDI. On the one hand, as trade flows are favoured, it reduces the interest of FDI (especially if the horizontal model is considered). On the other hand, the risk for foreign investors is reduced, which may spur FDI.

Several studies have tried to assess the impact of those determinants on FDI (see Ferrara and Henriot (2004) for a survey). They generally show that the sales of foreign affiliates are positively correlated with the size of the host country, and negatively with the difference of qualification of the labour force (Markusen and Markus, 1999). The horizontal model in those studies is thus dominant. However, some evidence of growing vertical FDI in some industries and areas have been recently detected, especially on US data (Mataloni, 2004).

The enlargement of the EU is to some extent very specific in the economic history. Indeed, it leads to a very unusual combination of an economic Union encompassing countries characterised by a huge gap in labour cost levels. In this context, both vertical and horizontal FDI may be favoured. In the following sections we try to give more precise estimations of factors determining the location of foreign affiliates which will help us to determine the potential of NM as host countries. Moreover, we try to evaluate the sectoral differences.

2. The econometric model

Gravitational models have been mainly developed in the literature to analyse external trades (see for instance, Fontagné, Pajot and Pasteels, 2002). However, some authors used those models as a tool to point out the underlying factors of multinational firms location (see for instance Gao, 2003, or Ferrara and Henriot, 2004). In this paper, we consider this latter framework and we extend it to a sectoral approach.

The importance of multinational firms in a country is assessed by their turnover[2]. We consider several potential explanatory variables and we retain those with a significative Student test.

Recall that a gravitational model is given by the following equation (in the additive version):

$$Y_{ij} = \mu + \sum_{k=1}^{K} X_{ij}^{k} \beta_k + u_{ij} , \quad (1)$$

where μ is a constant, i is the host country, j is the investor country, Y_{ij} is the flow from country j to country i and where, for $k=1,\ldots, K$, X^k are the explanatory variables. The term u_{ij} is the model error, which can be specified in many ways. The most general form is the following:

$$u_{ij} = \nu_i + \lambda_j + \varepsilon_{ij} , \quad (2)$$

where ν_i represents a non-observable individual effect specific to the host country, where λ_j represents a non-observable individual effect specific to the investor country and where ε_{ij} is the random part of the model. If both values ν_i and λ_j are constant, the model is referred to as fixed effects model, if both values are random variables, the model is referred to as random effects model and if only one of the two values is a constant, the model is referred to as mixed effects model. In this paper, we are going to use the last type of model to take the size of the investor countries into account.

The most general model considered in the next section is the following :

$$\log(CA_{ij}) = \mu + \lambda_j + \beta_1 \log(GDP_i) + \beta_2 \log(GDP_j) + \beta_3 \log(DIS_{ij}) + \beta_4 (\log(CS_i) - \log(CS_j)) + \beta_5 UE_{ij} + \beta_6 LC_{ij} + \varepsilon_{ij} , \quad (3)$$

where $log(CA_{ij})$ is the logarithm of the firms turnover of country j in the host country i and where: $log(GDP_i)$ is the logarithm of the host country GDP (in current US dollars),

$log(GDP_j)$ is the logarithm of the investor country GDP(in current US dollars),

$log(DIS_{ij})$ is the logarithm of the distance between the host and the investor countries[3],

[2] In few cases, production data are used if turnover is not available.

$log(CS_i)$ and $log(CS_j)$ are respectively the wage costs in current dollars for the host and investor countries,

UE_{ij} is a dummy variable taking 1 when the two countries are EU25 members and zero otherwise,

LC_{ij} is a dummy variable taking 1 in the case of common language between host and investor.

As regards the model hypothesis, we assume that effects λ_j and residuals ε_{ij} are independent and identically distributed, with zero mean and unknown variances σ^2_λ et σ^2_ε. The hypothesis of absence of correlation between explanatory variables X^k and effects λ_j will be tested by Hausman test (see Greene, 1993). Computations are carried out with the statistical software S-Plus.

3. Results on manufacturing industries

Let us focus first on the manufacturing industries as a whole. Data are stemming from the OECD database (OECD, 2004) for the most recent years (between 1999 and 2002 according to data availability). 15 countries are included as host countries: United States, Canada, Japan, Germany, France, Denmark, Spain, Netherlands, Norway, Sweden, Finland, Ireland, Portugal, Poland and Czech Republic. 23 OECD countries are taken into account as investors. However the number of observations is limited by the large number of non-available cross data.

Estimations are presented in Table 1. Model M1 is the model estimated by using all the data and the model M2 is estimated by using only EU25 members as host countries. Variable selection is done progressively by adding variables and by testing their coefficient in the model through a Student test. Moreover, we provide measures of goodness of fit through R^2 and AIC criteria.

We observe that the economic size of the countries is a decisive factor for the location of multinational firms. This seems to validate the horizontal model, in the wake of previous several empirical studies such as Gao (2003). In the global model, EU membership doesn't seem to be an important criterion in the localisation decision. However, it must be noticed that the identification of this criterion is made difficult by the fact that it is highly correlated with the distance as a large number countries of the sample are EU members. The existence of a common language plays a positive role in the location decision. The spread between wage cost in the host and in the investor countries has a lower impact. The coefficient is significant with a premium risk of 14 %. Moreover, in a previous similar study (Ferrara and Henriot, 2004), the elasticity was close to one instead of 0,2 here. This could be the consequence of a narrow sample of countries, characterised by more homogeneous profiles regarding this aspect.

[3] We use here the distances provided by CEPII, taking into account not only the distance between capitals but the distance between main cities of the countries (www.cepii.fr).

We also estimate the model considering only the EU-25 as host countries (Canada, Japan, United States are thus excluded of the sample). It can be noticed that the elasticities are similar to the global model.

Table 1 : Estimates for manufacturing industries

Explained variable : ($\log(CA_{ij})$)

	(M1) All countries	(M2) EU25 as host countries (1)
Intercept	-5.158* (-5.15)	-4.611* (-3.83)
$\log(GDP_i)$	0.979* (14.87)	1.010* (13,44)
$\log(GDP_j)$	0,883* (6,49)	0,865* (6,48)
$\log(DIS_{ij})$	-0,839* (-9.25)	-0,915* (-7.43)
$\log(CS_i) - \log(CS_j)$	-0.216 (-1.48)	-0.187 (-1.41)
LC_{ij}	1.239* (4.16)	1.194* (4.16)
σ_λ	0.7929	0.7713
σ_ε	1.186	1.063
R^2	0.729	0.742
AIC	908	719
N. Obs	266	222

(1) Only EU countries listed above are included.

*Note : Student statistics in parenthesis and estimates significantly different from zero with a risk α of 10% signalled with a *.*

Previous equations can be used to assess the attractiveness of a given country. We focus here on five host countries: Hungary, Slovenia, Slovak Republic, Romania and Bulgaria.

For each host country *i*, we compute through the model M1, for all investor country *j*, the estimated value $\log^*(CA_{ij})$. Thus, an estimate of the potential turnover is given by :

$$CA_{ij}^* = \exp(\log^*(CA_{ij})) \tag{4}$$

Results are presented in Graphs 1 to 5. American and German firms should be the main investors in those countries, which is partly confirmed by FDI data. We can also usefully compare the results of the model to the observed figures for two countries, for which those data are available (Poland and the Czech Republic). In the case of Poland, confirming previous similar estimates carried on earlier data (Henriot, 2003), Graph 6 shows that the two main source countries regarding the turnover of foreign firms in Poland (Germany and the Netherlands[4]) stand now above their potential. It is also true for France and Italy. Those results also confirm more qualitative analysis carried out on foreign investment in Central and Eastern Europe showing that the stock of FDI received by those countries in percentage of GDP is already very high according to international standards. On the opposite, a negative gap exists regarding the US firms, a result which is also in line with the fact that FDI in NM has been mainly driven by EU-15, while US firms were less active especially in the most recent period (Henriot, 2005). Similar conclusions can be drawn for the Czech Republic (Graph 7), pointing out a very active role of Austrian firms in this country.

We can also compare the potential turnover that may host NM estimated by the model and the current turnover of foreign affiliates of a given investor country. We do this calculation for German firms, using the model M1. Obviously, the results show that the United States will remain the main host country. Interestingly, Graph 8 shows that among European host countries, NM could rank just behind the big-4 (France, Italy, UK and Spain). Smaller countries, as the Netherlands or Portugal, are now clearly in competition with NM to host foreign investment. Moreover, it must be stressed that once NM will close the gap with EU-15 members in terms of GDP, they will strengthen their potential of attractiveness, even if wage cost increase may lead to limit their initial comparative advantage. Similar conclusions can be drawn for the location of US firms in Europe (Graph 9), although some small European countries still appear more attractive than NM: for instance Ireland is favoured because of a common language with the US.

[4] The data for the Netherlands have to be used carefully as it can refer to holdings registered in this country of companies originated from another country.

4. A sectoral approach

Previous results on the manufacturing industries as a whole validates a "mixed" model, where both variables related to the horizontal and the vertical models have an impact on the location decisions of multinational companies. It can be assumed that those results actually cover various microeconomic approaches of FDI, some firms being more attracted by market seeking criteria while others are more guided by costs factors. As the databank used here include only global data, it is impossible to discriminate those individual behaviours. However, we can go a bit further in the analysis, trying to display some sectoral specificities. Indeed, some sectors are more labour intensive than others. Moreover, transportation costs vary across sectors. The idea here is thus to test for each sector the degree of significativity of the variables used to describe the FDI behaviour for the manufacturing industries as a whole. Data are also stemming from the OECD database for the same years than in the model used for the manufacturing industries. They concern six sectors chosen for the importance of turnover of foreign affiliates (between brackets the ISIS revision 3 codes):

- Food, beverages and tobacco (15_16)
- textile(17_19)
- wood and papers (20_22)
- Chemical products (24)
- Electrical machinery and electronic equipment (31_32)
- Motor vehicles (34)

Our first aim was to estimate a model similar to (3) for each sector. Unfortunately, sectoral data are not available for all the countries leading thus to biased estimations. Indeed, the OECD database contains only partial information, focusing mainly on major OECD countries. For example, as regards the automotive sector, only 24 observations are available, leading thus to non robust results. In fact, because of the small number of observations, the standard errors of estimates are pretty strong, implying thus the rejections of non-null hypothesis for parameter estimates.

To get round this issue, we develop a model such as equation (3) including all the sectoral data, but we replace the random effect on the investor countries by a random effect on the sectors. We exclude Poland as host country because it deteriorates slightly the results. This seems to be due to the low levels of turnover realised in Poland.

To take the sectoral effects into account, we develop the following model with both random regression intercepts and slopes:

$$\log(CA_{ij}) = (\mu + \lambda_{Intercept,k}) + (\beta_1 + \lambda_{HOST,k}) \log(GDP_i) + \beta_2 \log(GDP_j) + (\beta_3 + \lambda_{DIST,k}) \log(DIS_{ij}) + (\beta_4 + \lambda_{COSTS,k}) (\log(CS_i) - \log(CS_j)) + \beta_5 UE_{ij} + \beta_6 LC_{ij} + \varepsilon_{ij}, \quad (4)$$

where k = 1, …, 6 represents the sectors and where the other variables have the same meaning than equation (3).

Results are presented in Table 2. Model M3 is the model estimated using all the data and the model M4 is estimated using only EU25 countries as hosts. We observe that all the parameter estimates are significant with a risk α of 10 %, except the distance for the EU25 restricted model. This can be due to the fact that the number of investors countries is smaller than in the model M2 referring to the manufacturing industries.

Results from models M1 and M2 are mainly confirmed. The main factors supporting location decisions appear to be the size of the host country and the spread of salary costs. This latter is more significant and has a bigger elasticity than in the models referring to the manufacturing industries as a whole. Moreover, the presence of a common language takes again large part into the decisions.

Table 2 : Estimates for the sectoral model

Explained variable : ($\log(CA_{ij})$)

	(M3) All countries	(M4) EU25 as host countries (1)
Intercept	-5.615* (-6.492)	-8.977* (-8.46)
$\log(GDP_i)$	0.638* (7.22)	1.005* (8.578)
$\log(GDP_j)$	0,600* (6.98)	0,290* (3.73)
$\log(DIS_{ij})$	-0,455* (-3.83)	
$\log(CS_i) - \log(CS_j)$	-0.724* (-2.13)	-0.675* (-1.75)
LC_{ij}	0.574* (2.35)	0.862* (2.41)
$\sigma_{Intercept}$	0.7359	1.0122
σ_{HOST}	0.0414	0.0530
σ_{DIST}	0.1610	
σ_{COSTS}	0.5295	0.7123
σ_{ε}	1.334	1.2125
R^2	0.450	0.510
AIC	813	552
N. Obs	221	157

(1) Only EU countries listed above are included.

*Note : Student statistics in parenthesis and estimates significantly different from zero with a risk α of 10% signalled with a *.*

The econometric method described in equation (4) makes possible to display different elasticties by sector for some key variables. The coefficient associated to the main market seeking criteria (host country GDP) is not very different across sectors. This is not the case for the wage cost differential. If all coefficients have the expected sign (lower cost in the host country than in the investor country foster foreign investment), elasticities differ significantly across sectors. The elasticity for wage cost differential is pretty high for electrical and electronic equipment. On the contrary, it is almost null for chemical products. As attractiveness of NM in an enlarged Europe distinguish themselves from EU-15 mainly by lower wages, those results can give a hint of the sectors that are the most sensitive to this issue.

Table 3: Sectoral estimates of the model M4

	Intercept	GDP Host	GDP Inv	lang	Wage cost diff.
Food	-8.643	1.0141	0.2899	0.8624	-0.21045
Motor Veh.	-8.324	0.9840	0.2899	0.8624	-0.53093
Wood	-9.652	1.0272	0.2899	0.8624	-0.81519
Chem.	-8.163	1.0013	0.2899	0.8624	-0.05381
Equi.	-8.477	0.9344	0.2899	0.8624	-1.63629
Text.	-10.602	1.0689	0.2899	0.8624	-0.80436

Conclusion

Global assessment of the turnover of foreign affiliates among main OECD countries allows to validate the economic theory underlying FDI location. Both market access variables and wage cost differential have a significant impact. This is true for a global analysis as well as if only EU is considered as a host country. The simulation carried out using a gravity model shows that NM will play a significant role as host countries of MNC's foreign affiliates. As lower wage cost than in EU-15 is the main comparative advantage of NM, the sectoral distribution of FDI in those countries may be influenced by the sector sensitivity at this variable. Indeed, sectoral estimates display some discrepancies across sectors regarding the elasticity of foreign affiliates turnovers to wage cost differential.

What could be the consequence for the location of industries in an enlarged Europe? Those results are too fragile to draw a full map of the manufacturing production in EU-25. Previous studies (Brülhard, 1996) pointed out that sectoral distribution of economic activities in the EU followed three different ways acrros sectors: a concentration of sectors characterised by scale economies (chemical industry, motor vehicules) around the gravity centre of the Union, a clusterisation of high tech industry (but undetermined geographicaly) and a growing specialisation of labour intensive sectors towards

countries characterised by low wage cost. To some extent, the results of our study provide additional elements which go in the same direction.

Further work may try to include better definition of market potential, using not only the GDP of the host country as a proxy, but also the GDP of neighbours weighted by the distance. This could allow to identify better centrifuge forces in the enlarged EU, if we consider that frontier effects have now disappeared. Other factors like fiscal differentiation may also be included, as some discrepancies may remain across EU members.

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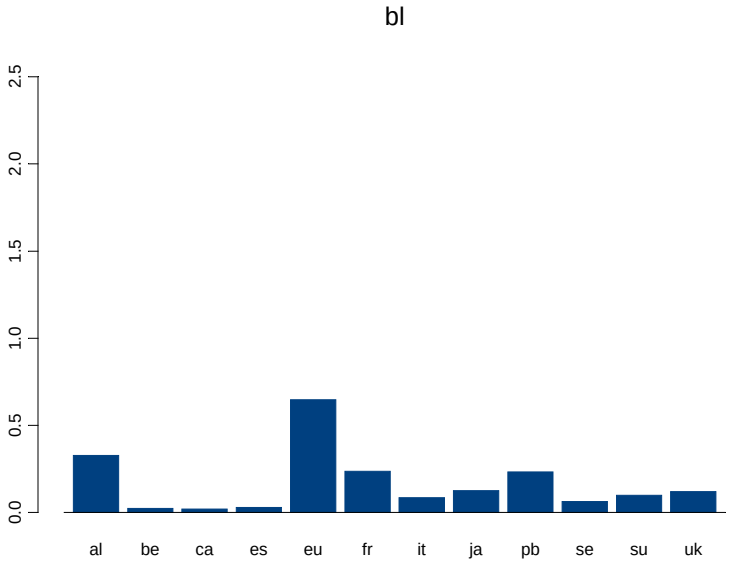
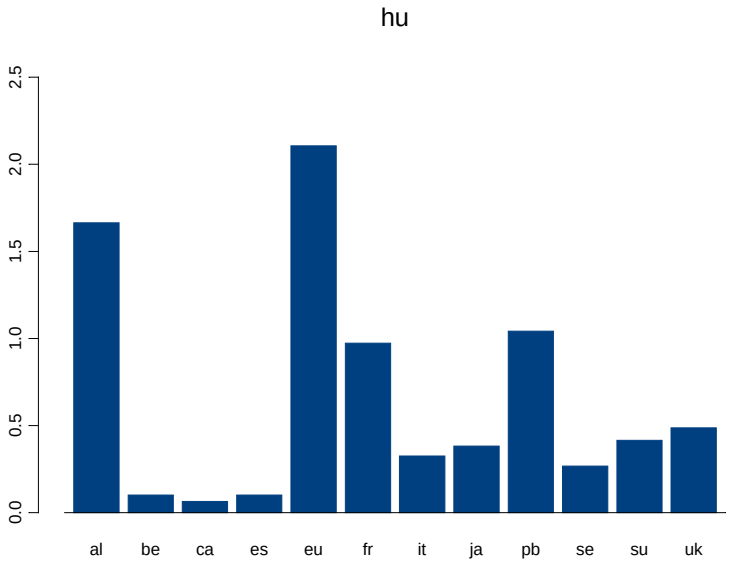
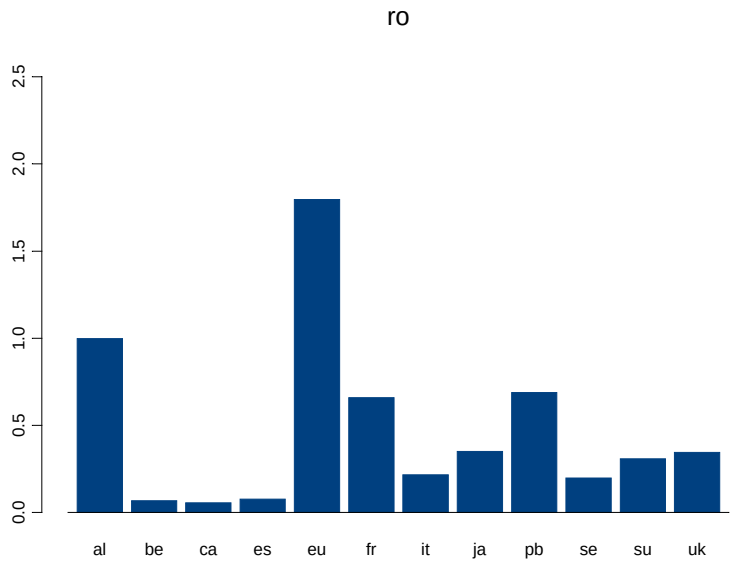
Graph 1 : Potential for manufacturing industries: Bulgaria (billions of US dollars)



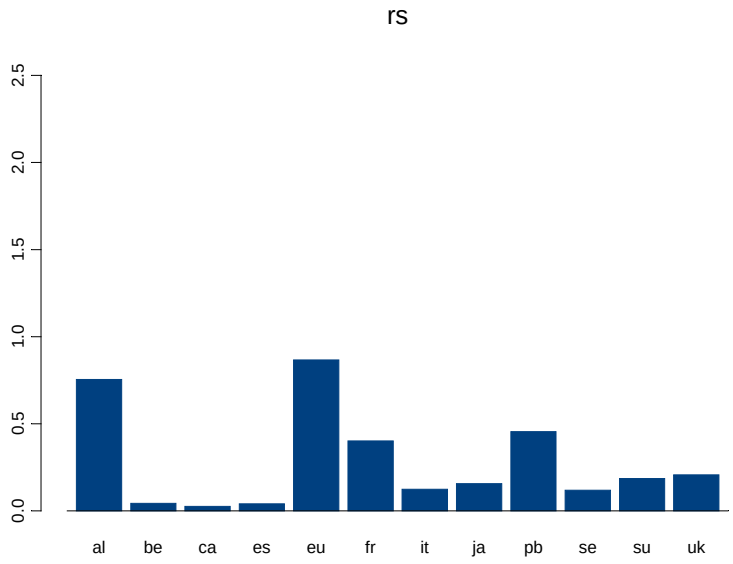
Graph 2 : Potential for manufacturing industries: Hungary (billions of US dollars)



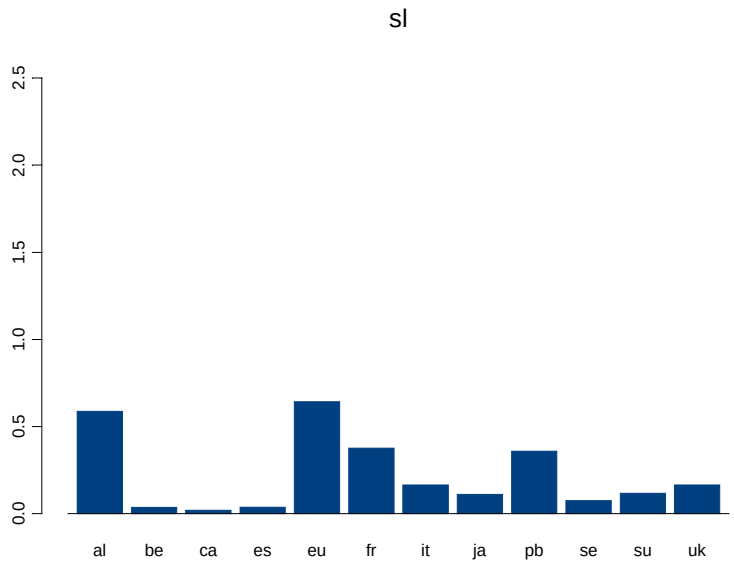
Graph 3 : Potential for manufacturing industries: Romania (billions of US dollars)



Graph 4 : Potential for manufacturing industries: Slovakia (billions of US dollars)

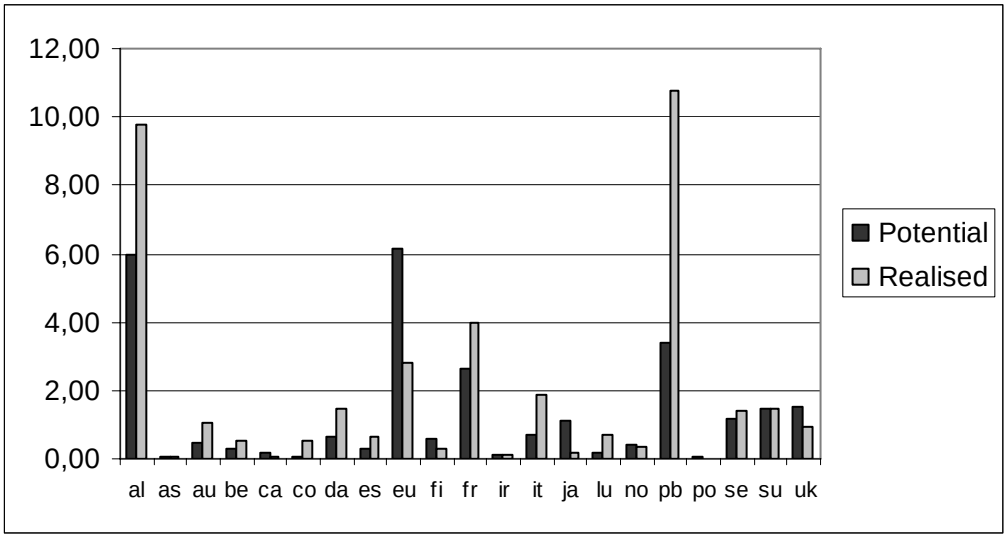


Graph 5 : Potential for manufacturing sector: Slovenia (billions of US dollars)



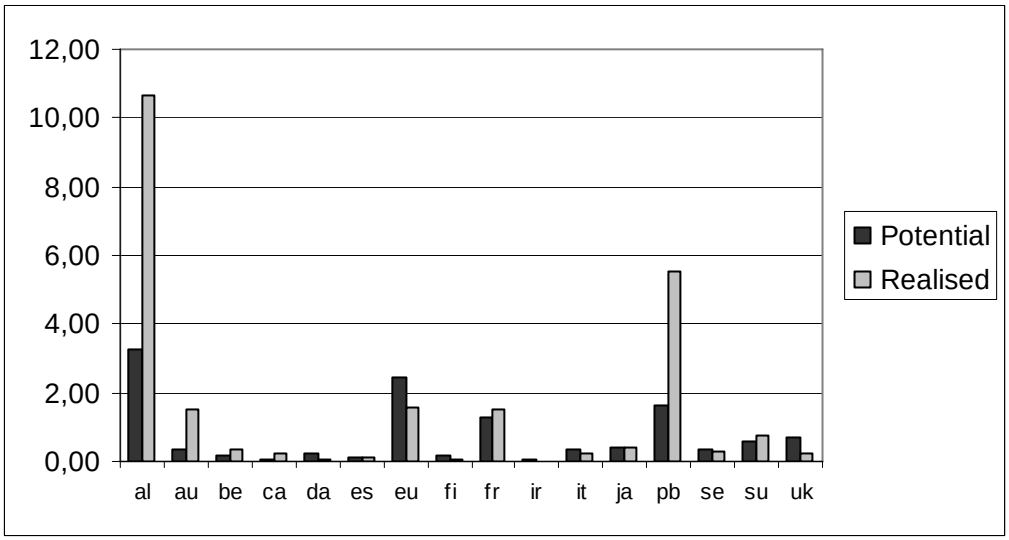
Graph 6 : Potential and realised turnover for manufacturing industries: Poland 2002

(billions of US dollars)

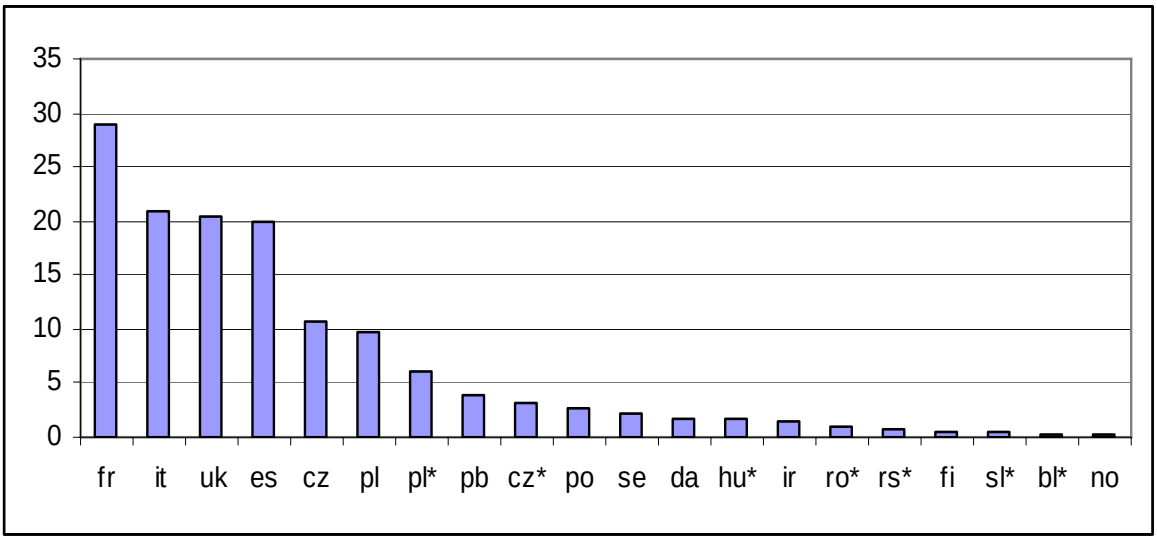


Graph 7 : Potential and realised turnover for manufacturing industries: Czech Republic 2002

(billions of US dollars)

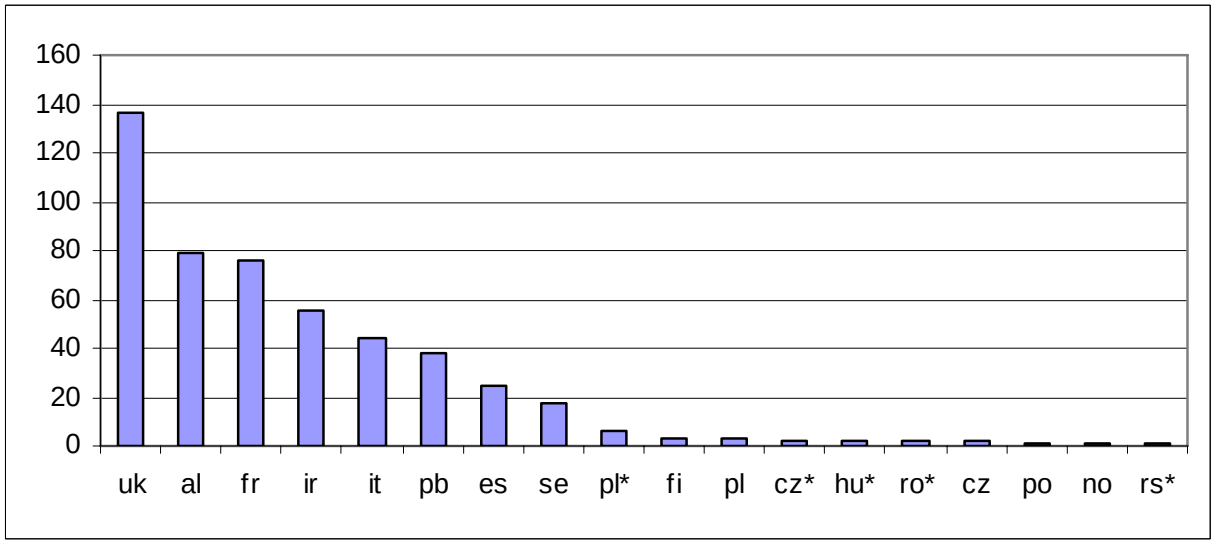


Graph 8: Turnover of German firms in various countries (potential * or realised for manufacturing industries) (billions of US dollars)



Note : As the structure of the OECD databank is based on host country declarations, the data refer to different years (1999, 2001 or 2002). For Poland and Czech Republic data refer to 2002. Potential for other NM as well as Romania and Bulgaria refer to 2002.

Graph 9: Turnover of US firms in various countries (potential * or realised for manufacturing industries) (billions of US dollars)



Note : As the structure of the OECD databank is based on host country declarations, the data refer to different years (1999, 2001 or 2002). For Poland and Czech Republic data refer to 2002. Potential for other NM as well as Romania and Bulgaria refer to 2002.

Annex 1: Country codes

al	**Germany**
au	**Austria**
as	**Australia**
be	**Belgium**
bl	**Bulgaria**
co	**Korea**
ca	**Canada**
cz	**Czech Republic**
da	**Denmark**
eu	**United States**
fi	**Finland**
fr	**France**
hu	**Hungary**
ir	**Ireland**
lu	**Luxembourg**
it	**Italy**
ja	**Japan**
no	**Norway**
pb	**Netherlands**
pl	**Poland**
po	**Portugal**
ro	**Romania**
rs	**Slovak Republic**
se	**Sweden**
su	**Switzerland**
uk	**United Kingdom**

Annex 2: Data source

Turnover of foreign affiliates: converted in US current dollars, OECD databank (partly available on the OECD website, www.oecd.org)

GDP: GDP in current US dollar, Cepii-Chelem databank

Wage cost: hourly compensation costs in US dollars for production workers in manufacturing industries, US Bureau of Labour Statistics (www.bls.gov). For NM as well as for Romania and Bulgaria, hourly labour costs (using Germany as the benchmark to get comparable data with the BLS sources) (www.eurostat.cec.eu.int)

Distance: Bilateral distance between main cities (www.cepii.org)

Common language: official languages (www.cepii.org)