

ON THE DIFFERENTIAL IMPACT OF FDI ON HOST ECONOMIES

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Abstract

This study sheds light on a central yet under-investigated issue in the European Integration debate, namely, the role of FDI on the growth process of EU countries. Most of the relevant literature to date treats host economies as homogeneous and consequently doesn't allow for a differential impact of FDI on their growth. The paper employs a small open economy two-sector model where two types of goods are produced: a high value added and a low value added good to account for the differential impact of the Foreign Direct Investment (FDI) inflow. The FDI inflow enters the two sectors' production function as a bundle of tangible and intangible assets thus, influencing domestic capital and labor. The model is tested empirically using data for the 'core' and Cohesion countries of the EU for the last two decades (1980-2001) during which the FDI has registered an unprecedented increase. The empirical findings validate the predictions of the model.

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1. Introduction

The accelerating expansion of international production as manifested by the worldwide flows of Foreign Direct Investment (FDI) and the strong competition of countries to attract foreign investors internally, raise the interest to understand this phenomenon and examine its consequences on the host nations, especially within the context of the ‘convergence’ debate in the enlarged EU. A two-sector model following Brock and Turnovski (1994) and Brock (1996) is thus incorporated to account for the role of FDI on recipient economies’ output. The key value added of the present study regards the differential impact of FDI flows on host countries’ output and hence growth, between very advanced and advanced economies within the EU on the basis of the quality of incoming flows. The model’s predictions are then empirically tested, which give support to the theoretical framework developed earlier. Important policy implications stem from the preceding analysis, which may be of particular interest to both national and EU policy makers as to the adopt of the suitable measures in order to benefit from foreign investments.

FDI can act in several ways to enhance growth. It is claimed that the greater the value-added content of FDI-related production and productivity spillovers (advanced management techniques, production technologies, organisational arrangements), the greater the expected impact (De Mello 1997). In addition, advanced technologies and skills embodied in FDI are transmitted to local firms inducing them to improve their efficiency through *learning by watching* i.e., by learning and interacting with foreign firms (Bengoa and Sanchez-Robles 2003; Zhang 1999). It is also considered a central source of human capital augmentation through labour training and skill acquisition as well as through training and technical assistance to local suppliers, subcontractors and customers (Narula and Marin 2003; Braconier *et al.*, 2001; Lall 1980). Also, linkages with domestic non- firm actors, i.e., public research institutes, universities and other institutes that promote science provide

another means for disseminating skills and technologies to the rest of the economy (Narula 2003)³.

Among recent studies that have explored the impact of FDI on the growth process of host nations, De Mello (1996) finds that total factor productivity (TFP) is positively affected by FDI in her sample of technological leaders whilst she obtains a negative relationship for technological laggards.

Blomstrom *et al.* (1994, 1996) attributed a qualitative aspect to capital accumulation process brought about by FDI than the mere augmentation of existing capital stocks, while Barrell and Pain (1997) estimated that around 30% of the growth of UK manufacturing productivity can be attributed to the impact of inward investment. The role of FDI in determining the endogenous growth rates via technological spillovers was further evidenced by Baldwin *et al.* (1999) for nine OECD countries, Zhang (1999) for the majority of the East Asian economies and Bende-Nabende and Ford (1998) for Taiwan.

Another major finding in the relevant literature regards the interaction of FDI and existing human capital in host economies (Balasubramanyam *et al.*, 1996; Borensztein *et al.*, 1998). More recently, Bengoa and Sanchez-Robles (2003) suggest that FDI is positively correlated with economic growth in countries of Latin America and stress the importance for the existence of adequate human capital, economic stability and liberalized markets to benefit from long-term capital flows⁴.

The paper uses an advanced econometric technique in growth empirics, i.e., the Arellano-Bond GMM approach that surpasses simple Least Squares (LS) regressions and Instrumental Variables (IV) techniques and makes it feasible to obtain robust results for the sample examined (Arellano and Bond, 1991).

³ The case of Ireland is characteristic to this end, which has been experiencing very high growth rates attributed to a large part to mass inward FDI in recent years.

⁴ However, there are studies, which indicate limited indirect benefits from FDI. See, among others, Aitken and Harrison (1999) for Venezuela, Braconier *et al.*, (2001) for Sweden, Barrios and Strobl (2002) for Spain and Narula and Marin (2003) for Argentina.

The rest of the paper is organized as follows: section 2 develops the theoretical model and derives its basic predictions. Section 3 discusses the econometric specification and methodology and presents the obtained results validating the preceding theoretical analysis. Finally, section 4 summarizes the paper's value added and concludes.

2. Theoretical Development

The FDI literature attributes a particular beneficial role to FDI for the host nations as long as these are capable of absorbing new technologies and percolate new ideas, i.e., based on their absorptive capacity.

This section presents a two-sector model with foreign direct investment. It aims at providing a theoretical framework that may explain some stylised facts and empirical evidence. Specifically, by introducing two-sectors with different levels of production sophistication and different degrees of absorptive capacity we can examine whether it is the composition – allocation rather than the level of foreign direct investment that matters for the host countries' output.

The model incorporated in this section is very close to the models introduced by Brock and Turnovsky (1994) and Brock (1996) and hence, the solution follows their work. A similar model examining the impact of reconstruction aid on the structure of the recipient economy is adopted in Demekas *et al.* (2002). In terms of production function formulation the approach adopted here follows closely the assumptions of the latter paper. Specifically, the host country produces two types of goods; a high value added and a low value added good. Two factors of production are used for their production, labor and capital. Foreign direct investment inflow is assumed to comprise a bundle of tangible and intangible assets that is associated with efficiency gains in the production, thus, influences both capital and labour. However, given that sectors may have different absorptive capacities, a given

bundle of tangible and intangible assets associated with foreign capital inflows may not benefit all sectors to the same extent.

The production structure in the host economy can be described as follows:

The production function of the high value added sector takes the form:

$Y_T = A_T(I_{FT})F(K_T, L_T)$, where Y_T is the output of the high value added sector, I_{FT} the foreign capital inflow allocated to this sector, K_T the amount of domestic capital and L_T the amount of labor. For tractability purposes and in order to capture the efficiency gains associated with the foreign capital inflow, a multiplicative separable production function is adopted.

The production of the low value added sector is similar:

$Y_N = A_N(I_{FN})H(K_N, L_N)$, where Y_N is the output of the low value added sector, I_{FN} the amount of foreign capital inflow allocated to this sector, K_N the amount of domestic capital and L_N labor.

It is assumed that $I_F = I_{FT} + I_{FN}$

The standard capital accumulation constraint holds:

$$\dot{K} = I$$

The allocation of total labor and total capital stock in the two sectors is constraint by the following equation respectively:

$$L_T + L_N = 1$$

$$K_T + K_N = K$$

The initial conditions are:

$$K(0) = K_0 \text{ and } b(0) = b_0$$

The host economy is inhabited by an infinitely representative agent who maximizes her intertemporal utility:

$$\int_0^{+\infty} U(C_T, C_N)e^{-\beta t} dt$$

, where C_T is the consumption of the high value added good, C_N the

consumption of the low value added good and β the rate of time preference.

The instantaneous budget constraint of the agent is:

$$\dot{b} = A_T(I_{FT})F(K_T, L_T) + pA_N(I_{FN})H(K_N, L_N) + rb - C_T - pC_N - pI$$

p is the relative price of the low value added good, the real exchange rate of the host economy.

The agent is assumed to accumulate bonds that pay an exogenously given interest rate r .

The representative agent maximizes her intertemporal utility function by choosing the consumption levels C_T , C_N , the labor allocation among the two sectors L_T , L_N , the rate of investment I , the rate of accumulation of traded bonds, b and the capital allocation among the two sectors, K_T , K_N .

The Hamiltonian corresponding to the above maximization problem is:

$$H = U(C_T, C_N)e^{-\beta t} + \lambda e^{-\beta t} (A_T(I_{FT})F(K_T, L_T) + pA_N(I_{FN})H(K_N, L_N) + I + rb - C_T - pC_N - pI - \dot{b})$$

Then, the optimality conditions associated with the above optimization problem are:

$$U_T = \lambda$$

$$U_N = \lambda p$$

where λ is the marginal utility of wealth, held in the form of internationally traded bonds.

$$A_T(I_{FT})F_K(K_T, L_T) = pA_N(I_{FN})H_K(K_N, L_N) = r$$

$$A_T(I_{FT})F_L(K_T, L_T) = pA_N(I_{FN})H_L(K_N, L_N) = w$$

where r is the rental rate of capital and w the real wage.

$$K = K_T + K_N$$

$$\frac{\dot{p}}{p} = r - H_K(K_N)$$

$$\frac{\dot{\lambda}}{\lambda} = \beta - r$$

It is assumed, as is common practice in the literature that the marginal utility of wealth remains constant. Consequently the rate time preference is set equal to the world real interest rate.

$$\dot{K} = Y_N(K, p) - C_N(\lambda, p)$$

The later corresponds to the low value added good market clearing condition, which implies that capital is a low value added good. Any output in excess of the domestic consumption of the low-value added good is accumulated as capital.

$$\dot{b} = Y_T(K, p) + I_F - C_T(\lambda, p) + rb$$

The latter corresponds to the market clearing condition of the high value added good market. The rate of accumulation of bonds equals the excess of the domestic supply of the high value added good over domestic consumption of the good plus the interest earned on outstanding foreign bonds and the foreign capital inflow.

The transversality conditions are:

$$\lim_{t \rightarrow \infty} \lambda b e^{-\beta t} = \lim_{t \rightarrow \infty} \lambda p K e^{-\beta t} = 0$$

The above optimality conditions can be used to derive the short-run equilibrium of the economy.

Assume that:

$$k_i = \frac{K_i}{L_i}, i = T, N, \quad A_T(I_{FT})f(k_T) = A_T(I_{FT})F(K_T, L_T) / L_T \quad \text{and}$$

$$A_N(I_{FN})h(k_N) = A_N(I_{FN})H(K_N, L_N) / L_N$$

It is also reasonable to assume that the high value added good sector is more capital intensive than the low-value added good sector i.e. $k_T > k_N$

The optimality conditions in intensive form are the following:

$$U_T = \lambda \tag{1}$$

$$U_N = \lambda p \tag{2}$$

$$A_T(I_{FT})f_K(k_T) = pA_N(I_{FN})h_K(k_N) = r \tag{3}$$

$$A_T(I_{FT})f(k_T) - k_T A_T(I_{FT})f_K(k_T) = p[A_N(I_{FN})h(k_N) - k_N A_N(I_{FN})h_K(k_N)] = w \quad (4)$$

$$K = L_T k_T + (1 - L_T)k_N \quad (5)$$

$$\frac{\dot{p}}{p} = r - A_N(I_{FN})h_K(k_N) \quad (6)$$

$$\frac{\dot{\lambda}}{\lambda} = \beta - r \quad (7)$$

$$\dot{K} = A_N(I_{FN})h(k_N) - C_N \quad (8)$$

$$\dot{b} = I_F + A_T(I_{FN})f(k_T) - C_T + rb \quad (9)$$

The optimality conditions (1) and (2) can be solved for:

$$C_T = C_T(p, \lambda) \quad (10)$$

$$C_N = C_N(p, \lambda) \quad (11)$$

Total differentiation of the optimality conditions (1) and (2) yields the following:

$$\frac{\partial C_T}{\partial p} = \frac{-\lambda U_{TN}}{D} \begin{matrix} < \\ > \end{matrix} 0 \quad (12)$$

$$\frac{\partial C_N}{\partial p} = \frac{\lambda U_{TT}}{D} < 0 \quad (13)$$

$$\frac{\partial C_T}{\partial \lambda} = \frac{U_{NN} - pU_{TN}}{D} < 0 \quad (14)$$

$$\frac{\partial C_N}{\partial \lambda} = \frac{pU_{TT} - U_{TN}}{D} < 0 \quad (15)$$

where $D = U_{TT}U_{NN} - U_{TN}^2 > 0$, given that the own effect is greater than the cross effect.

The sign of (12) depends on whether the high and the low value added goods are substitutes ($U_{TN} < 0$) or complements ($U_{TN} > 0$) in consumption. The signs of (14) and (15) are negative as long as both goods are normal (a decline in the marginal utility of wealth associated with an increase in wealth increases the consumption of both goods).

By total differentiation of the resource allocation conditions (3) and (4) the following conditions can be obtained:

$$\frac{\partial k_T}{\partial p} = \frac{A_N h}{A_T f_{kk}(k_N - k_T)} > 0 \quad (16)$$

$$\frac{\partial k_N}{\partial p} = \frac{A_N h - A_N h_k (k_N - k_T)}{p A_N h_{kk} (k_N - k_T)} > 0 \quad (17)$$

Equations (16) and (17) imply that a real exchange rate appreciation – an increase in the price of the low-value added good – increases the capital intensity of both sectors. The latter result holds since the increase in the relative price of the low value added good shifts resources to the low value added good sector. During the adjustment, the relatively more capital-intensive sector – the high value added good sector – releases a bundle involving a higher ratio of capital to labour. Consequently capital becomes relatively more abundant and the wage/rental ratio increases. Firms substitute capital for labor and the capital/labor ratio increases in both sectors.

We know that $L_T k_T + (1 - L_T) k_N = K$ (since $L_T + L_N = 1$) and that $Y_N = A_N h(k_N) L_N$

Combining these two expressions it is feasible to show that the following relationship holds for the output of the low-value added sector:

$$Y_N = A_N h(k_N) \frac{(K - k_T)}{(k_N - k_T)}$$

Thus the following result may be derived:

$$\frac{\partial Y_N}{\partial K} = \frac{A_N h(k_N)}{k_N - k_T} < 0 \quad (18)$$

given that the low-value added sector is less capital intensive than the high-value added sector.

Similarly:

$$Y_T = A_T f(k_T) \frac{K - k_T}{k_T - k_N}$$

and

$$\frac{\partial Y_T}{\partial K} = \frac{A_T f(k_T)}{k_T - k_N} > 0 \quad (19)$$

The signs of (18) and (19) can be interpreted in terms of the Rybszinski theorem. An increase in capital increases the output of the sector that uses capital more intensively – the output of the high value added goods sector – and reduces the output of the other – the low-value added good sector. This result holds since a relatively greater amount of capital is now employed in the high value added good sector; thus it attracts labour from the low value added good sector whose output therefore decreases.

Once we have elaborated on the short-run equilibrium of the model we can now proceed to defining the steady-state. The steady-state of the economy is reached when $\dot{K} = \dot{p} = \dot{b} = 0$. This implies that the following relationships must hold at the steady-state:

$$A_T f_k(\tilde{k}_T) = p A_N h_k(\tilde{k}_N) = r \quad (20)$$

$$(1 - \tilde{L}_T) A_N h_k(\tilde{k}_N) - \tilde{C}_N = 0 \quad (21)$$

$$\tilde{L}_T A_T f_k(\tilde{k}_T) - \tilde{C}_T + r\tilde{b} + I_F = 0^5 \quad (22)$$

Equation (20) implies that in the steady-state the marginal physical product of capital in the high value added sector and the low value added good must be equal to the exogenously given interest rate of foreign bonds. Equation (21) implies that in equilibrium the total output of the low value added good must be equal to the total consumption expenditure. Equation (22) states that in the long-run the current account must equal zero.

Equations (3) and (4) together with (20) determine $\tilde{k}_T, \tilde{k}_N, \tilde{p}$. Since these three variables are determined by the production block of the economy they are influenced only by supply shocks.

Once the basic building blocks of the model have been described we can now proceed to the analysis of structural shocks. Assume that there is a permanent increase in the foreign capital inflow directed towards the high value added sector. This leads to an increase in the marginal productivity of all factors of production in the high value added good sector; thus

⁵ Tildes denote steady-state values.

the output of the high value added sector increases and its relative price decreases leading to an appreciation of the real exchange rate: $\frac{\partial \tilde{p}}{\partial I_{FT}} > 0$. This real exchange rate appreciation tends to lower the demand of the low value added good sector. On the other hand, given that the output in the economy increases, the marginal utility of wealth decreases $\frac{\partial \tilde{\lambda}}{\partial I_F} < 0$; Therefore, the consumption of both goods increases. The overall impact on the output of the low value added good sector depends on the relative importance of the real exchange rate and wealth effects. The impact of the foreign capital inflow on the domestic capital will depend on whether labor moves towards the more labor-intensive or more capital-intensive sector. If the relative price effect dominates, capital increases and thus the output of the high value added sector increases and the output of the low value added sector decreases. The total output of the economy may increase or decrease; however there is an additional increase in the output of the high value sector derived from the efficiency in production associated with the increased foreign capital inflow in that sector that can compensate for the reduced low value added sector output. If this increase is large, i.e. the absorptive capacity of the economy is large the overall impact on the output of the economy may be beneficial.

3. Empirical Testing

3.1 Introductory Remarks

On the empirical side, De Mello (1996) splits her sample of countries between those of OECD and those that are non-OECD to account for heterogeneity. Her results support a definite positive FDI impact on both TFP and capital accumulation for the first group whilst she predicts the opposite relationship for the latter, suggesting a lower efficiency of ‘technological followers’ (p. 146) in the use of new technologies. Thus, the line of argument sustains that a minimum level of social capacity (Abramovitz 1986; Xu 2000)

especially in terms of human capital and skills, is required for growth enhancement in host economies.

Grossman and Helpman (1991) on the theoretical side, develop the ‘quality ladders’ argument constructing a two-country model of endogenous innovation and imitation to account for technological progress between the industrialized ‘North’ and the middle-income ‘South’. Innovation is assumed to take place in the North due to ample supplies of highly trained labor and specialized equipment, whereas the South imports product designs and production methods developed in the North, in an attempt to capitalize on advantageous factor cost conditions there. Whether the North will end up conducting all innovative activity depends on whether the South is ‘inefficient’ or ‘efficient’ follower, although it is always the North that leads innovation.

In terms of the above discussion, EU may be considered as consisting of the technological ‘North’ and the follower ‘South’ or the ‘core’ and the ‘periphery’ in an alternative phrasing. Core countries have long achieved high growth rates and are among the leaders in the international setting, whilst periphery has experienced high growth rates only in the late eighties or early nineties trying to converge to the core ones.

Explicitly, the role of foreign capital stock is expected to have exerted a significant impact on the growth of the core countries, given that these are the major recipients of foreign investments on one hand, and offer adequate amounts of technological prerequisites, making them the leaders -in Grossman and Helpman’s phrasing- in innovative capabilities, thus, attracting more ‘qualitative’ foreign investments. On the contrary, the periphery is lagging far behind with regards to technological capabilities. On these grounds, we wouldn’t expect to detect any major impact of FDI in the periphery’s growth process.

3.2 Sample, Data, Variables and Method

For this paper's purpose, the EU-12 is examined since the database covers the last two decades when only twelve countries have been members for the whole period. In the EU-12, two groups of EU countries may be distinguished: Belgium-Luxemburg (taken together), Denmark, France, Germany, Italy, the Netherlands and the UK are the core countries of the sample, -the 'North' innovators- whilst the periphery consists of Greece, Ireland, Portugal and Spain -the 'South' followers. The selection of the countries is based on common classification according to their income per capita and geographical market access of their industrial and commercial heartlands to central-western Europe.

Data was collected from OECD National Accounts, Economic Outlook and Science and Technology Statistics, UNCTAD FDI Statistics, and the IMF International Financial Statistics (IFS). Table 1 provides an analytical description of incorporated variables and their source.

Insert Table 1 here

The equation for growth takes the form:

$$\gamma_{i,t} = \beta_0 + \beta_1 x_{1,t} + \beta_2 x_{2,t} + \beta_3 x_{3,t} + \dots + \beta_n x_{n,t} + u_{i,t} \quad (1)$$

where γ is the vector of rates of economic growth, $x_{1,t}, \dots, x_{n,t}$ are growth determinants and $u_{i,t} \sim N(0, \sigma^2)$ is a random disturbance.

A problem that growth empirics entail is that growth theories are not explicit enough about what variables $x_{i,t}$ should be incorporated in the growth model of the form (1), i.e., what are those variables that must always be included in any empirical growth equation. In respect to this, we follow Levine and Renelt (1992) and Sala-i-Martin (1997), where the growth equation is of the following format:

$$\gamma = \beta_0 + \beta_1 w_{i,t} + \beta_2 z_{i,t} + \beta_3 x_{i,t} + u_{i,t} \quad (2)$$

where γ is the rate of economic growth, w is a vector of variables that must always be included in the model, z is the investigated variable and $x \in X$ is a vector of up to three variables taken from a pool of N variables available. By keeping always some variables, belonging in w , in the model plus the variable of interest z , one has to estimate (2) for all possible M combinations of x_i . If z comes out persistently significant, then it is claimed to be robust. However, this raises a tremendous amount of models to be estimated. So, a more relaxed procedure would be to include various variables from the pool of X interchangeably. Levine and Renelt (1992) use the initial level of income, the investment rate, the secondary school enrollment rate and the rate of population growth as standard variables in their model, while Sala-i-Martin (1997) uses the initial level of income and two measures for human capital, i.e., life expectancy and the primary school enrollment rate. Following this line, we also use the initial level of income, domestic capital stock (cumulated domestic investments) and the participation rate (employment/population) of the economy according to the theoretical model developed above. However, since both works of Levine and Renelt (1992) and Sala-i-Martin (1997) indicate the importance of human capital, we use interchangeably the participation rate with a human capital variable, i.e., the fraction of total researchers in the economy in total population.

According to the above then, the typical growth empirical model in a panel specification takes the form:

$$\log y_{i,t} - \log y_{i,t-1} = -c \log y_{i,t-1} + \beta_1 w_{i,t} + \beta_2 z_{i,t} + \beta_3 x_{i,t} + \eta_i + \varepsilon_{i,t}, \quad c > 0 \quad (3)$$

where $\log y_{i,t} - \log y_{i,t-1}$ is the growth rate γ ($y_{i,t}$ is income per capita) which is negatively related to the per capita income at the beginning of the period, $w_{i,t}$ now includes our two standard variables, η_i is a fixed individual component and $\varepsilon_{i,t}$ is the random error component ($u_{i,t} = \eta_{i,t} + \varepsilon_{i,t}$). Now, (3) may be rewritten as a dynamic panel data model as follows:

$$\log y_{i,t} = d \log y_{i,t-1} + \beta_1 w_{i,t} + \beta_2 z_{i,t} + \beta_3 x_{i,t} + \eta_i + \varepsilon_{i,t}, d > 0 \quad (4)$$

where $d = 1 - c$.

Estimation using panel data is advantageous over the estimation of conventional cross section growth models in that it allows the exploitation of the time-series information and enables the observation of country-specific effects (Carkovic and Levine, 2002).

A major drawback though of the relevant studies carried out to date is that they don't account for endogeneity problems arising from the use of explanatory variables that are considered to be endogenous, i.e., determined simultaneously with growth. Simple IV estimations on the other hand entail the problem that there are no ideal instruments available (Borensztein *et al.*, 1998). On top of that, the specification incorporated here, has a lagged dependent variable on the right hand-side, leading to biased estimators.

The Generalised Methods of Moments (GMM) estimator of Arellano and Bond (1991) utilised in this study, is superior to simple LS and IV approaches since it accounts for endogeneity problems and permits a considerable gain in efficiency (Hsiao 1986; Pesaran and Smith 1995). The Arellano-Bond GMM estimator removes the fixed effect by taking first differences and exploiting all available lagged values of the dependent variable and the exogenous regressors as instruments, thus, it produces substantial efficiency gains ((Judson and Owen, 1996).

The GMM estimator is consistent if there is no second-order serial correlation in the error term of the first-differenced equation; a test for the validity of the instruments (and the moment restrictions) is a test of second-order serial correlation in the residuals, m_2 . The most common test of the instruments is Sargan's (1958) test for over-identifying restrictions.

So, using our notation of variables, (4) is represented as below:

$$\Delta \log GDPC_{i,t} = \Delta \log GDPC_{i,t-1} + \beta_2 \Delta \log DOMI_{i,t} + \beta_3 \Delta PARTI_{i,t} + \beta_4 \Delta \log FDI_{i,t} + \beta_x \Delta x_{i,t} + \Delta \eta_i + \Delta \varepsilon_{i,t} \quad (5)$$

where Δ denotes the variables in first differences, GDP stands for the current period's per capita income level in logarithms, $GDP_{i,t-1}$ is the past value of per capita income in logarithms, $DOMI_{i,t}$ represents domestic capital stock in logarithms, $PARTI_{i,t}$ is the recipient economy's participation rate measured as the share of total employment in population, $FDI_{i,t}$ indicates foreign capital stock in the host country in logarithms and $x_{i,t}$ a set of conventionally incorporated variables. Tables 3 and 4 present the results obtained from alternative estimations.

The Wald test statistics indicate that all explanatory variables are significant and the Sargan test shows that appropriate instruments are included. The values of the m_2 test statistics are below the critical values⁶ for both sub-samples.

In regards to conventionally used variables included in X^7 , trade policy has been found to be an important growth element (Balassa 1982; Michaely *et al.* 1991; Pritchett and Sethi 1994; Edwards, 1997). Balasubramanyam *et al.* (1996b) follow Bhagwati (1978) and analyse the effect of export promoting (EP) or the import substituting (IS) strategy under the assumption that the efficiency of FDI varies between the two. We adopt the same perception here, and use the share of imports to GDP on the basis that EP countries are likely to have a relatively high ratio indicating thus, a relatively low level of import protection. In the same vein, openness has been found by Sala-i-Martin (1997) to be of great importance in his study for the variables that appear to be significantly correlated with growth (Bagwati 1978, 1985; Balasubramanyam *et al.*, 1996a, 1996b). So, to account for the above, and interchangeably with the EP strategy, we use an openness variable measured by the share of total trade in GDP.

The macroeconomic environment is another highly significant factor, especially in what regards macroeconomic stability (Obwova, 2001; Lipsey, 1999). A commonly used

⁶ 1.96 for 5% and 2.58 for 1%.

⁷ Discussion of the variables presented in this part is beyond the scope of the paper. For an extensive analysis, see references.

measure is the inflation rate (Fischer, 1993) “*as a symptom of lack of commitment and discipline in monetary policy*” (Bengoa and Sanchez-Robles, 2003, p.539). Another macroeconomic significant element regards the exchange rate stability (Cushman, 1987) thus, we also incorporate this variable instead of the inflation rate.

Finally, time dummies to control for particular events throughout the period (e.g. amendments to the original EC Treaty in 1987 and the Single Market put into effect in 1992) are introduced in the model as well as a time dummy controlling for the intermediate period of 1987 to 1992.

Firstly, we tried to estimate the empirical model for the EU-12 in order to be able to draw comparisons from the separate groups mentioned above. Nevertheless, this was not feasible as in no case could we obtain consistent estimators, which implied the heterogeneity of the whole sample. Even when testing for the core sample, the relevant tests indicated again the same problem for most of the specifications run, which again could be a sign of heterogeneity among them. Indeed, checking our sample, we found out that Denmark is the country that creates this inconsistency problem, thus, we excluded it from the ‘core’ group⁸. Tables 2 and 3 show the obtained results.

Insert Tables 2 and 3 here

Even a cursory look at the tables manifests the distinctive differential impact of FDI between the core and the cohesion countries⁹. FDI appears to be an important factor in the growth process of the six core countries whilst the results do not indicate a persistently significant effect for the cohesion sample. Instead, the growth path of the latter group is influenced by the degree of its openness and export substitution behaviour as well as by its macroeconomic conditions. It is surprising that not even the domestic capital stock emerges

⁸ Not surprisingly though, since Denmark differs in a lot of aspects with the rest countries, forming another group with the other Scandinavian states.

⁹ Kottaridi (2004) finds a similar result in her discussion of FDI agglomeration forces, although the emphasis is placed between core and peripheral regions of the EU taking into account the geographical position of countries parallel to the conventional classification.

to be of significant impact in contrast with the core countries, where both foreign and domestic capital stock turn out robustly significant. However, we need to mention at this point the limited number of observations of the cohesion group and the fact that the variable capturing domestic capital stock includes all kinds of invested capital. This may make a difference especially for these countries, as equipment investment might probably be the beneficial factor rather than the total stock. However, this was not feasible to check due to data limitation.

Overall, it is evident that the core sample works much better than the cohesion group. Undoubtedly, although the cohesion group also consists of advanced countries, internal problems have caused fluctuations in their growth process during the last two decades as evidenced by the non-robust results.

4. Conclusions

This paper is the first to introduce a production function where Foreign Direct Investment (FDI) comprises a bundle of tangible and intangible assets, thus, entering the production function allowing for efficiency gains. A small open economy is hereby incorporated predicting a differential impact of FDI according to its qualitative aspect and not necessarily on a quantitative basis. That is to say, the role of FDI is attributed to its allocation in different sectors with different absorptive capacities, and hence foreign capital may not be beneficial *per se* for the output augmentation and thereafter growth of the recipient economy.

The theoretical predictions are empirically tested for the ‘core’ versus the ‘peripheral’ countries of the EU-12 for the last two decades, i.e., 1980-2001. The core countries are well known as the major recipients of FDI not only in numerical terms –which anyhow makes a difference- but there is a wide consensus of the high value added capital flowing internally.

On the other hand, the cohesion countries have conventionally had low foreign inflows directed mainly to traditional sectors to exploit comparative advantage. Hence, according to the theoretical predictions, the first group of countries is expected to have benefited the most from FDI inflows in contrast with the latter group where the impact of FDI is questionable. Indeed, our results testify in favour of such a pattern validating the preceding theoretical analysis.

Future research on the topic may further investigate these theoretical predictions in a wider sample of countries and may advance our understanding of the FDI impact on the growth process of countries according to particular measures of absorptive capacities, such as human capital, institutional infrastructure etc.

Table 1. Description of Variables

Variables	Description
GDPC	GDP per capita at the price levels and PPPs of 1995, US\$ mln., OECD, Annual National Accounts, Comparative Tables.
FDI	Inward FDI stock at the price levels and PPPs of 1995, US\$ mln., UNCTAD, FDI Statistics and author's calculations.
POP	Total population, in 1000 units, OECD, Annual National Accounts, Population and Employment.
DOMI	Domestic capital stock at the price levels and PPPs of 1995, US\$ mln., OECD, Annual National Accounts, Main Aggregates and author's calculations.
HC	Human capital, Total researchers/Empl
TRES	Total researchers, number of units, OECD, Science and Technology, Main Science and Technology Indicators.
EMPL	Employment, in thousands of units, OECD, Annual National Accounts, Population and Employment.
INFL	Inflation rate, percentage, OECD, Annual National Accounts, Main Aggregates.
ER	Exchange rate, percentage, OECD, Annual National Accounts, Main Aggregates.
PPP	Purchasing power parity, OECD, Annual National Accounts, Exchange Rates, PPPs and Population.

Table 2. Econometric Results for the Core Countries

Dependent Variable: $\Delta \log \text{GDPC}$
 Arrelano-Bond dynamic panel data estimation

	Model 1	Model 2	Model 3	Model 4	Model 5
GDPC(-1)	.699*** 18.30	.776*** 21.34	.824*** 24.33	.827*** 25.24	.652*** 16.24
FDI	.029*** 4.58	.021*** 3.21	.017*** 2.63	.013** 1.90	.011* 1.72
DOMI	.119*** 5.78	.125***	.088*** 3.85	.074*** 3.15	.092*** 3.96
PARTI	-.006 -1.34			.011* 1.88	
HC		.007*** 2.83	.066 0.27		.008*** 3.82
EP	.037*** 6.36				.042*** 6.89
OPEN		.009*** 3.87	.013*** 5.64	.014*** 6.23	
INFL			-.296*** -5.48	-.004*** -6.16	
ER	-.012* -1.74	.004 0.57			.009 1.27
TDUM					.014*** 5.33
Intercept	-.006*** -3.75	.006*** -3.62	-.006*** -3.88	-.006*** -3.57	-.003 -1.56
Wald test	1397.37***	1156.43	1325.22***	1324.49	1363.91***
Sargan test	219.16	192.62	172.51	167.73	169.03
m_2	-0.31	-0.27	-0.51	-0.53	-0.50
N	120	120	120	120	120

z-statistics are in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.10

The m_2 test statistic indicates the lack of second order serial correlation, thus it validates the assumed moment restrictions. The Sargan's test is a test for over-identifying restrictions. It is the second test statistic recommended by Arellano and Bond (1991) on the validity of the instruments. Hence, our results provide optimal, consistent estimators.

where $\text{GDPC}(-1)$ =GDP per capita of the respective economy lagged by one period, FDI=inward FDI stock, DOMI=domestic investment stock, PARTI=employment/population HC=total researchers/employment, EP=IMP/GDP OPEN=total trade/GDP of respective economy, INFL=inflation rate, ER=exchange rate, TDUM=1 if 1986 < year < 1992, 0 otherwise.

Table 3. Econometric Results for the Cohesion Countries

Dependent Variable: $\Delta \log \text{GDPC}$
 Arrelano-Bond dynamic panel data estimation

	Model 1	Model 2	Model 3	Model 4	Model 5
GDPC(-1)	.777*** 12.66	.784*** 15.41	.837*** 16.43	.794*** 14.10	.783*** 13.23
FDI	.008 1.19	.006 1.02	.008 1.27	.013** 2.25	.013** 2.09
DOMI	-.0014 -0.36	.023 0.51	.013 0.26	.017 0.39	-.044 -1.06
PARTI	.017 0.90			.025 1.55	
HC		-.019** -2.18	-.012 -1.38		-.012 -1.27
EP	.027*** 3.37				.035*** 4.28
OPEN		.013*** 4.91	.014*** 4.86	.012*** 4.80	
INFL			-.002*** -3.52	-.002*** -3.92	
ER	-.056*** -3.48	-.043*** -2.94			-.037** -2.32
TDUM					.022*** 5.04
Intercept	.005** 1.99	.007** 1.99	.002 0.57	-.0006 -0.29	.008** 2.14
Wald test	2661.61***	2698.49***	2702.27***	2810.13***	2747.77***
Sargan test	137.04	120.80	111.72	123.09	111.21
m_2	-1.42	-1.72	-1.31	-1.23	-1.44
N	79	79	79	79	79

z-statistics are in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

The m_2 test statistic indicates the lack of second order serial correlation, thus it validates the assumed moment restrictions. The Sargan's test is a test for over-identifying restrictions. It is the second test statistic recommended by Arellano and Bond (1991) on the validity of the instruments. Hence, our results provide optimal, consistent estimators.

where $\text{GDPC}(-1)$ =GDP per capita of the respective economy lagged by one period, FDI=inward FDI stock, DOMI=domestic investment stock, PARTI=employment/population HC=total researchers/employment, EP=IMP/GDP OPEN=total trade/GDP of respective economy, INFL=inflation rate, ER=exchange rate, TDUM=1 if $1986 < \text{year} < 1992$, 0 otherwise.

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