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THE ENHANCING EFFECT OF HUMAN CAPITAL ON THE FDI AND ECONOMIC GROWTH NEXUS

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ABSTRACT

The importance of Human Capital accumulation in order to achieve greater economic growth is not neglected in economic theory. In this paper we look at the importance of human capital for enhancing the effect of another factor, inward foreign direct investment (FDI), that may affect growth. Governments in all continents now compete actively for FDI but not all countries reap the full benefits from it. Our study demonstrates that FDI has a greater impact on GDP growth for OECD countries that meet minimum thresholds of absorptive capacity measured by human capital proxy and private R&D. An active policy towards FDI implies therefore to support human capital development, learning and investment by local firms, as a way not only to attract high quality FDI but also to enhance the potential benefits arising from foreign presence.

Keywords: Foreign Direct Investment (FDI), Economic Growth, Human Capital, Technological Capacity, Absorptive Capacity Thresholds

The enhancing effect of human capital on the FDI and Economic Growth nexus

1. INTRODUCTION

As we enter into the second decade of the 21st century, the human capital accumulation combined with the presence of FDI is seen as a complementary to achieve incremented economic growth, despite the anticipated decline in FDI flows, opportunities for reaping the full benefits of inward direct investment remain high in the long run. Governments in all continents now compete actively for FDI. The surveys of the literature conclude that it is increasingly recognised that, within the right setting, foreign direct investment (FDI) can be a powerful engine for sustainable growth (Pack and Saggi, 1997; De Mello, 1997; Blomström and Kokko, 1998; OECD, 2002; Nissanke and Thorbecke, 2006; Ozturk, 2007; Meyer and Sinani, 2009).

Theoretically, the FDI – human capital – growth nexus has been bolstered by developments in growth theory which highlighted the importance of technology, efficiency and productivity in stimulating growth. FDI is usually viewed as a channel through which knowledge and technology is able to spread into host countries contributing positively to economic growth (Findlay, 1978; Romer, 1993; Markusen and Venables, 1999; Veugelers and Cassiman, 2004 and more recently Tang et al., 2008; Thangavelu et al., 2009 and Waldkirch, 2010). Notwithstanding, its benefits do not accrue automatically and evenly across countries, sectors and local communities: FDI impact is moderated by some aspects, among which host country contextual specificities. Moreover, FDI will contribute most fully to sustainable development when the underlying economic, social and environmental governance policies in place are adequate (Nissanke and Thorbecke, 2006; Greenaway et al., 2007).

A recurring theme appears to be the need for the host economy to have absorptive capacity in order to benefit from FDI (see, for example, Borensztein et al., 1998; Xu, 2000; Ford et al., 2008; Jyun-Yi and Chih-Chiang, 2008). Absorptive capacity may be defined as the host country's capacity to access, learn and implement new technologies from overseas (Rogers, 2004). That is, it represents the ability to connect new knowledge with existing knowledge and transform it for application in host context (Meyer and Sinani, 2009). Without such a capacity, local firms may be unable to catch up, lacking managerial resources to adequately respond to foreign entry and raise their performance.

While the relationship between FDI, growth and the role of the moderating variable 'absorptive capacity' has been intensely debated, the identification of the minimum thresholds of absorptive capacity for a positive effect from FDI to arise remains largely unexplored (Balasubramanyam et al.,1999; Xu, 2000; Ford et al., 2008;, Meyer and Sinani, 2009). For this reason, using two threshold variables (host country's human capital level and the share of R&D performed by business sector on total GDP), this paper revisits the relationship between FDI and economic growth. We contribute to a better understanding of the preconditions required for FDI to promote growth. Another aspect apparent from our review of the literature is its focus on developing countries and a scarce empirical examination of the welfare effects of foreign direct investment (FDI) in developed economies[1]. Notwithstanding, developed countries remained the prime destination of FDI. Hence, this paper attempts to identify the preconditions necessary for the effective utilization of FDI in developed economies. The study is based on a sample of 30 countries of OECD for the period 1997-2007.

Our results show the need of a minimum threshold of human capital and business R&D in order to increment the positive impact of FDI on economic growth. The estimated thresholds indicate that a considerable share of OECD countries is still below the minimum

[1] Valuable exceptions are the studies of Ford et al. (2008) for USA and Barrios and Strobl (2002) for Spain.

level of absorptive capacity required to gain with foreign presence. Hence, an active policy supporting human capital development, learning and investment by local firms, as a way to attract high quality FDI and to enhance the potential benefits arising from foreign entry must be at the centre of the policy agenda.

The remainder of this paper is organized as follows: in section 2, we discuss the main literature on the relationship between FDI and economic growth. Section 3 describes the data and the methodology used. In section 4, we present and discuss the empirical results. Section 5 concludes and discusses the main implications of our results.

2. FDI - GROWTH NEXUS AND MODERATING THRESHOLDS

To the extent that FDI is believed to transfer technology, promote learning by doing, train labour and, in general, result in spillovers of human skills and productivity at local level, it should promote host countries' economic growth. It has been also stated that the presence of foreign investors in the home economy can provide incentives to invest in education (Checchi et al., 2007). The surveys on the numerous empirical studies on the FDI-Growth nexus at economy-wide level provide good evidence that FDI contributes to growth (Pack and Saggi, 1997; De Mello, 1997; Blomström and Kokko, 1998; OECD, 2002; Greenaway et al., 2007; Ozturk, 2007). There is not however consensus on the associated magnitudes of the impact. One of the motives for the different findings relies on the role of several moderating variables. A great majority of recent empirical studies have found a positive effect of FDI on economic growth contingent on some host country specificities (Blomström et al., 2000; Lim, 2001; Alfaro et al., 2009; Meyer and Sinani, 2009).

The question that naturally arises is what conditions in the host country are important to enhance the positive impact from FDI on growth? From a look at the literature it is possible

to identify critical host country characteristics, being absorptive capacity a central one. Next we discuss these aspects and derive our research agenda.

2.1. Absorptive capacity thresholds

The majority of the literature emphasises that FDI can only contribute to economic growth through spillovers when there is a sufficient absorptive capacity in the host country. Absorptive capacity refers to the ability of an organization or region to identify, assimilate and exploit knowledge from the environment (Cohen and Levinthal, 1989). Table 1 summarizes the main studies on the role of host absorptive capacity for explaining FDI impact. Host absorptive capacity is frequently measured by human capital levels and, less often, by R&D expenditures or patents, which is in line with the modern concept of absorptive capacity as defined by Rogers (2004) and Meyer and Sinani (2009).

With the exception to Olofsdotter (1998) and Carkovic and Levine (2002), the great majority of the studies found it relevant, supporting an enhancing effect resulting from the interaction between FDI and absorptive capacity.

In particular, the contribution of FDI on economic growth seems to be enhanced by the high educational level of the population of the host economy, as found by Lai et al. (2006) and Fu (2008) on the Chinese case, Tytell and Yudaeva (2006) in Poland, Romania, Russia and Ukraine, and Chudnovsky et al. (2008) for the Argentine case. The same results were obtained by Rogers's (2004) study of 82 countries over a 25-year period and by Karbasi et. al.'s (2005) study of 42 countries over the period 1971-2000.

FDI effects upon growth is likely to depend on the technological conditions and capacity of the firms in the host country, as shown by Barrios et al.'s (2002) and Barrios and Strobl's (2002) studies for Spain, Greece and Ireland over the 1990s. R&D activities contribute to develop local firms' absorptive capacity, which in turn determine the overall

absorptive capacities of an economy, as they are the basic elements in a national innovation system. Hence, innovation activities of firms may also be used a proxy for absorptive capacity of the host economy. From a complementary perspective and using macro data, De Mello (1997), OECD (2002) and Fu (2008) conclude that countries and regions must reach a certain level of development of technological capacity, as FDI seems to have more limited growth impact in technologically less advanced countries or regions. Both measures of absorptive capacity, human capital and R&D activities, are indeed complementary because firm's and regions' R&D activity may suggest a need for highly skilled labour.

From the best of our knowledge, there is a gap in the literature regarding the quantification of the minimum threshold of human capital as proxy for absorptive capacity.

Borensztein et al. (1998), Balasubramanyam et al. (1999) and Xu (2000) are seminal studies quantifying a minimum threshold of absorptive capacity above which host countries can benefit from FDI.

Borensztein et al. (1998) study of a sample of 69 developing countries for the period of 1970-1989 proxies host country capacity stock of human capital by using the initial-year level of 'average years of male secondary schooling' constructed by Barro and Lee (1993). Their results reveal that only countries with an average of 0.52 years of male secondary schooling would positively benefit from FDI, with 46 out of the 69 countries being above that level in 1980. Xu (2000) used the same proxy as Borensztein et al. (1998) for host human capital and run regressions using samples selected according to different human capital thresholds covering US manufacturing affiliates in 40 countries. They found that FDI positive effect depended on countries achieving a minimum level of male secondary schooling somewhere between 1.4 and 2.4 years, which was a value much higher than the 0.52 years estimated by their previous counterparts. Out of the 30 observations used to estimate regressions, only five LDCs exceeded this threshold value, which, accordingly to the authors,

justified why they found technology transfer by US MNEs to have contributed to the productivity growth in DCs but not in LDCs. Jyun-Yi and Chih-Chiang (2008) adopted a proxy for human capital identical to that used by Borensztein et al. (1998) and Xu (2000), but they considered the overall population rather than just the men population. The minimum threshold obtained was 2.108 years of secondary school attainment, with 42 falling below the threshold and only 20 countries registering values above it.

Balasubramanyam et al. (1999) proxy inputs of human capital by manufacturing real wages. First they ranked the countries in the sample according to their inputs of human capital. They found the threshold to be at the 20^{th} observation, a little below the second quartile.

More recently, using data from 48 U.S. contiguous states for 1978–97, Ford et al. (2008) demonstrate that U.S. states with higher foreign presence grow faster relative to states with a low foreign presence, provided that the state has a minimum level of human capital. They considered as proxy for human capital the percentage of population with college degree. The authors estimated a range for the minimum educational thresholds to be of 12%-16% of the population with, at least, a college degree. They verified that 6 states were below the minimum threshold and 23 within that interval.

Finally, Meyer and Sinani (2009) measured human capital by the enrolment ratio in tertiary education, finding the minimum threshold for gross enrolment ratio in tertiary education to be of 33%. They also considered innovative activities, namely R&D as share of GDP and patents per resident. They found a minimum threshold of 2.93 patents per resident and of 1.33% the share of R&D in total GDP. Analysing the country data carefully, they found that 59%, 60% and 79% of the countries had values below the thresholds for human capital, R&D and patents respectively.

In spite of these contributes, there is still a gap in the empirical literature regarding the quantification of the minimum threshold of absorptive capacity required to a country to benefit from foreign entry. Hence, our paper identifies the thresholds for two proxies of absorptive capacity: human capital and business innovation activity.

We are aware that a few other host country factors may influence FDI effects upon growth performance and even the FDI-Growth-Human capital relationship. Next we identify the most significant out of the literature, and consider them in the empirical analysis.

2.2. GDP, institutional quality, openness and financial development

One of the first host country specificities pointed in the literature as likely to affect FDI impact on growth is the level of development of receiving countries. Blömstrom et al. (1994) was one of the pioneer studies providing support for such belief, by showing that FDI only promoted growth in higher-income developing countries. Jyun-Yi and Chih-Chiang (2008) tested this assumption with a sample of 62 countries and showed that FDI can promote economic growth only when the host country has achieved a certain threshold of development. Very recently, Meyer and Sinani (2009) conducted a meta-analysis of the empirical evidence on FDI spillovers and supported that spillover benefits tend to be higher in very low income and very high income countries, being almost insignificant in middle income economies.

A few empirical studies have suggested the conditional effect of FDI imposed by host country regulations, institutional stability (e.g. Karbasi et al., 2005) and institutional development (Busse and Groizard, 2005). Institutional quality is frequently proxied by the degree of property-right protection, bureaucratic efficiency (Olofsdotter, 1998) and/or indexes of economic freedom or corruption (Durham, 2004; Tytell and Yudaeva, 2006; Jyun-Yi and Chih-Chiang, 2008). These studies reveal that knowledge and productivity externalities from FDI occur predominantly in regions with a developed institutional setting and Thorbecke and

Nissanke (2006) argue that institutional capacity, jointly with host levels of human capital, play important roles for a sustainable technological diffusion by MNEs. More recently, Meyer and Sinani (2009) show that countries with a moderate degree of institutional development may benefit less from FDI spillovers, with benefits occurring mainly with high levels of corruption, when firms may be able to use illegitimate means to attain technologies from foreign investors.

Openness to international trade has also been suggested as a potential condition to benefit with foreign investments, by improving the competitive market environment and the level of technology exchange. FDI tends to be more likely to promote economic growth when host countries adopt liberalized trade regimes, encourage export-oriented FDI and maintain macroeconomic stability (see Balasubramanyam et al., 1996a, 1996b, 1999; Zhang, 2001; Lai et al., 2006, for the Chinese case; Greenaway et al., 2007 for 77 developing countries and Jyun-Yi and Chih-Chiang, 2008, for a diversified sample of countries from around the world). The exporting experience of local firms, which may also be enhanced by inward FDI (Fu and Balasubramanyam, 2005), allows them to reduce the gap between domestic production technology and that used by foreign firms and consequently to improve the capacity to absorb externalities from FDI (Barrios et al., 2002; Barrios and Strobl, 2002).

Very recently, Alfaro et al. (2009) have pointed out an additional moderating factor influencing the FDI-growth nexus: the development of host financial markets. In fact, their study reveals that only countries with well-developed financial markets gain significantly from FDI via TFP improvement, while physical factor accumulation and human capital do not seem to be the main channels through which countries benefit from FDI.

To conclude, many factors may influence FDI effects upon growth performance. Host absorptive capacity remains the precondition most debated in the literature, and further evidence is needed on this regard. Hence, in this paper our central focus is on absorptive

capacity, but we consider also a number of host country characteristics, namely initial level of GDP, institutional quality and openness to trade, that play an important role in forming the overall dynamic capabilities required to take advantage from the presence of foreign firms. More precisely, we search for a threshold level of endowments of absorptive capacity as necessary condition for the promotion of growth through FDI.

Table 1. Empirical Studies on the Effect of FDI on Host Countries' Economic Growth: moderating effect of absorptive capacity

Effect of FDI	Study	Countries	Time Span	Methodology	Growth Proxy	Host country moderating variables	Proxy for absorptive capacity	Threshold
Positive	Borensztein et al. (1998)	69 Developing Countries	1970-1989	SUR Techniques	Growth of real GDP pc	Absorptive Capacity	Human Capital: Initial average years of male secondary schooling	0.52 years of male secondary school attainment
	Olofsdotter (1998)	50 Countries	1980-1990	OLS	Growth of real GDP pc	Institutional Capability	Human Capital: average year of Schooling; and Openness to Trade	-
	Balasubramanyam et al. (1999)	46 Countries	1970-1985	OLS and GIVE	Real GDP growth	Absorptive Capacity; Exp.Promotion Strategy	Human Capital: Real Wage Level	Below the 2nd quartile of wage ranking
	Xu (2000)	40 Countries	1966-1994	2SLS and IVM	Growth Rate of Total Factor Productivity	Absorptive Capacity	Human Capital: Years of Secondary School attainment)	[1.4; 2.4] years of male secondary school attainment
	Barrios and Strobl (2002)	Spain	1990-1998	OLS and FE Panel Regression	Total Factor Productivity	Absorptive Capacity	R&D expenditures and exporting behaviour	-
	Barrios et al. (2002)[a]	Greece, Ireland and Spain	1992-1997	OLS	Labour Productivity of Domestic Firms	Absorptive Capacity	R&D expenditures and exporting behaviour	-
	Rogers (2004)	82 Countries	1965-1990	Cross-country Regressions	Growth Rate of GDP pc	Absorptive Capacity	Nº of students studying abroad, telecommunications, publications	-
	Lai et al. (2006)	30 Chinese Provinces	1996-2002	Pooled OLS, FGLS, FE and RE	Real GDP Growth	Absorptive Capacity	Human Capital: Aver. Educational Attainment pc; Openness to Trade	-
	Tytell and Yudaeva (2006)	Poland, Romania, Russia and Ukraine	1998-2003	OLS, FE, GMM	Log (Value Added), Total Factor Productivity	Absorptive Capacity; Export-Oriented FDI; Level of Corruption	Human Capital: % of Population with, at least, secondary school)	-
	Chudnovsky et al. (2008)	Argentina	1992-2001	FE Panel Regression	Log (Production of Firm)	Absorptive Capacity	Index of Absorptive Capabilities: R&D exp., innovation activities…	-
	Ford et al. (2008)	48 USA States	1978-1997	LSDV, SUR Techniques, OLS	Growth Rate of GDP Per Worker	Absorptive Capacity	Human Capital: Proportion of the Population with a College Degree	[12.04;15.56%] of pop. with college degree
	Fu (2008)[c]	31 Chinese Provinces	1998-2004	RE and FE	Real GDP Growth	Absorptive Capacity; Coastal Regions	Regional R&D Intensity and Human Capital (Proportion of Population with 15 years' schooling)	
	Jyun-Yi and Chih-Chiang (2008)	62 Countries	1975-2000	IVM, 2SLS, GMM	Growth of real GDP pc	Absorptive Capacity	Log initial real GDP pc; Human Capital: Average Years of Secondary School; Trade Openess	Initial GDP: 8.011; HC: 2.108; Trade: -0.813
	Meyer and Sinani (2009)	66 empirical studies	Since 1960s	Meta-Analysis	t-statistics of FDI spillovers' coefficients on economic growth	Absorptive Capacity	Patenting, tertiary education, R&D expenditures (%GDP)	Patenting: 2.93; Tertiary education: 32.75%; R&D: 1.33%
No effect	Carkovic and Levine (2002)	72 Countries	1960-1995	OLS and GMM	Growth of real GDP pc	Absorptive Capacity	Human Capital (Average Years of Schooling)	

[a]Only for Ireland and Spain; [b] Only in 29 countries; [c]FDI affects indirectly economic growth, through innovation efficiency.

3. DATA SET, METHODOLOGY AND SUMMARY STATISTICS

For the empirical analysis we used data from OECD Country Statistical Profiles 2009, UNESCO Custom Tables and World Development Indicators 2008 from World Bank. The data covers all 30 OECD countries for the period 1997-2007. Despite the limitations on the time span of analysis, due to the availability of data on human capital and technological competencies proxies, the 11-year period used in our analysis is reasonable to test our main questions of interest, namely whether developed economies also need to reach a minimum threshold of absorptive capacity to benefit from inward FDI.

The dependent variable is the natural log of real GDP per capita (2005 constant prices), so that fluctuations in independent variables (in absolute or relative terms) will cause percentage variations in real GDP per capita, in order to capture the effect on host economic growth. Similar specifications were adopted by several studies (e.g., Yao and Wei, 2007; Herzer et al., 2008). Our empirical specification for measuring the impact of FDI on growth performance of host OECD countries is represented in equation (1):

$$Log(GDPpc_{it}) = \beta_0 + \beta_1 FDI_{it} + \beta_2 HC_{it} + \beta_3 R\&D\_Busin_{it} + \beta_4 GDP(0)_{it} + \beta_5 Open_{it} + \beta_6 Econ\_Freed_{it} + u_i^2 \quad (1)$$

Our key explanatory variables will be FDI inflows (in percentage of GDP), human capital and technological competencies proxies. Human capital level is measured through the proportion of population aged between 25-64 years old with a college degree. Technological competencies are mainly captured by R&D expenditures from business sector in percentage of country's GDP. Additionally, the relative position of countries in terms of economic freedom is also included in our estimations, in order to test if host institutional capacity

[2] $u_i = \alpha_i + \varepsilon_{it}$, with α_i being random variables (i.i.d. random-effects) and $Cov(\mathbf{x}_{it}, \alpha_i) = 0$ (vector $\mathbf{x}_{it}$ correspond to independent variables introduced in our estimations).

matters for economic performance[3]. We control as well for initial host country development and the openness to international trade in our estimations.

The coefficient β_1 captures the direct effect of foreign direct investments in the relative variations of real GDP per capita. If β_1 is negative, or positive but insignificant, FDI inflows will not exert any positive impact on OECD countries economic growth. In opposition, if the coefficient is positive and statistically significant, FDI can act as an engine of growth for host economies. According to the literature reviewed, either result is possible to obtain. The coefficients β_2 and β_3 determine the potential effects of host human capital level and the share of R&D expenditures from business sector in total GDP, respectively. Both coefficients are expected to be positive since the economic growth is commonly known to be affected by the skills of workers (Hanushek and Wöessmann, 2008). β_4 captures a possible catching-up effect, being consistent with conditional convergence theories if the respective signal is negative. The results obtained for β_5 and β_6 will allow concluding whether more open economies have better growth trends, as well as any type of institutional capacity matter to the way host economies evolve over time.

Since the empirical literature suggests that a minimum absorptive capacity is required in order to host countries benefit with FDI, we estimate a second specification of model (1), where an interaction term between FDI and absorptive capacity proxies is included:

$$Log(GDPpc_{it}) = \beta_0 + \beta_1 FDI_{it} + \beta_2 HC_{it} + \beta_3 R\&D\_Busin_{it} + \beta_4 GDP(0)_{it} + \beta_5 Open_{it} + \beta_6 Econ\_Freed_{it} + \\ + \beta_7 FDI_{it} * \boldsymbol{X_{it}} + u_i, \text{ with } \boldsymbol{X_{it}} = \{\boldsymbol{HC_{it}}, \boldsymbol{R\&D\_Busin_{it}}\} \quad (2)$$

[3] We used the 2009 Index of Economic Freedom to proxy the institutional capacity of host economies. This Index is a series of 10 economic measurements created by the Heritage Foundation and Wall Street Journal, including dimensions like Business Freedom, Fiscal Freedom and Financial Freedom. We used data on the overall Index, with the 10 factors being averaged equally into a total score. Higher values of the Index correspond to countries with greater institutional capacity.

The model coefficients represented in equation (2) are similar to those presented in equation (1). The coefficient β_7 test whether host countries' absorptive capacity in terms of human capital and technological competencies is important to benefit with FDI inflows. If β_7 is positive and significant, the interaction between FDI and absorptive capacity proxies exerts an especially important influence upon growth performance of host economies. Moreover, if β_1 is negative, or positive but insignificant, a minimum threshold of absorptive capacity must be achieved to gain with foreign presence.

Table 2 provides the description of variables applied in our estimations and some summary statistics. Next section presents and discusses the empirical results, in addition to detailed explanation on the estimation of absorptive capacity thresholds.

Table 2. Variables and Descriptive Statistics

Variable	Description	Mean	Std. Dev.
Log(GDPpc)	Log of Real GDP per capita in US dollars (2005 constant prices)	10.198	0.380
FDI	Log of FDI inflows to GDP ratio	1.011	1.332
HC	Proportion of population aged between 25 and 64 years old with a college degree (%)	23.468	9.089
R&D_Busin	R&D expenditures by business sector as % of GDP	0.974	0.698
GDP(0)	Log of Initial Real GDP per capita in US dollars (2005 constant prices)	10.173	0.393
Open	Ratio (Exports + Imports) / GDP	0.773	0.530
Econ_Freed	Overall Index of Economic Freedom	68.918	7.147
FDI*HC	Interaction variable between FDI and HC	23.191	33.955
FDI*R&D_Busin	Interaction variable between FDI and R&D_Busin	0.008	0.018

4. EMPIRICAL RESULTS

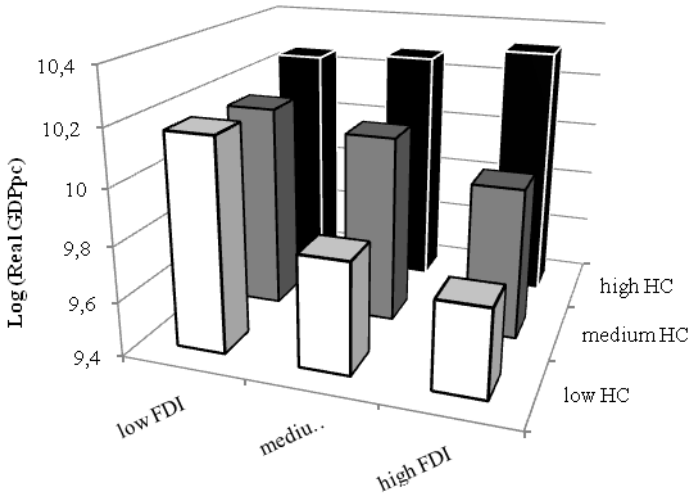
We started the empirical analysis by conducting a graphical exploration of the relationship between FDI and both threshold variables. It followed the econometric analysis and the calculation of thresholds. In this section we report these results.

4.1. Graphical analysis

The complementary between FDI inflows and absorptive capacity was initially explored using a graphical representation as illustrated in Figures 1 and 2.

In figure 1, OECD countries were divided into nine (3x3) groups according to the level of FDI and the proportion of active population with a college degree[4]. The white bars show that increasing levels of FDI combined with low levels of human capital produce negative effects on real GDP per capita (in natural logs). The grey bars reveal similar, though smoother, effects. Positive effects arising from foreign investments are only achieved when interacted with high levels of human capital in host countries. The evidence indicates that an interaction effect between FDI and human capital may exert an especially important influence in growth performance. In addition, the figure also indicates that, unconditional to the level of FDI inflows, higher levels of human capital conduct to higher levels in host economic growth.

Figure 1. Complementary relationship between FDI and Human Capital



[4] "Low FDI", "Medium FDI" and "High FDI" correspond to the 25, 50 and 75 percentiles of FDI inflows. The same approach was adopted to divide the levels of human capital in "Low HC", "Medium HC" and "High HC".

Figure 2. Complementary relationship between FDI and R&D_Busin

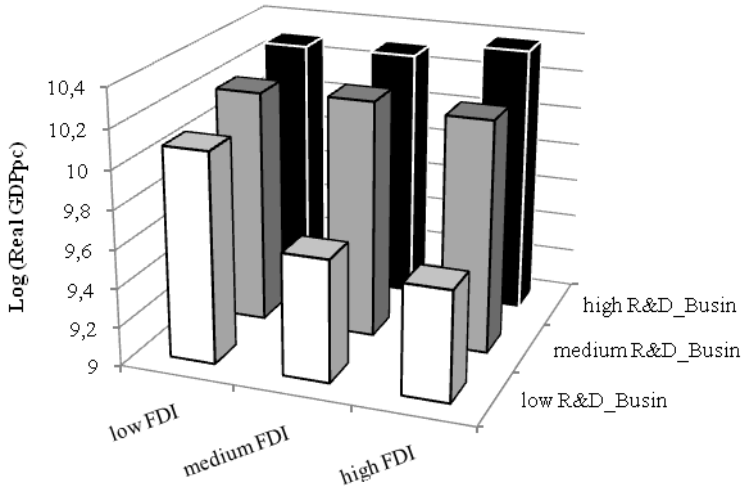


Figure 2 replicates the above analysis for the complementary detected between FDI and host technological competencies, proxied by R&D_Busin[5]. Similarly to the results obtained for human capital, increasing levels of FDI joined with low shares of R&D from business sector produce negative effects on real GDP per capita. The figure suggests that medium and high levels of technological competencies mixed with any level of FDI have positive impacts on relative evolution of host countries' economic performance.

4.2. Econometric analysis

The estimations reveal important results relating to the effects of FDI on economic growth. The first three columns with Model A show results for the human capital threshold. The columns with Model B reflect the results for the Business R&D variables.

The coefficient on HC, our measure of human capital, is positive and significant, highlighting the importance of education in the growth process of OECD countries.

[5] "Low R&D_Busin", "Medium R&D_Busin" and "High R&D_Busin" correspond to the 25, 50 and 75 percentiles of R&D_Busin, respectively.

The most striking result is that the sign of FDI coefficients are all negative and significant while the interaction terms FDI*HC and FDI*R&D_Busin are all positive and significant. Jointly these results reveal that a minimum threshold of human capital and business sector in % GDP are needed for FDI to contribute to growth.

The inclusion of other country variables besides improving the goodness-of-fit of our estimations, reveals that other factors seem to contribute to the way countries' economic performance evolve. More precisely, higher degrees of openness to international trade, as well as greater levels of economic freedom (thus higher institutional capacity) seem to improve economic performance of our sample. Contrary to the expectations, the coefficient of initial real GDP per capita does not present a negative signal, thus the conditional convergence hypothesis is not verified. A possible explanation for such result is the high level of development of the countries under analysis. The catching-up effect is more easily found in empirical studies on developing countries, rather than among developed ones (e.g. Borensztein et al., 1998).

Table 3. Estimation Results - Random Effects Estimations (GLS)

	A. Human Capital Threshold					*B. Business R&D Threshold*				
Dependent Var: Log(GDPpc)	Model A.1	Model A.2	Model A.3	Model A.4	Model A.5	Model B.1	Model B.2	Model B.3	Model B.4	Model B.5
FDI	-0.0207	-0.1310 ***	-0.1139 ***	-0.1066 ***	-0.1298 ***	-0.0240	-0.1176 ***	-0.0980 ***	-0.1259 ***	-0.1286 ***
	(0.0142)	(0.0360)	(0.0357)	(0.0342)	(0.0412)	(0.0183)	(0.0361)	(0.0357)	(0.0326)	(0.0327)
HC	0.0161 ***	0.0124 ***	0.0128 ***	0.0043	0.0007					0.0063
	(0.0035)	(0.0036)	(0.0034)	(0.0034)	(0.0044)					(0.0040)
FDI*HC		0.0048 ***	0.0043 ***	0.0037 ***	0.0046 ***					
		(0.0014)	(0.0014)	(0.0014)	(0.0017)					
R&D_Busin					8.7914	19.1892 ***	14.5514 **	14.1411 **	5.0417	0.4303
					(5.3925)	(6.4691)	(6.4971)	(5.7485)	(4.5898)	(5.3431)
FDI*R&D_Busin							8.2063 ***	6.9736 ***	8.2413 ***	8.5578 ***
							(2.7322)	(2.6902)	(2.3846)	(2.3776)
GDP(0)			0.4339 ***	0.3668 ***	0.3239 ***			0.3931 ***	0.2986 ***	0.2945 ***
			(0.1039)	(0.0829)	(0.0797)			(0.1101)	(0.0792)	(0.0760)
Open				0.1595 ***	0.1868 ***				0.2034 ***	0.2062 ***
				(0.0568)	(0.0666)				(0.0648)	(0.0640)
Econ_Freed				0.0159 ***	0.0176 ***				0.0205 ***	0.018 ***
				(0.0036)	(0.0041)				(0.0036)	(0.0040)
Constant	9.8351 ***	9.925 ***	5.4941 ***	5.1684 ***	5.4632 ***	10.0109 ***	10.0777 ***	6.0732 ***	5.5900 ***	5.7001 ***
	(0.0986)	(0.1011)	(1.0574)	(0.8590)	(0.8351)	(0.0864)	(0.0872)	(1.1196)	(0.8246)	(0.7939)
N	280	280	280	280	222	225	225	225	225	222
R^2 Within	0.0596	0.0958	0.0921	0.1246	0.1257	0.0277	0.0528	0.0505	0.134	0.1342
R^2 Between	0.2008	0.2301	0.5010	0.7523	0.7812	0.1350	0.2338	0.4683	0.7935	0.8097
R^2 Overall	0.2329	0.2805	0.4372	0.5963	0.6075	0.1651	0.2456	0.3536	0.6067	0.6262
Threshold	-	27.3%	26,5%	28.8%	28.3%	-	1,4%	1,4%	1.6%	1.5%
	HC Threshold ≈ 28%					HC Threshold ≈ 1,5%				
	No. of countries below the threshold (start, end) = (26, 13) average 1997-2007					No. of countries below the threshold (start, end) = (24, 23) average 1997-2007				

Notes: *Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level. Standard errors within parentheses.

4.3. Estimation of minimum absorptive capacity thresholds

For the estimation of minimum absorptive capacity thresholds, we adopted similar methodologies to those used in the studies of Borensztein et al. (1998) and Durham (2004). Such estimations are obtained from the maximization of equation (2) in order to FDI variable. If β1 is negative and β7 is positive, the appropriate threshold for the absorptive capacity proxy from which FDI starts having positive effects will be such that satisfies the following condition:

$$\frac{\partial(2)}{\partial FDI} = 0 \quad \Leftrightarrow \quad \beta_1 + \beta_7 \boldsymbol{X_{it}} = 0 \text{ with } \boldsymbol{X_{it}} = \{HC, R\&D\_Busin\}$$

More specifically, the precise break-even point for host human capital level is:

$HC \geq -(\beta_1 / \beta_7)$ with $\mathbf{X_{it}} = HC$

Similarly, the minimum threshold for the share of R&D expenditures performed by the business sector (in % of GDP) is:

$R\&D\_Busin \geq -(\beta_1 / \beta_7)$ with $\mathbf{X_{it}} = R\&D\_Busin$

For the human capital level, the results suggest that a minimum threshold must be attained and that such value is about 28% of the population aged between 25 and 64 years old with a college degree (obtained estimations are between 26,5% and 28,8%). For the share of R&D expenditures by business sector, the break-even point must be about 1,5% of total country's GDP (estimated thresholds are between 1,4% and 1,6%).

From the literature reviewed, very few studies have attained precise estimations for the minimum threshold of absorptive capacity that host economies must achieve to learn with foreign investments. The existing empirical evidence is even scarcer for the absorptive capacity proxies used in this study, so that we have few comparable results in the literature. Two notable exceptions are Ford et al. (2008) and Meyer and Sinani (2009), whose results for the threshold of human capital were between 12.04% and 15.56% of US population with a college degree and 33% of population with tertiary education, respectively. Since we use the

proportion of active population with such degree of education, rather than total population as did Ford et al. (2008), our results seem to be reasonable for the sample of countries under analysis and thus are more comparable with those of Meyer and Sinani (2009). Moreover, Meyer and Sinani (2009) also estimate a minimum threshold of R&D expenditures as percentage to GDP. Our results of 1,5% for the minimum level for R&D_Busin are thus comparable to their outcomes of 1,33%, very similar to ours.

Figures 3 and 4 illustrate the initial and final position of OECD countries relatively to the estimated thresholds of HC and R&D_Busin. We see a positive evolution over the period 1997-2007. At the beginning of the period, only three countries were above both thresholds (USA, Finland and Japan), in opposition to 23 countries that were below both break-even points. At the end of the period under study, the respective number of countries in each condition was 6 (South Korea, Sweden and Switzerland joined the previous three countries) and 12, respectively. In addition, in the late 1990s, both thresholds seemed to be difficult to surpass. One decade later, R&D_Busin threshold remained a barrier hard to overcome by the majority of countries, while the scenario for HC threshold was clearly better. More precisely, half of the countries that were below that threshold in the beginning of the period were positioned above the level of 28% of population with a college degree one decade later. However, despite the improvement of global scenario, the results highlight the need for policies aiming to upgrade such positions, in order to potentiate the gains from FDI. In fact, the average positions translated in Figure 5 show that only 4 countries (USA, Japan, Finland and Switzerland) had safe positions above both thresholds over the period under study, while a group of 8 countries exhibited very feeble position in relative terms[6].

[6] Namely, Italy, Greece, Hungary, Mexico, Poland, Portugal, Slovenia and Turkey.

Figure 3. Initial position of OECD countries relatively to the thresholds, 1997

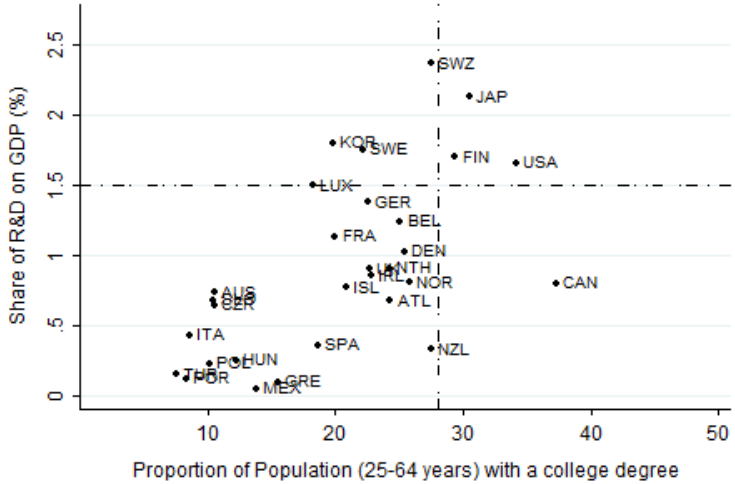


Figure 4. Final position of OECD countries relatively to the thresholds, 2007

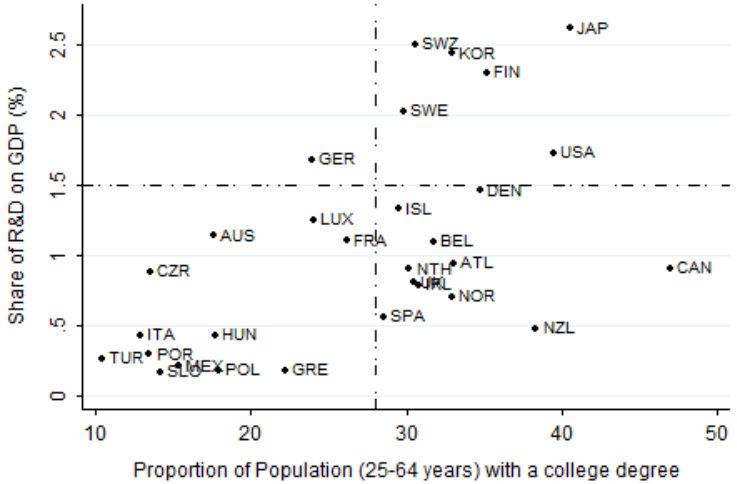
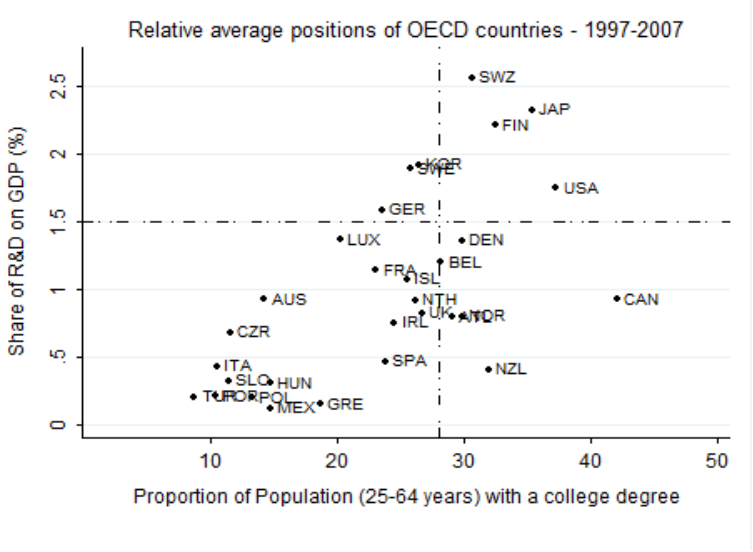


Figure 5. Average position of OECD countries relatively to the



5. CONCLUSION

Our objective in this paper was to calculate minimum thresholds of absorptive for countries to benefit with foreign presence. Despite the copious literature on the mechanisms through which FDI can promote host economic growth, the identification of thresholds remains scarcely explored. More recent literature on this question has focused on the moderating role of host specificities when assessing the possible effect of foreign presence on country's productivity and growth performance. The question that naturally arises is what conditions in the host country are important to explain variations in the FDI impact upon economic growth?

The results confirm the suspicion that FDI effect on economic growth should not be taken for granted, requiring the gathering of some conditions within host economies. By using the empirical setting of OECD countries for the period 1997-2007, our results are strongly supportive of a moderating effect played by both human capital and business sector R&D expenditures upon the growth enhancing effects of FDI. We contribute to the existing empirical evidence by quantifying the minimum thresholds required for countries to gain with FDI.

It was found that the benefits from inward FDI in terms of growth only emerge when the country level of population with a college degree reaches about 28% and the share of business sector R&D in total GDP is 1,5%.

We observed that a great portion of OECD countries still remain below both thresholds. Hence, it is crucial to stimulate R&D investments by private firms and to promote human capital accumulation. Regarding the human capital accumulation it is required to account for the differences between school attainment and quality education. The school attainment is not taken as a valuable component for economic growth when compared to the

effects of greater quality in education (Hanushek and Wöessmann, 2008, 2009). The job of aligning the domestic absorptive capacity to the activities of MNEs does not just fall on local firms. Governments also have a role to play, thus national policies matter. Host country policies toward attracting FDI and benefiting from foreign corporate presence are largely equivalent to policies for mobilising domestic resources for productive investment. They include improvements of the general macroeconomic and institutional frameworks; creation of a regulatory environment that is transparent and non-discriminatory and, hence, conducive to inward FDI; but also the improvement of physical infrastructures and the upgrading of technological and human competencies to the level where the full potential benefits of foreign corporate presence can be realised. The business sector is part of the solution and has the potential to be a strong partner in an investment strategy for growth and sustainable development.

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ANNEX I

Sample of countries used in the study

Australia	ATL	Hungary	HUN	Norway	NOR
Austria	AUS	Island	ISL	Poland	POL
Belgium	BEL	Ireland	IRL	Portugal	POR
Canada	CAN	Italy	ITA	Slovak Republic	SLO
Czech Republic	CZR	Japan	JAP	Spain	SPA
Denmark	DEN	Korea	KOR	Sweden	SWE
Finland	FIL	Luxembourg	LUX	Switzerland	SWZ
France	FRA	Mexico	MEX	Turkey	TUR
Germany	GER	Netherlands	NTH	United Kingdom	UK
Greece	GRE	New Zealand	NZL	USA	USA