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A Value Chain Analysis of Foreign Direct Investment

Claudia Canals
Marta Noguer

"la Caixa"

RESEARCH DEPARTMENT

”la Caixa”

Research Department
Av. Diagonal, 629, torre I, planta 6
08028 BARCELONA
Tel. 93 404 76 82
Telefax 93 404 68 92
www.research.lacaixa.es
e-mail: publicacionesestudios@lacaixa.es

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Abstract:**

This paper analyzes the determinants of FDI. We use a new data set covering greenfield and expansion projects at a detailed value chain level to examine which factors influence the decision to invest abroad. Our empirical framework is an augmented gravity model that incorporates elements of factor proportions theory. At the aggregate level, we find that distance discourages FDI, size and sharing a language encourages it, and that FDI targets relatively capital-scarce countries. When we classify investment projects according to their stage in the chain of production, we observe a lot of variation across stages. Nevertheless, economic size, distance, and capital abundance are still determining factors for most value chain stages and preserve the sign of their effect. Moreover, even though the results confirm FDI targetting capital scarce countries, we find evidence of a minimum requirement on the host country’s capital endowment in all the stages of production except extraction. Finally, ease of doing business is also important, especially so for the location of regional headquarters.

JEL Classification: F21, F23, D23, F10

Keywords: FDI, Gravity, Factor Proportions, Value Chain.

* Research Department, ”la Caixa”.

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1. Basic Concepts

1.1. FDI: Definition and Facts

Foreign Direct Investment (FDI hereafter) is formally defined as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (source country) in an enterprise resident in another economy (host country). In general, an investment flow is considered FDI if the source country enterprise controls 10 percent or more of the assets of the foreign entity and if the former exerts a significant degree of influence on the management of the latter[1].

In the last decade, cross-border capital flows, including FDI, increased much faster than cross-border trade or than world GDP (see Table 1.1). This trend is not expected to change, not at least in the short run, with global FDI flows projected to reach 1.2$ trillion in 2006[2].

TABLE 1.1 FDI in the Global Economy
Annual growth rate (percent)

	1986-1990	1991-1995	1996-2000	2002	2003	2004	2005
FDI Inflows	21.7	21.8	40.0	–25.8	–9.7	27.4	28.9
GDP (current prices)	11.1	5.9	1.3	3.9	12.1	12.1	9.1
Exports of goods and services	12.7	8.7	3.6	4.9	16.5	21.0	12.9

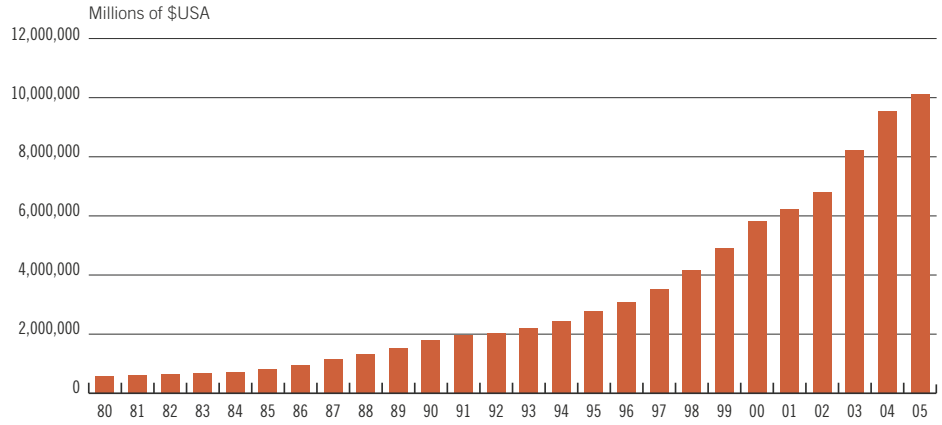
SOURCE: World Investment Report 2006.

Figures 1.1 and 1.2 provide further illustration of the increasing volume of FDI activity in the world economy. The first figure shows the rapid increase in the World Inward Stock of FDI since 1980, while the second one presents the evolution of inward flows of FDI during the same period. We observe that FDI inflows grew remarkably fast in the second half of the nineties. They slowed down for three years, coinciding with the general slowdown of the world economy that followed after 2001, and started growing again in 2004. The continuous growth of FDI inward stock over more than two decades provides a clear picture of the increasing relevance of FDI.

In regard to the geographical patterns of FDI flows, around 80 percent of them originate in developed countries and 60 percent of them target developed countries. Based on average figures for the 2000-2005 period, the top five foreign direct investors, in decreasing order, were the USA, UK, France, Netherlands, and Spain, accounting together for approximately 53 percent of world FDI (see figure 1.3); the top five destinations were the USA, UK, China, Germany, and France, accounting for 43 percent of the world FDI (see figure 1.4.).

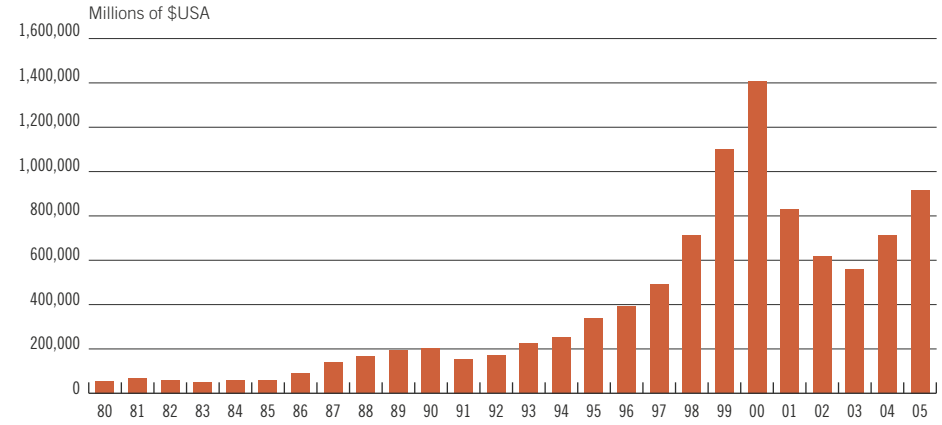
1. Source: UNCTAD World Investment Report, 2006.
2. According to Economist Intelligence Unit and the Columbia Program on International Investment, and reported in The Economist, Sep. 14th 2006.

FIGURE 1.1 **World FDI Inward Stock**



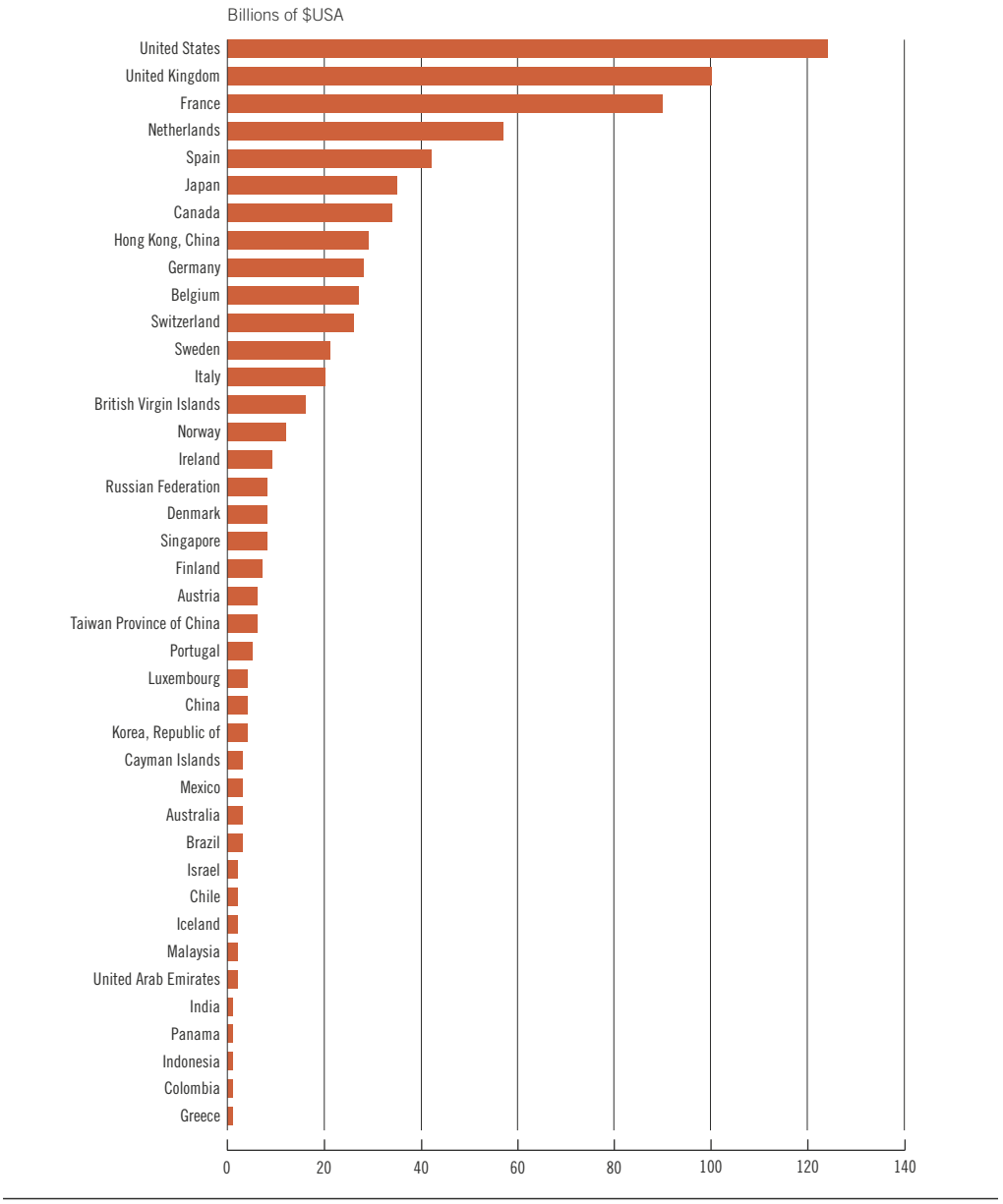
SOURCE: World Investment Report 2006.

FIGURE 1.2 **World FDI Inflows**



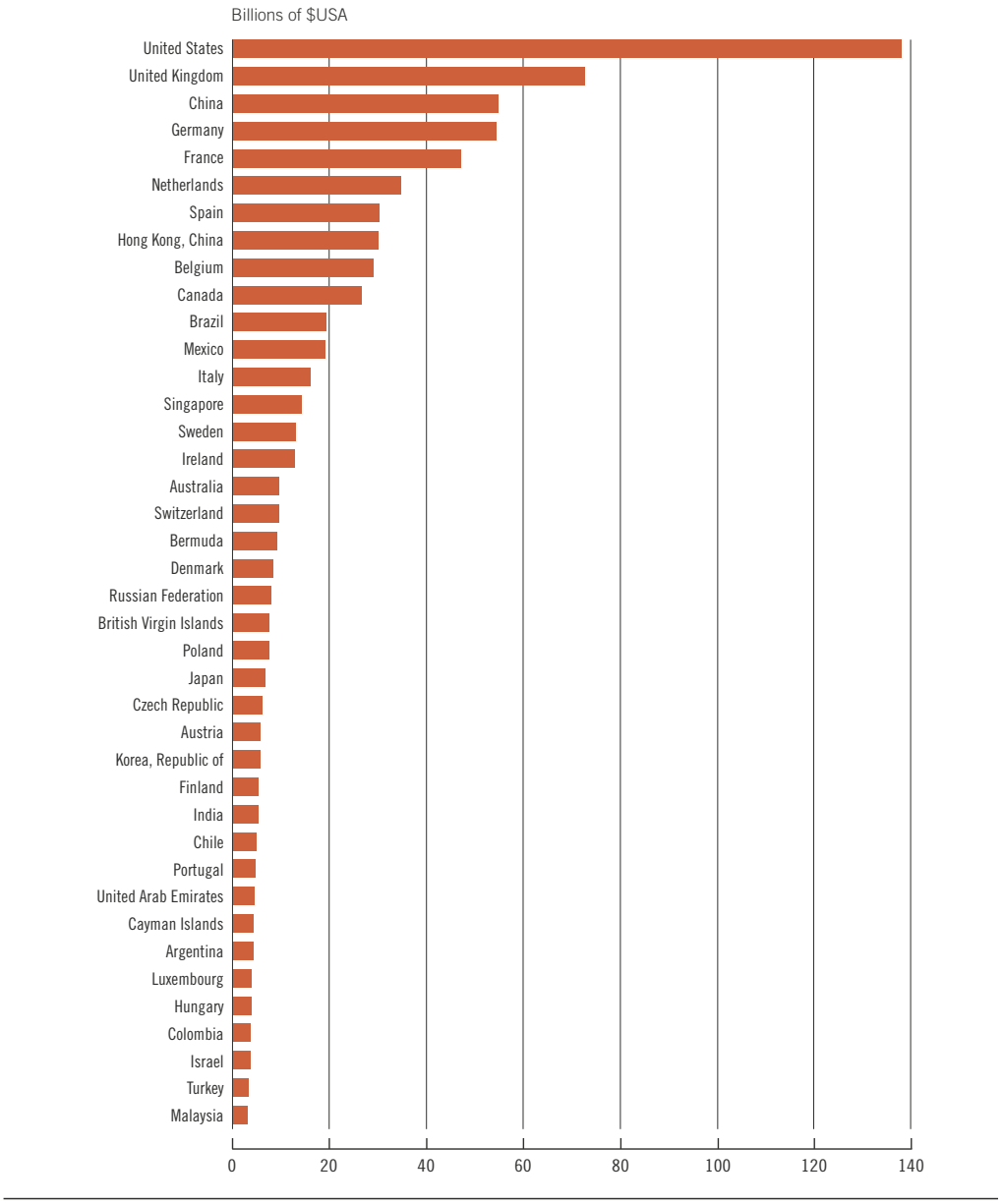
SOURCE: World Investment Report 2006.

FIGURE 1.3 FDI Outflows: Top 40 countries



SOURCE: World Investment Report 2006. Average FDI Outflows 2000-2005.

FIGURE 1.4 FDI Inflows: Top 40 countries



SOURCE: World Investment Report 2006. Average FDI Inflows 2000-2005.

Moreover, the World Investment Report 2006 underscores a few recent long term changes in the pattern of FDI flows. Most noticeably, developing countries, mainly driven by China, have become more attractive to foreign direct investors. Furthermore, there has been a shift towards the EU area as the dominant source of FDI, with more FDI outflows than the US or Japan[3].

3. See World Investment Report (2006) for a more detailed description of global FDI patterns.

1.2. Theoretical Motives for FDI

Before diving into the workings of our empirical approach, it is worthwhile to review the main theories that explain why a firm chooses to engage in FDI activity.

The decision of a firm to invest abroad is a complex one. Economic theory usually presumes that a firm investing abroad is at some initial disadvantage with respect to the local firms. Therefore, in order for that firm to undertake a foreign investment project, there must be some sort of offsetting advantage. Dunning (1977, 1981) provides a simple but systematic framework to understand what those advantages may be. He argues that a firm will have strong incentives to become multinational if it has: (1) ownership advantage, (2) location advantage, and (3) internalization advantage.

Ownership advantage: The investing firm must enjoy some type of economy of scale with respect to intangible assets, such as knowledge capital or organizational know-how, that can be easily exploited abroad and gives the firm some market power in the foreign market.

Location advantage: there must be a motivation for the firm to produce abroad rather than concentrate production at home, especially when there are scale economies at the plant level. Examples of such advantage might be savings in transport costs or tariffs, lower costs of production, proximity to natural resources, better access to consumers, etc.

Internalization advantage: the investing firm must have some incentive to exploit its ownership advantage internally, through an owned subsidiary, rather than licensing or selling its product or process to an unrelated foreign firm.

The *Knowledge-Capital model of FDI* presented in Carr *et al* (2001) provides a recent attempt to connect Dunning's ideas with specific firm and country characteristics.

In this model, multinationals are firms intensive in the use of knowledge capital and this generates ownership advantage on the basis that: (1) the services of knowledge capital can be easily "shipped" across borders; (2) knowledge-based assets are usually skilled-labor-intensive relative to production, and this generates a motive to operate different tasks in different locations; and (3) knowledge capital is often a "public good" within the firm since once it is created it can be exploited in all the subsidiaries at very low cost. With respect to location advantages, the model outlines different motives depending on the type of firm: horizontal or vertical.

Horizontal Firm: A firm may choose to produce abroad in order to save on the trade costs associated with exporting to a targeted market. In this case, the firm will set up foreign facilities that mirror those at home (Horizontal Expansion, HE hereafter). In this scenario, location advantages arise when the host-country economy and trade costs are large, and FDI would serve as a substitute for trade[4]. Hence, this hypothesis would predict that a firm is more likely to engage in FDI activity when transportation costs and trade barriers are high, and when investment barriers and scale economies at the plant level are low[5]. At

4. Krugman (1983), Horstman and Markusen (1992), Brainard (1992). A somewhat related motive would be what is referred to as Quid pro Quo FDI, a term coined by Bhagwati (1985) that refers to a situation where a firm does FDI in response to a protectionist threat.
5. If scale economies at the plant level were high enough, the cost of replicating production in different locations might offset the gains from saving on trade costs.

the same time, multinational activity would be two-way. Finally, market size abroad and at home would also have a positive impact, in the former case by increasing the market potential and in the latter by increasing the pool of potential investors abroad. Since size and trade barriers appear as fundamental determinants of horizontal FDI, an adaptation of the *gravity model*, which relates trade with size and distance, provides a good departing framework to study multinational activity.

Vertical Firm: A firm may choose to fragment the production process and to locate some stages of production abroad in order to access specific resources not available elsewhere or to arbitrage differences in relative factor prices (Vertical Expansion, VE hereafter). This is also known as the *factor proportions* hypothesis for the location of multinational activity[6]. Paraphrasing Arndt and Kierzowski (2001), fragmentation, which is the possibility of breaking a production process into physically separable phases (stages or intermediate inputs), is not a new concept. On the contrary, it dates back to the beginning of the Industrial Revolution or even earlier than that. What is relatively new is the possibility of locating different phases of the production process in very distant places. It is in this process of splitting the production process across borders where FDI fits in. In this setting, FDI would be equivalent to a sort of capital (factor of production) flow[7]. Thus, when factor proportions are identical, the differential in GDP shares of the home and host countries and their joint income should be the only determinants of trade volumes, and there should be no vertical multinational activities. At the same time, and again understanding FDI as an international movement of a production factor (capital flow), multinational activity should arise only in a single direction and between countries with large factor proportion differences[8]. Note, as well, that this type of FDI may require shipment back to the home country to complete the production process. In other words, vertical FDI would induce trade, implying complementarity. Thus, for a vertical firm, location advantages arise when trade costs are low, stages of production differ in factor intensities, and countries differ in relative factor endowments, or equivalently in production factor prices. Hence, in order to capture the central motivations for Vertical FDI, we shall extend the gravity framework aforementioned to control for factor endowment characteristics.

Finally internalization advantages may arise from characteristics of knowledge capital that generate ownership advantages and the risk of asset dissipation associated with arm's-length transactions. Nonetheless the Knowledge-Capital model has mainly focused on ownership and location advantages[9].

6. Markusen (1984), Helpman (1984), Helpman and Krugman (1985), Ethier and Horn (1990).
7. As underscored in Ethier (1995), FDI does not always imply an actual movement of capital. For instance, a Japanese company may purchase a US firm by using the proceeds of selling its own US bonds. In that case, there would be no flow of capital from Japan to the US. Ethier notes that "the distinctive feature about direct investment, then, is not that one country is on balance acquiring the assets of another [...]. The distinctive feature is that firms in one country are acquiring control of business operations in another country."
8. However, Brainard (1993) provides evidence that contradicts this line of thought.
9. See recent work by Antràs (2003 and 2005) for a deeper analysis on internalization motives.

1.3. Stages of the Value Chain

Before proceeding with the main analysis of the paper we need to introduce also the concept of the "value chain stage". This concept is central to our study since one of our goals is to investigate *whether* and *how* the determinant factors of FDI differ across the so-called value chain stages or stages of production.

The value chain is a term that refers to the production flow that a product follows from the point of its inception until it reaches the customer[10]. We can identify different phases (fragments) in the process of producing a certain good or service, with each stage adding value to the product (this is why it is called "value" chain). For the purpose of this paper we refer to those stages as "value chain stages". To give a simple example, the value chain for bread begins with the farmer who buys the land and seeds to grow the wheat. Then, a trucker picks up this wheat and transports it to the mill, and later to the processing plant that obtains the flour. Next to the wholesaler, and then to the baker that bakes the bread and sells it, or ships it to the retail bakery for the final purchase by the consumer. In this example, the initial product, wheat, is processed to obtain the final product, bread. Each of the stages, growing and picking up wheat, processing it to obtain flour, baking the bread, etc. are different stages of the production of bread and add value to the product until it becomes bread to be sold to the customer.

In our study, we classify the different types of FDI investment projects according to the stage of production that the investment aims to finance. We aggregate the different stages of the production process into six general stages of the chain of production (or value chain stages). These are: *extraction, manufacturing, business services, retail services, research and development (R&D hereafter), and regional headquarters (HQ hereafter).* To get an idea of how FDI and value chain stage fit together, let's imagine a simple example where a US car manufacturer decides to invest in a British subsidiary that will design all the marketing operations of the American firm. This is a typical VE-FDI situation. In such a case, the main firm is a Manufacturing firm, however, the FDI investment project (the UK marketing subsidiary) belongs to Business Services. Hence, the value chain splits stages into different countries[11].

In sum, the recent surge in FDI, together with the positive qualities associated to this sort of international capital flow, that is, its relative stability and its potential for spurring productivity and diffusing technology, have fed a growing discussion over the effects and determinants of FDI[12]. In particular, there is a lot to learn on the factors that drive firms in a certain source country and in a certain industry to invest abroad, and to do so in a particular host country, operating a specific stage of their chain of production. This paper contributes to the empirical literature on the determinants of FDI using a recently available data set on new and expansionary investment projects to examine which home and host country characteristics influence the decision of a firm to invest abroad, and whether those factors play a different role according to the stage of production that the firm intends to operate in the foreign country.

10. Hill and Jones (1998).
11. Notice that when more than one phase is undertaken in a certain location, we classify the FDI project according to the main activity performed there.
12. See for instance Romer (1993), Rappaport (2000) and Rodríguez-Clare (1996).

2. The Determinants of FDI

The main purpose of this paper is to study home and host country characteristics associated with FDI activity. We take first an aggregate approach, that is, we study the determinants of aggregate FDI activity between two countries in a particular year, and focus on the relative importance of factor proportions versus proximity-concentration arguments. Next, we exploit our data set at a higher level of disaggregation and classify investment projects into the aforementioned six stages of the chain of production to analyze whether the factors considered as potential determinants of FDI play a different role depending on the stage of production of the investment project.

Anticipating our main results, when we analyze the aggregate number of FDI projects, we find that FDI flows to relatively capital scarce countries and that distance discourages FDI while size, and sharing a language or a border encourage it. At the disaggregate level, we observe that the effect of distance, and of all the other factors as well, vary a lot across stages. Moreover, even though the disaggregated results confirm the finding that FDI flows to relatively capital scarce countries, we find evidence of a minimum capital requirement in the foreign country for all the stages of production except extraction. Finally, ease of doing business appears to be particularly relevant for the decision of where to locate regional HQ.

2.1. The Data

Our main data set is a panel covering 6,728 investment projects (new and expansions) over 29 source countries and 131 destinations, between January 2002 and June 2005[13]. The source of this data is the Locomonitor data base that documents 29,139 cross-border investment projects during that same period. We follow Gual and Torrens (2006), and our final sample includes only those projects undertaken by the 190 most important multinational firms. These firms are selected according to the following criteria: (1) firms that are listed in the top 100 transnational corporations by the UNCTAD World Investment Report (2004), (2) firms that are listed in the top 500 by Fortune (2004), and (3) firms that report more than 20 investment projects during the period considered[14].

For each project, the Locomonitor data base reports the following information: source country (or home, *h* hereafter); destination country (host or foreign, *f* hereafter), sector, and value chain stage where the firm invests; whether the project represents a new investment, expansion or relocation; the name of the investing firm; and a brief description of the project. For some of the projects, it also provides information on the technology or product of the investment, the motivation that drove the investment decision, the public incentives that influenced the decision to invest in that location, or the value of the investment. The latter is provided for a small number of projects only, too small to carry out a thorough analysis of the determinants of FDI based on the value of the investment. For this reason, when analyzing the determinants of FDI, we focus on the number of projects, that is, on the frequency of FDI activity, and not on the value of the investments[15].

13. See Appendix A for a complete list of the source and host countries.
14. For a complete description of the selection process see Gual and Torrens (2006).
15. The value of the investment for this subset of projects is still useful in reassuring the robustness of our results. Please refer to the robustness analysis section in "la Caixa" Working Paper No. 5/2006.

In the first part of the analysis we consider the number of investment projects between countries *h* and *f* in a particular year *t*. Given the number of investments per firm, the source, and the destination countries at each point in time, we can compute the number of projects for each country pair and year, including those observations (country pair-year) where that count is zero, that is, when no investment project takes place between two countries in a particular year. Our final sample for analysis includes a total of 14,384 observations for our dependent variable, which is defined as the number of FDI projects from firms in country *h* to invest in country *f* at time *t*[16].

In the second part of our study, we classify the projects according to their stage in the value chain. This further disaggregation of the data allows a better understanding of the determinants of the foreign investment decision of a firm. In that part of the analysis, we have a sample of 61,488 observations where 2,199 of them are non-zero. Similarly to the aggregate case, we include all country-value chain observations that are zero but do engage in an FDI relationship in another stage of the value chain. On the contrary, we exclude country-pairs that do not engage at all in FDI. Thus, for each value chain regression we have a sample of 6,966 observations (given the restriction just mentioned and other data restrictions like the availability of GDP data and other), with a minimum of 139 non-zero observations per value chain stage.

In all our study, we consider two different sets of independent variables. The first set includes standard gravity regressors while the second set controls for elements of factor proportions models. The data for all these variables is briefly described below and more detail is provided in Appendix B.

2.2. Descriptive Statistics

We start by summarizing the basic features of our dependent and independent variables.

In the first part of the analysis, our dependent variable records the number of projects between two countries in a particular year. Hence, it is a count variable that takes nonnegative integer values, with great predominance of zeros as we can see in Figure 2.1. More precisely, it ranges from 0 to 85 and is strongly right-skewed, with 87 percent of the observations being zero counts (refer to Table 2.1 for the summary statistics of the main variables).

16. Note that a sample of 29 source and 131 host countries of over 4 years would correspond to a panel of 15,080 observations. However, missing data on GDP and other regressors for some of the countries forces us to drop a few observations.

TABLE 2.1 Summary Statistics

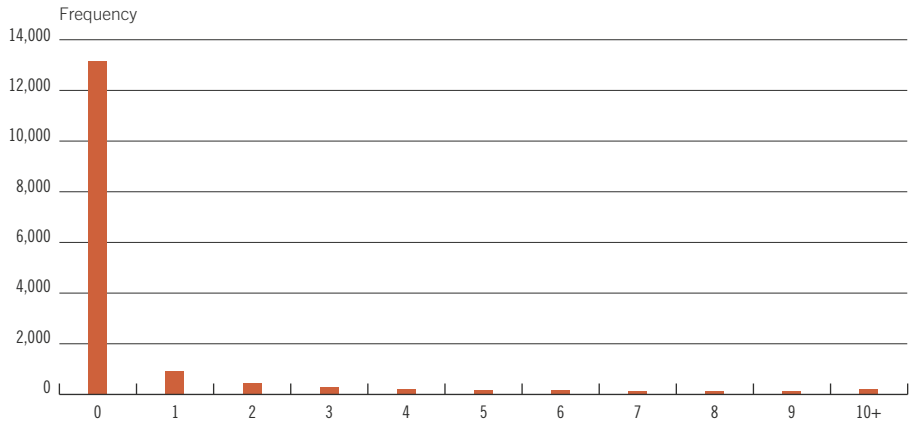
	Obs	Mean	Std. Dev.	Min	Max
Number of Projects	15,080	.40	2.40	0	85
$ln\ (GDP_{ht} \cdot GDP_{ft})$	14,384	9.97	2.20	4.04	17.86
$ln\ (dist_{hf})$	15,080	8.65	.82	4.16	9.90
$ln\ (L_h \cdot L_f)$	13,776	33.38	2.19	27.75	41.81
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	15,107	–.19	.49	–2.71	.86
$ln\left(\frac{Density_f}{Density_h}\right)$	13,776	.37	2.33	–7.84	7.88
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	9,396	–1.55	1.78	–6.01	3.55
$ln\ (EaseBus_f)$	1,308	3.97	1.04	0	5.15

Note: Summary of the aggregate dependent variable and the main regressors in logarithmic terms.

The most appropriate empirical method to deal with the excess of zero counts, and the evidence of overdispersion, is the Zero Inflated Negative Binomial distribution (ZINB)[17]. ZINB assumes that two different underlying mechanisms are involved in generating zero and non-zero counts. A negative binomial process generates both zero and positive counts, and in addition, zero counts can arise separately through a logistic process[18].

FIGURE 2.1 Overdispersion and Excess Zero Counts

Values for the Dependent Variable

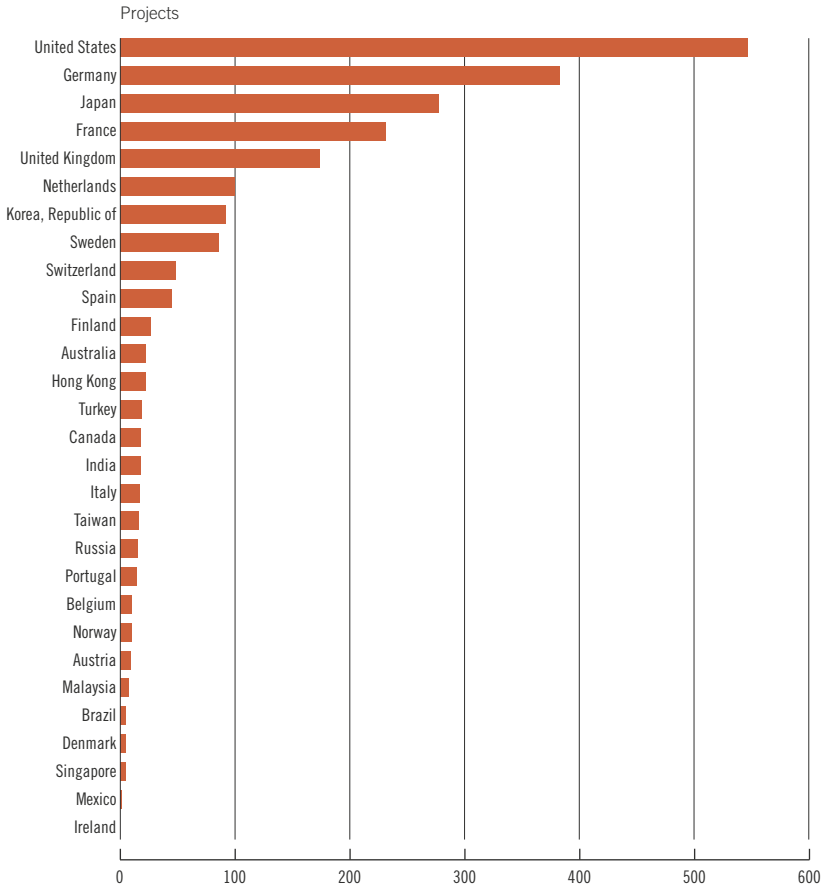


SOURCE: Locomonitor data base and own calculations.

In terms of the distribution of project counts across source and host countries, we observe a lot of variation with the USA being the country with more FDI operations abroad, 547 in 2003 for instance, followed by Germany, Japan, and France (see Figure 2.2)[19]. The country receiving the largest number of projects is, by far, China, with half of the projects, followed by the USA, and Russia (see Figure 2.3).

17. See the related paper, "la Caixa" Working Paper No. 5/2006, for a more detailed explanation of the ZINB distribution and its appropriateness.
18. We tested the appropriateness of the ZINB over a regular binomial using the Vuong statistic and we obtained high positive values in all our specifications, which favors ZINB over negative binomial. Refer to "la Caixa" Working Paper No. 5/2006 for further insight.
19. We graph year 2003 because it has the largest number of FDI projects in our sample.

FIGURE 2.2 Number of Outward FDI Projects by Source Country

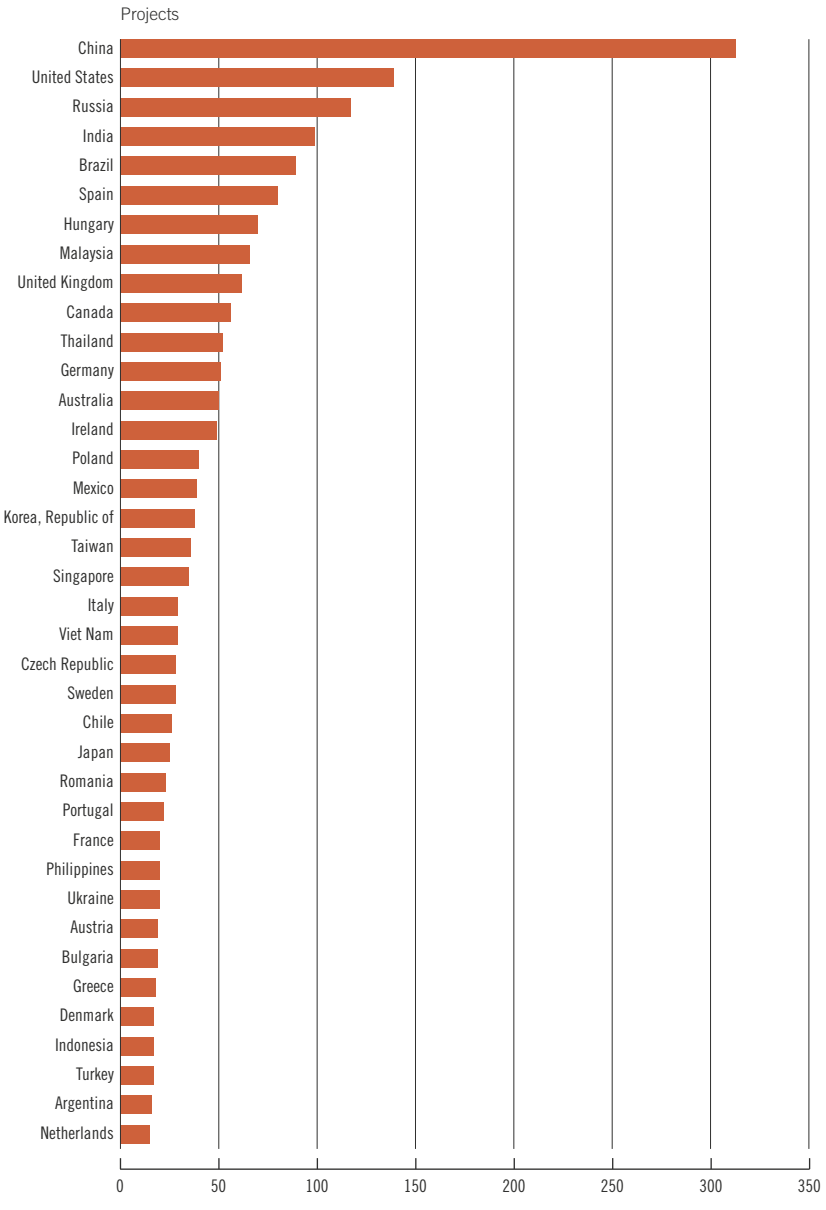


SOURCE: Locomonitor data base and own calculations. Projects corresponding to 2003.

Our basic set of regressors includes the product of GDPs, and the product of source and host country's population, as measures of size; distance between the two countries in the pair (measured as the great circle distance between the main cities in each of the two countries) which accounts for transportation and other transaction costs that influence FDI and increase with distance; relative education, measured as the ratio of net enrollment in secondary education over net enrollment on primary education in the host relative to the source country; density of the foreign country relative to the home country (where density is measured as total population over land area); the capital labor ratio of the host country relative to the source country; and a measure for ease of doing business in the host country, where the more favorable the environment to set up a business in the host country is, the lower the values the measure takes. Notice that the measures for size and distance would correspond to gravity arguments, the following three variables are related to the factor proportions approach, and the latter is a proxy for other transaction costs. Table 2.1 reports the basic descriptive statistics for all these regressors. It is interesting to notice that, on average, host countries tend to be less "educated", in secondary over primary terms, and more labor-abundant than the source countries, a mean of –0.19 for the former versus

–1.55 for the latter. In regard to simple correlations between all these variables, the largest correlation is by far that between the relative level of education and the relative capital labor ratio, which equals 0.63. This high correlation suggests that including one of these two variables while omitting the other may bias the results and lead us to attribute to the one included some or all of the effects of the omitted one.

FIGURE 2.3 Number of Inward FDI Projects by Host Country



SOURCE: Locomonitor data base and own calculations. Projects corresponding to 2003.

When turning to the dependent variable in the second part of the analysis, that is, the number of projects between two countries in a particular year and value chain stage, we observe that the stages with the higher average number of projects are retail services and manufactures (see Table 2.2). Moreover, we see that the maximum number of projects per country-pair is in manufactures and between Japan and China, and the second largest is the one from USA to China in Retail Services, which coincides with the maximum in retail services as well.

TABLE 2.2 Number of Projects by Value Chain Stage

Value Chain	Avg. Num. Projects	Maximum	Home	Foreign
Extraction	.03	4	USA	United Kingdom
Manufactures	.19	54	Japan	China
Business Services	.09	11	USA	India
Retail Services	.22	30	USA	China
R & D	.04	18	USA	China
HQ	.02	4	Germany	USA

Note: Year 2003. The second column shows the average number of projects by each value chain stage, the third column presents the maximum number of projects between two countries in each stage; column fourth and fifth list the home-host country pair with the maximum number of projects in each stage.

After this preliminary description of the variables, a more detailed study follows, aimed at providing further insight on the determinants of FDI.

2.3. The Determinants of FDI: Aggregate

We use a combination of a standard *Gravity* model and *Factor Proportions* models of trade as the basic framework to analyze which factors influence the decision to invest in a particular project abroad. We take a macroeconomic perspective and consider country-pair characteristics that might drive FDI patterns. In the first part of the analysis we pool together all the investment projects per year and country-pair recorded in our sample. In the second part, we work at a higher level of disaggregation and classify the investment projects per year and country-pair according to their stage in the value chain.

2.3.1. The Gravity Model

To derive our empirical specification, we start with a *basic gravity* model where the number of investment projects by firms from country *h* (home) in country *f* (foreign) at time *t* is explained by the size of countries *h* and *f* and the distance between them. Thus:

$$\begin{aligned} n_{hft} &= \alpha + \beta_1 ln\left(GDP_{ht} \cdot GDP_{ft}\right) + \beta_2 ln\left(dist_{hf}\right) + \epsilon_{hft} \\ & h = 1, ...29; f = 1, ..., 131; t = 2002, ..., 2005 \end{aligned} \quad (1)$$

where n_{hft} stands for the number of projects that country *h* establishes in country *f* at time *t* and can take integer values greater than or equal to zero[20]; GDP_{ht} is the gross domestic product of country *h* at time *t*, similarly for GDP_{ft}; and $dist_{hf}$ is the distance between country *h* and *f*.

20. Note that each of the 29 potential "investing" countries (home) do not invest in all of the 131 potential "host" countries (foreign). However, we still consider the complete set of (29home · 130foreign · 4year) observations which means that there are a large number of zero counts in our dependent variable.

Regarding Equation (1) we expect market size to enter with positive sign, that is, a positive β_1. In regard to the sign of β_2, it depends on what distance is proxying for. If, on one hand, it is proxying for trade costs, the sign of β_2 would be ambiguous, and dependent on the complementarity or substitution between FDI and trade. In particular, if FDI is a substitute for trade, distance will raise export costs and the profitability of setting up affiliates in the foreign country mirroring the ones at home, *horizontal expansion*, thus, implying a positive β_2. If instead, FDI and trade are complements, higher distance will be associated with higher costs of production and lower profitability of an investment abroad. That would be the case of *vertical expansion*, since the cost of putting together the different fragments increases with distance, which implies a negative β_2. On the other hand, if distance acts like a proxy for the overall transaction costs of doing FDI abroad, and if these costs increase with distance, then we would expect β_2 to be negative. Note, however, that some costs of doing FDI activity abroad may be totally independent from distance (ex. legal costs, information costs, etc.). Hence the sign on β_2 is again ambiguous.

We estimate Equation (1) using the ZINB estimator. Please refer to "la Caixa" Working Paper No. 5/2006 for a detailed presentation and discussion of the estimation results. For the sake of simplicity of exposition, this paper presents the elasticities and marginal effects derived from the ZINB estimates. If the regressor is a continuous variable, the elasticity gives us the percentage change in the expected number of projects from country *h* in country *f* in year *t* when the regressor increases by one percent. If the regressor is discrete, the corresponding figure gives us the marginal effect, that is, the additional number of projects we expect when the regressor increases by one unit (from zero to one)[21]. Table 2.3 summarizes these elasticities and marginal effects for the aggregate case when only gravity regressors are included.

The first column presents the elasticities and marginal effects derived from the estimation of the basic gravity framework, that is, controlling for size (*GDPs*) and distance. In the subsequent columns we extend the basic gravity framework to include other size controls, like population (L_i) or *GDP* per capita, and other geographical controls such as sharing a common border, sharing an official language, number of landlocked countries in the pair, and number of island countries in the pair. The results are quite robust to the inclusion of population as an additional control for size[22]. In particular, we find that:

- One percent increase in the product of **GDPs** raises the expected number of projects by roughly one percent.
- One percent increase in **distance** decreases the expected number of projects by a magnitude ranging between 0.45 and 0.77 percent.
- The effect of **population** is not robust and sometimes not even significant, but overall it seems to be positive.
- Sharing a **border** or a **language** both slightly increase the expected number of projects, as does being **landlocked**. **Island** is not significant. The positive sign on landlock could suggest substitution between trade and FDI, given that no access to sea routes makes trade more difficult.

21. Note that the elasticities and marginal effects are evaluated at the mean of the regressors.
22. Note that the inclusion of GDP and population together would be equivalent to controlling for GDP per capita.

TABLE 2.3 Effect of Independent Variables on the Expected Number of FDI Projects (Measured as Elasticity)

Basic Gravity Regression

Expected # counts	(1)	(2)	(3)	(4)
$GDP_{ht} \cdot GDP_{ft}$	.81 (.04)***	.96 (.04)***		1.00 (.04)***
$dist_{hf}$	–.45 (.03)***	–.77 (.06)***	–.77 (.06)***	–.70 (.06)***
$\frac{GDPpc_{ht}}{GDPpc_{ft}}$			.96 (.04)***	
$L_h \cdot L_f$		.05 (.025)**	1.01 (.03)***	.03 (.03)
border[1]				.07 (.02)***
language[1]				.08 (.01)***
landlock[1]				.04 (.01)***
island[1]				–.00 (1.14)

Notes: Standard errors are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels. [1] For this variable, the marginal effect is reported for a discrete change of the variable from 0 to 1.

2.3.2. Factor Proportions

We turn now towards comparative advantage motivations for FDI and extend the basic gravity equation above to include elements from Factor Proportions models. The new estimating equation becomes

$$\begin{aligned} n_{hft} &= \alpha + \beta_1 ln\left(GDP_{ht} \cdot GDP_{ft}\right) + \beta_2 ln\left(dist_{hf}\right) + \beta_3 ln\left(L_{ht} \cdot L_{ft}\right) + \\ &+ \beta_4 ln\left(\frac{Sec_{ft}/\Pr im_{ft}}{Sec_{ht}/\Pr im_{ht}}\right) + \beta_5 ln\left(\frac{Density_{ft}}{Density_{ht}}\right) + \beta_6 ln\left(\frac{K_{ft}/L_{ft}}{K_{ht}/L_{ht}}\right) + \\ &+ \beta_7 ln\left(EaseBus_{ft}\right) + Z_{hf} + \epsilon_{hft} \end{aligned} \tag{2}$$

where $\frac{Sec_{ft}/\Pr im_{ft}}{Sec_{ht}/\Pr im_{ht}}$ stands for the relative level of secondary education over primary education between foreign country, *f*, and home country, *h*, at time *t*; similarly for $\frac{Density_{ft}}{Density_{ht}}$, and capital-labor ratio ($\frac{K_{ft}/L_{ft}}{K_{ht}/L_{ht}}$); $EaseBus_{ft}$ stands for ease of doing business in the host country, and controls for some of the transaction costs between the country-pair (lower values corresponding to a better environment to set up a business); finally, Z_{hf} stands for other controls such as sharing a common border or a common language, and the number of landlocked countries or island countries in the pair *hf*.

As in the previous section, we compute the elasticities and present them in Table 2.4[23]. The elasticity signs on the basic gravity regressors, GDPs and distance, remain unchanged all over the different specifications, positive for GDPs and negative for distance. Once again, this indicates that GDP increases FDI while distance discourages it, with the latter suggesting either a vertical motive for FDI or transaction costs of FDI that increase with distance. In Column (1), we introduce our first factor proportions control, namely, the relative ratio of secondary

23. In order to construct the elasticity table we use the estimation results in table 6 of the ongoing research with the same name ("la Caixa" Working Paper No. 5/2006).

educated workers over primary educated workers abroad and at home, that proxies for the ratio of relative skilled over unskilled workers. It gets a negative elasticity, thus, FDI activity is less likely the more abundant the foreign country is in secondary over primary educated workers relative to home. This would suggest that FDI is searching for cheap unskilled labor, or that FDI travels from "North" (developed countries) to "South" (less developed countries). However, when we control for relative capital labor abundance (columns 3 to 5), besides a significant change in the magnitude of the effect of economic size (increasing from around 0.7 to 1.0), the significance of the effect of relative skill abundance disappears. The high correlation between our measures of relative skill-abundance and relative capital-labor endowment could explain a relatively lower weight of the skill abundance variable when the capital abundance variable is included (the omission of capital abundance would attribute to skill abundance the combined role of both variables). Nevertheless, it is highly unlikely that this high correlation explains the fact that skill abundance becomes insignificant once capital abundance is included. Instead, we attribute this effect to our measure of skill abundance being a noisy proxy for the level of skilled-unskilled labor abundance.

TABLE 2.4 Effect of Independent Variables on the Expected Number of FDI Projects (Measured as Elasticity)

Gravity adding Factor Abundance

Expected # counts	(1)	(2)	(3)	(4)	(5)
$GDP_{ht} \cdot GDP_{ft}$	.71 (.041)***	.70 (.04)***	1.06 (.07)***	1.05 (.08)***	.97 (.08)***
$dist_{hf}$	–.69 (.06)***	–.66 (.06)***	–.64 (.06)***	–.54 (.06)***	–.59 (.06)***
$L_h \cdot L_f$	.21 (.02)***	.22 (.02)***	.01 (.04)	.02 (.05)	.08 (.05)*
$\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}$	–.55 (.16)***	–.49 (.16)***	.12 (.18)	.06 (.18)	–.01 (.18)
$\frac{Density_f}{Density_h}$		–.08 (.02)***	–.09 (.02)***	–.09 (.02)***	–.10 (.02)***
$\frac{(K/L)_f}{(K/L)_h}$			–.43 (.05)***	–.39 (.06)***	–.43 (.06)***
$EaseBus_f$					–.17 (.06)***
border[1]				.06 (.03)**	.06 (.04)*
language[1]				.11 (.02)***	.10 (.02)***
landlock[1]				.07 (.02)***	.08 (.02)***
island[1]				.00 (.01)	.00 (.01)

Notes: Standard errors are reported in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels. [1] For this variable, the marginal effect is reported for a discrete change of the variable from 0 to 1.

To sum up, the main results when controlling for gravity and factor proportions elements together indicate that:

- One percent increase in the product of **GDPs** yields a 1 percent increase in the number of FDI projects.

- A particular pair of countries will trade around 0.65 percent more than another pair of countries that are 1 percent **farther away** from each other.

- Both the effects of population and relative **skilled** abundance are small and not significant.

- One percent increase in the relative **density** of the foreign country decreases the number of projects by 0.1 percent.

- One percent increase in the relative **capital** abundance of the foreign country yields 0.4 percent less projects. Hence, the more capital abundant the foreign country is relative to home, the lower the frequency of FDI activity between them. This is consistent with the idea of FDI being a conventional capital flow, since you would expect capital to target countries with a relatively higher return to capital, that is, those relatively labor-abundant or relatively capital-scarce[24].

- **Ease of doing business** gets a negative elasticity, thus, suggesting that countries where the process of setting up a business is easier (lower regressor value), are more likely to attract FDI.

- As for all the **geographic variables**, their effects are similar to those in the basic gravity case. That is, border, language, and landlock all have a positive overall effect on the expected number of FDI projects between two countries, while island is not significant.

2.4. The Determinants of FDI: Stages of the Value Chain

In this section we classify FDI projects according to their stage in the value chain of production. As aforementioned, we consider six potential stages in the production of a good: extraction, manufacturing, business services, retailing services, R&D, and HQ.

For each stage v, we estimate Equation (2) above with the dependent variable counting the number of projects between countries h and f at time t that belong to that stage (v). Hence, we are allowing for the possibility that the βs differ across stages in the value chain, that is, for the possibility that the independent variables have a different effect on the likelihood and frequency of FDI activity, depending on the stage in the value chain the project belongs to.

Again, to get a better sense of the overall effect of each of the regressors and how they compare across stages, Table 2.5 reports elasticities for each of them. For simplicity, we only present the results for the full regression, that is, with all the independent variables[25].

24. Please refer to footnote 7.
25. Again, this table is constructed using the estimates in the working paper ("la Caixa" Working Paper No. 5/2006).

TABLE 2.5 Effect of Independent Variables on the Expected Number of FDI Projects by Value Chain Stage (Measured as Elasticity)

Expected # counts	(1) Extraction	(2) Manufactures	(3) Business	(4) Retail	(5) R & D	(6) HQ
$GDP_{ht} \cdot GDP_{ft}$	.60	1.27	1.26	1.34	.74	1.05
$dist_{hf}$	.01	–.64	–.81	–.73	–.27	–1.79
$L_h \cdot L_f$	–.02	–.07	–.03	–.30	.26	.99
$\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}$	.77	.36	–.12	.70	2.85	5.10
$\frac{Density_f}{Density_h}$	–.10	–.12	–.15	–.13	–.02	–.24
$\frac{(K/L)_f}{(K/L)_h}$	–.49	–.71	–.80	–.51	–1.29	–1.6
$EaseBus_f$	.23	–.51	–.62	–.28	–.47	–2.65
border[1]	.02	.05	.00	.05	.00	.00
language[1]	.02	.01	.04	.04	.01	.00
landlock[1]	.00	.07	.03	–.01	.01	.00
island[1]	.00	.00	.00	.00	.00	.00

Notes: In the disaggregate case the standard errors are not reported in the table. Nonetheless, the model estimates presented in the "la Caixa" Working Paper No. 5/2006 show that most of the results are significant. [1] For this variable the marginal effect is reported for a discrete change of the variable from 0 to 1.

We can summarize the main results as follows:

- **Economic size** (GDPs) is a determining factor and increases expected FDI activity in all stages. The magnitude of its effect is especially important for manufacturing, business services, and retailing services. Overall, this effect ranges between 0.6 and 1.3 (1 percent increase in the combined economic size of two countries raises the expected number of projects between 0.6 and 1.3 percent).

- **Distance** discourages FDI activity in all stages but extraction. This makes sense from an economic perspective since factors driving extraction investment have little to do with distance and a lot more with the specific location of natural resources. Distance has the largest impact on the number of regional HQ projects. This indicates that investing firms would rather locate regional HQ nearby. Monitoring purposes could be an explanation.

- For **Population**, the sign and magnitude of the effect varies a lot across stages in the value chain.

- The overall effect of **relative skill abundance** of the host country is positive on the frequency of FDI activity in all the stages of production, except in Business Services, where it gets a negative sign. Thus, in general education promotes inward FDI, especially in R&D and HQ. Nevertheless a note of caution is warranted with respect to these estimates since our measure of relative skill abundance is a noisy proxy for the true level of skilled-unskilled labor abundance.

- **Density** has a negative but modest effect on FDI activity, indicating that the more dense the foreign country is relative to home, the less FDI activity will exist between them.

- As in the aggregate analysis, the effect of relative **capital-labor abundance** of the foreign country is always negative, although its magnitude of its effect varies considerably across stages. We interpret this finding as FDI targeting capital-scarce countries where its profitability is higher. However, in this particular case, we can get further insight into the mechanisms behind this effect if we look at the regression results from the ZINB model (please refer to Tables 8 and 9 in the "la Caixa" Working Paper No. 5/2006). From those estimates, we conclude that there is a minimum requirement of capital on the host country in order for an FDI link to be established. In other words, the host country must have a minimum level of capital in order to increase the likelihood of receiving an FDI project. Once this threshold is surpassed, FDI flows to relatively labor abundant (or relatively capital scarce) countries.

- **Geographic** variables exert, in general, a weak impact when looking stage by stage in the value chain.

- Finally, **ease of doing business** gets the expected sign (negative) in all the stages of production, except again extraction. Remember that lower values of the variable correspond to a more favorable environment to set up a business. Thus, the negative sign says that high values on ease of doing business (bad environment) decrease the quantity of projects between two countries. The largest impact of the business environment is on regional HQ projects.

One possible criticism to the results presented in this paper relates to the choice of the dependent variable. In particular, we use of the number of projects undertaken by large firms between two countries instead of the usual volume of FDI flows (or inward stock) from the source to the host country. Nonetheless, we find that the results are not conditioned by this choice of unit of measurement and they are indeed quite robust. Please refer to the "la Caixa" Working Paper No. 5/2006 for a robustness analysis in that respect.

3. Concluding Remarks

The recent surge in Foreign Direct Investment (FDI) activity and the increased complexity of production processes that split across borders warrant an investigation on the driving factors behind this type of cross border investment.

This paper provides a novel approach to the analysis of the determinants of FDI on two grounds. First, it uses a recently available data set on FDI investment projects to reexamine which home and host country characteristics influence the decision of a firm to invest abroad. Second, it uses one further level of disaggregation in the data to investigate whether the influence of these characteristics varies across value chain stages.

Before analyzing which country characteristics may have an effect on the decision to invest abroad, it is important to determine first why a firm might choose to engage in FDI activity. In order for a firm to undertake a foreign investment project, there must be some sort of advantage that offsets the initial disadvantage it faces relative to local firms. The literature has underscored three types of advantages derived from ownership, location, and internalization considerations. That is, a firm has strong incentive to invest in a subsidiary abroad if the firm owns an intangible asset yielding market power abroad (ownership); if there is a reason to locate production abroad rather than concentrate it at home (location); and if it pays off to exploit the ownership advantage internally rather than through licensing to a foreign firm (internalization).

The knowledge-capital model of multinationals focuses on ownership and location advantages and provides a theoretical framework that relates them to firm and country characteristics. In this model two types of multinational activity may arise, horizontal and vertical. In both, ownership advantage derives from multinational firms being intensive in the use of knowledge-capital. The sources of location advantage, however, are somewhat different between horizontal and vertical firms. In the case of horizontal expansion, a firm engages in FDI mainly to access foreign markets and in order to save on trade costs associated with exporting. Since distance increases trade costs, it would exert a positive effect on horizontal FDI. In the case of vertical expansion, a firm chooses to fragment its production process and to operate some of the stages abroad through FDI in order to arbitrage differences in factor prices. In that scenario, trade costs would depress FDI activity, since this type of FDI requires shipment to several countries in order to obtain the final good.

Based on these theoretical reasons for FDI activity, our departing empirical framework will be a gravity model that relates bilateral FDI with size and distance. Moreover, the search for lower production costs, especially determining in vertical FDI, is associated to differences in production factors endowments. To control for this possibility, we extend the basic gravity model to include measures of relative factor endowments.

At the aggregate level, our most robust findings can be summarized as follows. On the gravity side, size and sharing a common language promote FDI while distance discourages it. This negative effect of distance could be interpreted as evidence suggesting vertical motives for FDI, as opposed to horizontal motives. However, this interpretation

considers distance, exclusively, as a measure of trade costs and ignores other barriers to FDI that increase with distance. If we take a broader interpretation of our "distance" measure, then we can only conclude that any barrier to FDI that increases with distance has a negative impact on FDI. For instance, it could well be that investments in nearby countries are easier to monitor than businesses in far-away countries, discouraging FDI in the latter. In regard to factor proportion differences, our results indicate that FDI targets countries that are relatively capital-scarce (or relatively labor-abundant).

When we classify investment projects according to their stage in the chain of production, that is from a disaggregate standpoint, we conclude that, in general, the effect of all the regressors varies substantially across stages. Nonetheless, there is some regularity. Economic size, as well as distance, are determining factors in explaining the number of FDI projects between countries in a particular value chain stage, and preserve their sign with respect to the aggregate analysis. Even though the results confirm the aggregate finding that FDI targets capital-scarce countries, we find evidence of a minimum requirement on the foreign country's capital endowment in all the stages of production except extraction. Ease of doing business is important for all types of FDI, especially so for regional HQ. Geographic variables have a small effect. Finally, FDI in extraction behaves in a way that differs from all the other stages and seems to be unaffected by the regressors considered in our study. This finding is not at odds with economic intuition since factors driving extraction investment have little to do with distance or relative factor proportions and a lot more with the specific location of natural resources.

In a nutshell, our findings underscore an important role for both economic size and transaction costs associated with distance and language barriers in determining FDI activity. Furthermore, FDI in stages of production other than extraction targets capital-scarce countries and requires a minimum level of capital in the host country, while a favorable business environment promotes inward FDI in all stages and especially regional HQ.

Appendix A: Country List

Home Countries (Source)

Australia
Austria
Belgium
Brazil
Canada
Denmark
Finland
France
Germany
Hong Kong
India
Ireland
Italy
Japan
Korea, Republic of
Malaysia
Mexico
Netherlands
Norway
Portugal
Russian Federation
Singapore
Spain
Sweden
Switzerland
Taiwan, Province of China
Turkey
United Kingdom
United States

Host Countries (Destination)

Afghanistan
Albania
Algeria
Angola
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Belgium
Bolivia
Bosnia and Herzegovina
Brazil
Brunei Darussalam
Bulgaria
Cambodia
Canada
Chad
Chile
China
Colombia
Costa Rica
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Finland
France
Georgia
Germany
Ghana
Greece
Guatemala
Guinea
Haiti
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Iran, Islamic Republic of
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Korea, Republic of
Kuwait
Latvia
Lebanon
Libyan Arab Jamahiriya
Liechtenstein
Lithuania
Luxembourg
Macao
Macedonia
Madagascar
Malaysia
Maldives
Malta
Mauritius
Mexico
Moldova, Republic of
Morocco
Mozambique
Namibia
Netherlands
New Zealand
Nicaragua
Nigeria
Norway
Oman
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Puerto Rico
Qatar
Romania
Russian Federation
Saudi Arabia
Serbia & Montenegro
Singapore
Slovakia
Slovenia
Somalia
South Africa
Spain
Sri Lanka
Sudan
Suriname
Sweden
Switzerland
Syrian Arab Republic
Taiwan, Province of China
Tanzania, United Republic of
Thailand
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
United Arab Emirates
United Kingdom
United States
Uganda
Ukraine
Uruguay
Uzbekistan
Venezuela
Viet Nam
Zambia
Zimbabwe

Appendix B: Data Description and Sources

Variable	Description	Source
# of FDI Projects	Number of FDI projects in country *f* from firms in countries *h*, recorded in the Locomonitor data base.	Locomonitor data base, January 2002-June 2005.
GDP; GDP/cap	Gross domestic product, in current US$, and Gross domestic product per capita, in current US$.	World Economic Outlook, IMF, September 2006.
Distance	Great-circle distance in kilometers between the principal cities in countries *h* and *f*.	Own calculations based on area, latitude, and longitude data from the CIA World Factbook, 2006.
Population	Total Population.	World Bank, GDI 2006.
Border	Equals 1 if countries *h* and *f* share a common border. Zero otherwise.	Own construction based on data from CIA World Factbook, 2006.
Language	Equals 1 if countries *h* and *f* share a common (official or widely spoken) language. Zero otherwise.	Own construction based on data from CIA World Factbook, 2006.
Landlock	Number of landlocked countries in the pair *hf*.	Own construction based on data from CIA World Factbook, 2006.
Island	Number of island countries in the pair *hf*.	Own construction based on data from CIA World Factbook, 2006.
Secondary-Primary	Enrollment ratio in secondary education over Enrollment ratio in primary education in the host country, relative to the equivalent in the source country.	UNESCO, Statistical Yearbook. Use Net enrollment in primary education and secondary education. For missing values we use either the gross enrollment or estimate them from gross or net enrollment rates available. For specific extrapolations refer to the authors.
Density	Population over land area in kilometers.	Population data from World Bank WDI; area data from CIA World Factbook, 2006.
Capital-Labor	Capital endowment over population. Capital accumulation is calculated using perpetual inventory method from 1978.	Population data from World Bank WDI; Investment data from Penn World Tables 6.1; initial capital from Hall and Jones (1999).
EaseBus	Ease of Doing Business measure, with lower values indicating worse scenario.	Easiness of doing business from the World Bank, http://www.doingbusiness.org

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