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The FDI Determinants among OECD Countries

A Multinomial Logit Estimation

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Abstract

This paper investigates the foreign direct investment (FDI) determinants among OECD countries between 2006 and 2011. The stock market valuation of the host economy is included as a new determinant of FDI and to test the impact of the recent financial crisis on the multinationals' location choices. The study uses a multinomial logit model to analyse positive, zero and negative FDI flows determinants. The results suggest that the likelihood of multinationals investing, compared to non-investing or disinvesting, is higher towards countries performing worse in terms of stock market prices. However, in 2009 this trend was substantially reduced. This study, finally, states that it is essential to include zero and negative FDI flows in the estimation for a reliable analysis of the FDI determinants. This enables the authorities to configure the best policies to attract new investments and sustain existing ones.

Keywords: Foreign direct investment, multinationals, multinomial logit model, stock market prices.

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1 Introduction

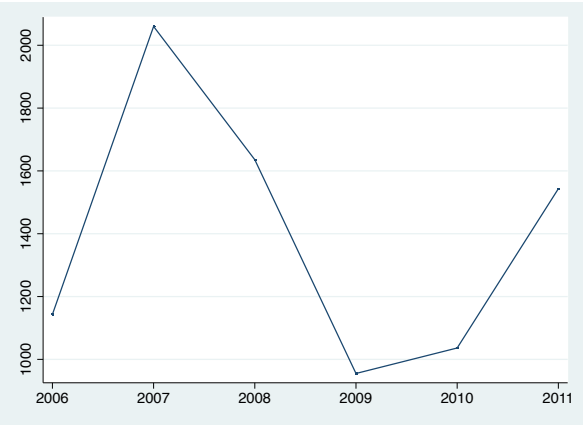
The aim of this study is to investigate the foreign direct investment (FDI) determinants among OECD countries between 2006 and 2011. The period includes the recent financial crisis that substantially affected FDI flows in 2008 and 2009. In this framework the stock market price of the host country is introduced as a new FDI determinant and to test the impact of the crisis on the multinationals' FDI location choices. The stock market price is particularly useful as it is a very volatile index that immediately responds to financial crashes, while other indicators need time to adjust. The first hypothesis of the present study is that multinationals are generally more likely to locate in countries with lower stock market prices. The second hypothesis is that the first hypothesis does not hold during the years of the recent financial crisis. To our knowledge, the existing literature never directly studied the relationship between FDI and the host country's stock market valuation, so the explanations behind it are based on closely related arguments.

To explain the motivations behind the first hypothesis we mainly looked to Krugman (2000) and Hausmann and Fernandez-Arias (2000). Krugman (2000) described the "Fire-Sale" FDI theory. According to this, during the Asian financial crisis between 1997 and 1998, foreign multinationals were attracted by local firms, since they were facing financial difficulties and were being forced to sell assets. Foreign multinationals were not affected by the crisis and were able to exploit their bargaining power and liquidity to buy local firms at "Fire-Sale" prices, particularly through mergers and acquisitions (M&A). Applying the "Fire-Sale" FDI theory to this framework, to some extent the lower the stock market prices, the greater local firms' financial difficulties and propensity to sell at "Fire-Sale" prices, the higher is the likelihood of FDI inflows. Referring to the literature, the "Fire-Sale" FDI theory has been mainly tested for the Asian 1997-98 crisis. We investigated whether it can be generalized as "business as usual" for the multinational, not limited to crisis-periods. We then looked at Hausmann and Fernandez-Arias (2000). They argued that multinationals are more likely to establish controlling positions in financially and institutionally less developed countries to overcome local inefficiencies. We believe this is the case for the stock market valuation too. Particularly, the lower the stock market prices, the greater local firms' inefficiencies, the higher is the likelihood of foreign multinationals establishing controlling positions (through FDI).

The next section decribes the impact of the recent crisis on FDI flows. It will be useful to understand the motivations behind the second hypothesis. Further on, the estimation tecnique and results are summarized.

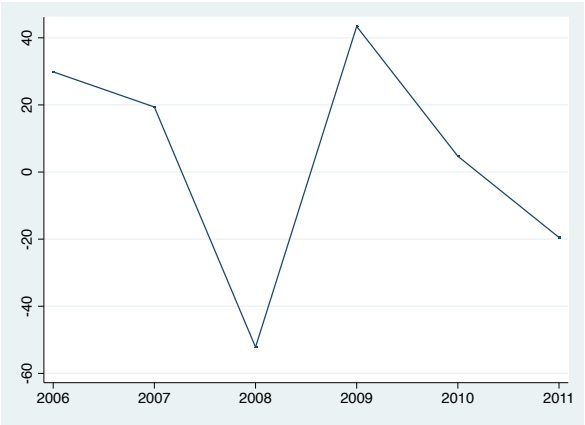
According to the UNCTAD World Investment Reports (2009, 2010, 2011), from 2003 to 2007 global FDI flows rose substantially, reaching a peak of 1979 billion-US$ in 2007. But in 2008 and 2009 all components of these flows dropped: equity investments, intra-company loans and reinvested earnings. In 2008 global FDI inflows fell by about 16% from 2007 and in 2009 they dropped further by about 37%. Around 85% of transnational corporations worldwide reduced their investment plans because of the crisis in 2009 and 79% were directly affected. We believe that because of the very poor economic and financial conditions, in 2008/2009 multinationals were more likely to invest in better-performing countries (hypothesis 2). In 2010 global FDI flows started to rise slightly again. In 2011 they finally returned to their pre-crisis average, but were still 23% below the 2007 peak. Figures 1.1, 1.2, 1.3 and 1.4 show the yearly averages of FDI flows, the changes in stock market prices, economic growth and the institutional and political quality of the OECD countries between 2006 and 2011. The figures indicate how deeply the recent financial crisis affected developed countries' financial, economic and political systems.

Figure 1.1 – FDI flows



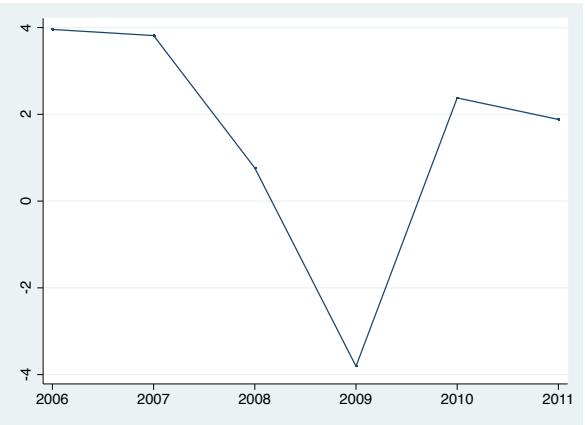
Source: Own elaboration based on the OECD data.
Notes: (i) FDI flows are in current million-US$.

Figure 1.2 – S&P index



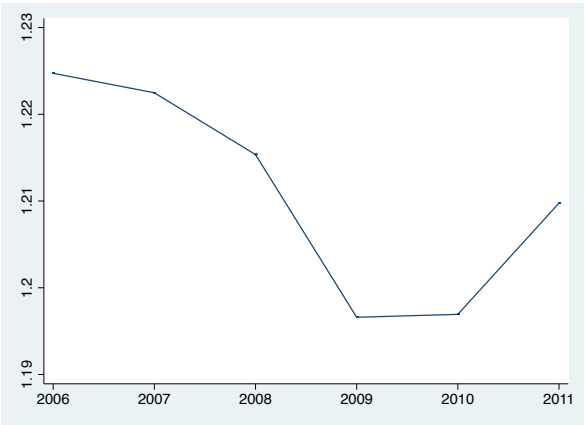
Source: Own elaboration based on the World Bank data.
Notes: (i) S&P index is the yearly % change.

Figure 1.3 – GDP growth



Source: Own elaboration based on the World Bank data.
Notes: (i) GDP growth is the yearly % change.

Figure 1.4 – Governance



Source: Own elaboration based on the World Bank data.
Notes: (i) Governance is an average of six governance indicators.

Another consequence of the recent financial crisis was the increase in the number of negative FDI flows. Negative FDI is an instance of disinvestment and may indicate sale of foreign equity, loss of a foreign enterprise, repatriated earnings or reverse intra-industry loans. The problem about zero and negative FDI flows is that they are usually excluded from econometric models, since FDI flows need logarithms. According to the literature, there are several ways to deal with zero FDI flows, but negative values have been examined rarely. About 25% of the observations are negative, so they must be included.

We built a multinomial logit (MNL) model to include zero and negative values. We transformed the dependent variable into a qualitative variable, with three possible outcomes: "POSITIVE", "NEGATIVE" or "ZERO" for the respective FDI flows. The MNL model is different from the standard FDI estimations, as it does not analyse the intensive margins. We checked how the FDI determinants affected the likelihood of multinationals investing, compared to disinvesting or non-investing, but we did not estimate their impact on the total amount of investments. To complete the analysis and to include the intensive margins of FDI we proposed an extension of our approach, in line with Helpman *et al.* (2008). Helpman *et al.* developed a two-stage estimation for bilateral trade that can be applied to the study of bilateral FDI flows. First, they built a probabilistic model to study the determinants of the extensive margins of trade. Then they estimated the "Mill's Ratio" from the first model and included it in a second regression to analyse the determinants of the intensive margins. The MNL model can be seen as an extension of the first stage of the Helpman *et al.* approach. We believe that calculation of the "Mill's Ratio" for the multinomial probabilistic model and its inclusion in the second-stage regression would solve the problem of exclusion of negative and zero FDI flows and would permit a fuller understanding of both extensive and intensive margins.

The results seem to confirm the hypotheses. Multinationals were generally more likely to invest in countries with lower stock market valuation, but not during the recent financial crisis. As reported above, global FDI flows dropped between 2008 and 2009, while during previous local crises they had risen. Two main factors drove the collapse: difficult access to finance and lower corporate profits reduced multinationals' capacity to invest, while high risk and uncertainty due to very poor economic and financial conditions reduced their propensity to invest (Poulsen and Hufbauer, 2011). The financial crisis was global and affected the majority of countries. Foreign multinationals were also affected and could not buy local firms, not even at "Fire-Sale" prices. New investments fell and existing assets were relocated to better-performing countries.

The main contributions of the present study can be summarized. We believe this is the first attempt to study the stock market valuation of the host economy as a determinant of FDI. In addition, it was used to test the impact of the recent financial crisis (2008-2009) on FDI location choices. Finally, we recognize the huge impact of disinvestments and put forward an idea for their inclusion. This last contribution seems particularly important as the exclusion of negative flows may lead to selection bias, compromising the effectiveness of the results. We believe previous research has never provided an exhaustive solution to this.

This paper is divided into seven sections. Section 2 summarizes the literature in the field. Sections 3 and 4 cover the methodology and data. Section 5 provides a theoretical framework and explicitly states the main hypotheses. Section 6 presents and discusses the empirical results and Section 7 draws some conclusions.

2 Literature review

This chapter is divided into three sections and summarizes the existing literature on the FDI determinants. First, a general overview on the FDI determinants is provided. Section 2.2 then focuses on the relationship between FDI and stock market valuation. Section 2.3 finally describes the existing techniques to deal with zero and negative FDI flows.

2.1 FDI determinants

In the late 1970s, Dunning (1977) published the famous eclectic paradigm, better know as the OLI (Ownership, Location, Internalization) framework, describing the reasons behind multinationals' activity. He summarized the advantages of establishing foreign affiliates instead of exporting or licensing. Ownership of knowledge, Location and Internalization advantages are the bedrocks of Dunning's contribution. But the locational advantage is the only factor that differentiates FDI from licensing and exporting.

In the light of the OLI paradigm, the understanding of the FDI location determinants was promptly debated. Moreover, a second issue frequently attracted the attention of researchers: the relationship between FDI and economic growth in the host country. Several papers followed creating a broad, continuously renewed literature.

An interesting contribution came from Lim (2001). He summarized the recent papers in the two fields. It turns out that there is general consensus about the positive effect of FDI on economic growth. Theoretically, the transfer of knowledge to the host economy is the reason why FDIs are growth-enhancing. According to Lim, the development of the host country's economy passes through improvements in technology, efficiency and productivity. Empirically, the scarce evidence about more developed countries seems to confirm the "growth-enhancing FDI" theory. The results are more mixed however, for developing countries, where the positive FDI spillovers are sometimes replaced by very limited or zero effects. The positive effect of FDI on economic growth does seem generally true though, and the result gives even more importance to understanding the multinationals' FDI decisions. In the second part of his paper Lim concentrated on FDI determinants literature. It turns out that market size, infrastructure quality, political and economic stability and free trade zones are important factors attracting FDI.

Several empirical analyses focused on understanding the FDI determinants. Farrell *et al.* (2004), for instance, built a panel data for Japanese outward FDI to some developed countries in the period 1984 to 1998. They discovered that macroeconomic stability and the number of antidumping investigations in the host country were the major factors attracting Japanese FDI. Furthermore, they found a robust and positive relationship between "JFDI" and imports, while the link between "JFDI" and exports was changing from one industry to another. Ranjan and Agrawal (2011) studied the FDI determinants in BRIC countries over the period 1975 to 2009. After controlling for several variables, the market size of the host country, trade openness, infrastructure facilities and macroeconomic stability and growth turned out to significantly attract FDI. Mutti and Grubert (2004) concentrated on the role of taxation in the host country, separately for developed and developing economies. They recognized the importance of lower taxation in order to attract FDI. But, the impact was much bigger for developing countries, while other factors were predominant for developed ones (for example, better infrastructures). Stein and Daude (2001) developed a gravity model for bilateral FDI stocks and recognized the huge impact of the host country's institutional quality in attracting OECD FDI. Finally, after controlling for several institutional indicators, from different databases and with different estimation methods, their results turned out to be very robust.

Even though the literature is broad, it seems that the understanding of FDI determinants is still young. For example, referring to Blonigen (2005), only recently has the focus of research passed from a partial to a general equilibrium analysis, so that there is still a long way to a complete knowledge. Moreover, according to Chakrabarti (2001), several FDI determinants are not consistently valid. In fact, implementing an Extreme Bound Analysis (EBA), a tool that tests hypotheses after slightly changing the information set, he found that only market-size is statistically robust. To conclude, the importance and complexity of the topic call for much more research.

2.2 FDI and the stock market valuation

To our knowledge, only Claessens *et al.* (2001) and Gast (2005) have focused directly on the relationship between FDI and stock market valuation, but nobody has concentrated on the host country's stock market valuation as a factor possibly attracting FDI. Claessens *et al.* built up a random-effect Panel Data for 77 countries over the period 1975 to 2000 and found that FDI and stock market development in the host economy were complementary. But they analysed FDI as a determinant of the stock market development, not the reverse. Gast implemented a fixed-effect panel data for 22 OECD countries from 1991 to 2001. He discovered a positive relationship

between stock market booms in the source country and FDI outflows. But he did not analyse the effect of stock market booms in the host economy.

The literature about FDI and financial markets usually deals with a partially different issue. Researchers' interest often followed the Tobin's framework that studied the effect of stock market miss valuations on multinationals' investments choices. Tobin's Q is the ratio between the market value and the replacement value of a firm. In other terms, it expresses an over- or undervaluation of the firm on the stock market. Tobin's theory suggests that an over/undervaluation would increase a firm's willingness to invest or disinvest, respectively.

Several researchers have developed theoretically and tested empirically Tobin's implication. For example, Shleifer and Vishny (2003), Baker *et al.* (2009), and De Santis *et al.* (2004), all studied the effect of stock market miss valuation on multinationals' investment decisions. They all found that overvaluation of a firm on the stock market is positively related with the total amount of outward investment. This is known as the "Cheap Financial Capital Hypothesis". On the other side, the "Cheap Assets Hypothesis" predicts a negative relationship between the host country's stock market valuation and FDI flows into that country. Following Shleifer and Vishny, the main assumption for the first hypothesis is that financial markets are inefficient, while managers are completely informed about their own firms' performance, so they are able to understand and exploit the financial market's inefficiencies. Obviously, the same assumption does not hold for the "Cheap Assets Hypothesis", which is in fact not empirically supported.

From this argumentation, it is clear that our knowledge about the topic is still incomplete. In fact, as explained above, the relationship between FDI flows and stock market valuation of the host country has barely been taken under consideration. To conclude, we believe this is the first attempt to study stock market trend in the host economy as determinant of FDI.

2.3 How to deal with zero and negative flows

How to treat zero and negative FDI flows is a major question. Several papers avoid the problem by excluding these values from their estimates. But, recent research has highlighted the problems of selection bias that the exclusion of zero and negative flows can create.

The main contribution came from Helpman *et al.* (2008), who built a model of international trade with heterogeneous firms that account for positive and zero trade flows. They improved on the

standard gravity equation, developing a two-stage estimation to assess separately the intensive and extensive margins of trade, correcting for biases due to selection or to exclusion of extensive margins. This approach turned out to be necessary for correct analysis of bilateral trade. Moreover, using importer and exporter fixed-effect, they can account for unilateral flows.

Several papers followed their approach and the same procedure can be applied to the study of bilateral FDI. Garrett (2011) developed a theoretical and an empirical framework on bilateral FDI flows, implementing a two-stage Heckman estimation. Following Helpman *et al.* (2008), he developed a monopolistic model with firm heterogeneity to include zero-FDI in the estimation and to study the threshold productivity level for having FDI flows. Overall, the Helpman *et al.* procedure remains one of the best contributions to the literature in the last few years, but negative FDI values are still not considered.

Other papers offer some ways to deal with zero and negative values. Yeyati *et al.* (2007) focused on FDI outflows from USA, Europe and Japan to developing countries. They analyzed the effects of business and interest rate cycles in the source country on FDI outflows and made a simple transformation to deal with zero and negative FDI, using the following formula:

$$sign\,(X)\,log\,(|X|+1)$$

X stands for the dependent variable FDI flows. The log of (x+1) allows them to account for zero FDI, while the absolute value and the FDI sign before the log are necessary in order to include the negatives. Cavallari and D'Addona (2013) investigated business cycles as determinants of FDI. Through a bilateral Panel Data study, they discovered that output, interest and exchange rate volatility substantially reduced the amount of FDI flows. First, they followed the same approach as Yeyati *et al.*, using semi-log transformation to account for zeros and negatives. Then they compared the previous model with a Heckman selection estimate treating the negative values as zeros. The real volatility turned out to play an important role in the decision to invest or not, but seemed to lose importance on the intensive margins.

3 Methodology

This chapter describes the methodology used to investigate the determinants of bilateral FDI flows among OECD countries between 2006 and 2011. As mentioned above, some problems arise when dealing with FDI flows data. First, some observations are missing. Using an unbalanced panel data easily solves this. Then, when taking the logs, zero and negative flows are excluded from the observations. Section 3.1 summarizes the existing approaches to deal with zeros and negatives, highlights the respective limitations and provides a solution. Section 3.2 introduces the MNL model and section 3.3 finally describes the empirical estimation used.

3.1 Existing approaches, limitations and solution

As explained in the literature review, in order to avoid selection bias due to the exclusion of zero FDI flows, several papers follow the Helpman *et al.* approach, implementing a Heckman two-stage estimation. They are able to account for zeros and partially correct the selection bias. However, the problem of negative flows persists.

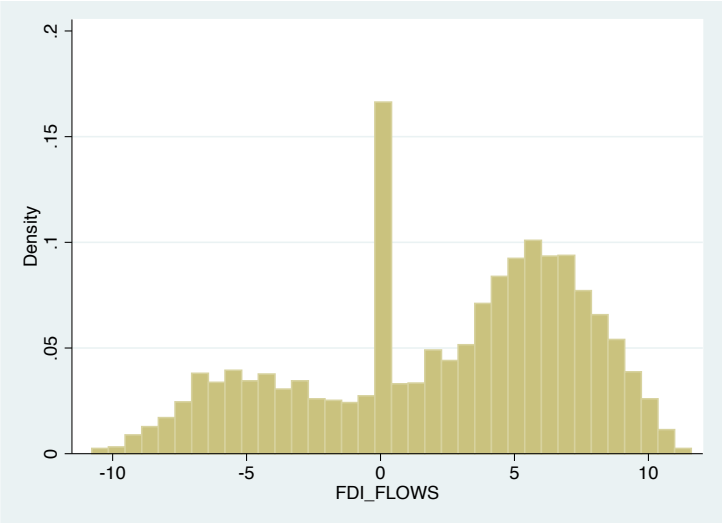
Overall, there are three main solutions in the literature to deal with negative flows:

- Excluding negative values. This can create a problem of selection bias, particularly when there are numerous negative observations. In fact, it can occur that the excluded values contain important information. In our sample we have 1144 negative FDI flows (about 25% of the observations). Thus, this approach seems not to be applicable;
- Treating negative flows as zeros. This solves the problem of selection bias but, at the same time, bases the model on a big assumption, since negative and zero values reflect different behaviour by the multinationals. Assuming they are the same may compromise the effectiveness of the results;
- Using a semi-log transformation. This seems to be the best alternative, but it substantially reduces the explanatory power of the model.

Figure 3.1 shows why the last solution substantially reduces the explanatory power of the model. The transformation divides positive and negative values in two separate groups. Each group seems to be normally distributed when considered alone, but the normality fells when dealing with all the observations together. The semi-log transformation seems to be useful in explaining differences between positive and negative values rather than the overall FDI trend. Finally, coefficients can be

interpreted as elasticities only for large values of the dependent variable, since log (1+FDI) does not approximate log (FDI) for very small FDI flows.

Figure 3.1 – Pdf of FDI flows after semi-logs



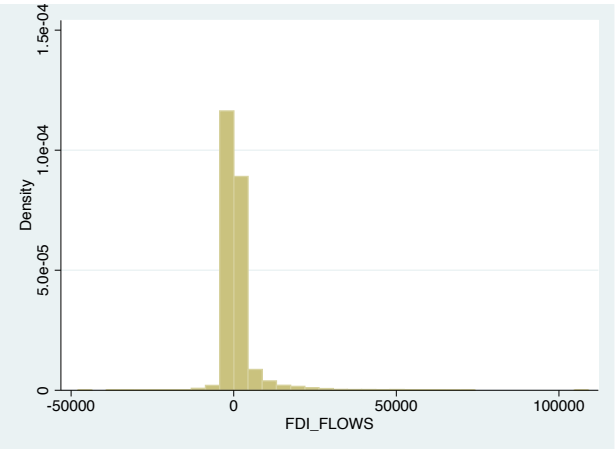
Source: Own elaboration based on the OECD data.
Notes: (i) the following formula is used for the transformation: *sign (X) log (|X|+1),* where *X* stands for FDI flows.

A better methodology is required to perform a correct estimation. In order to include zero and negative values, to differentiate them and to build a powerful model, two possible alternatives are discussed: first, using FDI values without logarithms; second, extending the first stage of the Helpman *et al.* approach.

The "log-exclusion" idea would simplify the problem and the methodology would be the same as Helpman *et al.*. First, a probabilistic model would be used to estimate the extensive margins. Intensive margins' determinants would then be analysed using non-log FDI values. Negative flows would therefore be included in the final estimation. But the problem of this approach arises with the nature of the FDI data. The log-transformation is in fact useful when data are highly non-normally distributed, to reduce the impact of the outliers and to interpret coefficients as elasticities.

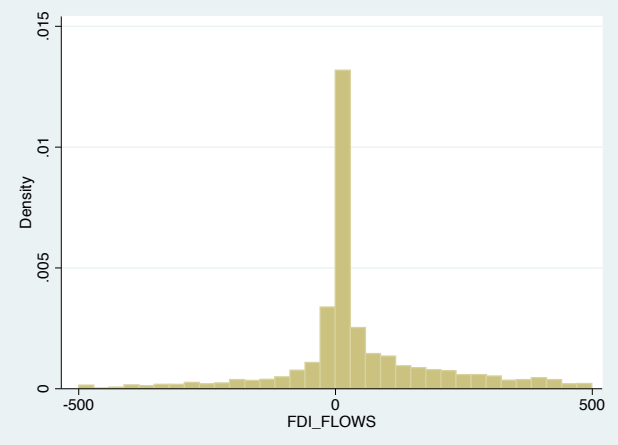
The histograms in figures 3.2 and 3.3 represent the probability density function of the FDI flows before the log-transformation. Figure 3.3 suggests that the values are normally distributed. Figure 3.2 shows, however, that some huge FDI flows substantially extend the length of the tails of the distribution. Figure 3.4 finally represents the probability density function of the FDI flows after the log-transformation. From figure 3.2 and 3.4, one can assume that the log-transformation is necessary to reduce the impact of the numerous big FDI values.

Figure 3.2 – Pdf of FDI flows before logs



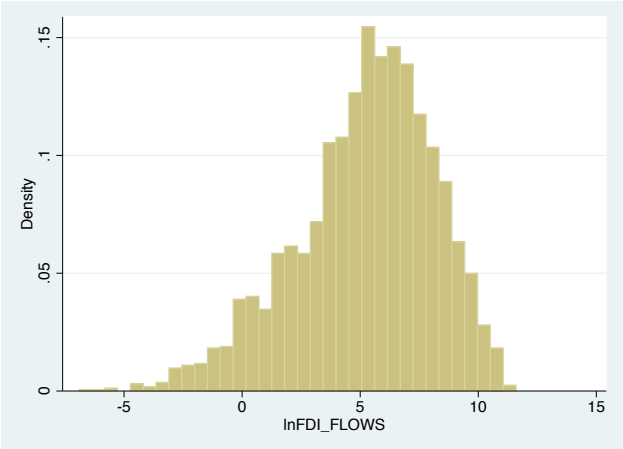
Source: Own elaboration based on the OECD data.
Notes: (i) all observations are included (ii) FDI flows are in current million-US$.

Figure 3.3 – Partial pdf of FDI flows before logs



Source: Own elaboration based on the OECD data.
Notes: (i) observations are limited to the FDI values between -500 and +500. (ii) FDI flows are in current million-US$.

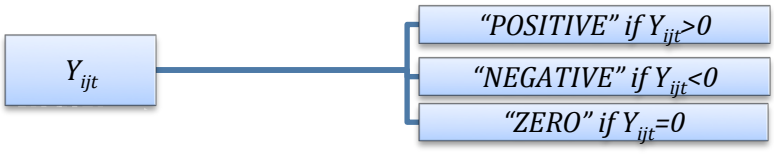
Figure 3.4 – Pdf of FDI flows after logs



Source: Own elaboration based on the OECD data.
Notes: (i) the log-transformation excludes zero and negative FDI flows.

We finally decided to focus on the extension of the first stage of the Helpman *et al.* approach. In order to account for zero as well as negative FDI flows, we improved on their first-stage probabilistic model using multinomial logit (MNL) estimation. This is a generalization of the binary logit model, with three or more qualitative outcomes. In this framework, the dependent variable has three possible outcomes (figure 3.5).

Figure 3.5 – FDI flows transformation for the MNL model



Source: Own elaboration.
Notes: (i) Y_{ijt} stands for the FDI outflows from country *i* to country *j* in time *t*.

To complete the analysis, the subsequent step would be to generate a "Mill's ratio" of the multinomial model and to include it in the final regression. Thus, it would be possible to account for zero and negative flows in the analysis of the intensive margins of FDI. However, the present paper focuses on the first stage (the MNL model), for two main reasons: first, the study of all the probabilities of positive, compared to negative or zero outcomes is already an ample analysis and merits individual study; second, some econometric problems could arise with the Helpman *et al.* approach extension. It is therefore better to implement the second step of the analysis with the advice of expert econometricians, which is not available to me right now. To conclude, the Helpman *et al.* approach needs the probit instead of the logit model. We chose the second one because of the numerous "stata" commands that are not available for the multinomial probit estimation. However, their difference is very little and their results turned out to be very similar (results using the multinomial probit model are not reported).

3.2 MNL model

Consider Y_{ijt} as the transformed dependent variable, explained by a vector of K explanatory variables (X'_{ijt}). As mentioned above, the dependent variable becomes a categorical and unordered variable. One way to derive the MNL model is through a latent variable representation. First, it is necessary to choose one of the outcomes as the benchmark option. Then, the utility (U) of each of the alternatives is compared to the utility of the benchmark:

(3.1) $$Y^*_{ijt,h} = U_{ijt,h} - U_{ijt,0}$$

$Y^*_{ijt,h}$ is the latent variable; h stands for the alternative; 0 stands for the benchmark. In the MNL model the latent variable is assumed to follow a linear model and the final regression can be fully described as follows:

(3.2) $$Y^*_{ijt} = X'_{ijt}\beta + \varepsilon_{ijt} \qquad i,j=1,\ldots,N;\ i \neq j;\ t=1,\ldots,T.$$

$$with \quad Y_{ijt} = h \text{ if } Y^*_{ijt} > 0$$
$$or \quad Y_{ijt} = 0 \text{ if } Y^*_{ijt} \leq 0$$

N is the number of individuals and T the number of periods; ε_{ijt} is the unobservable error term. The MNL model indicates if an increase of the explanatory variable increases or decreases the likelihood of the alternative, compared to the benchmark. The drawback of the MNL model is that

it is not possible to interpret the magnitude of a coefficient, but only the sign. To do that, the relative risk ratio (RRR) is calculated.

The MNL model is a multi-equation model, since it simultaneously estimates all the possible logistic regressions that compare each of the alternatives to the benchmark. Assuming that the dependent variable has three qualitative outcomes, the probability for each of the alternatives is as follows:

(3.3) $$P_{ijt,1} = P[Y_{ijt}=1] = (exp(X'_{ijt}\beta_1)/(exp(X'_{ijt}\beta_1)+(X'_{ijt}\beta_2)+(X'_{ijt}\beta_3))$$

(3.4) $$P_{ijt,2} = P[Y_{ijt}=2] = (exp(X'_{ijt}\beta_2)/(exp(X'_{ijt}\beta_1)+(X'_{ijt}\beta_2)+(X'_{ijt}\beta_3))$$

(3.5) $$P_{ijt,3} = P[Y_{ijt}=3] = (exp(X'_{ijt}\beta_3)/(exp(X'_{ijt}\beta_1)+(X'_{ijt}\beta_2)+(X'_{ijt}\beta_3))$$

Where β_j (*with j=1,2,3*) denotes a vector of alternative-specific coefficients. It is necessary now to choose one of the alternatives as the benchmark. One of the coefficients is set to zero (alternative 1) and formulas (3.3), (3.4) and (3.5) become as follows:

(3.6) $$P_{ijt,1} = P[Y_{ijt}=1] = (1/1+exp(X'_{ijt}\beta_2)+exp(X'_{ijt}\beta_3))$$

(3.7) $$P_{ijt,2} = P[Y_{ijt}=2] = (exp(X'_{ijt}\beta_2)/1+exp(X'_{ijt}\beta_2)+exp(X'_{ijt}\beta_3))$$

(3.8) $$P_{ijt,3} = P[Y_{ijt}=3] = (exp(X'_{ijt}\beta_3)/1+exp(X'_{ijt}\beta_2)+exp(X'_{ijt}\beta_3))$$

This leads to the following probabilities of each alternative relative to the benchmark option:

(3.9) $$P[Y_{ijt}=2]/P[=Y_{ijt}=1] = exp(X'_{ijt}\beta_2) = RR2$$

(3.10) $$P[Y_{ijt}=3]/P[=Y_{ijt}=1] = exp(X'_{ijt}\beta_3) = RR3$$

RR2 (RR3) is the relative risk of the alternative 2 (3) compared to the benchmark. To conclude, the relative risk ratio (RRR) indicates how the relative risk of the alternative compared to the benchmark option changes whit a unit increase in the explanatory variable. In a general form, with *h* standing for the alternative and *0* for benchmark, the final formula is as follows:

(3.11) $$RRR = [P(Y_{ijt}=h|x_{ijt}+1)/P(Y_{ijt}=0|x_{ijt}+1)] / [P(Y_{ijt}=h|x_{ijt})/P(Y_{ijt}=0|x_{ijt})] \; i,j=1,\ldots,N;\; i\neq j;\; t=1,\ldots,T$$

3.3 Empirical estimation

In this study the empirical estimation follows the MNL model. Y_{ijt} is the FDI outflows from country i to country j in time t and is a qualitative variable with three possible outcomes (see figure 3.5). X'_{ijt} is a vector of K explanatory variables (the FDI determinants), that are listed in the following chapter. According to Helpman *et al.*, time-invariant unobservable source and host country fixed effects (α_i and α_j) are used to account for unilateral flows; unobservable time fixed effect (λ_t) are finally included. The empirical model is as follows:

(3.12) $$Y^*_{ijt} = \alpha_i + \alpha_j + \lambda_t + X'_{ijt}\beta + \varepsilon_{ijt} \qquad i,j=1,\ldots,N;\ i \neq j;\ t=1,\ldots,T$$

N is the number of countries and T the number of periods (years); ε_{ijt} is the unobservable error term. The MNL model indicates if an increase of the explanatory variable increases or decreases the likelihood of the alternative (investing), compared to the benchmark (non-investing or disinvesting).

In this study we implemented six models, three to understand the investing/non-investing decisions and three for the analysis of the investing/disinvesting choices. First, we built the basic models. Then, control variables were included to check for robustness. To interpret the results we finally calculated the relative risk ratios (RRRs).

4 Data

4.1 Data description

Dependent variable:

- FDI_FLOWS stands for bilateral FDI outflows. Data are available in current million-US$ in the OECD stat database. As explained above, our dependent variable is finally transformed as in figure 3.5 in order to develop the MNL model.

Referring to the literature, we included the following FDI determinants in the model.
Explanatory variables:

- The variable TRADE is the natural log of bilateral exports. Data are available in current 1000-US$ in the World Bank WITS database (World Integrated Trade Solutions).
- GDP_host and GDP_source are the natural logs of the total GDP (in current US$) of the host and the source country, respectively. GDP_growth is the GDP growth (annual %) of the host country. Data are available in the World Bank database.
- The variable INFRASTRUCTURE is the number of telephone lines (per 100 people) in the host country. Data are available in the World Bank database.
- The variables TAX and BUSINESS&CONSTRUCTION describe the business environment of the host country. Data are available in the Doing Business Indicators database of the World Bank. We selected three variables from all the indicators: cost of starting a business (as a % of income per capita), cost of dealing with construction permits (as a % of income per capita) and total tax rate (as a % of profits). The total tax rate includes profit tax, labour tax and contributions as well as other taxes. Since both the cost of starting a business and of dealing with construction permits are expressed as a percentage of income per capita, they can be combined. This is useful in order to create a single variable representing the ease of doing business in the host country. BUSINESS&CONSTUCTION is our final indicator and is the simple average of the two variables.
- The variable GOVERNANCE shows the institutional quality of the host economy. There are six Worldwide Governance Indicators in the World Bank database: Voice and Accountability, Political Stability and Absence of Violence, Governmental Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. In our model, the variable GOVERNANCE is an average of these six.

- S&P INDEX is the S&P Global Equity Index (annual % change) of the host country. It measures the US-dollar price change in the stock market covered by the S&P Global BMI and the S&P frontier BMI. Data are available in the World Bank database. To analyse the relationship between FDI flows and the host country's stock market value during the financial crisis, we introduced two interaction terms in the model: between the S&P INDEX and a dummy for 2008 and between the S&P INDEX and a dummy for 2009.

The model includes some of the standard gravity variables:

- DISTANCE and LANGUAGE data are available in the CEPII database. LANGUAGE is a dummy variable expressing whether two countries have a common language. DISTANCE expresses the distance between two countries in km. There are several calculation methods. The most frequent in bilateral trade and bilateral FDI literature is the weighted distance (*distwces* in the CEPII database), which we used in our model. It takes into consideration the principal cities of each country, not only the biggest one. Then, the distance between two countries is calculated based on the distances between the principal cities, weighting the intra-city distances in relation to the cities' shares in the country's total population.
- The variable RELIGION accounts for the countries' shares of Catholics, Protestants and Muslims. It investigates the religious affinity of the host and the source economies. Data are available in the CIA world factbook. The formula, as in Helpman *et al.*, is as follows: RELIGION= *(% Protestants in host country * % Protestants in source country) + (% Catholics in host country * % Catholics in source country) + (% Muslims in host country * % Muslims in source country).*

4.2 Descriptive statistics

Table 4.1 – Descriptive statistics

VARIABLE	Obs	Mean	Std.Dev.	Min	Max
FDI_FLOWS	4526	1392.00	6228.75	-47935.38	109097.00
TRADE	5220	6980.89	20086.06	0.07	330189.30
DISTANCE	5400	5060982.00	5290.98	10.05	19537.12
LANGUAGE	5400	0.08	0.27	0	1
RELIGION	5400	2667.68	2627.77	0	9960.04
GDP	5400	1389361.00	2621941.00	12113.10	15000000.00
GDP_growth	5400	1.50	3.43	-8.54	10.49
INFRASTRUCTURES	5400	43.98	13.19	17.15	67.24
TAX	5400	45.64	12.00	20.80	77.50
BUSINESS&CONSTRUCTION	5400	48.09	63.17	4.75	294.90
GOVERNANCE	5400	1.21	0.54	-0.19	1.90
S&P INDEX	5400	4.28	36.23	-69.94	99.60
S&P INDEX*2008	5400	-8.70	19.92	-69.94	0.00
S&P INDEX*2009	5400	7.23	19.14	-23.10	99.60

Source: Own elaboration based on the data described in section 4.1.
Notes: (i) FDI_FLOWS, TRADE and GDP are in current million-US$. (ii) GDP is the same for host and source country.

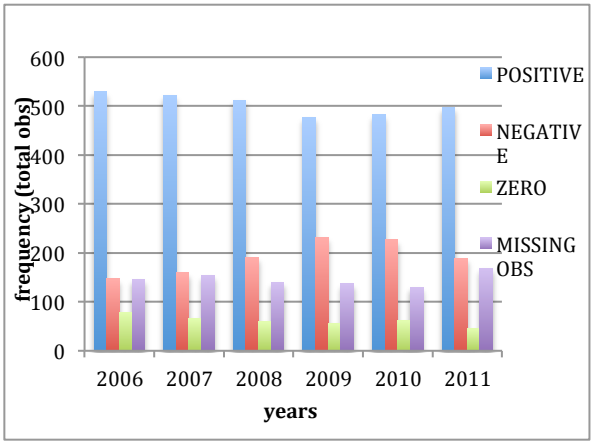
Table 4.1 shows some descriptive statistics for all the variables included in the empirical model. Particularly, descriptive statistics about the variable *FDI_FLOWS* are in million-US$ (before the transformation in a categorical, unordered variable for the MNL model)

4.3 FDI trend

Figures 4.1 and 4.2 show the frequency of positive, negative and zero FDI flows over the period. Figure 4.1 includes missing values and shows the total number of observations for each alternative. Figure 4.2 shows the proportions of each alternative as percentages of the total number of observations (excluding missing values). The patterns of positive, negative and zero values are clear. The additional information in the first figure is that the number of missing observations does not follow any pattern. The frequency of positive values drops during the first two years of the crisis from 70% of the total observations in 2006 to about 60% in 2009. Then it starts to rise slightly again and is back to just below 70% in 2011. The frequency of the negative values goes in exactly the opposite way. From around 20% of the total observations in 2006, it gradually rises, peaking at approximately 30% in 2009; it remains much the same in 2010, like the positive values and falls slightly in 2011. Zero values seem to fall slowly over the period: from around 10% of the total observations in 2006 zeros drop by about 5 percentage points.

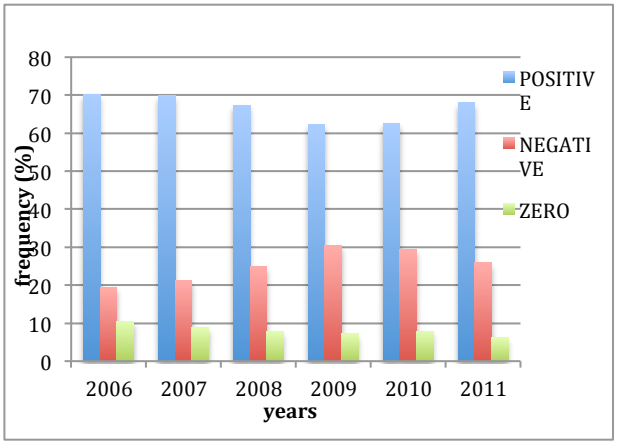
The huge impact of the crisis mainly affected positive and negative values, reducing investments and increasing disinvestments. Zeros gradually decreased, for different reasons. We believe that the gradual fall in zero values reflects rising globalization, with its increase in the number of bilateral FDI relations between developed countries.

Figure 4.1 – FDI trend (total obs.)



Source: Own elaboration based on the OECD data.
Notes: (i) the figure represents total positive, negative, zero and missing FDI observations among 30 OECD countries.

Figure 4.2 – FDI trend (percentages)



Source: Own elaboration based on the OECD data.
Notes: (i) the figure represents percentages of positive, negative and zero FDI flows among 30 OECD countries.

5 Conceptual framework and hypotheses

The purpose of this chapter is to provide an overview on the arguments and theories explaining the effects of the FDI determinants on FDI flows. Referring to these arguments and theories (discussed in the first six sections), the expected results and the main hypotheses are then summarized in section 5.7.

Section 5.6 summarizes arguments and theories explaining the relationship between FDI and the stock market valuation of the host country. Section 5.6.1 describes the "Fire-Sale" FDI mechanism as an interesting explanation for the aforementioned relationship. Section 5.6.2 describes a theory developed by Hausmann and Fernandez-Arias (2000), which mainly refers to the relationship between FDI and the institutional and financial environment of the host economy. However, we believe it plays an important role in explaining the relationship between FDI and the host country's stock market valuation too.

According to Lim (2001), a firm becomes multinational mainly for two reasons: to serve foreign markets or to have access to cheaper inputs. Horizontal multinationals follow the first reason, while vertical ones pursue the second. Moreover, horizontal FDIs have huge fixed costs (for instance, costs of building production plants), but very limited variable costs (they do not have to deal with transport costs or trade barriers). It may be convenient for a multinational to be organized horizontally when transport costs are high or when the host market is very large, since horizontal multinationals can gain from a larger market through economies of scale. This is not so for vertical FDIs. Vertical multinationals' motivations are linked to the second reason: to relocate part of their production process in a low-cost foreign country. FDI determinants can therefore have different impacts on FDI flows depending on the multinational's orientation. One by one, we discuss now the expected signs of our FDI determinants' coefficients.

5.1 FDI and trade

Literature about the relationship between trade and FDI is broad and contradictory. Mundell (1957) was the first to formally describe the relation between factors and goods movements. Through the neoclassical model of trade but allowing for factor mobility, he detected a negative relationship between factors and goods movements. He states that: "An increase in trade impediments stimulates

factor movements and an increase in restrictions to factor movements stimulates trade"[1]. On the other hand, Markusen (1983) built a model describing the opposite relation. These two are the pioneers of the substitution and complementarity literature about trade and FDI.

There are several recent explanations of the two possibilities. Bloningen (2005), for instance, maintains it mainly depends on the product exported. It is possible that trading a final good similar to that produced by the foreign affiliate will create a substitutive effect between the two; however, trading an intermediate good may be useful to the foreign affiliate in order to produce the final product. In this case, trade and FDI would be complementary. Lim suggests that horizontal FDIs are profitable when trade barriers or transport costs are high (say, with less trade), so that trade and FDI are expected to be substitutes. On the other hand, vertical multinationals need to move components or final goods between the source and the host country. Vertical FDIs will therefore be higher when transport costs and trade barriers are lower (with more trade), so that trade and FDI are more likely to be complementary. Finally, more trade relationships between two countries may reflect greater awareness of the behaviour of the parties and more information about the foreign market. In this sense, they are expected to be complementary.

5.2 Gravity variables

In terms of DISTANCE, LANGUAGE and RELIGION, we expect the proximity between source and host countries to increase bilateral FDI flows. In this case, "proximity" assumes a broad meaning, not only geographical, but also cultural.

Garrett (2011) holds that the geographical distance between two countries negatively affects FDI flows for both intensive and extensive margins; a common language is significant only for the intensive margins, while religious affinity positively affects extensive margins. However, Lim (2001) opines that the explanation for bilateral trade also holds for geographical distance, since bilateral trade is closely linked to transport costs. Greater distance means higher transport costs, so multinationals will be more willing to replace exports with horizontal FDIs. In the case of vertical FDIs, greater distance (higher transport costs) is negatively related to the total FDI amount.
In the literature, the net impact of the geographical distance between two countries is generally negatively related to the total FDI value, but the opposite may arise when dealing with horizontal multinationals.

[1] See Mundell (1957)

5.3 Market size and economic growth

Referring once again to Lim (2001), a larger host country GDP increases horizontal FDIs, but seems not to affect vertical decisions. The overall effect is expected to be positive and this is one of the few certainties in the FDI literature. Referring to Chakrabarti (2001), after testing for the robustness of most of the FDI determinants, market size is the only one that is really robust. GDP growth follows the same argumentation as market size. In fact, economic growth reflects a potential larger market. Finally, the GDP of the source country is also expected to have a positive effect on FDI flows. Larger source market size is directly related to the number of firms in the country, leading to more domestic and foreign investments.

5.4 Infrastructure

Regardless the type of FDI, better infrastructure is expected to attract foreign investment and we use "telephone lines per 1000 people" as a proxy for it. This only partially reflects the real infrastructure development of the host country but it is used in several papers, for instance by Kinoshita and Campos (2003) and Morisset (2000). However, we do not expect infrastructures to be a key factor in OECD countries, whereas it may be in developing or transition economies.

5.5 Business environment

Referring to Lim (2001), expectations about the business environment are not backed by strong evidence, since the lack of good measures may lead to uncertain results. We have included new business indicators, made available only recently by the World Bank, with the aim to overcome the measurement uncertainty raised by Lim. We also expect that costs for starting a business and dealing with construction permits are negatively related to FDI inflows, since they raise the fixed costs of investing. In addition, we assess the impact of the host country's total tax rate as another FDI determinant. As noted by Bloningen (2005), while the negative impact of taxes on FDI inflows is commonly recognized, its magnitude varies with the data and methodology used.

Several papers focus on the effect of the host country's corporate tax rate. One important contribution comes from Devereux *et al.* (2002), who analysed 21 OECD countries over the period 1983 to 1999, to see whether they compete over corporate tax rates in order to attract FDI. They develop two models, the first with firm mobility and the second with capital mobility. To analyse multinationals' behaviour we focus on the first. Devereux *et al.* use two different measures for the corporate tax rate. First, they analyse the statutory tax rate and then the EATR (Effective Average

Tax Rate). The first is the basic measure, as it does not account for deductions. The second seems more complete but it is difficult to calculate it properly. However, Devereux *et al.* find significant competition among the 21 OECD countries over both the EATR and the statutory tax rate. Other papers find similar results (Buettner (2002) and Bénassy-Quéré (2005)). To conclude, we expect our explanatory variable TAX to have a significant negative impact on FDI flows.

5.6 Stock market value and institutional environment

5.6.1 The "Fire-Sale" FDI hypothesis

Krugman (2000) described the "Fire-Sale" FDI mechanism referring to the Asian crisis between 1997 and 1998. During these years, FDI flows to Asian countries rose steeply, while domestic investments fell. Krugman maintains there are two main reasons: firstly, Asian governments cancelled the old policies against foreign investments, opening Asian borders to FDI inflows (this was because of IMF pressure as well as the local firms' urgent need for liquidity). At the same time, foreign multinationals started to look with interest at Asian firms, because of assets available at "Fire-Sale" prices. This led to a steep increase in FDI inflows, particularly through mergers and acquisitions. Kugman provides some real-world examples to confirm this: for instance, General Motors and Ford wanted to increase their presence in South Korea in 1998, acquiring stakes in automobile manufacturers; Procter & Gamble bought a substantial share of Ssanyong Paper Co., and so on. This happened because the local firms could not pay back their short-term debts and, to avoid bankrupcy, they had to sell their stakes to foreign investors. Foreign multinationals, with no liquidity problems (because they were not affected by the crisis), could buy local firms for lower prices than in a non-crisis situation, exploiting their bargaining power.

The discussion becomes even more interesting when speaking about the recent wider financial crisis. From the explanation above, one can assume that the evidence about the Asian crisis also refers to the recent one. But there are some critical differences that change expectations. During the Asian crisis foreign investors had no liquidity constraints, whereas the actual crisis has hit the majority of countries worldwide. Moreover, referring to Poulsen and Hufbauer (2011), the recent crisis started in western developed countries. In contrast with previous local crises, the global financial crisis substantially reduced the total amount of FDI. Referring to our sample of countries, this happened bacause all the OECD economies were affected, resulting in generalized liquidity constraints due to limited access to credit and balance sheet deterioration (Poulsen and Hufbauer, 2011). Thus, multinationals have been unable to buy foreign assets. All the FDI components have fallen during the crisis: multinationals repatriated foreign affiliates' profits, intercompany loans

dropped steeply and equity investments followed the same trend. The reduction in equity investments is the worst signal of the crisis, as it indicates that long-term projects are interrupted. To some extent, this reflects the multinationals' worry about the duration of the crisis (Poulsen and Hufbauer, 2011). To sum up, multinationals have reallocated their activities towards countries less affected by the crisis and sharply cut new investments. Finally, because of the critical economic and financial conditions, managers are guided by caution, leaving aside high-risk projects and looking for safer options (Poulsen and Hufbauer, 2011).

5.6.2 The Hausmann and Fernandez-Arias hypothesis

Referring to Claessens *et al.* (2001), two opposing hypotheses describe FDI movements: at one extreme, it is commonly believed that FDI follows a good financial and institutional environment. However, some authors argue that FDI goes to countries that are financially and institutionally underdeveloped. At a glance, the first hypothesis seems much more likely, since a safer market protects investors, increasing their willingness to invest. But, referring to Hausmann and Fernandez-Arias (2000), this is wrong when comparing FDI with other capital flows. While it is true that the total amount of capital flows goes to financially and institutionally developed countries, at the same time the FDI share of the total capital flows goes in the opposite direction. In other terms, capital flows tend to go less to countries with weaker institutions, but more in the form of FDI. Thus, the overall effect is uncertain. But what are the reasons behind this hypothesis? Hausmann and Fernandez-Arias (2000) argued that multinationals tend to establish foreign affiliates in order to maintain control in countries with weaker institutions. FDI's purpose is acquiring controlling positions rather than transferring capital (Krugman, 2000). Relying on foreign firms through capital flows other than FDI would be riskier, while maintaining a control position can partially overcome a host country's inefficiency. However, several existing papers pointed out that the effect of the institutional indicators on the FDI flows is significantly positive. But, as explained by Globerman and Shapiro (2002), this effect is subject to diminishing returns, so the positive impact on FDI flows is mainly credited to developing or emerging economies. To summarize, capital flows seem to be higher towards institutionally and financially developed countries, but the FDI share goes in the opposite direction. Depending on the magnitude of each effect, FDI and the financial and institutional efficiency of the host country may substitute or complement each other.

This explanation mainly refers to the financial and institutional efficiency of the host economy. However, the stock market price reflects, to some extent, the performance of the host country's firms. We believe that a bad-performing country may attract FDI instead of other capital flows,

since multinationals can directly control the foreign enterprises and reduce inefficiencies. In addition, Aguiar and Gopinath (2005) argued that during a crisis the foreign investors do not bring only liquidity in the local market but increase also trasparency, relationships and management. Thus, also local firms are more willing to attract or maintain foreign investors to improve their efficiency.

5.7 Expected results

Following the arguments and theories presented above, we summarize all the expected signs of the explanatory variables' coefficients in table 5.1.

Table 5.1 – Expected signs

VARIABLES	*FDI FLOWS*
TRADE	+/-
DISTANCE	-
LANGUAGE	+
RELIGION	+
GDP_host	+
GDP_source	+
GDP_growth	+
INFRASTRUCTURE	+
TAX	-
BUSINESS&CONSTRUCTION	-
GOVERNANCE	+/-
S&P INDEX	**-**
S&P INDEX*2008	**+**
S&P INDEX*2009	**+**

Source: Own elaboration.
Notes: (i) the table summarizes expected signs of the explanatory variables on FDI flows.
(ii) main hypotheses are in bold.

The literature always considers the effect of the FDI determinants on the intensive margins of FDI. Only a few recent papers, such as Garrett (2011), analyse the determinants of the extensive margins. Moreover, no comparison has examined investment/disinvestment decisions. This and the expected signs in table 5.1 mainly refer to the intensive margin literature and the interpretations of the authors. But, as our model studies the likelihood of positive FDI flows compared to zeros and negatives, the expected signs might be partially different, following other motivations. Table 5.2 shows the expected effects of the explanatory variables on the likelihood of multinationals choosing positive FDI (or investing), compared to zeros (first column) and negatives (second column). Furthermore, some new considerations affect the results in the second column, while the extensive margins' results are expected to generally follow the explanations above.

Table 5.2 - Expected signs; positive or zero/negative FDI flows

LIKELIHOOD	*ZERO→POSITIVE*	*NEGATIVE→POSITIVE*
TRADE	+/-	+/-
DISTANCE	-	*No*
LANGUAGE	+	*No*
RELIGION	+	*No*
GDP_host	+	+
GDP_source	+	+
GDP_growth	+	+
INFRASTRUCTURE	+	+
TAX	-	-
BUSINESS&CONSTRUCTION	-	*No*
GOVERNANCE	+/-	+/-
S&P INDEX	**-**	**-**
S&P INDEX*2008	**+**	**+**
S&P INDEX*2009	**+**	**+**

Source: Own elaboration.
Notes: (i) the table summarizes expected signs of the explanatory variables on the likelihood of multinationals investing, compared to non-investing (column 1) or disinvesting (column 2). (ii) main hypotheses are in bold.

According to the UNCTAD definition, FDI flows are negative when at least one of the three components of FDI (equity capital, reinvested earnings or intra-industry loans) is negative and not offset by positive amounts of the remaining components. These are instances of disinvestment[2]. Following the OECD definition, in the case of equity, the direct investor may sell all or part of the equity held in the direct investment enterprise to a third party; or the direct investment enterprise may buy back its shares from the direct investor, thereby reducing or eliminating its associated liability. Negative reinvested earnings mean that the dividends paid out by the direct investment enterprise are higher than current recorded income, or that the direct investment enterprise is operating at a loss. Negative intra-industry loans between the direct investor and the direct investment enterprise may be another cause of negative flows[3].

Disinvestment may reflect partial sale of equity, negative reinvested earnings, a loss of the direct investment enterprise or negative intra-industry loans. In all these cases, it implies a previous investment. Thus, we assume that negative flows can exist only where there are already FDI relationships. In other words, we assume first that multinationals decide whether to invest in a foreign country. Then, depending on various factors, the decision to disinvest may follow. Non-

[2] See http://unctad.org/en/Pages/DIAE/Investment%20and%20Enterprise/FDI_Flows.aspx
[3] See http://www.oecd.org/daf/inv/investmentstatisticsandanalysis/fdistatisticsanddata-frequentlyaskedquestions.htm

investing decisions can be taken in every moment. However, this has important implications. We expect the likelihood of investing compared to disinvesting to be affected more by variable factors than by "fixed costs" or stable variables. Therefore, we do not expect the gravity variables to have any real effect, though having a common language or religious affinity may slightly increase the probabilities of a successful relationship with the foreign enterprise. The variable BUSINESS&CONSTRUCTION will be important in the first decision about whether to invest, but is not expected to affect subsequent decisions. On the other hand, we expect the S&P INDEX and the relative interaction terms, GDP_growth and TAX to have the biggest impact in investing/disinvesting choices. The variables TRADE, GDP_host, GDP_source, INFRASTRUCTURE and GOVERNANCE are much more stable, so their impact is expected to be stronger in the first column. However, we expect they play a role in the second column too.

5.8 Main hypotheses

As mentioned before, we believe this is the first attempt in the literature to analyse the host country's stock market valuation as a determinant of FDI, while the other FDI determinants have already been studied several times. Thus, our main hypotheses directly refer to this issue and they are explicitly defined as follows:

Hypothesis 1: Multinationals are more likely to locate in countries with lower stock market prices.

Hypothesis 2: Hypothesis 1 does not hold during the years of the recent financial crisis.

To conclude, as the crisis started at the end of 2008, we expect Hypothesis 2 to be stronger in 2009. In fact, as shown in figures 4.1 and 4.2, the decline of investments (and the rise of disinvestments) peaked in 2009.

6 Results

The data used for the estimation has a gravity structure since bilateral FDI flows are used. We selected 30 OECD countries to analyse bilateral FDI determinants among developed countries. Therefore, we had 29 bilateral observations per country between 2006 and 2011 (T=6). Because of 874 missing values, we dealt with an unbalanced Panel of 4526 total observations. Final results were estimated using Stata12 and reported in tables 6.1 and 6.2.

Table 6.1 - RRR after MNL estimation; invest or non-invest

VARIABLES	**Models**		
	(1)	**(2)**	**(3)**
	RRR	*RRR*	*RRR*
*TRADE^*	1.111*	1.116	1.117
	(0.067)	(0.082)	(0.082)
*DISTANCE^*	0.356***	0.305***	0.301***
	(0.041)	(0.035)	(0.035)
LANGUAGE	8.498**	8.955**	12.253**
	(8.235)	(8.054)	(12.352)
RELIGION	1.0002***	1.0002***	1.0002***
	(0.00003)	(0.00005)	(0.00005)
*GDP_host^*	2.399***	2.405***	2.527***
	(0.214)	(0.252)	(0.301)
*GDP_source^*	1.908***	2.117***	2.113***
	(0.147)	(0.192)	(0.190)
GDP_growth	0.995	1.054**	1.052*
	(0.025)	(0.026)	(0.028)
INFRASTRUCTURE		1.102***	1.106***
		(0.010)	(0.011)
TAX			1.000
			(0.011)
BUSINESS&CONSTRUCTION			0.997*
			(0.002)
GOVERNANCE	7.038***	2.540***	2.123***
	(1.063)	(0.443)	(0.449)
S&P INDEX	**0.989*** **	**0.991** **	**0.991** **
	(0.004)	**(0.004)**	**(0.004)**
S&P INDEX*2008	**1.013** **	**1.008**	**1.007**
	(0.006)	**(0.007)**	**(0.007)**
S&P INDEX*2009	**1.018*** **	**1.019*** **	**1.019*** **
	(0.006)	**(0.006)**	**(0.006)**
Observations	4526	4526	4526
Pseudo R^2	0.1619	0.1878	0.1947

Source: Own elaboration.
Notes: (i) FDI_FLOWS is the dependent variable. (ii) host, source country and time fixed effect are included. (iii) robust standard errors are in parentheses. (iv) *, ** and *** denote significance at 10%, 5% and 1%, respectively. (v) ^ stands for natural log. (vi) main hypotheses are in bold.

Table 6.2 - RRR after MNL estimation; invest or disinvest

VARIABLES	Models		
	(4)	(5)	(6)
	RRR	*RRR*	*RRR*
*TRADE^*	1.021	1.029	1.042
	(0.039)	(0.040)	(0.040)
*DISTANCE^*	1.071	1.060	1.057
	(0.056)	(0.056)	(0.057)
LANGUAGE	1.516***	1.437***	1.351**
	(0.210)	(0.200)	(0.188)
RELIGION	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)
*GDP_host^*	1.140***	1.096**	1.234***
	(0.051)	(0.050)	(0.062)
*GDP_source^*	1.016	1.017	1.009
	(0.044)	(0.044)	(0.044)
GDP_growth	1.077***	1.088***	1.082***
	(0.015)	(0.015)	(0.016)
INFRASTRUCTURE		1.016***	1.010**
		(0.004)	(0.004)
TAX			0.972***
			(0.004)
BUSINESS&CONSTRUCTION			1.000
			(0.001)
GOVERNANCE	0.648***	0.542***	0.433***
	(0.052)	(0.049)	(0.044)
S&P INDEX	**0.994****	**0.994***	**0.994****
	(0.003)	**(0.003)**	**(0.003)**
S&P INDEX*2008	**1.006**	**1.004**	**1.005**
	(0.004)	**(0.004)**	**(0.004)**
S&P INDEX*2009	**1.012*****	**1.013*****	**1.012*****
	(0.004)	**(0.004)**	**(0.004)**
Observations	4526	4526	4526
Pseudo R^2	0.1619	0.1878	0.1947

Source: Own elaboration.
Notes: (i) FDI_FLOWS is the dependent variable. (ii) host, source country and time fixed effect are included. (iii) robust standard errors are in parentheses. (iv) *, ** and *** denote significance at 10%, 5% and 1%, respectively. (v) ^ stands for natural log. (vi) main hypotheses are in bold.

According to the multinomial logit model it is necessary to estimate the relative risk ratios (RRRs) in order to interpret the magnitude of the coefficients and it is important now to understand how to deal with them. As already explained, the relative risk is the probability of choosing the alternative over the probability of choosing the benchmark. If RRR>1 the probability of selecting the alternative compared to the probability of selecting the benchmark increases with the explanatory variable. On the other hand, if RRR<1 the probability of selecting the alternative compared to the benchmark decreases with an increase of the explanatory variable.

If RRR > (<) 1 an increase in the explanatory variable increases (reduces) the multinationals' likelihood of investing, compared to the benchmark option. In table 6.1, we use the "ZERO" (non-invest) outcome as the benchmark, while in table 6.2 we use the "NEGATIVE" (disinvest) outcome as the comparison group. Moreover, models 1 and 4 are the basic models. Finally, to check for robustness, we added INFRASTRUCTURE as a control variable in models 2 and 5 and BUSINESS&CONSTRUCTION and TAX in models 3 and 6.

6.1 FDI and trade

The variable TRADE is only significant in model 1 (table 6.1), at 10% level. A unit increase in the log of TRADE increases the probability of investing relative to non-investing by about 11%, holding all the other variables in the model constant. Then, when checking for robustness in models 2 and 3, TRADE is not significant any more. It is not significant at all in table 6.2, indicating that bilateral exports do not affect the multinationals' investing/disinvesting decisions. Referring to the expected results, several factors may cause substitution or complementarity between goods and factors movements; one explanation is that they overcome each other, resulting in a null effect. However, the explanation that factors other than bilateral trade affect multinationals' location choices among OECD countries is more reliable.

6.2 Gravity variables

As expected, the variables DISTANCE, LANGUAGE and RELIGION are significant in table 6.1 but not in Table 6.2. They also have the expected signs. Holding all the other variables in the model constant, a unit increase in the log of DISTANCE reduces the relative risk of investing compared to non-investing by about 65% in model 1 and 70% in models 2 and 3. The coefficient of the variable LANGUAGE indicates that if a country-pair has a common language, the probability of investing relative to non-investing increases by a factor of approximately 8.5 in model 1, 9 in model 2 and 12 in model 3. The effect of the dummy variable LANGUAGE is significant at 5% level. Finally, a unit increase in RELIGION increases the likelihood of the multinationals investing. The effect is significant in all the models in table 6.1 at 1% level, but only very limitedly. On the other hand, only LANGUAGE is significant in table 6.2, while the other gravity variables do not affect multinationals' investing/disinvesting decisions. LANGUAGE is significant at 1% level in models 4 and 5 and 5% in model 6. However, the impact is much lower than in the first table. Sharing a language increases the probability of investing relative to disinvesting by about 50%, 55% and 65% in models 4, 5 and 6, respectively (holding all the other variables constant).

6.3 Market size and economic growth

GDP_host is robust in both the tables, indicating that the host country's market size plays an important role in all the multinationals' decisions. GDP_source is significant and robust in table 6.1, but not in table 6.2, meaning that the source country's market size is a key factor for extensive margins of FDI, but not for investing/disinvesting decisions. GDP_growth has a stronger impact and significance on investment/disinvestment decisions than on the extensive margins. In detail, a unit increase in the log of GDP_host reduces the relative risk of disinvesting compared to investing by about 14%, 10% and 23% respectively in models 4, 5 and 6 (holding all the other variable constant); while it reduces the relative risk of non-investing compared to investing by a factor of approximately 2.5 (about 150%) in models 1, 2 and 3. GDP_host is significant at 1% level in all the models, except for a 5%significance in model 5. GDP_source is significant at 1% level in models 1, 2 and 3 and a unit increase in the log of GDP_source raises the probability of investing compared to non-investing by about 100%. It is not significant in table 6.2. GDP_growth positively affects multinationals' likelihood of investing rather than disinvesting and is always significant at 1% level in table 6.2. A unit increase in GDP_growth (1% increase) reduces the relative risk of disinvesting compared to investing by about 8%, while the probability of investing relative to non-investing increases by 5%. Moreover, GDP_growth is not significant in model 1, is significant at 5% in model 2 and at 10% in model 3, proving not to be very robust.

6.4 Infrastructure

The variable *INFRASTRUCTURE* is not included in models 1 and 4, since is it used for a robustness check of the other variables. The interpretation of the coefficient is valid for the remaining models. INFRASTRUCTURE is significant at 1% in models 2, 3 and 5 and at 5% in model 6. The signs are as expected, reflecting the fact that better host country infrastructures make the multinationals more likely to invest. A unit increase in INFRASTRUCTURE increases the relative risk of investing compared to non-investing by a factor of approximately 1,10; in table 6.2 it reduces the probability of disinvesting relative to investing by about 2% and 1% in models 5 and 6.

6.5 Business environment

The variables TAX and BUSINESS&CONSTRUCTION are also used as control variables and appear only in models 3 and 6. As expected, their impact on the likelihood of investing is generally negative. But BUSINESS&CONSTRUCTION is only significant in model 3, while TAX is only significant in model 6. A unit increase in BUSINESS&CONSTRUCTION (1% increase) reduces

the probability of investing compared to non-investing by about 0.3%. A 1% increase in TAX raises the relative risk of disinvesting compared to investing by about 3%. TAX is significant at 1% level, while BUSINESS&CONSTRUCTION is only significant at 10%. The results about business environment are in line with our previous arguments. Thus, the ease of starting a business can be interpreted as a fixed cost of FDI, while taxes on profits are variable costs, affecting investment/disinvestment decisions.

6.6 Institutional environment

Results about GOVERNANCE are controversial and hard to interpret. It seems that a better institutional environment attracts more FDIs, but at the same time sustains such investments worse. In other terms, better institutions decrease the likelihood of multinationals non-investing, but increase the likelihood of disinvesting too. In detail, a unit increase in GOVERNANCE increases the probability of investing relative to non-investing by a factor of about 7.0, 2.5 and 2.1 in models 1, 2 and 3. On the other hand, it increases the relative risk of disinvesting compared to investing by about 35%, 46% and 57% in models 4, 5 and 6. GOVERNANCE is significant at 1% level in all the models. The composition of the variable GOVERNANCE partially answers to its controversial results, since it is an average of six indicators and the total effect may be misleading. However, a possible interpretation is presented in the discussion (section 6.8).

6.7 Stock market value

Multinationals generally invest more in the countries that are performing worse in terms of stock market prices, though during the first years of the crisis the trend was consistently reduced. A unit increase in S&P INDEX (1% increase) reduces the probability of investing relative to non-investing by about 1%, holding all the other variables in the model constant; while it reduces the relative risk of investing compared to disinvesting by approximately 0.6%. The S&P INDEX is always significant at different levels.

Interpretation of the S&P INDEX during the years of the crisis is more complicated, as interpreting interaction terms in non-linear models raises some issues. It is not possible to interpret the coefficient directly, but the interpretation of the S&P INDEX*2009 in table 6.1 is as follows: the effect of an increase in the S&P INDEX on the relative risk of investing compared to non-investing is about 2% lower in 2009. In table 6.2 the effect of an increase in the S&P INDEX is about 1.2% lower in 2009. The S&P INDEX*2009 is significant at 1% level in all models. However, the S&P INDEX*2008 is only significant in model 1, but it does not pass the robustness check.

Hypothesis 1 is directly tested and confirmed. Hypothesis 2 cannot be directly tested because of the nature of our model. But it can be said that in 2009 the likelihood of the multinationals investing in countries performing poorly on the stock market was lower. To some extent, therefore, hypothesis 2 is partially confirmed.

6.8 Discussion

These results are generally in line with our expectations. They suggest that the "fixed costs" of investing (such as the ease of starting a business and dealing with construction permits, and geographical and cultural affinity) are important factors in the extensive margin decisions, but not in investing/disinvesting choices. Moreover, more volatile variables (such as the total tax rate and economic growth) have a stronger effect on investing/disinvesting choices than on the extensive margins, while more stable variables (such as market size and infrastructures) have a much weaker impact in table 6.2 than in table 6.1. We argue that multinationals try to take all factors into account before investing in a host country, so that their disinvestment choices depend more on variable and unpredictable determinants.

Overall, the explanatory variables have the expected signs. Larger market size, faster economic growth, better infrastructures, and geographical, cultural and religious proximity, all increase the likelihood of multinationals investing. On the other hand, higher taxes and costs of starting a business reduce foreign investments likelihood. Additionally, the institutional effect is controversial. It seems that better institutions attract new FDI, but sustain existing ones worse. However, results can be interpreted as follows. First, foreign multinationals invest in less efficient countries to overcome local inefficiencies (Hausmann and Fernandez-Arias (2000)). But disinvestments are then more likely to arise in countries with weaker institutions, since multinationals are not locally supported.

Results suggest that multinationals are more likely to locate in countries with lower stock market prices, but in 2009 this trend was consistently reduced. Thus, our hypotheses are confirmed. This may indicate two possible multinational behaviours: first, they may be more willing to maintain a controlling position in less efficient firms to overcome inefficiencies; second, they may be attracted by poorly performing firms where they can buy them at lower prices. In 2009 the latter mechanisms are weaker, since the global crisis substantially reduced the multinationals' liquidity and global foreign investments dropped steeply. Bankruptcies and big losses boosted disinvestments. In view

of the strength of the crisis, even multinationals that were less affected reallocated their assets towards low-risk countries.

6.9 Robustness tests

The MNL model assumes that results for each pair of alternatives do not depend on the other outcomes available. In other words, deleting one alternative should not affect the remaining results. This assumption is known as the IIA (Independence of irrelevant alternatives). To test it we used the Hausman test and results are reported in table 6.3.

Table 6.3 - Hausman test of IIA assumption

Omitted alternative	*Chi^2*	*p value*	*Evidence*
"POSITIVE"	114.411	0.000	Against H_0
"NEGATIVE"	10.381	0.239	For H_0
"ZERO"	0.959	0.998	For H_0

Source: Own elaboration.
Notes: (i) H_0= IIA assumption; in other words, deleting the alternative does not affect remaining results.

The IIA assumption is rejected when the "POSITIVE" outcome is omitted. In the empirical analysis, however, the "POSITIVE" alternative is never omitted, so that this negative result is not a concern. The exclusion of the "ZERO" and "NEGATIVE" outcomes does not affect the remaining results (IIA assumption is not rejected) and the MNL model can therefore be used. Furthermore, likelihood ratio tests were used to test whether it is possible to combine two outcome categories. Results are reported in table 6.4.

Table 6.4 - LR tests for combining outcome categories

Categories tested	*Chi^2*	*p value*	*Evidence*
"POSITIVE" and "NEGATIVE"	215.807	0.000	Against H_0
"POSITIVE" and "ZERO"	1218.371	0.000	Against H_0
"ZERO" and "NEGATIVE"	1048.695	0.000	Against H_0

Source: Own elaboration.
Notes: (i) H_0= variables do not differentiate between categories; in other words, it is possible to combine the categories.

We reject the null hypotheses that the variables do not differentiate between the categories, so we cannot combine them. This result is particularly important, since it highlights the necessity to differentiate between zero and negative FDI flows. Moreover, the fixed effects included in the estimation partially solve the problem regarding potentially omitted variables, while the robust

standard errors eliminate possible heteroskedasticity. In addition, the Wooldridge test for autocorrelation in panel data was performed. The null hypothesis that there is no first order autocorrelation is not rejected (p value = 0.105). Finally, the Wald tests for the main hypotheses were run and results are reported in tables 6.5 and 6.6.

Table 6.5 - Wald test hypothesis 1

Null hypothesis	***Chi^2***	***p value***	***Degrees of freedom***
S&P INDEX=0	7.074	0.029	2

Source: Own elaboration.

Table 6.6 - Wald test hypothesis 2

Null hypothesis	***Chi^2***	***p value***	***Degrees of freedom***
S&P INDEX*2009=0	16.028	0.000	2

Source: Own elaboration.

7 Conclusion

The purpose of this study was to investigate the determinants of FDI among OECD countries between 2006 and 2011. In particular, the stock market valuation of the host economy is included as a new determinant of FDI. The first hypothesis tests whether FDI flows and stock market valuation of the host country are complementary or substitute for each other. The second hypothesis tests the first hypothesis during the recent financial crisis (2008/09). Finally, in order to include zero and negative FDI flows in the estimation, the multinomial logit (MNL) model is used.

The results show statistically significant evidence that the likelihood of multinationals investing, compared to non-investing or disinvesting, is generally higher in countries performing worse in terms of stock market prices. However, in 2009 this trend substantially decreased. The results suggest that the "Fire-Sale" FDI hypothesis can be generalized as "business as usual" and that multinationals invest more in less efficient countries in order to overcome local inefficiencies. However, during the recent financial crisis this was no longer true. The crisis was in fact global and affected the majority of countries. Difficult access to credit and deterioration of balance sheets reduced multinationals' capacity to invest, while the very poor economic and financial conditions reduced their propensity to invest. Existing assets were reallocated towards low-risk countries, new investment fell and disinvestment increased.

The problem with zero and negative FDI flows is that they are usually excluded from econometric models, since FDI flows need logarithms. The Helpman *et al.* (2008) approach solves the problem of the exclusion of zero FDI flows, but the literature has never provided an exhaustive solution for the negative values. In line with Helpman *et al.*, we proposed an extension of their analysis so as to include zeros as well as negatives. The MNL model can be seen as an extension of their first-stage probabilistic estimation, where the dependent variable (FDI flows) has three possible outcomes (for positive, negative and zero flows). However, this presents some limitations. The MNL model tells us how the FDI determinants affect the likelihood of multinationals investing, compared to disinvesting or non-investing, but does not analyse intensive margins of FDI. To do that, according to Helpman *et al.*, one should calculate the "Mill's ratio" of the multinomial model and include it in the second-stage regression. This way zero and negative values would be included and extensive and intensive margins would all be analysed.

The exclusion of negative flows, particularly during the recent financial crisis, may result in selection bias, compromising the effectiveness of the results. Moreover, results suggest that zero and negative values cannot be combined in one category. Thus, we believe it is essential to include zero and negative flows in the estimation and to differentiate them. This is important to enable the authorities to gain a deeper understanding of the FDI determinants. While analysis of investing/non-investing decisions is useful to configure policies to attract new investments, understanding the determinants of investing/disinvesting is essential to sustain existing ones.

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Appendix A. Country list

Table A.1 - Country List

OECD countries		
Australia	Hungary	Norway
Austria	Iceland	Poland
Belgium	Ireland	Portugal
Canada	Italy	Slovak Republic
Czech Republic	Japan	Spain
Denmark	Korea, Republic	Sweden
Finland	Luxembourg	Switzerland
France	Mexico	Turkey
Germany	Netherlands	United Kingdom
Greece	New Zealand	United States

Source: Own elaboration.

Appendix B. Final results with deflated variables

For the sake of comparison results in real terms are reported in tables C.1 and C.2. The variables GDP_host and TRADE are deflated by the GDP deflator of the host country, GDP_source by the GDP deflator of the source country. FDI_FLOWS has the same values in nominal and real terms, because of its qualitative transformation for the MNL model.

Table B.1 - RRR after MNL estimation with deflated variables; invest or non-invest

VARIABLES	**Models**		
	(1)	**(2)**	**(3)**
	RRR	*RRR*	*RRR*
TRADE^+	1.145**	1.132*	1.136*
	(0.068)	(0.081)	(0.081)
*DISTANCE^*	0.376***	0.314***	0.313***
	(0.043)	(0.036)	(0.035)
LANGUAGE	8.389**	8.623**	10.711**
	(8.111)	(7.668)	(10.337)
RELIGION	1.0002***	1.0002***	1.0002***
	(0.00003)	(0.00005)	(0.00005)
GDP_host^+	2.116***	2.215***	2.289***
	(0.173)	(0.219)	(0.256)
GDP_source^+	1.809***	2.063***	2.050***
	(0.138)	(0.183)	(0.181)
GDP_growth	0.999	1.062**	1.062**
	(0.026)	(0.026)	(0.028)
INFRASTRUCTURE		1.106***	1.109***
		(0.010)	(0.011)
TAX			1.000
			(0.011)
BUSINESS&CONSTRUCTION			0.998
			(0.002)
GOVERNANCE	6.087***	2.167***	1.851***
	(0.869)	(0.370)	(0.399)
S&P INDEX	**0.988*** **	**0.991** **	**0.991** **
	(0.004)	**(0.004)**	**(0.004)**
S&P INDEX*2008	**1.012** **	**1.006**	**1.006**
	(0.006)	**(0.007)**	**(0.007)**
S&P INDEX*2009	**1.019*** **	**1.020*** **	**1.021*** **
	(0.006)	**(0.006)**	**(0.006)**
Observations	4526	4526	4526
Pseudo R^2	0.1591	0.1866	0.1933

Source: Own elaboration.
Notes: (i) FDI_FLOWS is the dependent variable. (ii) host, source country and time fixed effect are included. (iii) robust standard errors are in parentheses. (iv) *, ** and *** denote significance at 10%, 5% and 1%, respectively. (v) ^ stands for natural log. (vi) + denotes deflated variable. (vii) main hypotheses are in bold.

GDP deflator data are available in the World Bank database. From tables 6.1, 6.1, C.1 and C.2 it is clear that results are comparable. There are only two differences: TRADE in table C.1 is significant at 10% level in models 1, 2 and 3, while in table 6.1 is only significant in model 1; BUSINESS&CONSTRUCTION is significant in table 6.1 but not in table C.1.

Table B.2 - RRR after MNL estimation with deflated variables; invest or disinvest

VARIABLES	**Models**		
	(4)	**(5)**	**(6)**
	RRR	*RRR*	*RRR*
TRADE^+	1.021	1.027	1.042
	(0.039)	(0.039)	(0.040)
*DISTANCE^*	1.070	1.057	1.057
	(0.056)	(0.056)	(0.057)
LANGUAGE	1.516***	1.437***	1.351**
	(0.210)	(0.200)	(0.188)
RELIGION	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)
GDP_host^+	1.138***	1.096**	1.227***
	(0.050)	(0.049)	(0.059)
GDP_source^+	1.017	1.020	1.010
	(0.044)	(0.044)	(0.044)
GDP_growth	1.078***	1.089***	1.083***
	(0.015)	(0.016)	(0.016)
INFRASTRUCTURE		1.016***	1.010**
		(0.004)	(0.004)
TAX			0.972***
			(0.004)
BUSINESS&CONSTRUCTION			1.000
			(0.001)
GOVERNANCE	0.645***	0.539***	0.428***
	(0.052)	(0.049)	(0.044)
S&P INDEX	**0.994****	**0.994****	**0.994****
	(0.003)	**(0.003)**	**(0.003)**
S&P INDEX*2008	**1.006**	**1.004**	**1.005**
	(0.004)	**(0.004)**	**(0.004)**
S&P INDEX*2009	**1.012*****	**1.013*****	**1.013*****
	(0.004)	**(0.004)**	**(0.004)**
Observations	4526	4526	4526
Pseudo R^2	0.1591	0.1866	0.1933

Source: Own elaboration.
Notes: (i) FDI_FLOWS is the dependent variable. (ii) host, source country and time fixed effect are included. (iii) robust standard errors are in parentheses. (iv) *, ** and *** denote significance at 10%, 5% and 1%, respectively. (v) ^ stands for natural log. (vi) + denotes deflated variable. (vii) main hypotheses are in bold.