

REGULAR ARTICLE

FDI Determinants in Developing Countries: A Firm-Level Analysis

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ABSTRACT

Foreign direct investment (FDI) has been an important driver of economic growth in developing countries. Between 2005 and 2017, FDI grew significantly in developing countries as the corresponding global growth rate of FDI inflows is around 32 percentage points higher than the world growth rate. The purpose of this paper is to analyze FDI determinants at the firm level in developing countries. Using a sample of 96,826 firms from 125 countries between 2005 and 2017, we adopt a fractional probit regression with endogenous covariates, a more suitable estimation method for addressing the FDI variable. The micro-level results show that exports, investment, and human capital have a statistically positive impact on FDI inflows, while credit barriers and taxes have a negative effect. Also, market size and resources foster FDI, whereas inflation and environmental emissions lower foreign investment levels. This study demonstrates that governments wishing to attract FDI should adopt a variety of policies, including the promotion of international trade and measures that boost investment and human capital in firms and ease the access to credit.

JEL Classification: F21, F23, C25, O12

1 | Introduction

Foreign direct investment (FDI) has been a crucial determinant of economic growth in developing economies. FDI allows for better technology diffusion to host countries, increases management skills through imitation effects, allows for the development of import and export networks, and boosts productivity. Several studies have described the impact and mechanisms of FDI on economic growth (e.g., see De Mello 1997; Lipsey 2000; Colen, Maertens, and Swinnen 2009).

There has been a significant increase in FDI inflows in developing countries in the last two decades, as described in Figure 1. Between 2005 and 2017, the global growth rate of FDI inflows in

the world was 79.43% while in developing countries this growth rate reached 111.48%. Also, the average annual growth rate of FDI in the world in the same period is equal to 4.99%, while in the developing countries, it is equal to 6.44% (UNCTAD 2020).

Given the relevance of FDI on economic development, it is paramount to understand why some countries attract higher FDI inflow levels than others. Identifying factors that attract FDI is relevant, allowing the usage of this information by governments who may formulate policy mixes more suitable to attract FDI to their countries.

This paper contributes to the literature on FDI determinants in several ways. Firstly, we use data at the firm level to evaluate

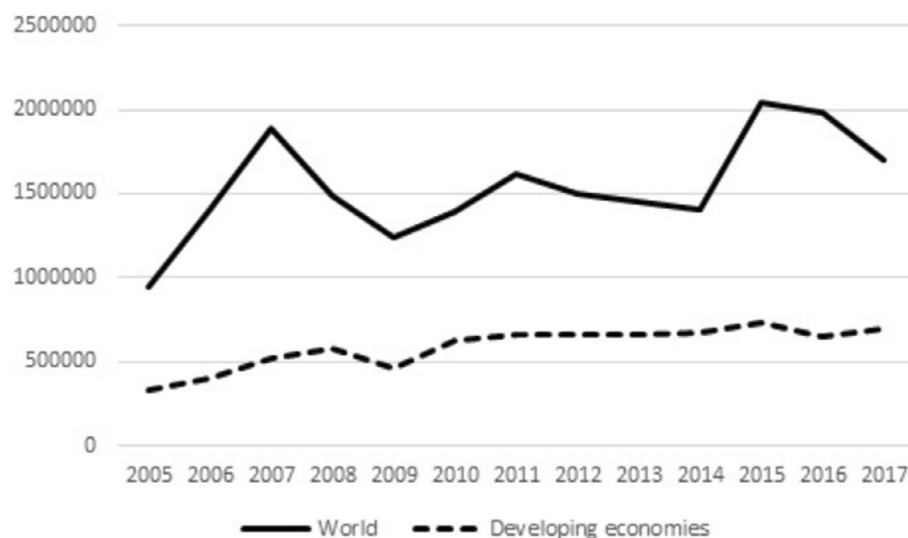


FIGURE 1 | Foreign direct investment inflows, 2005–2017 (millions of USD in current prices). *Source:* UNCTAD statistics.

FDI determinants in developing countries. While the literature generally uses data at the country level, we consider that microdata may uncover some relevant relationships between the key variables. Also, we use the World Bank Enterprise Surveys (WBES), having a rich sample of 96,826 firms from 125 countries from 2005 to 2017. The WBES is a high database quality with detailed information on a significant number of countries and firms, allowing for the characterization of FDI and its determinants at the firm level. Finally, considering that FDI is typically measured in percentage (e.g., of Gross Domestic Product (GDP)), we use an estimation method that has not been employed in this literature to the best of our knowledge. Considering the nature of the dependent variable (FDI), we apply a fractional approach instead of conventional methods that consider either that FDI is a boundless, continuous variable or with a binary outcome.

The paper is structured as follows. Section 2 describes the literature review on FDI determinants. Section 3 presents the data and methodology. Section 4 discusses the results. Finally, Section 5 concludes the paper.

2 | Literature Review

The empirical literature on FDI determinants has analyzed the relevance of diverse variables included in several theoretical approaches, namely, the OLI paradigm (e.g., Dunning 1977, 1979), which emphasizes variables such as human capital, infrastructures and economic stability; the institutional approach (e.g., Root and Ahmed 1978; Bond and Samuelson 1986; Grubert and Mutti 1991), considering, among other variables, political instability, financial and fiscal incentives; the new trade theory (e.g., Dixit and Grossman 1982; Krugman 1983; Helpman 1984, 1985), which, for instance, underlines the role of market size, factor endowments and openness to trade¹. This paper aims to discover the FDI micro and macro determinants such as economic factors, infrastructure, institutional-political factors, natural resources, and the human factor in line with the literature.

It is widely known that openness to trade might stimulate the attraction of foreign investments. Therefore, trade is found to be

a factor with a positive impact on foreign investment. Almost all of the studies obtained a positive and statistically significant result (e.g., Asiedu 2006; Botrić and Škuflić 2006; Cleeve 2008; Mhlanga et al. 2010; Kok and Ersoy 2009; Kersan-Skabic 2013; Noorbakhsh et al. 2001), while the remaining papers (e.g., Mohamed and Sidiropoulos 2010; Vijayakumar et al. 2010) suggest that the impact of trade openness on FDI is not statistically significant. Thus, we formulate the following hypothesis:

Hypothesis 1. *Openness to trade has a positive impact on FDI.*

Another determinant of FDI is the infrastructure facilities, such as energy supply, communication facilities and transportation. It affects production and transaction costs, thus influencing incentives for FDI attraction into a country or region. As such, we may expect a positive and significant impact of investment in infrastructures on FDI. For example, electric power is crucial for efficiency-seeking FDI. However, Kok and Ersoy (2009) work did not obtain any significant results. Khachoo and Khan (2012) used the same indicator in logarithmic form and showed a significantly positive relationship between this variable and FDI inflows. Also, telephone mainlines is a determinant that may represent communication facilities; for example, Kok and Ersoy (2009) discovered a strong positive effect. Mateev (2009) proposes a generalizing approach for the infrastructure factor, using the EBRD Index of Infrastructure Reform. Du et al. (2012) also used a proxy for the infrastructure determinant as the highway density, which had a significant positive impact. Thus, although some studies report that infrastructures have no impact on FDI (e.g., Cleeve 2008; Mohamed and Sidiropoulos 2010), the majority of the papers conclude that investment in infrastructures has a positive, significant impact on FDI (e.g., Kok and Ersoy 2009; Asiedu 2006; Biswas 2002; Mhlanga et al. 2010; Vijayakumar et al. 2010; Khachoo and Khan 2012). Based on the identified relationships, we test the hypothesis:

Hypothesis 2. *Investment in infrastructures boosts FDI.*

One of the most important factors that affect the decisions regarding the location of FDI is the human factor. Human capital

allows for an improvement in the firm's productivity and facilitates innovation (Brooks et al. 2010), so we expect a positive relationship between human capital and FDI. Several pieces of research present education or human capital as a relevant factor of FDI. Noorbakhsh et al. (2001) used three variables to capture the effect of human capital. Mateev (2009) used the percentage of the labour force that possesses tertiary or higher education as a literacy proxy. Arbatli (2011); and Du, Lu, and Tao (2012) apply the factor called education. The first paper uses the average years of school attainment as a proxy, while the second one uses the ratio of the number of students enrolled in higher education institutions to the total population. Some of the studies obtained significant results, claiming a positive influence of Education on FDI flows (e.g., Asiedu 2006; Cleeve 2008; Noorbakhsh et al. 2001; Arbatli 2011; Du, Lu, and Tao 2012), while others suggest that human capital has no significant impact on FDI (e.g., Schneider and Frey 1985; Cleeve 2008; Mateev 2009). Given these results, the premise to be considered is:

Hypothesis 3. *Human capital fosters FDI.*

Domestic credit is another factor in FDI that describes the financial market and capital availability. It reflects the amount of credit provided to private sectors and may significantly impact cross-border investment (Korgaonkar 2012). Some studies show that broader financial markets are more attractive for foreign investors (e.g., Jurcau, Andreicovici, and Matis, 2011), arguing that banking sector reforms and credit are crucial to attracting FDI (e.g., Bevan, Estrin, and Meyer, 2004). While most studies report a positive, significant effect of domestic credit on FDI (e.g., Aqeel, Nishat, and Bilquees, 2004; Havrylchyk and Poncet 2007; Klein, Peek, and Rosengren 2000; Asiedu 2002; Nasser and Gomez 2009), this result is not consensual as there are papers that conclude that domestic credit has a negative impact on FDI or plays no significant role in attracting foreign inflows (e.g., Zakaria 2007; Anyanwu and Erhijakpor 2004). Hence, we conjecture that:

Hypothesis 4. *Barriers to credit decrease FDI.*

The political environment—such as political regime, stability, risk, and others—influences uncertainty in the process of making decisions about FDI. The institutional environment impacts investors' costs, protects their interests, and, thus, affects foreign investment decisions. As such, we expect that political instability has a negative impact on FDI (Bénassy-Quéré et al. 2007). Some papers include political instability as an FDI determinant, but the results are not unanimous (e.g., see Henisz 2000; Tang 2012; Jiménez et al. 2011). Using a variety of proxies for political instability (e.g., risk of expropriation, government credibility to honor agreements, the rule of law, bureaucracy, corruption, number of insurrections and assassinations), most studies conclude that there is a negative effect on FDI (e.g., Schneider and Frey 1985; Asiedu 2006; Mohamed and Sidiropoulos 2010; Biswas 2002). However, some papers report a non-significant impact of political instability on FDI (e.g., Cleeve 2008) or even a positive relationship between the two variables (e.g., Mhlanga et al. 2010). Nevertheless, we suppose that:

Hypothesis 5. *Political instability has a negative effect on FDI.*

Corporate tax rates are another driver of FDI flows. It directly influences foreign investment returns and, hence, investors' decisions when initiating foreign investment. Thus, higher host country's tax rates may discourage FDI inflows. However, the literature has provided contradicting evidence about the role of tax rates on FDI: while Bellak and Leibrecht (2009), Arbatli (2011) and Tang (2012) found a significantly negative relationship between corporate tax rates and FDI flows, Cleeve (2008) found that tax rates do not have a statistically significant impact on foreign inflows, regardless of the proxies used for tax rates (e.g., tax incentives, tax exemptions, repatriation of profits). Also, Root and Ahmed (1978) obtained mixed results, with some of the proxies for tax rates suggesting a negative impact on FDI, while others have no significant effect. Still, we infer that:

Hypothesis 6. *High taxes reduce FDI.*

The natural resource abundance may be a factor which attracts FDI (Kekic 2005 and Gauselmann, Knell, and Stephan 2011). In order to minimize costs and ease access to relevant production factors, firms may be willing to invest in countries rich in natural resources as natural resources of better quality and/or lower cost than those available at the domestic market may be key to firm competitiveness (Dunning and Lundan 2008). In fact, the impact of the natural resources on the FDI-growth relationship may be through capital accumulation in the resource sector (Poelhekke and van der Ploeg 2013). Several studies have investigated the role of natural resources on FDI and, as expected, most studies found a positive and significant impact of the former variable on the latter (e.g., Asiedu 2006; Mohamed and Sidiropoulos 2010; Cheung and Qian 2009; Deichmann et al. 2003; Ledyeva 2009). Various proxies for natural endowments have been considered: the weight of resources—such as fuel (Mohamed and Sidiropoulos 2010), as well as minerals (Asiedu 2006) and ores (Cheung and Qian 2009)—in total exports; the industrial production index for oil and natural gas (Ledyeva 2009); the (weak, moderate, high) intensity of natural resources endowment (Deichmann et al. 2003); a dummy variable for investment in extractive industry (Mhlanga et al. 2010). Although the vast majority of papers concludes for a positive relationship between natural resources and FDI, Mhlanga et al. (2010) show that resources endowments have no statistical impact on FDI. Also, Asiedu and Lien (2011) argue that natural resources may result in lower levels of FDI inflow in the non-resource tradable sector of the economy and Asiedu (2006) suggests that foreign investment does not have technology transfers and positive spillovers of job creation because countries that are rich in resources may attract FDI to natural resource activities. Given the above discussion, we will check if:

Hypothesis 7. *Natural resources promote FDI.*

A main macroeconomic factor that is considered to determine FDI is market size. The market size may be a relevant variable to consider in the analysis as larger markets attract higher FDI levels, namely market-seeking FDI (Dunning and Lundan 2008). Many studies included in the analysis of the FDI determinants variables such as market size (e.g., Mateev 2009; Riedl 2010; Sharma and Bandara 2010; Khachoo and Khan 2012), economic size (e.g., Tang 2012), the size of the economy (e.g., Jurcau et al. 2011), or the size of the domestic market (e.g., Arbatli 2011).

In most of the studies, the proxy used for the market size is the GDP (e.g., Asiedu 2006; Mohamed and Sidiropoulos 2010; Vijayakumar et al. 2010; Botrić and Škuflić 2006; Hayakawa, Lee, and Park, 2013; Kersan-Skabic 2013), although there are differences across papers: Sharma and Bandara (2010) and Riedl (2010) used the level of GDP in currency units, Mateev (2009), Cleeve (2008) and Kersan-Skabic (2013) applied GDP per capita, and others use the natural logarithm of GDP (Tang 2012; Jurcau et al. 2011). Proxies other than based on the GDP have also been considered: Schneider and Frey (1985) and Mhlanga et al. (2010) use the Gross National Product (GNP) and Botrić and Škuflić (2006) and Mohamed and Sidiropoulos (2010) use the number of inhabitants to measure market size. Almost all of the results point out that there is a significant positive effect of market size on FDI flows. Only Arbatli (2011) and Botrić and Škuflić (2006) shows a meaningful negative relationship between market size and FDI inflows. Mohamed and Sidiropoulos (2010) reveal that the number of inhabitants has no statistical effect on FDI. According to the above discussion, we suggest that:

Hypothesis 8. *Market size augments FDI.*

Another macroeconomic determinant that is considered to affect foreign investment is economic stability. A country with price stability and the balance of payments equilibrium can attract a higher FDI level (Cleeve 2008; Assunção et al. 2013). Many studies use inflation as a proxy for economic stability (e.g., Schneider and Frey 1985; Asiedu 2006; Vijayakumar et al. 2010; Kok and Ersoy 2009; Mhlanga et al. 2010; Mohamed and Sidiropoulos 2010; Kersan-Skabic 2013), as high or volatile inflation values suggest there is macroeconomic instability in the country, which may reduce FDI inflows (Botrić and Škuflić 2006). Some studies measure economic stability using the balance of payments deficit (e.g., Schneider and Frey 1985; Botrić and Škuflić 2006), as it may imply the existence of restrictions to free movements of capital across countries, therefore reducing FDI inflows, as firms may not be able to repatriate its profits (Schneider and Frey 1985). Other proxies for economic stability have been considered, namely the unemployment rate (e.g., Botrić and Škuflić 2006), the nominal exchange rate (e.g., Cleeve 2008) or the financial sector development index (e.g., Mohamed and Sidiropoulos 2010). The results are somewhat mixed, with some of the studies implying a negative impact of inflation on foreign investment (e.g., Schneider and Frey 1985; Asiedu 2006; Kok and Ersoy 2009; Mohamed and Sidiropoulos 2010), while others consider a non-significant impact (e.g., Vijayakumar et al. 2010; Mhlanga et al. 2010) or even a positive effect of inflation on FDI inflows (e.g., Kersan-Skabic 2013). Schneider and Frey (1985) report a negative impact of balance of payments deficit on FDI inflows, while Botrić and Škuflić (2006) conclude that this effect is positive. The results also suggest that the nominal exchange rate (Cleeve 2008) and the financial sector development index (Mohamed and Sidiropoulos 2010) positively impact foreign investment. Considering the different outcomes of previous research, we want to check the following assumption:

Hypothesis 9. *Macroeconomic stability stimulates FDI.*

Environmental regulation and pollution emissions may represent another FDI driver. To avoid strict environmental

regulations, which imply costs to firms, firms may opt to invest in countries where laws are not as rigid and/or pollution emissions are not significant (Chung 2014). While this rationale may be theoretically sound, the empirical evidence has produced conflicting results. Some of the studies suggest that less strict environmental regulations attract FDI (e.g., Cole and Elliott 2005; Kellenberg 2009). For instance, Muthukumara and Wheeler (1998) consider some polluting industries based on their emission intensity levels and conclude for a negative impact in Organization for Economic Cooperation and Development (OECD) countries and a positive one in developing countries. Chung (2014) analyzes Korean data and finds out that less strict environmental regulation attracts FDI. Other papers, however, conclude that environmental regulations have either ambiguous (e.g., Eskeland and Harrison 2003) or no statistical effect (e.g., Javorcik and Wei 2004) on FDI. Given this reasoning, we want to verify if:

Hypothesis 10. *Environmental emissions have a negative impact on FDI.*

3 | Data and Methods

The World Bank Enterprise Surveys (WBES) was used to analyze data for 125 countries from 2005 to 2017, obtaining information on 96,826 firms. The WBES is a “comprehensive” dataset that includes microdata from several country survey datasets, allowing to gather information at the firm level.² Each firm is included in one of the following 15 sectors: metal; chemicals, plastics and rubber; construction; electronics and communication equipment; food; furniture and wood; textiles, leather and garments; tourism, hotels, and restaurants; machinery, equipment and vehicles; non-metallic mineral products; petroleum products; retail trade; transports and communication; other manufacturing; and other services. Firms are also classified into one of six regions: Africa; East Asia and Pacific; East Europe and Central Asia; Latin America and Caribbean; the Middle East and North Africa; and South Asia.

The dependent variable (FDI) corresponds to the percentage of the firm that foreigners own. WBES also allows us to compute some independent and control variables, such as the size of the firm, firm's age and age squared (to account for non-linear effects of age), human capital, firm's exports (which is a proxy for trade openness), firm's perception of political instability, investment, credit constraints, and taxes.

In addition to firm-level data, we include in our study country-level data which, according to the literature, may be relevant for explaining FDI. We use the World Development Indicators (WDI) to obtain information on natural resources, inflation (which is a proxy for macroeconomic stability) and Gross Domestic Product per capita (GDPpc), which is a proxy for market size. We also include in our analysis the country's territorial emissions in MtCO₂ using data from Gilfillan, Marland, Boden, and Andres (2019), UNFCCC (2019) and BP (2019).

Table 1 describes the main variables and presents some descriptive statistics.

Considering the relatively high values of the standard deviations of some of the variables (compared with the correspondent mean), we can conclude that the sample exhibits significant variability. On average, 7.65% of the firms' shares are owned by foreigners, with the corresponding standard deviation being significantly higher than the mean value, suggesting substantial variability in FDI levels in our sample.

On average, 10.86% of the firm's total sales are exported (either directly or indirectly), but there is some variability in exports' behaviour as the standard deviation is around 26.13. As for investment, 43.03% of the firms purchased any new or used fixed assets. Interestingly, 38.51% of firms offered formal training to their employees, revealing that human capital is relevant for a significant fraction of the firms in the sample.

Concerning the obstacles faced by firms, 10.83% of the firms in the sample report that political instability is the biggest obstacle to the firm's activities, while 15.01% of the firms consider that barriers related to access to credit and finance are the biggest obstacle. Also, 32.39% of the firms declare that tax rates are a significant obstacle to their activities.

Firms are somewhat heterogeneous in their size and age, although we can conclude that firms' experience in the market is relatively high, as their average age is around 19 years.

Considering the variables at the country level, we can conclude that, on average, natural resources rents account for 7.85% of the country's GDP and mean annual inflation is around 6.96%. In the sample, the average GDP per capita is approximately 4.93 thousand dollars. Even at the country level, the sample exhibits a high level of variability, considering that the standard deviation of these variables is relatively high. That is particularly true for territorial emissions, whose standard deviation is almost three times the corresponding mean.

Given the literature review and hypotheses stated in the previous section, we want to analyze FDI determinants. Our dependent variable, FDI, corresponds to the percentage of the firm owned by foreigners. The variable is always in the interval between 0 and 1 (or 0% and 100%). Thus, the dependent variable's nature rules out the possibility of using Ordinary Least Squares (OLS) as our estimation method. OLS implies that the dependent variable is continuous and not truncated

TABLE 1 | Variables and descriptive statistics.

	Variable	Description	Mean	Std. dev.
Dependent variable	FDI	Percentage of the firm owned by foreigners	0.0765	0.2464
Independent variables at the firm level	Exports	The proportion of total sales that are exported directly or indirectly	10.8625	26.1321
	Investment	Dichotomous variable equal to one if the firm purchased any new or used fixed assets (such as machinery, vehicles, equipment, land or buildings); zero otherwise	0.4303	0.4951
	Human capital	Dichotomous variable equal to one if the firm offers formal training; zero otherwise	0.3851	0.4866
	Credit barriers	Dichotomous variable equal to one if access to finance is perceived as the biggest obstacle to the firm's activities; zero otherwise	0.1501	0.3571
	Political instability	Dichotomous variable equal to one if political instability is perceived as the biggest obstacle to the firm's activities; zero otherwise	0.1083	0.3107
	Taxes	Dichotomous variable equal to one if the firm identifies tax rates as a major obstacle to the firm's activities; zero otherwise	0.3239	0.4680
	Size	Natural log of the number of employees	3.3623	1.3886
	Age	Age of the firm	18.7107	15.3818
	Age ²	Age of the firm squared	586.6891	1277.959
	Resources	Total natural resources rents (% of GDP)	7.8532	8.2919
Independent variables at the country level	GDPpc	Gross Domestic Product (GDP) per capita (thousand dollars)	4.9328	5.8491
	Inflation	Annual percentage change in the consumer price index	6.9648	5.7125
	Emissions	Territorial emissions in Metric tons of carbon dioxide (MtCO ₂)	561.1907	1550.333

or restricted to a particular interval of values. Also, OLS usage in this situation is problematic as it is not guaranteed that the dependent variable's predicted values are between the interval $[0,1]$. Thus, the chosen estimation method must consider the nature of the dependent variable (see, e.g., Wooldridge 2010), which assumes values in the unit interval. Therefore, considering our main hypotheses to be tested and the nature of FDI, we adopt the fractional probit regression, which implies the following specification for the conditional mean of FDI, $E(F_i, C_i, X_i)$:

$$E(F_i, C_i, X_i) = \Phi(\alpha + \beta F_i + \gamma C_i + \delta X_i),$$

where FDI_i is the percentage of the firm i owned by foreigners; F_i represents the vector of independent variables at the firm level, including size, age, age squared, human capital, exports, investment, and obstacles related to political instability, credit, and taxes; C_i denotes the vector of independent variables at the country level, which comprises resources, inflation, GDPpc and emissions; X_i consists of the sector and region variables dummy and $\Phi(\cdot)$ denotes the standard normal cumulative distribution function.

In addition to the nature of the dependent variable, our estimation procedure should also take into account the fact that some regressors may not be exogenous, that is, there is endogeneity. In fact, the literature on exports and FDI has long ago recognized that, while exports (a proxy for international trade) may impact FDI, FDI may also be an important driver of exports (e.g., Kastratović 2020; Sabra 2021; Sahoo and Dash 2022; Srivastava 2006). As such, exports represent an endogenous covariate, implying we must accommodate that in our estimation method. To solve the issue of endogeneity, we use the fractional probit regression as presented above and resort to instrumental variables, as the fractional probit framework easily accommodates the existence of endogenous regressors (see, e.g., Wooldridge 2010). This requires defining an instrument for exports, that is, a variable correlated with exports but not with the error term. We follow the insight of Fisman and Svensson (2007) and consider the industry-location averages of exports as the instrument for exports in our estimation procedure. The rationale behind this instrument relies on the fact that exports depend on a set of characteristics specific to the firm, but also on factors affecting the industry/economic sector of the firm as a whole. These factors related with the industry are exogenous to the firm, allowing us to pick up the industry-location average as a suitable instrument. This instrument has been widely used in the literature (e.g., Ha et al. 2021; Martins et al. 2020; Nur-tegin and Jakee 2020).

All estimated regressions include robust standard errors for heteroskedasticity.

For robustness purposes, we estimate several regressions, excluding some of the variables and considering new ones: we consider only independent variables at the firm level and variables at both the firm and the country levels; we get results considering the presence and absence of sector and regions dummies; we also include all independent variables but a binary dependent variable, which takes the value one, if FDI_i is greater

than or equal to 10% and zero, otherwise, and estimate a probit regression.

4 | Results and Discussion

With data on 96,826 firms between 2005 and 2017, we estimate the previous section's model and display the results in Table 2. To evaluate the robustness of our results, Table 2 shows the estimates for the following regressions: (1) fractional probit regression with independent variables at the firm level; (2) fractional probit regression with independent variables at the firm level and country level; (3) fractional probit regression with independent variables at the firm level, including region and sector dummies; (4) fractional probit regression with independent variables at the firm level and country level, including sector dummies; (5) fractional probit regression with independent variables at the firm level and country level, including region dummies; (6) fractional probit regression with independent variables at the firm level and country level, including region and sector dummies; (7) (binary) probit regression with independent variables at the firm level and country level, including region and sector dummies.

These different specifications presented in Table 2 allow us to evaluate the contribution of independent variables at the firm and country levels; to assess the region's role and sector dummies, and compare the fractional probit regression results and the (binary) probit regression. Table 2 also displays the log pseudolikelihood for each specification, as well as likelihood ratio (LR) tests, which allow us to conclude that regression (6) explains better FDI behaviour than the other regressions. Thus, we will focus our analysis on the results of regression (6). In any case, the signal and significance of the independent variables presented in Table 2 do not change, in general, across the different regressions, which suggests that our results are robust.

Our estimates for regression (6) show that exports have a positive and significant impact on FDI, suggesting that firms that export have higher FDI levels, which validates our Hypothesis 1. This result, which holds for all regressions considered in Table 2, is in line with research at the macro-level (e.g., Asiedu 2006; Botrić and Škuflić 2006; Cleeve 2008; Mhlanga et al. 2010; Kok and Ersoy 2009; Kersan-Skabic 2013) that suggests that trade openness positively contributes to FDI.

As for investment in infrastructures, the coefficient is positive and statistically significant, showing that investment boosts FDI, supporting our Hypothesis 2. Interestingly, this positive effect of investment on FDI—which agrees with the existing evidence at the macro-level (e.g., Kok and Ersoy 2009; Asiedu 2006; Mhlanga et al. 2010; Vijayakumar et al. 2010; Khachoo and Khan 2012)—does not hold for regression (7), meaning the probit regression fails to recognize the significance of this variable. The results also show that human capital fosters FDI, corroborating our Hypothesis 3. The fact that both Hypotheses 2 and 3 are confirmed raise important policy implications as governments that want to attract foreign capital should seriously consider investments in infrastructures and human capital.

TABLE 2 | FDI determinants: Regression results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Exports	0.0065*** (0.0006)	0.0071*** (0.0006)	0.0134*** (0.0007)	0.0119*** (0.0007)	0.0077*** (0.0006)	0.0118*** (0.0007)	0.0115*** (0.0007)
Investment	0.1113*** (0.0119)	0.0787*** (0.0123)	0.0226* (0.0125)	0.0647*** (0.0123)	0.0318** (0.0125)	0.0220* (0.0126)	0.0037 (0.0127)
Human capital	0.1599*** (0.0123)	0.2056*** (0.0125)	0.1426*** (0.0130)	0.1698*** (0.0126)	0.1998*** (0.0131)	0.1670*** (0.0132)	0.1890*** (0.0134)
Credit barriers	−0.1953*** (0.0185)	−0.2011*** (0.0189)	−0.2540*** (0.0192)	−0.1964*** (0.0189)	−0.2547*** (0.0193)	−0.2472*** (0.0194)	−0.2553*** (0.0191)
Political instability	0.0066 (0.0184)	−0.0512*** (0.0187)	0.0341* (0.0195)	−0.0406** (0.0187)	0.0189 (0.0196)	0.0172 (0.0196)	0.0283 (0.0199)
Taxes	−0.0456*** (0.0126)	−0.0523*** (0.0128)	−0.0399*** (0.0133)	−0.0436*** (0.0128)	−0.0463*** (0.0133)	−0.0405*** (0.0133)	−0.0459*** (0.0134)
Size	0.1607*** (0.0053)	0.1820*** (0.0057)	0.1789*** (0.0060)	0.1715*** (0.0060)	0.2063*** (0.0059)	0.1945*** (0.0062)	0.2191*** (0.0063)
Age	−0.0132*** (0.0009)	−0.0140*** (0.0009)	−0.0124*** (0.0009)	−0.0131*** (0.0009)	−0.0138*** (0.0009)	−0.0134*** (0.0009)	−0.0110*** (0.0009)
Age ²	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)
Resources		0.0136*** (0.0006)		0.0133*** (0.0006)	0.0041*** (0.0008)	0.0045*** (0.0008)	0.0037*** (0.0008)
GDPpc		−0.0035*** (0.0012)		−0.0047*** (0.0012)	0.0045*** (0.0013)	0.0030** (0.0013)	0.0022* (0.0013)
Inflation		−0.0158*** (0.0015)		−0.0136*** (0.0013)	−0.0134*** (0.0013)	−0.0115*** (0.0012)	−0.0139*** (0.0013)
Emissions		−0.0002*** (0.0000)		−0.0001*** (0.0000)	−0.0001*** (0.0000)	−0.0001*** (0.0000)	−0.0001*** (0.0000)
Constant	−2.0286*** (0.0193)	−2.0198*** (0.0235)	−1.7840*** (0.0424)	−2.1601*** (0.0429)	−1.6793*** (0.0247)	−1.7368*** (0.0449)	−1.6467*** (0.0448)
Region dummies	No	No	Yes	No	Yes	Yes	Yes
Sector dummies	No	No	Yes	Yes	No	Yes	Yes
Log pseudolikelihood	−465103.81	−464303.98	−463206.09	−463896.92	−463278.90	−462962.54	−467490.59
LR test		1599.66*** (vs. model (1))	3795.45*** (vs. model (1))			2682.88*** (vs. model (2))	
Observations	96,826	96,826	96,826	96,826	96,826	96,826	96,826

Note: *** (**) [*] statistically significant at 1% (5%) [10%]. Robust standard errors in parentheses.

Credit barriers unambiguously decrease FDI, as the respective coefficient in Table 2 is negative and statistically significant. Thus, Hypothesis 4 is confirmed, supporting several studies

at the macro level that suggests that access to credit is a relevant FDI determinant (e.g., Aqeel et al. 2004; Havrylchyk and Poncet 2007; Asiedu 2002; Nasser and Gomez 2009).

Again, this fact has important policy implications, as the introduction of measures aimed to facilitate firms' access to credit will promote FDI.

The estimated coefficient for political instability in regression (6) is not statistically significant. While the results are somewhat mixed across the several regressions presented in Table 2, once we include in the analysis variables at both the firm and country levels, along with region dummies, political instability no longer has a significant impact. It remains true regardless of using the fractional or binary probit regressions. Thus, while Hypothesis 5 affirms that political instability has a negative effect on FDI, this is not confirmed by our data.

As expected, taxes have a negative impact on FDI. The corresponding coefficient is negative and statistically significant in all regressions. This result, which endorses Hypothesis 6, is in line with evidence at the macro level that shows that fiscal policy may be a particularly relevant FDI determinant (e.g., Bellak and Leibrecht 2009; Arbatli 2011; and Tang 2012), as low taxes promote FDI.

The results for natural resources unambiguously suggest that Hypothesis 7 is validated. The estimated coefficient is positive and significant, confirming that natural resources may boost FDI. As for market size, once we control for regions, we conclude that our proxy GDPpc positively impacts FDI. This result confirms previous research at the country level (e.g., Asiedu 2006; Mohamed and Sidiropoulos 2010; Cheung and Qian 2009; Ledyeva 2009) and corroborates Hypothesis 8, being valid in both the fractional and binary probit specifications.

The results in Table 2 show that macroeconomic stability promotes FDI, supporting Hypothesis 9. The inflation coefficient is negative and significant in all regressions, seconding macroeconomic research which suggests that economic stability is a key FDI determinant (e.g., Asiedu 2006; Kok and Ersoy 2009; Mohamed and Sidiropoulos 2010). Thus, governments seeking to promote FDI should introduce measures to ensure the stability of their economies.

Concerning CO₂ emissions, our estimations indicate that emissions have a negative effect on FDI, thus confirming Hypothesis 10. This result raises important policy implications as low territorial emissions may be a way to attract foreign capital and governments that seek to foster FDI may be able to introduce measures that aim to control/reduce emissions in their country.

Because we have considered non-linear regressions, the estimated coefficients in Table 2 do not represent the marginal effect of the independent variable in the conditional mean of the dependent variable; thus, we present the marginal effects of the relevant, statistically significant FDI determinants in Table 3. Given the several specifications shown in Table 2 and the LR tests previously discussed, marginal effects on Table 3 refer to specification (6) of Table 2.

Considering that FDI refers to the percentage of the firm owned by foreigners, the estimated marginal effects suggest

TABLE 3 | Estimated marginal effects.

Variables	Marginal effect
Exports	0.0118*** (0.0007)
Investment	0.0220* (0.0126)
Human capital	0.1670*** (0.0132)
Credit barriers	-0.2472*** (0.0194)
Taxes	-0.0405*** (0.0133)
Resources	0.0045*** (0.0008)
GDPpc	0.0030** (0.0013)
Inflation	-0.0115*** (0.0012)
Emissions	-0.0001*** (0.0000)

Note: *** (**) [*] statistically significant at 1% (5%) [10%].

that, on average, a boost of 1 percentage point in the proportion of total sales that are exported leads to an expansion of 1.18 percentage points on FDI, *ceteris paribus*. Similarly, fixed assets' investment raises FDI by 2.2 percentage points, and human capital fosters FDI in 16.7 percentage points. The existence of credit barriers hurts FDI, decreasing it, on average, by 24.7 percentage points, while high taxes reduce FDI by 4 percentage points. As for natural resources, an increase of 10 percentage points leads to an average boost of 4.5 percentage points in FDI. Also, an increment of 1 thousand dollars in GDP per capita has a positive average impact of 3 percentage points in FDI, while an increase of 1 percentage point in inflation reduces FDI by 1.2 percentage points. Finally, a rise in CO₂ emissions of 1 thousand metric tons leads to a decline of 10 percentage points in FDI.

5 | Conclusion

This paper empirically reports the role of several factors on FDI. The analysis is based on a rich dataset with information on 96,826 firms for 125 countries from 2005 to 2017. The results are in line with previous research at the macro level and provide several insights. At the firm level, it is revealed a positive and statistically significant relationship between exports and FDI. Also, it was found that investment and human capital have a significant positive impact on FDI. Conversely, higher credit barriers or taxes lead to a lower level of FDI. Regarding the variables

at the country level, resources and market size positively affect FDI, whereas an increase in inflation or environmental emissions reduces FDI levels.

Policymakers can take some guidelines for government intervention and political analysis from this work. To obtain higher FDI levels, they should promote international trade and adopt political measures that aim to foster investment and human capital. In addition, public authorities must develop reforms that facilitate access to credit and introduce a more flexible fiscal policy that stimulates new firms' entrance into the country. Finally, governments should promote economic growth and macroeconomic stability to increase FDI levels.

Our contributions to the literature in this research topic include analyzing data at the firm level, using a rich dataset on 96,826 firms for 125 countries from 2005 to 2017. We also consider a fractional probit regression in our methodology because of the FDI variable's nature, which assumes values between zero and one. We suggest that future research seeks to evaluate the key variables in a panel data framework, allowing for firm and country heterogeneity over time. Additionally, it would be interesting to extend this investigation to developed countries, comparing and distinguishing the main determinants of FDI in both developed and developing countries.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data used in this study are available in Enterprise Surveys, The World Bank, <http://www.enterprisesurveys.org>.

Endnotes

¹ For a systematic review of the approaches to FDI, see, e.g., Assunção et al. (2013).

² See Table A1 for a list of the World Bank Enterprise Surveys included in the analysis.

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TABLE A1 | World Bank Enterprise Surveys included in the analysis.

Afghanistan	2008; 2014	Costa Rica	2010	Indonesia	2009; 2015	Morocco	2013	St Lucia	2010
Albania	2007; 2013	Croatia	2007; 2013	Iraq	2011	Myanmar	2014; 2016	St Vincent and Grenadines	2010
Angola	2006; 2010	Cyprus	2019	Israel	2013	Namibia	2006; 2014	Sudan	2014
Armenia	2009; 2013	Czech Republic	2009; 2013	Jamaica	2010	Nepal	2009; 2013	Suriname	2010; 2018
Azerbaijan	2009; 2013	Côte d'Ivoire	2009; 2016	Jordan	2013	Nicaragua	2006; 2010; 2016	Sweden	2014
Bahamas	2010	Dominica	2010	Kazakhstan	2009; 2013	Niger	2009; 2017	Tajikistan	2008; 2013
Bangladesh	2013	Dominican Republic	2010; 2016	Kenya	2013; 2018	Nigeria	2007; 2014	Tanzania	2006; 2013
Barbados	2010	Ecuador	2006; 2010; 2017	Kosovo	2013	North Macedonia	2009; 2013	Thailand	2016
Belarus	2008; 2013; 2018	Egypt	2013; 2016	Kyrgyz Republic	2009; 2013	Pakistan	2007; 2013	Timor-Leste	2009; 2015
Benin	2009; 2016	El Salvador	2006; 2010; 2016	Lao	2009; 2012; 2016; 2018	Panama	2006; 2010	Togo	2009; 2016
Bolivia	2006; 2010; 2017	Estonia	2009; 2013	Latvia	2009; 2013	Papua New Guinea	2015	Tonga	2009
Bosnia and Herzegovina	2009; 2013	Eswatini	2006; 2016	Lebanon	2013	Paraguay	2006; 2010; 2017	Trinidad and Tobago	2010
Botswana	2006; 2010	Ethiopia	2011; 2015	Lesotho	2009; 2016	Peru	2006; 2010; 2017	Tunisia	2013
Brazil	2009	Fiji	2009	Liberia	2009; 2017	Philippines	2009; 2015	Turkey	2008; 2013
Bulgaria	2007; 2009; 2013	Gabon	2009	Lithuania	2009; 2013	Poland	2009; 2013	Uganda	2006; 2013
Burkina Faso	2009	Gambia	2006; 2018	Madagascar	2009; 2013	Romania	2009; 2013	Ukraine	2008; 2013
Burundi	2006; 2014	Georgia	2008; 2013	Malawi	2009; 2014	Russia	2009; 2012	Uruguay	2006; 2010; 2017
Cambodia	2013; 2016	Ghana	2007; 2013	Malaysia	2015	Rwanda	2006; 2011	Vanuatu	2009
Cameroon	2009; 2016	Greece	2018	Mali	2007; 2010; 2016	Samoa	2009	Vietnam	2009; 2015

(Continues)

TABLE A1 | (Continued)

Cape Verde	2009	Guatemala	2006; 2010; 2017	Mauritania	2006; 2014	Serbia	2009; 2013	Yemen	2010; 2013
Central African Republic	2011	Guinea	2006; 2016	Mauritius	2009	Sierra Leone	2009; 2017	Zambia	2007; 2013
Chad	2009	Guinea Bissau	2006	Mexico	2006; 2010	Slovak Republic	2009; 2013	Zimbabwe	2011; 2016
Chile	2006; 2010	Guyana	2010	Micronesia	2009	Slovenia	2009; 2013		
China	2012	Honduras	2006; 2010; 2016	Moldova	2009; 2013	Solomon Islands	2015		
Colombia	2006; 2010; 2017	Hungary	2009; 2013	Mongolia	2009; 2013	South Sudan	2014		
Congo	2009	India	2014	Montenegro	2009; 2013	Sri Lanka	2011		