The Determinants of Multilateral Development Banks' Participation in Infrastructure Projects

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Abstract
Multilateral development banks (MDBs) have important functions in infrastructure projects. Besides their traditional lending role, they provide additional guarantees to private investors about the creditworthiness of the project. An empirical analysis is performed for the determinants of MDBs' participation in infrastructure projects in developing countries using data from 1990 to 2007 obtained from the World Bank's Private Participation in Infrastructure database and through limited dependent variable models. The results suggest that the participation of MDBs is higher for less populous and poorer countries, in line with past empirical findings, and where legal and financial systems are underdeveloped. However, neither political risk nor even respect for human rights seems to play an important role in explaining multilateral participation.

1. Introduction

Infrastructure investments are essential to achieve economic prosperity, as they promote growth and enhance well-being. MDBs assume an important role in the financing of infrastructure projects. Besides the traditional view of MDBs as lending institutions, a broader view is being requested for their role resulting from other functions: mechanism of credit enhancement and risk reduction, enabling the raising of private flows and helping governments to perform the necessary reforms (Bhattacharyay 2009; Hainz and Kleimeier 2006; Matsukawa and Habeck 2007; OECD 2006; Pessoa 2008; World Bank 1994).[1]

After decades of discussion about aid effectiveness and the controversial role of multilateral institutions, a conclusion has not yet been reached. Two different perspectives are at stake: one that sees MDBs as not being necessary for countries that have their own bilateral lending programmes and well- developed capital markets; and the opposite view where MDBs are an important source of funds linking their assistance to the implementation of structural reforms in the recipient countries, with a more effective and acceptable intervention, given their status as independent entities. In the early years of operations, MDBs financed and supported primarily public sector infrastructure projects through loans, technical assistance and policy-based lending. More recently, in the 1990s, private capital flows faced an exponential increase to many middle-income countries and to a few low-income countries, such as, China and India. This fact has raised doubts about the role of MDBs, particularly in emerging countries. As pointed out by Buiter and Fries (2002) and Gurria and Volcker (2001), the episodes of rapid development and economic growth were concentrated in specific countries from East and South Asia, and until now this growth has not been translated into general poverty reduction and enhancement of the population's living conditions. As a conclusion, it is argued that the MDBs' original mission still makes sense for those countries, although it should not be an indefinite task.

This paper develops an empirical analysis on infrastructure projects, explaining the MDBs' participation and their allocation of aid. Our focus is on infrastructure projects developed in low- and middle- income countries using public-private partnerships (PPPs).[2] These partnerships are often the easiest solution for governments that are struggling with a lack of resources needed to implement infrastructure projects and appear as a key instrument to promote economic growth and enhance well-being.

The implementation of infrastructure projects using PPPs in developing countries is far from an easy task and faces several limitations. First, capital markets are incipient and underdeveloped, the regulatory and institutional framework does not encourage private sector investment and political and economic instability could impair infrastructure projects. Second, we must add the typical nature of infrastructure investments, which are prone to specific risks, namely, the existence of natural monopolies that exclude competition, investments are capital intensive, immobile and not easily redeployed for other uses, and outputs are usually non-tradable and their price is subject to regulatory adjustment, given the political sensitiveness of the services/goods to be provided (see, for instance, Grimsey and Lewis 2002). In this scenario, the participation of MDBs with its 'protective umbrella' is critical to stimulate private involvement in infrastructure PPPs.

Using a model based on the recipients' needs, an empirical analysis is developed to test how the probability of the participation of MDBs in infrastructure PPPs responds to the level of 'needs' of a country. We adopt a broader view of a recipient need model using not only variables that characterise the economic and financial environment, but also variables to measure respect for human rights and to account for the level of institutional development (political and legal variables).

Our data set was obtained from the World Bank's Private Participation in Infrastructure (PPI) database (available at http://ppi.worldbank.org), with data on developing countries from 1990 to 2007, covering 96 different countries. This data set was also used to explore the aid-allocation process as a two-stage process using a two-part model and sample selection models.

The main contribution of this paper is to add to the literature on infrastructure projects concerning the financial support provided by MDBs. The innovation relies on the variables used and on the econometric approach followed. As far as we know, this is the first empirical analysis that tests simultaneously a vast variety of variables in an attempt to provide a more complete picture of the drivers of aid-allocation processes. If we focus on a particular dimension, the results will probably be inaccurate or misleading.

In a context of a worldwide financial crisis, these topics are gaining relevance and are of major importance to governments, private

sector investors and multilateral institutions, and even for the host countries' population. International banks have adopted a more conservative attitude, retreating to preserve capital from risky infrastructure investments in developing countries. MDBs are being called to fill this financial gap and a more active role is now required to create more effective partnerships with the private sector and act as a catalyst for development. Therefore, the explanation of what country factors matters the most to explain MDBs' participation in infrastructure PPPs is of critical importance.

This paper is organised as follows. The next section presents a brief literature review. Section 3 summarises the hypotheses to be tested and the variables. Section 4 explains the research methodology and the econometric approach. The data description is given in Section 5. Results are presented and discussed in Section 6. Finally, the main conclusions are presented.

2. Literature Review

This paper is supported by different lines of the literature. First, it is related to the literature about the role of international financial institutions (IFIs) in addressing financial market failures (Lindbaek et al. 1998; Stiglitz 1998). There is a relationship between IFIs and private international capital markets, and they may be seen as complementary or substitute. Viewed as complements, MDB participation is claimed to have a catalytic effect on private participation, encouraging private sector involvement in projects. On the other hand, as substitutes, MDB lending will be directed at countries that have little access to private international capital markets and with underdeveloped internal financial markets (Bird and Rowlands 2007).

Several authors have tested the 'catalytic effect', mostly in the context of International Monetary Fund (IMF) programmes, but the results are not conclusive. The IMF provides finance to correct macroeconomic imbalances and to promote adjustments in the balance of payments for countries in distress; however, it claims to perform a more important catalytic role by encouraging others to lend. By enhancing liquidity and reducing the risks of default, the IMF may increase confidence in capital markets and make them more prepared to lend. However, as noted by Bird and Rowlands (2005), the empirical evidence has failed to discover any strong and reliable catalytic effect. In addition, the empirical evidence cited by Ghosh et al. (2002) and Cottarelli and Giannini (2002) suggests that catalytic finance has not been effective. Also, Clemens (2002) showed that the World Bank has an effect neither as substitute for private international lending nor as a catalyst for such lending. With a different conclusion, the study of Ratha (2001) found some evidence that multilateral lending encouraged private flows by signalling and fostering a better investment environment in the borrowing countries. However, in the short term, multilateral loans behaved counter-cyclically with private flows, emphasising the so-called *substitution* effect.

Second, the paper is also related to the literature on aid. The majority of the academic literature is about aid effectiveness and its relation to economic growth. Some authors argue that there is a positive relationship between aid and growth (Addison et al. 2005; Hansen and Tarp 2001; Minoiu and Reddy 2010; Radelet 2006), whilst others proclaim the opposite view that aid is not effective (Doucouliagos and Paldam 2009) and even worse that aid has negative effects, perpetuating corruption, increasing bureaucracy and helping bad governments to remain unaccountable (Easterly 2006; Moyo 2009).

In an influential work, Burnside and Dollar (2000) found that aid is beneficial to countries that adopt appropriate and stable policies; therefore, aid is effective if the proper conditions are in place. Besides the relevance of the macroeconomic policy environment, additional aspects of governance were considered important, for instance, the positive effect of democracy (Kosack 2003; Svensson 1999), the level of corruption, rule of law and the burden of bureaucracy (Dollar and Levine 2006; Kenny 2008). The importance given to one or another aspect of governance has been differently valued according to the author's position; nevertheless, a fact already established in the literature is that aid effectiveness depends on the *quality* of governance. This conditional aid framework has been incorporated into policy making and has given rise in the United States to a new aid agency, the Millennium Challenge Corporation, which provides financial assistance on the basis of both need and merit: 'countries ranking among the poorest would qualify for aid only if they demonstrated a commitment to democratic, rule-based governance, social investment, and liberal economic policies' (Tierney et al. 2011). The European Union and some of the major MDBs — the World Bank, the Asian Development Bank and the African Development Bank — have also institutionalised performance-based allocation formulae rewarding countries with 'good' policies (Asian Development Bank 2005).

About the *explanation* of aid flows, since the pioneering work of McKinley and Little (1977) models to explain aid allocation are divided into *donor interest* and *recipient need* models. The *recipient need* model assumes that donors are motivated purely by humanitarian motives and the *donor interest* model is based on the assumption that donors are motivated mostly by commercial, political and strategic self-interests.

Authors exploring donor interest models include Gates and Hoeffler (2004), Gelb (2010), Harrigan et al. (2006) and Kilby (2006), among others. It is generally accepted that the allocation of aid by multilateral institutions is less influenced by donor interest than bilateral flows (Headey 2007; Maizels and Nissanke 1984; Rodrik 1995). However, it is possible to find examples that conclude that even in a multilateral framework the patterns of lending suffer from the major donors' influence (see, for instance, Kilby 2006; Harrigan et al. 2006).

When drawing our attention to recipient need models that explain the allocation of aid, it is important to note that traditionally the concept of 'need' was almost always measured by income level and, interestingly, two systematic biases have been reported in the aid-allocation literature. First, less populous countries receive more aid per capita than more populous ones and, second, very poor countries often tend to receive less aid than less poor countries (Alesina and Dollar 2000; Dowling and Hiemenz 1985; Neumayer 2003). As explained by Neumayer (2003) and McGillivray and Feeny (2008), aid is potentially more effective in small countries and the very poor countries are regarded as unimportant and uninteresting for donor countries or even that these countries do not have the capacity to manage and absorb larger aid flows.

The majority of the empirical papers are more concerned with bilateral flows. Specifically, about MDBs and their lending patterns, we may find the studies of Frey and Schneider (1986), Maizels and Nissanke (1984), Neumayer (2003) and Tsoutsoplides (1991).

Maizels and Nissanke (1984) explained aid allocation from the principal bilateral donors and from multilateral agencies using two periods 1969-70 and 1978-80. The results confirmed that recipient need criteria are relatively more important for multilateral

institutions than for bilateral donors. Typically, some of the major donors used bilateral aid as an instrument of foreign policy (e.g., the United States) or as an instrument to increase trade (e.g., the United Kingdom). Frey and Schneider (1986) developed four models of the World Bank's lending to developing countries for the period 1972-80. The results suggested that the best model is obtained with the combination of economic and political factors. Besides economic variables related to macroeconomic stability, wealth and growth, political factors, such as, the 'capitalist' climate, political stability and past colonial experience, are also relevant to explain the lending activity.

Tsoutsoplides (1991) explained aid allocation by the European Community (EC) for the period 1975-80 using two alternative models—one trying to explain the EC pattern of geographical allocation of aid using variables related to the needs of the recipient countries and another using variables related to the interests of the EC. Multilateral aid provided by the EC was mostly driven by the needs of the recipients, measured by their current account balance of payments and by their basic human needs, measured by the Physical Quality of Life Index (PQLI).[3]

More recently, Neumayer (2003) focused his attention on aggregate multilateral flows and, in addition, explored the differences between four regional development banks (the Caribbean, the African, the Asian and Inter-American Development Bank) and three United Nations Agencies. At an aggregate level, multilateral flows exhibit a bias towards less populous countries, richer countries receive less aid as expected, and countries that show more respect for political freedom and that enjoy a longer experience of colonisation by an OECD country receive more aid than others. Human development needs (represented by a low PQLI score) are relevant for the United Nations agencies, but not considered by the regional development banks, which mostly focus on economic need. As pointed out by Neumayer (2003), 'given that all development banks proclaim a commitment to poverty reduction and human development as well; their perception of what constitutes recipient need seems to follow a narrow view of being confined to the level of national income'.

Some authors argue that the explanation of aid flows should be done using a mix of donor's interest variables and recipient's needs variables (Berthelemy 2006; Dollar and Levin 2006; McGillivray 2003; Poe and Sirirangsi 1993). The option is to adopt 'hybrid' models. A more recent research line on aid allocation is concerned with the demand side of lending and includes Humphrey and Michaelowa (2013) and Knack et al. (2012). These studies present a different point of view since the previous academic literature assumed that the patterns of lending are the result of an exclusive decision taken by the MDBs or their principal shareholders, balancing their decisions with the needs identified in the recipient countries and with the implicit assumption that countries will always want to borrow from the MDBs. However, recently the emerging countries, such as, China, India and Brazil, showed strong financial positions with stable accounts, low levels of public debt, high international reserves and easy access to international capital markets, with no need to request funds from MDBs. In this new scenario, Humphrey and Michaelowa (2013) show that the preferences of borrower countries should be taken into account and that the demand factors play an important role in MDB lending.

Finally, this paper is also related with the literature about the determinants of infrastructure investments (Banerjee et al. 2006; Hammami et al. 2006). In these articles, different countries' factors are explored as potential determinants of investments in infrastructure using the World Bank PPI database. Although with different goals, the results may be used for the purposes of comparison. Banerjee et al. (2006) tested empirically whether institutional factors affect private investment in infrastructure, using a dataset on 40 developing countries from 1990 to 2000. They found that economic and legal variables are more important in explaining private investment. Countries that enjoy macroeconomic stability (with higher GDP per capita and higher GDP growth) and with a stable judicial system (higher regulatory quality and better contract enforcement) are rewarded with more private investment in infrastructure. A surprising result was related to the variable of corruption, suggesting that more corrupt countries attract more private investment. Hammami et al. (2006) used the PPI database from 1990 to 2003 to explore the determinants of the number of PPPs in infrastructure and the dollar value of investments in infrastructure PPPs, expressed as a percentage of GDP. The results indicate that PPPs are more common in countries with heavy debt burdens and with larger markets. Institutional quality also appears as a relevant factor, as countries with less corruption and effective rule of law enhance the number of PPPs projects.

In this paper, our main focus is the explanation of MDBs involvement in infrastructure projects based on a recipient need model, but including a larger set of potential explanatory variables to characterise countries in the economic, financial, political and legal dimension, and furthermore concerning respect for human rights. The next section explains the rationale for the hypotheses to be tested in the empirical analysis that follows.

3. Hypotheses

From the previous exposition it is clear that risks are enhanced for infrastructure projects in developing countries, therefore the involvement of MDBs assumes particular relevance. But what characterises countries that explain the MDBs' participation in a project? And what explains the level of financial flows? The empirical analysis has a two-fold goal: first, to answer the question how the political, legal, social, economic and financial environment in host countries affects the probability of MDBs' participation in infrastructure projects; and second, how the same characteristics explain the level of aid provided by MDBs.

For reasons of simplicity, we divide the potential relevant characteristics of a country into four dimensions—political, legal, economic/financial and social — and consequently hypotheses are derived in these same dimensions.

3.1 Political Risk

Countries that are more politically stable should be preferred for the development of infrastructure projects, given its intrinsic nature (long-term and complex investments with high levels of uncertainty). Political variables have been reported in several papers as important determinants of investment and aid flows: Trumbull and Wall (1994) in their analysis of aggregated bilateral aid include a measure of political and civil rights which they find to be important; Berthelemy (2006) and Dollar and Levin (2006) find that democracies receive more aid. Hammami et al. (2006) argue that PPPs should be preferred by governments that are more market-oriented with stable and accountable governments. Therefore, a positive relationship is expected between MDBs involvement in PPPs arrangements and the level of democracy and political stability of a country.

H1: The probability of having an infrastructure project with MDBs' participation is positively related to the level of political stability and democracy in a country.

Political risk is higher for countries where governments do not exhibit political checks and balances or that restrain electoral competition. Therefore, the variables used are (all drawn from Beck et al. 2000):

- *Index of political competitiveness*, a variable that characterises the competitiveness of elections. It measures the number of parties competing in elections and ranges from 1 (low) to 7 (high competitiveness).
- The quality of governance affects a country's ability to benefit from international capital flows. A key element in the description of any political system is the number of decision makers whose agreement is necessary before policies can be changed and it is generally accepted that countries with multiple decision makers may offer greater protection to investors from arbitrary government actions — the variable *checks* is used as a measure of government accountability.

3.2 Legal Risk

A PPP is, in essence, a bundle of financial and non-financial contracts. For infrastructure projects with high asset specificity, high complexity and uncertainty and low competitiveness, these contracts are a cornerstone of PPPs arrangements. Nevertheless, these contracts are naturally incomplete and prone to opportunistic behaviour. Private investors must ensure they have legal rights and that the local law enforcement is efficient. It is expected that countries with stronger property rights which are recognisable to investors will be able to raise more long-term private capital to develop infrastructure projects, and MDBs are expected to participate more in PPPs developed in countries with 'good' legal practices and sound institutions.

H2: The probability of having an infrastructure project with MDBs' participation is positively related to the level of legal development.

As proxies for the level of development, the following variables are used, which were considered in previous studies (Esty and Megginson 2003; Gatti et al. 2008; Subramanian et al. 2008):

- *Creditor rights index* — The creditor rights index is based on LaPorta et al. (1998) index and expanded by Djankov et al. (2007). The creditor rights index varies between 0 (poor creditor rights) and 4 (strong creditor rights).
- *Contract enforcement days* — The number of calendar days to resolve a payment dispute through courts, also from Djankov et al. (2007). LaPorta et al. (1998) emphasise the importance of legal enforcement as well as the quality of the laws on the books (measured by the creditor rights index). Both measures of the quality of the legal system are important and provide a complementary analysis.
- *Legal origin* — A dummy variable that identifies a country's legal origin. A link between the ori - gin of a country's legal tradition and the operation of its financial system was first established by LaPorta et al. (1998).[4] The authors have found that countries with common law legal institutions (with an English legal origin) provide better protection to creditors than do countries with civil law institutions (with French legal origin). More recently, Beck et al. (2004) reinforced this idea.

3.3. Economic and Financial Risks

The macroeconomic environment can also affect projects' risks and the participation of the different agents. Given the nature of MDBs, it is expected that the poorer countries will receive more aid and, according to the aid literature, a bias is expected towards less populous countries (Alesina and Dollar 2000; Neumayer 2003). At the same time, a higher interest is expected in PPPs to solve infrastructure problems by governments with larger deficits and higher debt burdens. In this framework, the following hypotheses are derived:

H3: Countries with lower GDP per capita and economic growth will have a higher probability of having an infrastructure project with MDBs' participation.
H4: Countries with large deficits and heavy debt burdens will have a higher probability of having an infrastructure project with MDBs' participation.
H5: Less populous countries will have a higher probability of having an infrastructure project with MDBs' participation.

The variables used are:

- *Real GDP per capita* and *economic growth*, used to measure the evolution of the country's wealth.
- *External debt* and *general government balance*, used to measure the degree of foreign indebtedness. Governments with large and structural deficits increase foreign indebtedness, which may become unsustainable over time, and a higher debt burden implies a higher risk of default.
- *Population* — Given our focus on the role of MDBs, we also expect that more aid will go to small countries.

As far as the level of financial development is concerned, it is expected that MDBs will participate more in infrastructure projects implemented in countries with a low level of development. As lending institutions, MDBs are a fundamental source of funds to countries where the local capital markets are incipient and poorly developed, which leads to the next hypothesis:

H6: Countries with a poorly developed financial system will have a higher probability of having an infrastructure project with MDBs' participation.

There is no single measure of financial development (see, for instance, Esty 2003). The variables to assess the level of financial development are drawn from Beck et al. (2009):

- *Liquid liabilities of the financial system to GDP* — this is a traditional measure of financial depth and measures the size of the financial intermediary sector relative to the size of the economy. This indicator shows the degree to which the financial sector mobilises domestic savings—larger depth should reflect greater financial development.
- *Private credit to GDP* — measured by the financial claims on the private sector by deposit money banks and other financial institutions divided by GDP. Countries with higher private credit to GDP usually have higher rates of economic growth.

3.4 Social Risk

Measures of human development are included in what we roughly call 'social factors'. It is expected that proxies for human development should have an effect in explaining MDBs' participation in any project (including infrastructure). This is a natural consequence of their status as 'development finance institutions'. Isham et al. (1997) showed empirically that higher civil liberties are associated with better economic returns on government projects. Nielsen (2013) has recently confirmed that foreign aid donors impose aid sanctions for human rights violations, although this is a selective practice applied only to some repressive states. The results are mixed, but the literature has pointed to the relevance of human rights variables (Isham et al. 1997; Lebovic and Voeten 2009; Neumayer 2003; Nielsen 2013; Poe and Sirirangsi 1993). The following hypothesis is tested:

H7: The probability of having an infrastructure project with MDBs' participation is higher for countries with greater respect for human rights and civil liberties.

Besides the traditional measure of the *per capita income* as a proxy of well-being and economic development (already included in this research), two additional proxies for human rights and social development are used, drawn from the 'Cingranelli-Richards (CIRI) Human Rights Dataset', and also a measure of civil liberties is used from the survey 'Freedom in the world':

- *Empowerment Rights Index* — This is an additive index constructed from the Freedom of Movement, Freedom of Speech, Workers' Rights, Political Participation and Freedom of Religion indicators. It ranges from 0 (no government respect for these five rights) to 10 (full government respect for these five rights).
- *Physical Integrity Rights Index* — This is an additive index constructed from the Torture, Extrajudicial Killing, Political Imprisonment and Disappearance indicators. It ranges from 0 (no government respect for these four rights) to 8 (full government respect for these four rights).
- *Civil liberties* are measured on a 1-7 scale, with one representing the highest degree of freedom and seven the lowest.

In addition, dummies are included in the regressions to account for sector and regional differences. Concerning sectors, we further develop the analysis in Section 6.3. Finally, time-dummies are also included in all regressions to capture potential time-specific effects that may influence the MDBs participation in infrastructure projects.

4. Research Methodology and Econometric Approach

Some of the problems of the first empirical analyses were related to the models used. As noted by Berthelemy (2006), Harrigan and Wang (2011) and McGillivray (2003), in the aid-allocation literature the vast majority of studies have used ordinary least squares (OLS) and do not take into account the censored nature of the aid variable. This approach may have led to biases in the results and wrong conclusions. In an attempt to overcome some of these past empirical fragilities, we use limited dependent variable models. First, binary choice models are used to explain the probability of an MDB participation in a project, and second, two-part models and sample selection models are used to explain aid allocation as a two-stage process (for more details about the econometric approaches see, for instance, Cameron and Trivedi 2005).

4.1 Binary Choice Models

The first problem consists of describing the probability of the participation of an MDB in an infrastructure project, where there are only two alternatives. In this situation, a binary choice model should be used. The dependent variable is:

$$y = \begin{cases} 1 & \text{probability } p \\ 0 & \text{probability } 1-p \end{cases} \qquad (1)$$

The simplest alternative is to use the Linear Probability Model (LPM) with OLS regression, but it has some drawbacks, namely, the possibility of the predicted probabilities exceeding one or being less than zero and the assumption that the partial effect of any explanatory variable is constant. More proper models are the *Probit* and *Logit* that belong to the class of binary response models. The choice of one of these models will guarantee that the predicted values will be in the 0-1 interval. Either the *Probit* or the *Logit* is binary response model of the form,

$$P(y = 1|x) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k) \qquad (2)$$

where $x = (x_1, x_2, ..., x_k)$ and $G(.)$ is a function taking values strictly between zero and one: $0 < G(z) < 1$ for all real numbers z. In the Probit model, $G(.)$ is the standard normal cumulative distribution function (cdf), which is expressed as an integral, and where $\phi(z)$ is the standard normal density,

$$G(z) = \Phi(z) \equiv \int_{-\infty}^{z} \phi(v) dv \qquad (3)$$

An alternative choice could be the logistic distribution function:

$$G(z) = \frac{\exp(z)}{1 + \exp(z)} = \Lambda(z) \qquad (4)$$

In order to estimate the parameters, a likelihood function is maximised. The coefficients β_j for $j = 1, 2,..., k$ give the signs of the partial effects of each x_j on the response probability, but not their magnitude (the interpretation of their value is not as straightforward as in the LPM). Average marginal effects (AME) should be computed to show the average response of all individuals. The marginal effect is obtained for each observation and next the sample average of individual marginal effects is computed to obtain the overall marginal effect.

4.2 Tobit and Selection Models
In the second set of regressions, the response variable is nonnegative, partly continuous and assumes the value zero with positive probability. To evaluate such a process empirically, three estimation methods are available: a two-part model, a Heckman procedure or a Tobit regression.

Tobit is usually the starting point. This model estimates the financial support provided by MDBs in only one step, taking directly into account its censored nature. Nevertheless, because the Tobit model relies on strong assumptions of normality and homoscedasticity of the error term, better results are often provided by more general models, namely, two-part models or using Heckman sample selection models.

There are many different situations where the problem at study may be seen as a two-part decision of first to engage in an activity and then deciding the level of the activity. If we expect independence between these two parts, a two-part model is the better choice. Alternatively, if the same factors that influence one part are expected to influence the other, with decisions intertwined, then the suitable model is the bivariate sample selection model or Heckman sample selection model (also called type 2 Tobit).

A two-part model is appealing because it is possible to explain y with two different mechanisms: a *Probit* or a *Logit* model to explain the probability of $y = 0$ versus $y > 0$, and a second process to explain 'how much' y using only the positive outcomes. As such, aid allocation is described as a two stage process, that is, 'yes/no' (stage one deciding on eligibility) and 'if yes, how much' (stage two). If we define a binary indicator variable $d = 1$ for *participants* in the activity under study, and $d = 0$ for *non-participants*, the two-part model is given by,

$$f(y \mid x) = \begin{cases} Pr[d = 0 \mid x] & \text{if } y = 0 \\ Pr[d = 1 \mid x] f(y \mid d = 1, x) & \text{if } y > 0 \end{cases} \qquad (5)$$

for some choice of density $f(.)$, although proper choices of $f(.)$ should ensure positive values for the *participants*, for instance, the log-normal. Usually, the same regressors appear in both parts of the model, and concerning the estimation the two parts are assumed to be independent: first, with all the observations, a binary choice model is estimated; second, using only observations with $y > 0$, the parameters of the density $f(y|d = 1, x)$ are estimated.

Concerning the Heckman sample selection model, a joint distribution for the censoring mechanism and outcome is considered. In this specification, a censoring latent variable differs from the latent variable generating the outcome of interest. The model includes a *participation equation*,

$$y_1 = \begin{cases} 1 \text{ if } y_1^* > 0 \\ 0 \text{ if } y_1^* \leq 0 \end{cases} \qquad (6)$$

and a resultant *outcome equation*,

$$y_2 = \begin{cases} y_2^* \text{ if } y_1^* > 0 \\ - \text{ if } y_1^* \leq 0 \end{cases} \qquad (7)$$

In this formulation, y_2 is observed when $y_1^* > 0$, and no particular value of y_2 is necessarily observed when $y_1^* \leq 0$ For the latent variables, we have linear models with additive errors, according to

$$y_1^* = \beta_{01} + X_1'\beta_1 + \varepsilon_i$$
$$y_2^* = \beta_{02} + X_2'\beta_2 + \varepsilon_2 \qquad\qquad (8)$$

where X_1, X_2 are vectors of explanatory variables. And the conditional mean in the sample selectivity model is

$$E[y_2|X_1, X_2, y_1^* > 0] = E[\beta_{02} + X_2'\beta_2 + \varepsilon_2|\beta_{01} + X_1'\beta_1 + \varepsilon_1 > 0] = \beta_{02} + X_2'\beta_2 + E[\varepsilon_2|\varepsilon_1 > -(\beta_{01} + X_1'\beta_1)] \quad (9)$$

If the errors ε_1 and ε_2 are independent, then the last term simplifies to $E[\varepsilon_2] = 0$, and OLS regression of y_2 on X_2 will give a consistent estimate of β_2 (assumption made in a two-part model). However, any correlation between the two errors means that the conditional mean is no longer $\beta_{02} + X_2'\beta_2$ and is necessary to account for selection. With the additional assumption that the correlated errors are joint normally distributed and homoscedastic, the unknown parameters can be estimated through Maximum Likelihood Estimation (MLE). However, if it is still a strong assumption, then an alternative estimation procedure that relies on weaker distributional assumptions may be used — the Heckman two-step procedure or *Heckit* estimator (not developed here).

5. Data and Variables

In this cross-sectional study, the dependent variables were obtained from the PPI database using projects developed in low- and middle-income countries that reached financial closure from 1990 to 2007. Data were collected on 96 different countries, also classified into six regions. According to the database, infrastructure projects were classified into four sectors: energy (electricity and natural gas), telecommunications, transport (railways, airports, toll roads and seaports) and water/sewerage. In addition, projects are classified into four broad categories of private participation: management and lease contracts, concessions, *greenfield* projects and divestitures. For the purpose of this work, only concessions, *greenfield* projects and partial divestitures were used, types of private participation that could be considered PPPs, sharing the key characteristics of long-term nature of the relationship, distribution of risks between both partners — public and private, bundling of different project phases and private finance.

The explanatory variables were chosen based on the literature review and were already described in Section 3. With these variables, the goal was to minimise collinearity problems and to maximise the number of non-missing observations. It should be noted that other possible relevant variables were previously tested, namely *corruption* and *colonial past*, but they were excluded due to problems of data availability.

For the explanatory variables, the first set of data pertains to the political systems, where all the indicators are drawn from Beck et al. (2000). The second set of data includes proxies for the quality and enforceability of the legal system and are computed for 129 countries by Djankov et al. (2007), expanding the former data set of LaPorta et al. (1998), available only for 49 countries. Concerning macroeconomic data, all the variables are available from the World Bank's World Development Indicators. Proxies for a country's level of financial development are taken from Beck et al. (2009), from the World Bank's Financial Development Database, and finally, proxies to measure the degree of social development of a country and respect for human rights are drawn from 'The Cingranelli-Richards (CIRI) Human Rights Dataset' (available online at http://ciri.binghamton.edu/index.asp) and from the survey 'Freedom in the world' (available online at http://www.freedomhouse.org).

Two different databases were obtained. The first with the infrastructure project as the unit of observation with 2366 observations, and the second with the observations aggregated per country and year, with $N = 732$. The total number of observations in each database depends on the availability of the explanatory variables and is the result of the consequent matching process. Table 1 provides the general summary statistics for the global database encompassing the information for the dummy variables except time-dummies, and the table in the Appendix summarises the variables and data sources.

Table 1. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
MDBs' participation	3727	0.1135	0.3172	0	I
Index Political Competitiveness	3726	5.8608	1.6886	I	7
Checks (number)	3695	3.6203	3.5559	I	18
Creditor rights	3721	1.6238	0.9051	0	4
Contract enforcement days (ln)	3727	5.9143	0.3796	3.30	7.29
English legal origin dummy	3727	0.2047	0.4036	0	I
French legal origin dummy	3727	0.4438	0.4969	0	I
German legal origin dummy	3727	0.2455	0.4304	0	I
Socialist legal origin dummy	3727	0.1060	0.3079	0	I
Physical Integrity Index	3698	2.8756	2.0900	0	8
Empowerment Index	3427	5.1576	3.3823	0	10
Civil liberties	3727	4.1755	1.4475	I	7
Liquid liabilities to GDP	2656	0.4078	0.2369	0.06	1.30
Private credit to GDP	2653	0.3475	0.2904	0.02	1.66
General government balance to GDP	3489	−0.4567	6.3455	−35.02	33.20
External debt to total exports	3465	20.6000	19.9892	0.02	117.81
Economic growth	3723	5.1297	5.4734	−32.12	34.50
Real GDP per capita (ln)	3725	7.3574	0.9035	4.44	9.14
Population (ln)	3727	18.5781	1.8400	14.30	21.00
Energy sector dummy	3727	0.4052	0.4910	0	I
Telecom sector dummy	3727	0.1854	0.3887	0	I
Transport sector dummy	3727	0.2739	0.4460	0	I
Water/sewerage sector dummy	3727	0.1355	0.3423	0	I
East Asia and the Pacific	3727	0.3303	0.4704	0	I
Europe and Central Asia	3727	0.1527	0.3597	0	I
Latin America and the Caribbean	3727	0.3198	0.4665	0	I
Middle East and North Africa	3727	0.0223	0.1476	0	I
South Asia	3727	0.1068	0.3089	0	I
Sub-Saharan Africa	3727	0.0682	0.2520	0	I

Source: Prepared by author.

6. Empirical Results

All the regressions were performed using the statistical software STATA 12. Two preliminary notes: first, because correlation was expected among the observations within each country, clustered robust standard errors were used when possible, relaxing the independence assumption and only requiring observations to be not correlated between countries (clusters); second, because collinearity may cause problems making the regression coefficients unreliable, a collinearity diagnostic was performed using the VIF measure (variance inflation factor) available in STATA.[5] The results of the collinearity diagnostic test performed revealed that region-dummies show high levels of collinearity with VIF measures above 10, deserving correction. As a consequence, these variables were excluded to improve the results' accuracy.

6.1 The Probability of an MDB's Participation in an Infrastructure Project

Table 2 presents the results of the regressions on the probability of structuring a PPP with MDB participation. Each column presents a different specification, *Logit*, *Probit* and in column 3, the results of a restricted *Probit* model are shown. It is worth mentioning that the dependent variable is zero for 84.8 per cent of the projects (2006 observations of the total sample of 2366). MDBs participate only in 360 projects (15.2 per cent of the total).

Table 2. Determinants of MDBs' Participation in PPP Infrastructure Projects

Dependent Variable: MDBs' Participation	Logit Full Specific (1)	Probit Full Specific (2)	Probit Restricted Model (3)
Index Political Competitiveness	0.066	0.031	
	(0.56)	(0.51)	
Checks (number)	−0.045	−0.025	−0.024
	(−1.27)	(−1.45)	(−1.36)
Creditor rights	−0.235**	−0.132**	−0.120**
	(−2.44)	(−2.52)	(−2.23)
Contract enforcement days (ln)	0.377**	0.209**	0.187**
	(2.26)	(2.25)	(1.98)
English legal origin dummy	0.090	0.056	0.027
	(0.37)	(0.41)	(0.20)
German legal origin dummy	−0.654**	−0.358**	−0.308**
	(−2.10)	(−2.04)	(−2.19)
Socialist legal origin dummy	−0.643*	−0.301*	−0.368**
	(−1.95)	(−1.65)	(−2.09)
Physical Integrity Index	0.011	0.007	
	(0.28)	(0.32)	
Empowerment Index	−0.064	−0.034	−0.025
	(−1.24)	(−1.21)	(−0.90)
Civil liberties	−0.173	−0.091	−0.104*
	(−1.48)	(−1.36)	(−1.65)

(Table 2 Continued)

(Table 2 Continued)

Dependent Variable: MDBs' Participation	Logit Full Specific (1)	Probit Full Specific (2)	Probit Restricted Model (3)
Liquid liabilities to GDP	0.922	0.398	0.478
	(1.18)	(0.92)	(1.14)
Private credit to GDP	−1.459**	−0.701**	−0.760**
	(−2.23)	(−2.11)	(−2.34)
General government balance to GDP	−0.010	−0.005	
	(−0.69)	(−0.66)	
External debt to total exports	0.002	0.001	
	(0.57)	(0.48)	
Economic growth	−0.019	−0.009	
	(−0.83)	(−0.75)	
Real GDP per capita (ln)	−0.292***	−0.161***	−0.136***
	(−3.22)	(−3.18)	(−2.96)
Population (ln)	−0.330***	−0.181***	−0.172***
	(−4.19)	(−4.04)	(−5.27)
Energy sector dummy	0.162	0.104	
	(0.39)	(0.45)	
Telecom sector dummy	−0.100	−0.039	
	(−0.26)	(−0.18)	
Transport sector dummy	0.114	0.054	
	(0.32)	(0.27)	
Time Dummies	Jointly Significant*	Jointly Significant*	Jointly Significant**
Constant	4.373*	2.334*	2.358***
	(1.86)	(1.81)	(2.83)
Number of observations	2366	2366	2443
Log-likelihood value	−928.43	−928.88	−961.92
Percent Correctly Predicted	84.62%	84.70%	84.73%
Pseudo R-squared	7.98%	7.93%	7.40%
Link test (p-value of hatsq)	0.807	0.674	0.874
Goodness of fit (Hosmer Lemeshow/p-value)	0.428	0.871	0.704
LR test (p-value)[a]	----	----	0.784

Source: Prepared by author.
Notes: * statistically significant at 10% level, ** at 5% level, *** at 1% level.
[a] LR statistic comparing the full model specification with the restricted specification.
Clustered robust t statistics in parentheses.

The qualitative results of *Logit* and *Probit* specifications (column 1 and 2) are very similar with very close goodness-of-fit measures — percentage correctly predicted of around 85 per cent, and pseudo *R*-squared around 8 per cent. In addition, concerning model specification, both models seem to be appropriate to model our data. The linktest[6] performed show no evidence of misspecification problems either for the *Logit* or *Probit* models. An additional measure of goodness of fit is also presented in Table 2, with the Hosmer-Lemeshow test not rejecting the null hypothesis that estimated and observed probabilities agree.

The estimates from the models show a consistent pattern. In general, the main results point to a significant support of the economic/financial and legal variables to explain MDBs' participation in PPP projects. As expected, richer (measured by *GDP per capita*) and more populous countries tend to have projects with lower participation of MDBs. These findings are according to our hypotheses (*H3* and *H5*) and confirm Neumayer's (2003) results. Variables like external debt and general government balance appear as not significant, rejecting our hypothesis *H4*.

The legal dimension is the other important driver of MDB participation, although it does not confirm our hypothesis *H2*. According to the results, countries with higher legal risk measured by the index of creditor rights and the number of days to enforce a contract have a higher probability of an MDB's participation in a PPP project. In addition, there is evidence that the legal origin of a country matters. A possible explanation for these results is given by the organisational structure and the web of legal and financial contracts inherent to PPP arrangements that provide a substitute for poor investors' protection favouring MDB participation. Subramanian et al. (2008) had already noted that project finance arrangements and PPPs are often used in countries with weaker laws protecting investors.

In the financial dimension, more developed financial countries, as measured by *private credit to GDP*, have a lower probability of MDB participation in PPP projects, as expected, in line with our hypothesis *H6*. Where the domestic financial and capital markets are relatively underdeveloped, the capacity for local financing of large-scale private investments will be constrained. Therefore, a relatively higher probability of MDBs participation will be expected, other things being equal. These results may also be interpreted based on the literature that sees MDBs as substitutes for private investment.

More surprising is the fact that political and human rights variables are not significant in the full specifications of the models *Logit* and *Probit*. The political environment does not play a determinant role explaining the MDBs' participation (rejecting *H1*) and, more importantly, human rights variables do not seem to matter, denying the idea that their participation is higher for countries that are more socially responsible, given their role as 'development' banks (rejecting *H7*). However, it should be mentioned that this result is consistent with previous findings in the literature, for instance, Lebovic and Voeten (2009) revealed in their empirical analysis that objective measures of human rights have no independent effect on multilateral aid allocations.

As far as sector-dummies are concerned, they are not relevant but a detailed analysis is presented in Section 6.3, and the effect of time is jointly significant in all specifications.

After these conclusions, we ran a restricted form of the *Probit* model using only the potential statistical significant variables that showed a *t*-statistic above 1, in absolute terms: $|t| > 1$. The results are presented in column 3 of Table 2 and are very close to the results obtained with the full specification. The LR test performed shows that the restricted model is not rejected, showing a *p*-value of 0.784. It is worth mentioning that the variable of *civil liberties* is now marginally significant, presenting the expected sign, meaning that countries with higher respect for civil liberties will enjoy more MDBs' participation in PPP projects. Next, we turn our attention to the computation

Table 3. Average Marginal Effects for the Probability of MDBs' Participation in PPP Infrastructure Projects

Dependent Variable: MDBs' Participation	Average Marginal Effect Probit Restricted
Creditor rights	−0.0260
Contract enforcement days (ln)	0.0406
English legal origin dummy	0.0059
German legal origin dummy	−0.0579
Socialist legal origin dummy	−0.0681
Civil liberties	−0.0225
Private credit to GDP	−0.1651
Real GDP per capita (ln)	−0.0296
Population (ln)	−0.0374

Source: Prepared by author.

of average marginal effects (AME) focusing on the restricted *Probit* model. Contrary to what happens with linear regression models, with nonlinear models the coefficients β_j do not have a direct interpretation as the marginal effect — with nonlinear models, the marginal effects are nonlinear functions of the parameter estimates and levels of the explanatory variables. It should be noted that for dummy independent variables, the AME gives the discrete change rather than the marginal effect, i.e., for binary variables, it computes the discrete change when the variable changes from 0 to 1. Table 3 presents the AME to the statistically relevant variables. The results show that, in general, the magnitude of the effect is very small and more precisely:

• Increasing real GDP per capita by 1 per cent, decreases on average the probability of MDBs' participation by 2.96 per cent, approximately all else held constant;

- If the number of days to enforce a contract increases by 1 per cent, the probability of an MDB's participation increases on average by approximately 4.06 per cent, *ceteris paribus*;
- If a country is 1 per cent more populous, the probability of an MDB participating in a PPP infrastructure project is on average 3.74 per cent less, approximately holding all other factors fixed;
- Particularly significant is the magnitude of the *Private credit to GDP* coefficient—if this variable increases by 0.1 (more developed financial countries), this will reduce the probability of an MDB's participation by about 1.65 per cent, on average controlling for all the other relevant factors.

The next section attempts to explain the process of aid allocation as a two-stage process, using the real amount of financial support provided by MDBs to infrastructure projects per country/year.

6.2 The Determinants of the MDBs' Financial Support

In order to meet the second goal of the empirical analysis — how the political, legal, social, economic and financial environment in host countries affect the level of financial flows provided by the MDBs — the dependent variable is now the real value of aid provided by the MDBs to each country/year leading to

Table 4. Descriptive Statistics for MDBs' Financial Support to PPP Projects

Variable(*)	Obs	Mean	Std. Dev.	Skewness	Kurtosis	Min	Max
MDB support	732	33.34	162.17	19.62	464.92	0	3944.79
MDB support y > 0	286	85.34	250.99	12.96	197.22	0.28	3944.79
ln (MDB support)	286	3.46	1.46	−0.38	3.61	−1.28	8.28

Source: Prepared by author.
Note: (*) Expressed in real USD values.

732 observations.[7] A more appropriate dependent variable would be aid as a share of total investment, but the share is negligible with very little variation, preventing us from using this approach.

Concerning the amount of financial support provided by MDBs, the majority of the sample observations assume the zero value (61 per cent of the 732 observations) and the positive values are very heavily skewed with non-normal kurtosis. The methods used rely mostly on the normal distribution of the data, and a logarithmic transformation was performed on the dependent variable. After this, the variable is almost symmetrically distributed and has negligible non-normal kurtosis, as it is possible to see in Table 4.

It is interesting to note that the majority of the MDBs' financial flows are registered to emerging countries, such as, Brazil, Chile, India and Philippines. At first glance, it may be considered a surprising aspect because MDBs' development role implies a focus on poorer countries. A more accurate analysis leads to the conclusion that it is the emerging countries that mostly need capital to finance their development and their infrastructure projects relying on multilateral lenders to cover the lack of financial resources from other sources.

The financial support provided by MDBs may be considered as a two-step decision. First, based on the intrinsic characteristics of a country, the decision is taken as to whether or not to provide support, and next, the second decision has to do with 'how much' support to give to the selected countries. Based on the previous exposition, theoretically a two-part model seems to be an appropriate model for this dependent variable.

In this specification, y is modelled first as a *Probit* regression for $y = 0$ versus $y \neq 0$ and next, the positive values are modelled with another distribution (using OLS in this case). The *Probit* model achieves 68.4 per cent of the observations correctly classified. Table 5 presents the results obtained with a Tobit regression, a two-part model and with Heckman selection model estimated by MLE, assuming a joint normal distribution for the unobservables of the two parts. It should be mentioned that a two-step estimation was also performed using *Heckit*, but the same qualitative results were obtained and no apparent improvement was achieved (results not presented).

The dependent variable is used in logs rather than levels; however, the log transformation does not exist for observations equal to zero. To overcome this problem, we follow the approach proposed by Cameron and Trivedi (2009) concerning Tobit estimation.[8] The two-part or sample selection models are more appropriate because they use the zero observations without needing further adjustments.

It is now possible to disentangle factors that determine the decision to provide financial support, from factors that drive the 'amount' of such financial support, allowing a richer analysis. Factors that influence the MDBs' decision to provide financial support include measures of legal risk, in line with our previous results where riskier countries have a higher probability of benefiting from this support, in what

Table 5. Determinants of the Financial Support Provided by MDBs to PPP Infrastructure Projects

Dependent Variable: Real Dollar Value of MDB Support (ln)	TOBIT (1)	Two-Part Model		Heckman (MLE)	
		y>0 (2)	dy (3)	y>0 (4)	dy (5)
Index Political Competitiveness	0.420	−0.112	0.101	−0.114	0.101
	(1.40)	(−0.87)	(1.28)	(−0.95)	(1.28)
Checks (number)	−0.132	−0.021	−0.023	−0.021	−0.022
	(−1.03)	(−0.30)	(−0.60)	(−0.31)	(−0.58)
Creditor rights	−0.537**	0.172*	−0.155**	0.175*	−0.155**
	(−2.32)	(1.85)	(−2.33)	(1.86)	(−2.33)
Contract enforcement days (ln)	1.177**	0.177	0.268**	0.172	0.268**
	(2.33)	(1.00)	(2.13)	(1.01)	(2.13)
English legal origin dummy	0.313	−0.278	0.111	−0.28	0.111
	(0.49)	(−1.33)	(0.48)	(−1.42)	(0.48)
German legal origin dummy	−1.182	0.43	−0.309	0.435	−0.31
	(−1.20)	(1.45)	(−1.27)	(1.53)	(−1.27)
Socialist legal origin dummy	0.751	0.155	0.167	0.153	0.167
	(0.82)	(0.40)	(0.62)	(0.42)	(0.62)
Physical Integrity Index	−0.208	0.051	−0.063*	0.052	−0.063*
	(−1.37)	(0.77)	(−1.75)	(0.81)	(−1.75)
Empowerment Index	0.083	0.049	0.022	0.049	0.022
	(0.68)	(1.13)	(0.57)	(1.20)	(0.56)
Civil liberties	−0.892***	0.109	−0.225**	0.113	−0.225**
	(−2.99)	(0.84)	(−2.28)	(0.86)	(−2.28)
Liquid liabilities to GDP	2.988*	0.592	0.726*	0.581	0.726*
	(1.85)	(0.91)	(1.82)	(0.95)	(1.81)
Private credit to GDP	−2.055	−0.078	−0.504	−0.071	−0.504
	(−1.54)	(−0.14)	(−1.36)	(−0.13)	(−1.37)
General government balance to GDP	−0.117**	−0.024	−0.024**	−0.024	−0.024**
	(−2.49)	(−1.14)	(−2.10)	(−1.21)	(−2.10)
External debt to total exports	0.017	0.015*	0.004	0.015**	0.004
	(0.97)	(1.88)	(0.73)	(2.00)	(0.72)
Economic growth	0.052	0.008	0.015	0.008	0.015
	(0.83)	(0.30)	(0.95)	(0.31)	(0.95)
Real GDP per capita (ln)	0.705**	0.448**	0.109	0.446***	0.109
	(2.34)	(2.52)	(1.07)	(2.63)	(1.07)
Population (ln)	1.180***	0.351***	0.246***	0.347***	0.246***
	(4.80)	(3.28)	(3.27)	(3.29)	(3.27)

(Table 5 Continued)

(Table 5 Continued)

Time Dummies	Jointly Significant ***	Jointly not Significant	Jointly Significant ***	Jointly not Significant	
Constant	−41.064***	−9.028***	−8.210***	−8.875***	−8.211***
	(−6.16)	(−3.16)	(−5.67)	(−3.02)	(−5.67)
Number of observations	732	286	732	732	732
Log-litelihood value	−1094.19	−462.69	−427.52	−890.21	
(Pseudo) R-squared	6.08%	29.82%	12.71%	8.67%'	

Source: Prepared by author.
Notes: * statistically significant at 10% level, ** at 5% level, *** at 1% level.
ᵃ⁾ For the Heckman model, the correlation (y yhat)⁻² is presented.
Clustered robust t statistics in parentheses, except for Tobit.

may be seen as an attempt to create a protective umbrella through the involvement of MDBs in these projects, making them more attractive to private investors.

Also interesting is the sign and significance of the *Civil liberties* measure showing that countries that do not respect freedom (with higher values in this indicator) are penalised with lower MDB involvement (which gives support to *H7,* developed in Section 3), although the *Physical integrity index* is marginally significant exhibiting the wrong sign.

Concerning economic and financial factors, countries facing difficulties with large deficits will have more probability of benefit from MDBs' financial support, which seems to confirm *H4.* In contrast, countries with more financial development, measured by *Liquid liabilities to GDP* appear more interesting to MDBs. Also important is the variable of *Population* showing the opposite sign. Larger markets appear more attractive to provide financial support by MDBs. For this purpose, it should be noted that Hammami et al. (2006) had already reported that countries with larger markets and heavy debt burdens were more attractive to develop infrastructure PPPs.

Factors that explain the 'amount' of financial support include higher *GDP per capita* and the size of the market. In this analysis, richer countries and with more population received more financial support from MDBs. In addition, countries with higher debt levels will benefit from higher MDB flows. More interesting is the variable *Creditor rights*, which invert the sign in the two parts of the model. It appears that once the decision is taken to provide financial support to a riskier legal country, the amount of such support will increase for countries that recognise more rights to creditors.

Time-dummies appear particularly relevant in explaining the decision to give support, with almost all coefficients positive and statistically significant, showing a positive trend over time (individual coefficients not reported).

When we drop the assumption of independence of the two parts of the model, an alternative model can be used — the sample selection model estimated through MLE (Heckman MLE). In this specification, the same variables were used in both equations (selection equation and outcome equation). Columns 4 and 5 of Table 5 exhibit the results. Comparing the results from the two-part model and Heckman MLE, they are similar (the same coefficient estimates were obtained in the two equations with almost the same statistical significance achieved). The log-likelihood of the two models is the same, -890.21, and in addition the LR test of independence of the equations obtained with Heckman MLE gives a *p*-value of 0.91. As such, the estimated correlation between the errors of the two parts is not significantly different from zero and the hypothesis that the two parts are independent cannot be rejected, making the choice of a two-part model more appropriate.

The next section develops the analysis by sectors, highlighting the differences across industries.

6.3 The Determinants of the MDBs' Participation in PPPs by Sectors

Results are presented in Table 6 using the Logit full specification for the four broad sectors of infrastructure — energy, telecommunications, transport and water/sewerage.

Table 6. Determinants of MDBs' Participation in PPP Infrastructure Projects by Sectors

Dependent Variable: MDBs' Participation	Energy Logit (1)	Telecom Logit (2)	Transport Logit (3)	Water Logit (1)
Index Political Competitiveness	−0.005	0.163	−0.116	2.358***
Checks (number)	0.004	−0.037	−0.082	−0.201
Creditor rights	−0.397***	−0.063	−0.132	−1.266***
Contract enforcement days (ln)	0.637**	0.235	0.47	−2.255
English legal origin dummy	0.369	0.402	0.169	−7.859***
German legal origin dummy	−1.333***	−0.152	−0.332	0.301
Socialist legal origin dummy	(omitted)ᵃ	−0.768	0.909	−0.239
Physical Integrity Index	−0.116	0.176*	0.207**	0.562***
Empowerment Index	−0.097	−0.049	0.152	−0.635***
Civil liberties	−0.273*	0.1	0.305	0.116
Liquid liabilities to GDP	1.071	−0.368	0.178	5.185*
Private credit to GDP	−1.003	−1.511	−2.471**	−1.177
General government balance to GDP	−0.011	−0.015	−0.018	0.289**
External debt to total exports	0.012**	0.002	−0.003	−0.002
Economic growth	−0.02	0.025	0.026	0.014
Real GDP per capita (ln)	−0.330**	−0.047	0.071	−0.913
Population (ln)	−0.448***	−0.14	−0.401**	−1.082**
Time Dummies	Jointly not Significant	Jointly Significant***	Jointly Significant**	Jointly Significant**
Constant	8.401***	−1.589	−13.990**	22.293
Number of observations	937	438	697	231
Percent Correctly Predicted	82.60%	84.25%	87.52%	90.91%
Pseudo R-squared	7.99%	14.05%	21.70%	37.38%
Number of countries	60	75	53	28

Source: Prepared by author.
Notes: *statistically significant at 10% level, ** at 5% level, *** at 1% level.
    a) Dropped due to collinearity problems.

Comparing Table 2 with these results, it is possible to see that strong similarities exist between the energy sector and the full sample results. This is an expected outcome, given that the majority of the PPP projects are in this sector (around 40 per cent of the total sample). Therefore, poorer and less populous countries with underdeveloped legal and financial systems enjoy higher probability of MDBs' participation in energy PPPs. Countries with higher debt burdens also benefit from a higher probability of MDBs involvement, in line with *H4*, and governments lacking internal resources tend to resort to PPPs in order to build their infrastructure in the energy sector.

For telecommunications projects, none of the previous determinants appears to be of statistical relevance; only a strong time-effect is evident and the respect for human rights (measured by the physical integrity index) is statistically relevant. Telecommunications PPPs represent nearly 19 per cent of all infrastructure projects and, typically, this is a highly profitable sector requiring advanced and innovative technologies and the expertise of the private sector.

Transport projects (which account for 27 per cent of the full sample) usually are capital intensive, requiring high levels of financial resources. The probability of MDBs' involvement is higher for countries with underdeveloped financial systems, emphasising a substitution effect. Finally, the water sector represents 14 per cent of the total infrastructure PPPs. In this sector, countries that exhibit higher political competitiveness are rewarded with more MDB participation. Until now, the political variables have never been statistically relevant. This is a result in contrast with the multisector results for all four sectors taken together (Table 2), but it is not surprising, because sectors such as water (and energy) tend to be 'more public', given the political sensitiveness of the goods to be provided. Riskier legal countries seem to benefit with higher MDB participation and results for the social variables are mixed.

7. Conclusion

Infrastructure projects are prone to specific risks, given their nature, and usually imply commitments for longer maturities, which makes investors particularly exposed to risk. Therefore, lenders should evaluate the different risk factors, project-specific but also related to the country environment where the project will be developed. This risk assessment will be reflected in the willingness to enter into a PPP arrangement and in the degree of such commitment. MDBs have a fundamental role to play, acting like additional partners and providing a protective umbrella. In times of financial distress, the challenge is to promote more effective partnerships between MDBs and the private sector to complete complex arrangements. In order to be a real contribution to development, MDBs should maximise the 'crowding-in' of private sector engagement, rather than taking their place ('crowding out'), although our results are mixed.

Aggregate empirical studies that evaluate country-specific determinants of infrastructure PPPs can detect trends and provide useful insights into the macroeconomic and structural characteristics that may encourage the intensity of investments and the participation of different agents. The empirical evidence shows that economic and legal conditions are the most important dimensions, explaining the probability of MDBs' participation in infrastructure projects, particularly factors related to the market size (population) and to a country's income level. As such, MDBs participate more in infrastructure projects developed in poorer, less populous countries and with underdeveloped legal and financial systems. Our findings support hypotheses 3, 5 and 6. Political variables are not statistically significant, therefore rejecting hypothesis 1. Perhaps more disappointing is the fact that human rights variables at an aggregate level do not play an important role as determinants of the probability of such participation (rejecting *H7*). If we focus on the results obtained with a two-part model, to disentangle factors that influence the decision to provide support from factors affecting the amount of support, different conclusions are obtained. To explain the MDBs' decision to support projects, riskier legal environments and countries that respect civil liberties are selected. To explain the level of support, it seems that MDBs are acting like any other investor, choosing countries with better creditor rights, larger markets and with better wealth conditions.

Finally, it is relevant to mention some of the limitations of the present empirical study. First, it is not possible to know in advance whether the same results will be obtained through a different set of explanatory variables. Second, concerning MDB involvement in infrastructure projects, we only considered characteristics of the recipient country to explain the probability of such involvement, also expressed in the amount of the financial support. However, further research may be extended to include variables for the 'donor interest'.

As a final note, this paper should be considered an exploratory study, although important insights have been obtained. It is hoped that this empirical approach could add to the scarce literature on the field and to be a starting point to increase the knowledge of the role of MDBs in infrastructure projects. Given the limitation of the data available, we consider that further research is needed to provide a deeper understanding of the allocation of MDB flows to infrastructure PPPs and to ascertain their role as complements or substitutes for private investment. In the end, what matters is to test their effectiveness as development agents.

Data Appendix

Variables and Data Sources

Variables	Data Sources
• MDBs participation—Binary indicator (yes or no) • Real Dollar value of MDBs support	Dependent variables were derived from the World Bank's database—Private Participation in Infrastructure (PPI) Project Database Available online at: http://ppi.worldbank.org/
• Index of Political Competitiveness, which varies from 1 (low) to 7 (high competitiveness) • Checks—number of governmental checks and balances, which varies from 1 to 18	Beck et al. (2000)—New tools and new tests in comparative political economy. The database of political institutions.
• Creditor rights—An aggregate index, which varies from 0 for weak creditor rights to 4, meaning strong creditor rights • Contract enforcement days (ln)—the number of days to resolve a payment dispute through courts • Legal origin—English, French, German and Socialist. We use 3 dummies, French civil law being the reference	Djankov et al. (2007)
• Physical Integrity Rights Index, ranges from 0 (no government respect) to 8 (full government respect) • Empowerment Rights Index, ranges from 0 (no government respect) to 10 (full government respect)	The Cingranelli-Richards (CIRI) Human Rights Dataset. Available online at: http://ciri.binghamton.edu/index.asp
• Civil liberties, which varies from 1 (highest degree of freedom) to 7 (the lowest)	Survey 'Freedom in the world'. Available online at http://www.freedomhouse.org
• Liquid liabilities to GDP • Private credit to GDP	Beck et al. (2009). World Bank's Financial Development Database
• General government balance (percent of GDP)	World Bank's World Development Indicators.
• External debt (percent of total exports) • Economic growth—GDP growth (annual %) • Real GDP per capita (ln)—constant 2000 US$ • Population, total (ln)	

Notes

1. For infrastructure projects, loans provided by MDBs and similar agencies are a critical source of funds. Even more, their participation reduces the perception of risk to the other agents and reinforces the social aspects of the project. Some advantages obtained directly from the MDBs' participation are: they extend maturities, reduce spreads and through the enhancement of the project's viability, they provide countries with experience in using complex financial structures and dealing with IFIs. Indirectly, such participation acts like a sign to lenders of the creditworthiness of the deal, facilitating the raise of private funds, because projects are subject to detailed appraisals including several financial and non-financial aspects before being approved.

2. PPPs are long-term agreements between the private and public sector for the provision of an infrastructure asset and/or a socially relevant service.

3. Physical Quality of Life Index (PQLI): This is an aggregate indicator of three statistics—literacy rate, infant mortality and life expectancy—and it is a measure of the quality of life or well-being of a country.

4. The English legal origin includes the common law of England, and the former colonies, United States, Australia and Canada. The French legal origin includes the civil law of France and also countries Napoleon conquered (including Portugal and Spain) and former colonies. The German legal origin includes the laws of the Germanic countries in Central Europe, but also countries in East Asia. The Socialist legal origin includes the new countries that emerged from the breakup of the Soviet Union, plus Mongolia (Djankov et al. 2007).

5. VIF is an indicator of how much of the inflation of the standard error could be caused by collinearity. As a rule of thumb, values above 10 should be a cause of concern and must be corrected (see Cameron and Trivedi 2009).

6. *Linktest* is a STATA routine that performs a test for model specification, providing a means of assessing adequacy for the relationship between outcome and predictors. The idea behind *linktest* is that if the model is properly specified, it should not be able to find any additional predictors that are statistically significant. *Linktest* uses the linear predicted value (**hat**) and linear predicted value squared (**hatsq**) as the predictors to rebuild the model. The variable **hat** should be a statistically significant predictor, since it is the predicted value from the model.

On the other hand, if the model is properly specified, variable **hatsq** should not have much predictive power. *Linktest* also tests the adequacy of the link function.

7. It is worth emphasising that this analysis is different from the one presented in the first set of regressions (Table 2), because previously the unit of analysis was the PPP project with $N = 2366$ observations, and now the analysis is developed per country and year.

8. All censored observations of $\ln(y)$ are set to an amount slightly smaller than the minimum non-censored value of $\ln(y)$. This is not the most advisable procedure, although it consists of small variations from the original data.

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