The Determinants of Private Sector and Multilateral Development Agencies Participation in Infrastructure Projects

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Abstract

Much more investment will be needed in developing countries, to achieve the Millennium Development Goals, specifically, the goal of reducing poverty. In this respect, the private sector investment is critical, bringing more funds, expertise and efficiency to the development of projects in several essential areas, like energy, transport, water and telecommunications. In addition, the involvement of Multilateral Development Agencies (MDAs) plays an important "enabling" function acting like a mechanism of risk reduction and enhancing credit. To address these unexplored topics, an empirical analysis is performed of the cross-country determinants of the private sector and MDAs participation in infrastructure Public Private Partnerships, using developing countries data, from the World Bank's Private Participation in Infrastructure database. The results suggest the following: the participation of MDAs is higher for less populous and poorer countries. Yet, neither the level of political risk of a country nor respect for human rights seems to play an important role in explaining multilateral participation in projects. Concerning the private participation, also proxies for the country economic risk are more relevant. Private sector seems to prefer to invest in projects located in richer and less populous countries. Also statistically relevant is the country legal origin and if the project has a MDA participation.

Keywords: *Public-Private Partnerships, Infrastructures, Investment Policy, Limited Dependent Variable Models*

JEL classification: H54, G31, G38, C25

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1   Introduction and background

Infrastructure investments are essential to achieve economic prosperity, promoting growth and enhancing well-being. It is well known that the developing countries will need much more investment, particularly private sector investment, to achieve the Millennium Development Goals (MDGs), specifically, the goal of reducing poverty.[1] The private sector involvement will bring more funds, expertise and efficiency to the development of projects in several essential areas, like energy, transport (roads, tunnels, bridges, railways, airports), water and sanitation and telecommunications.

In order to foster private participation, developing countries should pursue macroeconomic stability and improve their institutional framework, namely, strengthening procedures for contract enforcement and dispute settlement and developing a coherent set of policies for trade, tax and competition. Additionally, the role of MDAs is critical in all this process, on one hand, enhancing credit and acting like a mechanism of risk reduction and on the other hand, helping governments to perform the necessary reforms. This has been emphasized in several works, for instance, World Bank (1994), OECD (2006), Hainz and Kleimeier (2006), Matsukawa and Habeck (2007), Pessoa (2008) or Sorge and Gadanecz (2004).

One way of increasing the private participation in infrastructure projects is through PPPs. These partnerships are a worldwide phenomenon, spread in developed countries, but also in developing ones. They appear as a key instrument to promote economic growth and enhancing well-being, aspects of particular importance in developing countries. Nevertheless, the implementation of PPPs in these countries is a challenging task, facing several limitations. For instance, according to Pessoa (2006), many developing countries face problems in adopting an adequate regulatory framework, have underdeveloped capital markets and non-competitive industries and are dependent from investments made by a few of international and large companies, resulting in a lack of negotiation power. Therefore, political, legal, social, economic and financial risks may be even more important in developing countries than in developed ones and as a consequence, this same conclusion seems to be evident about the participation of MDAs in PPPs arrangements, for those countries.

From the combination of developing countries risks with the risks that are inherent to infrastructure investments[2] and in addition, the fact that the majority of the invest-

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[1]The MDGs were established in 2000, when leaders of countries from the entire world committed to devote every effort in order to achieve eight development goals by 2015. They include reducing extreme poverty and hunger, reducing child mortality, improving maternal health, achieve universal primary education, fighting disease epidemics and developing a global partnership for development.

[2]The existence of natural monopolies that exclude competition, the assets nature (capital-intensive, immobile and not easily redeployed for other uses), the fact that outputs are usually non-tradable and

ments are carried out with Project Finance[3], we may conclude, at first glance, that such ventures were not appealing for private investors. But the reality shows another picture. The 1990's, surprisingly, face a boom in Foreign Direct Investment (FDI) to infrastructure projects in developing countries. Some explanations to this exponential growth presented by Ramamurti and Doh (2004) are the end of natural monopolies making regulation less needed, the prospect of quick profits for first-movers and the use of Project Finance to reduce the risks. Another aspect mentioned is the adoption of favorable legal measures and the end of outright expropriations, creating a new climate for FDI in developing countries. As an additional illustration of the importance of private sector participation, Straub (2008) points out the case of seven Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Mexico and Peru), where private investment represented 16,4% of total investment in infrastructure in the period 1980-85, and if we consider the period of 1996-2001, the percentage increase to 62,9%.

According to the PPI Database[4], the peak of the private infrastructure boom was 1997, thereafter a number of factors led to a reduction in the number and amount of projects, namely, the financial crisis of 1997-98, the slowdown in economic activity, the bursting of the dot-com and telecommunications bubbles and also, the fact that privatization was a one-time phenomenon. More recently and after a downward trend from 1998 to 2003, private investment in infrastructure projects increase from 2004 to 2008, although in this last year the number of projects face a small decline. Investments were more evenly spread across all developing regions, however it become more concentrated in sectors like telecommunications and energy who lead the recovery, followed by transport with investments stabilized over the last three years. The sector with a traditionally minor expression is still the water and sewerage sector (see Graph 1 and 2 in the annex).

In respect of MDAs participation in the total count of infrastructure projects, the rate of participation as oscillated between 26% in 1991 and 5% in 2008, with an average annual value of 13% during the period of 1990-2008 (see Graph 3).

Although outside of the time span of the present study, it should be mentioned that the environment for PPP projects has been severely impacted by the recent financial crisis. The World Bank in its *"February 2010 Assessment of the impact of the crisis on new private participation in infrastructure projects Update 5"* (World Bank, 2010) witnessed the decline in the number and value of projects reaching financial closure and

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the existence of pricing problems related to political sensitiveness of the services to be provided, all these factors contribute to enhance the riskier nature of infrastructure investments (see for instance, Grimsey and Lewis (2002), for more details).

[3]That implies that project own assets and cash flows are the sole source to meet financial obligations and to provide returns to investors.

[4]The World Bank's Private Participation in Infrastructure Database, available at http://ppi.worldbank.org.

reinforce the importance of strong economic and financial fundamentals and the backing of financially solid sponsors, in order to make projects viable. In addition, the role of MDAs is emphasized in times of financial distress, multilateral and bilateral agencies continue to provide critical funding to private infrastructure projects.

To address these issues, we pretend to perform an empirical analysis of the cross-country determinants of private sector and MDAs participation in PPPs, using developing countries data from the World Bank PPI database. To the best of our knowledge, no other empirical study address these particular topics, although the risk reduction effect of the participation of MDAs has been tested on the credit spreads of Project Finance loans (see for instance, Sorge and Gadanecz (2004) and Kleimeier and Megginson (2000)) and the determinants of aid allocation by multilateral development banks and of FDI to developing countries have been also studied (see for instance, Neumayer (2003); Neumayer and Spess (2005) and Rose-Ackerman and Tobin (2005)).

Based on the previous work of Hammami et al. (2006), we will try to explore how different country risk factors affect the private sector participation and MDAs participation in PPPs arrangements. Hammami et al. (2006) is to the best of our knowledge, the only empirical study on PPPs using the PPI database.[5] In their study, different risk factors are explored as potential determinants of the number and value of PPPs projects in developing countries, using projects' data from 1990 until 2003.

Using the Hammami et al. (2006) study as a starting point, we will try to overcome some of the limitations of their work, namely:

- First, we will use only projects that share the main characteristics of PPPs and not, the full database available. Projects that are management and lease contracts and full privatizations are therefore excluded;[6]

- Second, we will use more recent data (1990 to 2007), in the expectation that the use of more recent data will add positively to the research;

- Third, we will use some new explanatory variables - we will include indicators of the degree of social and financial development of a country.

Finally and not yet studied, as far as we know, the main contribution of our work will be the explanation of which risk factors are more relevant in determining the private sector participation in infrastructure PPPs, as well as, the MDAs participation in such projects.

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[5]Although the database is often referred in descriptive studies, providing statistical information. See for instance, Blanc-Brude et al. (2007), Pessoa (2008) or de Mästle and Izaguirre (2008).

[6]This aspect was also emphasized by Pessoa (2008), mentioning that not all forms of private sector involvement in public provision are PPPs.

In context of financial crises where international banks are retreating from emerging markets to preserve capital, MDAs are being called to fill the gap and a more active role is now required, creating more effective partnerships with the private sector. This is a topic that is gaining relevance and as an example of this, the conference on "PPP in infrastructure" which took place in December 2008, for the first time, devote one-day to the roles which can be played by multilateral capacity building agencies as well as private sector associations. In this respect, Bhattacharyay (2009) highlight the advantages of the involvement of MDAs in infrastructure projects. A synthesis is "they can help improve the flow of private savings and capital into infrastructure investments by (i) developing bankable projects; (ii) designing appropriate, innovative financial instruments; (iii) assisting countries to enhance their technical capacity and knowledge, (iv) enhancing financial market depth, efficiency, liquidity, and adherence to international and regional standards or best practices; and (iv) promoting further financial integration".

The plan of the rest of this paper is as follows: Next we will present the hypotheses to be tested and the proxies used as measures of different risk attributes, we then discuss the methodology with a focus on models of limited dependent variable. In section 4, we present the data. Results are presented and discussed in section 5. Finally, section 6 concludes.

2   Conceptual framework and hypothesis development

As emphasized above, risks are enhanced for infrastructure PPPs developed in emerging countries and the involvement of MDAs plays an important "enabling" function acting like a mechanism of risk reduction. Essentially, the involvement of multilateral organizations (financial institutions and export credit agencies) provide a third-party guarantee, increasing the creditworthiness of the arrangement. Therefore, in addition to the primary lending function, MDAs also have a catalyzing function of private funds, which assumes particular relevance in times of financial distress. But what country factors are more relevant in explaining the MDA participation in a project? And which risk is the more influential for the involvement of private sector?

In the empirical analysis that follows, we will try to answer the question how the political, legal, social, economic and financial environment in host countries influence risk perceptions and hence, the participation of the private sector and MDAs in infrastructure PPPs.

Political Risk

We would expect to find a clear relationship between the participation of private sector and MDAs in PPPs arrangements and the political risk of a country. More precisely, private sector will prefer to invest in politically stable countries and MDAs should participated in PPPs more frequently for projects developed in countries characterised by high political risk - the higher the political risk of a country, the higher the probability of a PPP to be structured with MDAs participation and inversely, the lower the degree of private sector involvement.

Hypothesis 1 - The probability of having a PPP with a MDA participation is positively related to the level of political risk.

Hypothesis 2 - The degree of private participation in a PPP is negatively related to the level of political risk.

As proxies for the level of political risk, that may affect infrastructure investments we will use measures of the democratic regime (related to the access to government offices: elections and their competitiveness) and of democratic governance, meaning the process whereby government make and implement legally binding decisions, all drawn from Beck et al. (2000). Political risk is higher for countries where governments do not exhibit political checks and balances[7] or that restrain electoral competition.

- Index of Political Competitiveness, a variable that characterize the competitiveness of elections. It measures the number of parties competing in elections and range from 1 (low) to 7 (high competitiveness). More political competitiveness will lead to a reduction of the political risk of a country, with more transparent and accountable governments, which are pre-requisites for PPPs to be successful.

- 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 - to measure that we will use the variable *checks* that is a measure of government accountability. As an additional measure of the relationship of the executive and legislative branches we will collect information on a country's political system - countries are classified as direct presidential (0), strong president elected by assembly (1) or parliamentary (2).

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[7]Checks and Balances refers to the separation of powers - a system of distribution of power among the executive, legislative and judicial branches of government used to balance the powers and prevent one branch to obtain power in excess.

Legal Risk

A PPP is, in essence, a bundle of contracts - financial and non-financial contracts. Typically these contracts are naturally incomplete and prone to opportunistic behaviour. Therefore, private investors must ensure they have legal rights and that the local law enforcement is efficient. It is expected that countries with strong legal protection will be able to raise more long-term private capital to develop infrastructure projects and the participation of MDAs with its effect of "umbrella" will be less important for these countries, thus:

Hypothesis 3 - The probability of having a PPP with MDAs participation is positively related to the level of legal risk.

Hypothesis 4 - The degree of private participation in a PPP is negatively related to the level of legal risk.

As proxies for the level of legal development, we will use the following:[8]

- Creditor rights index - We measure the creditor rights in the country in which the project is located based on LaPorta et al. (1998) index and expanded by Djankov et al. (2007). The authors show that legal creditor rights is an important determinant of private credit development. 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) emphasizes the importance of legal enforcement as well the quality of the laws on the books (measured by the creditor rights index). Both measures of the quality of the legal system matters and provide a complementary analysis (laws on the books and its applicability).

- Legal origin - A dummy variable that identifies a country's legal origin. This variable was first proposed by LaPorta et al. (1998) with four possibilities - English, French, German and Nordic - and expanded by Djankov et al. (2007), adding a fifth category - Socialist (transition).[9] A link between the origin of a country's legal tradition and the operation of its financial system was first established by

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[8]Also used in previous studies, Esty and Megginson (2003), Subramanian et al. (2008) or Gatti et al. (2008).

[9]The English legal origin includes the common law of England, and the former colonies, U.S., 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 Nordic legal origin - laws of the four Scandinavian countries. And the Socialist legal origin - for the new countries that emerged from the breakup of the Soviet Union, plus Mongolia. The Socialist category do not apply to countries that have gone back to their pre-communist legal systems, where they were assigned to their pre-war legal systems.

LaPorta et al. (1998). The authors have found that countries with common law legal institutions provide better protection to creditors than do countries with civil law institutions. More recently, reinforcing this idea, Beck et al. (2004) empirically demonstrate that countries with civil law, provide creditors with weaker legal rights and as a consequence, firms face higher obstacles in contracting for external finance than firms in other countries.

Economic and Financial Risks

The macroeconomic environment can also affect project risks and the participation of private sector and MDAs in PPPs, thus:

Hypothesis 5 - The probability of having a PPP with MDAs participation is positively related to the level of economic and financial risks.

Hypothesis 6 - The degree of private participation in a PPP is lower for countries with higher economic and financial risks.

In general, economic and financial risks assessments improve for countries with larger economic size (GDP), lower inflation, low external debt and more developed financial markets. Each determinant of economic and financial development derives from the theoretical literature, for instance, Cantor and Packer (1996), Eichengreen and Mody (2000) or Altunbas and Gadanecz (2003), found that the following macroeconomic fundamentals are important as explanatory variables of the capital flows to emerging markets:

- Real GDP per capita and economic growth, used to measure the evolution of the country's wealth.

- Inflation rate and international reserves. As Cantor and Packer (1996) argue, a high rate of inflation points to structural problems in the government's finances and is a focus of instability. Therefore a controlled inflation and the existence of significative international reserves are indicators of a country macroeconomic stability.

- External debt and general government balance. It is expected that governments with large deficits and high debt burden will be more interested in PPPs to solve infrastructure problems. But at the same time, these two variables are a focus of economic instability increasing the risk level of a country. A higher debt burden imply a higher risk of default and the weight of the burden increases as a country's external debt rises relative to its foreign currency earnings (exports of goods and

services). In addition, governments with large and structural deficits increase foreign indebtedness, which may become unsustainable over time.

- Fuel exports as a measure of a country's natural resources. As mentioned in Rose-Ackerman and Tobin (2005), the existence of natural resources is expected to attract much more investment regardless of other relevant factors, and this is also true for infrastructure projects.

- Population - An additional factor that should be accounted for, is the dimension of the market. Concerning PPPs, it is an important feature of the attractiveness of a project to the private sector, specifically, if projects are to be financed also with user charges. Therefore, PPPs tend to be more common in larger markets.

Linking infrastructure development more effectively with private finance markets would help to leverage and mobilize more capital. By contrast, underdeveloped financial markets makes the private participation on infrastructure projects relatively more difficult, particularly, as reported by de Mästle and Izaguirre (2008), when domestic investors are becoming more prominent as a major source of funds to infrastructure projects. In addition and as mentioned by Delmon (2007), the provision of new risk mitigation instruments by MDAs and the deepening of local capital markets also contribute to the sustainability of PPPs. There is no single measure of financial development, but we will use the following, mostly commonly used and drawn from Beck et al. (2009):[10]

- Liquid liabilities of the financial system to GDP - is a traditional measure of financial depth and measure the size of the financial intermediary sector relative the size of the economy. This indicator show the degree to which the financial sector mobilizes domestic savings - larger depth should reflect greater financial development.

- Financial claims on the private sector by deposit money banks and other financial institutions divided by gross domestic product (GDP) - countries with higher private credit to GDP, usually have higher rates of economic growth;

- And finally, we will use the ratio of deposit money bank assets to the sum of deposit money and central bank assets. This is a measure of the relative importance of commercial *vs* central banks. It has been shown that countries where commercial banks have a higher role in financial intermediation (rather than central banks) also face a higher degree of financial development.

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[10]See, for instance, Esty (2003).

Social Risks

As a final dimension to be assessed in its importance for PPPs projects we will include measures of human development that we roughly called "social factors". It is expected that proxies for human development should have an effect, particularly in explaining MDAs participation in infrastructure projects, although that effect should not be so clear concerning private participation.

Hypothesis 7 - The probability of having a PPP with MDAs participation is higher for countries with higher respect for human rights and civil liberties.

Hypothesis 8 - The degree of private participation in a PPP is higher for countries with higher respect for human rights and civil liberties.

Besides the traditional measure of per capita income, as a proxy of well-being and economic development (also included in our study), we will use two proxies for human rights and social development, drawn from the "Cingranelli-Richards (CIRI) Human Rights Dataset" and also a measure of civil liberties, 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 is measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest.

In addition, we would like to know whether sectoral differences and regional differences have an effect on PPPs projects, therefore we will use:

- Dummies for regions - East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia and Sub-Saharan Africa;

- Dummies for sectors - energy, telecommunications, transport and water/ sewerage as the base sector.

Finally, we include time dummies in all regressions to capture potential time-specific effects that may influence the participation of different agents in infrastructure projects.

3   Methodology

Our goal is to understand the relative importance of each risk factor in determining the degree of participation of the private sector and also, that may affect the probability of a MDA participation in infrastructure projects developed through PPPs.

When the problem consists of describing the probability of the participation of a MDA in a PPP, where we have only two alternatives, a discrete choice model should be used. 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 exceed one or to be less than zero, the assumption that the partial effect of any explanatory variable is a constant and the LPM will, by definition, produce heteroscedasticity in the residual variance. Nevertheless, the LPM may be used as a starting point and as an exploratory tool.

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 model belong to the class of binary response models of the form:

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

where $G(.)$ is a function taking on 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), and in the logit model, the logistic distribution function.

In order to estimate the parameters, a likelihood function is maximized. The coefficients β_j give the signs of the partial effects of each x_j on the response probability, but the interpretation of their magnitude is not as straightforward as in the LPM.

For the purpose of study the probability of having a PPP with MDAs participation, depending on the proxies for different risks, we will use the three methods mentioned above, although the LPM only as an exploratory tool, given its limitations.

To study the degree of private participation in response to different risks, meaning that y is a fractional response variable, ranging from 0-100, we will use the generalized linear models (GLM), first proposed by Papke and Wooldridge (1996), with robust stan-

dard errors. More precisely, our choice will rest on fractional response models that can accommodate continuous values between 0 and 1 and in addition, can handle proportions of exactly 0 or 1.

In both regressions, because we will expect correlation among the observations within each country, we will use clustered robust standard errors.

The explanatory variables capture several country attributes that are expected to have a significative effect on infrastructure investment through PPPs. We will use all the variables presented in the previous section, in both regressions and particularly, when explaining the degree of private participation, a dummy variable for MDAs participation will also be considered, as it is an important factor that may influence a higher or lower participation of the private agents.

Table 1 includes more detailed information on the variables and the expected effect of the explanatory variables on y, and Table 2 gives the summary statistics (see the Data Appendix).

4 Data

In this cross-sectional study, the dependent variables were constructed from the Private Participation in Infrastructure (PPI) Project Database (World Bank), using projects developed in low- and middle-income countries that reached financial closure from 1990 - 2007. We collect data on 96 different countries, also classified in six regions - East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, South Asia and Sub-Saharan Africa. According to the database, infrastructure projects are 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 our work, we will use concessions, greenfield projects and partial divestitures - types of private participation that could be considered PPPs, sharing the key characteristics of long term nature of the relationship, distribution of risks between the public partner and the private partner, bundling of different project phases and private finance.

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), available in 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 from "The Cingranelli-Richards (CIRI) Human Rights Dataset"[11] and from the survey "Freedom in the world".[12]

5 Results and discussion

All the results are presented in the data appendix and were obtained using STATA software.

As a first step and because collinearity may cause problems turning the regression coefficients unreliable, we perform a collinearity diagnostics using the VIF (variance inflation factor) measure. The results point to no collinearity problems, as all the VIF values are small.[13]

For clarity purposes, we divide the discussion of the estimation results in two sections.

5.1 The probability of a MDA participation in PPPs

Table 3 presents the results of the regressions on the probability of structuring a PPP with a MDA participation. Each column presents a different specification, logit, probit and LPM (only as a benchmark).

The estimates from the three models are consistent, meaning that the signs of the coefficients are the same across models and almost all the same variables are statistically significant in each model. In addition, for almost all those variables, the sign of the effect is according to what was expected (see Table 1). It should be noted that logit and probit specifications lead to very similar qualitative results. In addition, goodness-of-fit measures are very close - percent correctly predicted around 85% and pseudo R-Squared around 10%.

The main results point to a strong support of the economic variables, meaning that economic risk seems to be the most relevant factor. As expected, richer (measured

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[11]Available on-line at http://ciri.binghamton.edu/index.asp

[12]Available on-line at http://www.freedomhouse.org/template.cfm?page=439.

[13]VIF is an indicator of how much of the inflation of the standard error could be caused by collinearity.

by GDP per capita) and more populous countries tend to have projects with lower participation of MDAs. These findings are according to Neumayer (2003) results - in a study of aid flows from regional multilateral development banks, the author reported that are the countries with lower per capita incomes that received more aid flows and a bias towards less populous countries was evident. In addition, countries with higher deficits, seems to benefit more with MDAs participation in PPPs projects, in order to make projects viable. In the same line is the result showed for international reserves. The lower the level of a country's reserves, more difficult will be the access to international loans. Therefore, if a country is in a fragile payment position this will be translated to increased difficulties in borrowing from external sources, making a MDAs participation more needed.

The legal dimension is also an important determinant of MDAs participation. Accordingly to our 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 a MDA participation in a PPP project. Concerning the legal origin, the signs of the coefficients reported are in line with what was expected, although statistically relevant, only appear the Socialist legal origin.

Concerning political risk proxies, only statistically relevant is the number of checks and balances, meaning that MDAs participate more in projects developed in countries with less accountable regimes, providing necessary additional political guarantees in order to attract private investors.

In the financial dimension, more developed financial countries, as measured by private credit to GDP, have a lower probability of MDAs participation in PPPs projects, as expected.

Surprisingly, human rights variables do not appear particularly relevant, with the exception of the empowerment index. Concerning this indicator, MDAs participation seems to be a response to the level of social risk, and not as expected initially, a way of reward countries that prove to respect more human rights. As emphasized by Neumayer (2003), development banks proclaim a commitment to poverty reduction and human development as well, but their perception of what constitutes the developing countries needs appear to be confined to the level of national income.

Likelihood ratio (LR) tests were performed, using logit specification, to assess the overall significance of each risk dimension, as well as, the sector, regions and time dummies (results are presented in Table 5). There is evidence in favor of the economic and legal risk dimensions assessed in our study, but the financial dimension and more importantly, human rights variables, as well as, political risk proxies seems do not mat-

ter in explaining the probability of a MDA participation in a PPP project, although individually, some of these variables have a statistically significant effect.

Concerning regional and sector dummies, LR tests show that regions are jointly not significant and the same is true for sectors. In respect to the time dummies, there is some weak evidence of the time explaining the probability of MDAs participation (individual coefficients not reported).

Next we turn our attention to the computation of average marginal effects.[14] In Table 7, the average marginal effects are presented only to the statistically relevant variables. The results show that, in general, the magnitude is very small and more precisely:

- Increasing real GDP per capita in 100%, decreases the probability of MDAs participation (on average) by 0.0484, approximately, all else held constant;

- If the number of days to enforce a contract increases by 100%, the probability of a MDA participation increases by 0.0456, *ceteris paribus*;

- If a country is 100% more populous, the probability of a MDA to participate in a PPP infrastructure project is 0.0336 less, approximately, all else held constant;

- Particularly significant is the magnitude of the Private credit to GDP coefficient, meaning that more developed financial countries reduces the probability of a MDA participation in about 0.132, controlling for all the other relevant factors.

5.2   The degree of private sector participation in PPPs

Table 4 presents the results of the regressions on the percentage of private sector participation in infrastructure projects. Again, each column presents a different specification, fractional logit, fractional probit and LPM.

Private sector participation in PPPs projects is higher for countries with higher GDP per capita and with less population, pointing to the fact that a higher degree of private sector participation occurs for projects developed in richer, but smaller markets. Nevertheless, our results are in line with Neumayer (2003) and Neumayer and Spess (2005), where the authors show that population and GDP per capita are important determinants of foreign direct investment to developing countries.

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[14]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.

The empirical evidence shows that countries with an English legal origin tend to attract more private sector participation. The legal protection provided by the common law of England is rewarded face to the omitted class, the French civil law system. Following LaPorta et al. (1998) and Djankov et al. (2007), among others, common law systems tend to provide better protection to private investors. In addition, concerning the legal environment, measures of creditor rights and of a reliable enforcement, do not show a statistically significant effect in private sector investment decision.

MDAs participation, as expected, is an economically and statistically important determinant of the degree of private sector participation. If a project have a MDA participation, this will have an effect of "umbrella" for all the project, acting like a mechanism of risk reduction, providing guarantees and as a sign of creditworthiness to private lenders, increasing their willingness to enter the project. The results show that if a project has a MDA participation, then the percentage of private sector participation increases by 0.0458, all else held constant (see Table 8).

Concerning political risk, the number of checks and balances is also an important determinant of the degree of private sector participation, which is higher for countries with better governance quality.

Slightly unexpected is the sign and significance of the coefficient on Liquid liabilities to GDP. Our results point to higher private sector participation in projects developed in countries that mobilize few domestic savings. An explanation could rest in the fact that private sector participation in infrastructure projects is essentially external participation and is the answer to overcome a lack of lending capacity in the home country.[15] The average marginal effects to the relevant variables are presented in Table 8.

LR tests were performed using logit specification. The results show that, particularly relevant to explain the percentage of private sector participation, appear the economic and financial dimensions (see Table 6). Although not individually relevant, sector dummies are jointly important and in respect to the regional analysis, the empirical results only show the Sub-Saharan Africa dummy statistically relevant, compared to Middle East and North Africa. In addition, a LR test indicates that regions dummies are just marginally jointly significant. A time effect was also tested and jointly, the time dummies are not relevant explaining the degree of private sector participation.

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[15]Esty (2003) had already noted that international banks are more likely to finance projects in countries with less developed financial systems.

6   Summary and Conclusions

Poor countries face chronic infrastructure deficiencies, particularly on sanitation, water or electricity. Infrastructure projects are prone to specific risks, given its nature and usually imply commitment for longer maturities, what makes investors particularly exposed to risk. Therefore, private 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 in a PPP arrangement and in the degree of such commitment. MDAs have a fundamental role to play, acting like an additional partner, where the challenge is to promote more effective partnerships between MDAs and the private sector, as each looks to the other to complete complex arrangements.

The empirical evidence on the determinants of MDAs and private sector participation in infrastructure projects show that economic conditions constitutes the most important risk dimension, particularly related to the market size (population) and to a country's income level.

As such, MDAs participate more in infrastructure projects developed in poorer (measured by GDP per capita and international reserves), less populous countries and with legal and financial systems underdeveloped. 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.

Concerning private sector participation, our results support the arguments that the degree of private sector participation is higher for richer and less populous countries with a common law legal origin and with less developed financial systems. Also, projects with MDAs participation will have a higher degree of private sector involvement, highlighting the MDAs "enabling" function, as the perceived level of risk is reduced to the private agents.

Notwithstanding the popularity of PPPs and their exponential growth in recent years, few research has been made on this topic. Building in the first empirical study of Hammami et al. (2006) about the determinants of PPPs in infrastructure, we hope that this new empirical approach, exploring new branches, could add to the scarce literature on the field and contribute to further research.

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A   Data Appendix - Variables

Table 1 - Expected effect of the explanatory variables on y

Explanatory variables	Effect on a country risk level	Dependent variable	
		Probability of a PPP with a MDA participation	Degree of private participation
Political Risk			
Political System	-	-	+
Index of Political Competitiveness	-	-	+
Checks (number)	-	-	+
Legal Risk			
Creditor rights	-	-	+
Contract enforcement days (ln)	+	+	-
Legal origin dummy (base: French)	-	-	+
Social Risk			
Physical Integrity Index	-	+	+
Empowerment Index	-	+	+
Civil liberties	+	-	-
Financial Risk			
Deposit money bank assets	-	-	+
Liquid liabilities to GDP	-	-	+
Private credit to GDP	-	-	+
Economic Risk			
General government balance to GDP	+	+	-
External debt to total exports	+	+	-
Economic growth	-	-	+
Fuel exports	-	-	+
Real GDP per capita (ln)	-	-	+
Inflation Rate	+	+	-
Population (ln)	-	-	+
International reserves	-	-	+
MDA dummy	-		+

The independent variables are:

- Political System - presidential(0), assembly-elected presidential (1) or parliamentary (2);

- Index of Political Competitiveness, which varies from 1 (low) to 7 (high competitiveness);

- Checks - number of governmental checks and balances, witch varies from 1 to 18;

- Creditor rights - An aggregate index, which varies from the value 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 will use 3 dummies, being the French civil law the reference;

- Physical Integrity Rights Index, it ranges from 0 (no government respect) to 8 (full government respect);

- Empowerment Rights Index, it ranges from 0 (no government respect) to 10 (full government respect);

- Civil liberties, which varies from 1 (highest degree of freedom) to 7 (the lowest);

- Deposit money bank assets, divided by the sum of deposit money and central bank assets;

- Liquid liabilities to GDP;

- Private Credit to GDP;

- General government balance (percent of GDP);

- External debt (percent of total exports);

- Economic growth - GDP growth (annual %);
- Fuel exports (% of merchandise exports);
- Real GDP per capita (ln) - constant 2000 US$;
- Inflation Rate (annual percent change, GDP deflator);
- Population, total (ln);
- Reserves (in months of imports).

And for the regression on the percentage of private participation: a MDA dummy - a binary variable that takes the value 1 if the PPP project has a MDA participation and takes the value 0, otherwise.

Table 2 - Summary statistics

Variable	Number of observations	Mean	Std. Dev.	Min	Max
Percentage of private participation	3727	0.803	0.297	0	1
MDAs participation	3727	0.113	0.317	0	1
Political system	3724	0.636	0.776	0	2
Index of Political Competitiveness	3726	5.861	1.689	1	7
Checks (number)	3695	3.620	3.556	1	18
Creditor rights	3721	1.624	0.905	0	4
Contract enforcement days (ln)	3727	5.914	0.380	3.30	7.29
English legal origin dummy	3727	0.205	0.404	0	1
French legal origin dummy	3727	0.444	0.497	0	1
German legal origin dummy	3727	0.246	0.430	0	1
Socialist legal origin dummy	3727	0.106	0.308	0	1
Physical Integrity Index	3698	2.876	2.090	0	8
Empowerment Index	3427	5.158	3.382	0	10
Civil liberties	3727	4.175	1.448	1	7
Deposit money bank assets	3563	0.868	0.140	0.12	1
Liquid liabilities to GDP	2656	0.408	0.237	0.06	1.30
Private credit to GDP	2653	0.348	0.290	0.02	1.66
General government balance to GDP	3489	-0.457	6.346	-35.02	33.20
External debt to total exports	3465	20.600	19.989	0.02	117.81
Economic growth	3723	5.130	5.473	-32.12	34.50
Fuel exports	3327	10.358	16.688	0	99.657
Real GDP per capita (ln)	3725	7.357	0.903	4.44	9.14
Inflation Rate	3723	82.902	405.424	-23.48	15442.30
Population (ln)	3727	18.578	1.840	14.30	21.00
International reserves	3480	6.558	3.887	0.06	23.69
Energy sector dummy	3727	0.405	0.491	0	1
Telecom sector dummy	3727	0.185	0.389	0	1
Transport sector dummy	3727	0.274	0.446	0	1
Water sector dummy	3727	0.135	0.342	0	1
East Asia and Pacific dummy	3727	0.330	0.470	0	1
Europe and Central Asia dummy	3727	0.153	0.360	0	1
Latin America and Caribbean dummy	3727	0.320	0.466	0	1
Middle East and North Africa dummy	3727	0.022	0.148	0	1
South Asia dummy	3727	0.107	0.309	0	1
Sub-Saharan Africa dummy	3727	0.068	0.252	0	1

B Data Appendix - Results

Table 3 - Determinants of MDAs participation in PPPs infrastructure projects

Dependent variable: **MDAs participation**	LOGIT (MLE)	PROBIT (MLE)	LPM (OLS)
Political system	0.091	0.057	0.026
	(0.68)	(0.75)	(1.25)
Index of Political Competitiveness	0.04	0.022	0.003
	(0.31)	(0.32)	(0.2)
Checks	-0.065**	-0.034**	-0.004
	(-2.4)	(-2.37)	(-1.22)
Creditor rights	-0.183*	-0.106**	-0.032**
	(-1.84)	(-1.97)	(-2.14)
Contract enforcement days (ln)	0.393***	0.242***	0.082***
	(2.58)	(2.78)	(3.25)
English legal origin dummy	-0.195	-0.118	-0.028
	(-0.6)	(-0.65)	(-0.54)
German legal origin dummy	-0.596	-0.359	-0.117*
	(-1.34)	(-1.44)	(-1.8)
Socialist legal origin dummy	-0.928**	-0.452*	-0.082
	(-2.09)	(-1.89)	(-1.3)
Physical Integrity Index	0.007	0.002	0.002
	(0.15)	(0.1)	(0.25)
Empowerment Index	-0.088*	-0.048*	-0.011
	(-1.74)	(-1.76)	(-1.66)
Civil liberties	-0.192	-0.102	-0.025*
	(-1.49)	(-1.38)	(-1.71)
Deposit money bank assets	0.336	0.206	0.047
	(0.55)	(0.59)	(0.48)
Liquid liabilities to GDP	0.882	0.451	0.106
	(0.87)	(0.83)	(0.92)
Private credit to GDP	-1.136*	-0.564*	-0.109
	(-1.78)	(-1.8)	(-1.58)
General government balance to GDP	0.036*	0.022**	0.005*
	(1.68)	(1.97)	(1.82)
External debt to total exports	0.002	0.001	0
	(0.31)	(0.27)	(0.27)
Economic growth	0.009	0.007	0
	(0.33)	(0.46)	(0.05)
Fuel exports	-0.006*	-0.004*	-0.001
	(-1.65)	(-1.75)	(-1.58)
Real GDP per capita (ln)	-0.417***	-0.230***	-0.058***
	(-3.49)	(-3.35)	(-3.28)
Inflation Rate	0	0	-0.000*
	(-1.04)	(-1.21)	(-1.9)
Population (ln)	-0.289**	-0.164**	-0.047***
	(-2.53)	(-2.49)	(-2.93)
International reserves	-0.102**	-0.051**	-0.012**
	(-2.23)	(-2.03)	(-2.13)
Energy sector dummy	0.047	0.033	0.006
	(0.11)	(0.14)	(0.12)
Telecom sector dummy	-0.295	-0.151	-0.035
	(-0.67)	(-0.6)	(-0.68)
Transport sector dummy	-0.012	-0.02	-0.002
	(-0.03)	(-0.09)	(-0.04)
East Asia and Pacific dummy	-0.738	-0.404	-0.115*
	(-1.48)	(-1.54)	(-1.88)
Europe and Central Asia dummy	0.157	0.117	0
	(0.25)	(0.36)	(0)
Latin America and Caribbean dummy	0.24	0.137	0.004
	(0.37)	(0.41)	(0.06)
South Asia dummy	-0.008	-0.014	-0.021
	(-0.01)	(-0.03)	(-0.19)
Sub-Saharan Africa dummy	0.283	0.223	0.057
	(0.4)	(0.57)	(0.55)
Time dummies	jointly significant**	jointly significant**	jointly significant**
Constant	5.215*	2.674*	1.126***
	(1.89)	(1.77)	(3.14)
Number of observations	2095	2095	2095
Log-Likelihood Value	-799.556	-800.324	
Percent correctly predicted	85.11%	85.30%	
(Pseudo) R-Squared	0.1002	0.0993	0.0878

legend: * statistically significant at 90% level, ** at 95% level *** at 99% level
Clustered robust t statistics in parentheses

Table 4 - Determinants of the degree of private sector participation
in PPPs infrastructure projects

Dependent variable: Percentage of private participation	LOGIT (GLM)	PROBIT (GLM)	LPM (OLS)
Political system	-0.128	-0.075	-0.015
	(-0.57)	(-0.68)	(-0.72)
Index of Political Competitiveness	0.041	0.037	0.012
	(0.43)	(0.66)	(0.83)
Checks	0.050**	0.027***	0.005**
	(2.42)	(2.6)	(2.39)
Creditor rights	-0.058	-0.035	-0.007
	(-0.66)	(-0.73)	(-0.59)
Contract enforcement days (ln)	0.149	0.067	0.003
	(0.71)	(0.61)	(0.11)
English legal origin dummy	0.933**	0.448**	0.094**
	(2.25)	(2.17)	(2.03)
German legal origin dummy	-0.548	-0.316	-0.068
	(-0.94)	(-1.00)	(-0.93)
Socialist legal origin dummy	-0.54	-0.336	-0.095
	(-0.85)	(-1.00)	(-1.35)
Physical Integrity Index	-0.081	-0.039	-0.009*
	(-1.64)	(-1.50)	(-1.80)
Empowerment Index	-0.021	-0.013	-0.001
	(-0.55)	(-0.64)	(-0.24)
Civil liberties	-0.026	-0.016	-0.002
	(-0.21)	(-0.25)	(-0.13)
Deposit money bank assets	-0.716	-0.378	-0.06
	(-1.16)	(-1.21)	(-0.90)
Liquid liabilities to GDP	-2.039***	-1.028***	-0.180**
	(-2.88)	(-2.81)	(-2.25)
Private credit to GDP	-0.088	-0.027	-0.009
	(-0.13)	(-0.08)	(-0.15)
General government balance to GDP	-0.004	-0.003	-0.001
	(-0.23)	(-0.29)	(-0.39)
External debt to total exports	0.006	0.003	0.001
	(1.30)	(1.29)	(1.18)
Economic growth	0.002	0.003	0.000
	(0.12)	(0.26)	(0.18)
Fuel exports	-0.012**	-0.007**	-0.001**
	(-2.13)	(-2.20)	(-2.08)
Real GDP per capita (ln)	0.386*	0.191*	0.031
	(1.79)	(1.77)	(1.62)
Inflation Rate	0.000	0.000	0.000
	(-0.39)	(-0.32)	(-0.87)
Population (ln)	-0.324***	-0.157**	-0.029**
	(-2.81)	(-2.57)	(-2.50)
International reserves	0.024	0.012	0.003
	(0.59)	(0.56)	(0.61)
MDAs dummy	0.461**	0.235**	0.040**
	(2.27)	(2.24)	(2.26)
Energy sector dummy	-0.139	-0.085	-0.017
	(-0.33)	(-0.39)	(-0.38)
Telecom sector dummy	0.463	0.259	0.045
	(1.28)	(1.38)	(1.18)
Transport sector dummy	0.262	0.16	0.021
	(0.82)	(1.02)	(0.65)
East Asia and Pacific dummy	0.047	0.061	0.005
	(0.13)	(0.33)	(0.13)
Europe and Central Asia dummy	-1.041	-0.475	-0.086
	(-1.45)	(-1.31)	(-1.27)
Latin America and Caribbean dummy	-0.454	-0.186	-0.035
	(-0.93)	(-0.71)	(-0.71)
South Asia dummy	-0.056	0.019	-0.016
	(-0.07)	(0.05)	(-0.23)
Sub-Saharan Africa dummy	-1.357***	-0.672**	-0.134**
	(-2.64)	(-2.49)	(-2.35)
Time dummies	jointly not significant	jointly not significant	jointly significant**
Constant	5.842**	2.960**	1.232***
	(2.50)	(2.46)	(5.26)
Number of observations	2095	2095	2095
Log-Likelihood Value	-621.457	-620.828	
(Pseudo) R-Squared	0.0946	0.0919	0.0944

legend: * statistically significant at 90% level, ** at 95% level *** at 99% level
Clustered robust t statistics in parentheses

Table 5 - Likelihood Ratio tests for MDAs participation in PPPs infrastructure projects

Dependent variable: MDAs participation	LR tests LOGIT (N=2095)	Overall significance at 95% level
Risk dimensions:		
Political	LR chi2(3) = 3.68 Prob > chi2 = 0.2984	Not significant
Legal	LR chi2(5) = 12.19 Prob > chi2 = 0.0323	Significant
Social	LR chi2(3) = 5.34 Prob > chi2 = 0.1484	Not significant
Financial	LR chi2(3) = 3.47 Prob > chi2 = 0.3246	Not significant
Economic	LR chi2(8) = 42.93 Prob > chi2 = 0.0000	Significant
Dummies:		
Sector	LR chi2(3) = 3.16 Prob > chi2 = 0.3679	Not significant
Regions	LR chi2(5) = 9.42 Prob > chi2 = 0.0934	Not significant
Time	LR chi2(16) = 30.38 Prob > chi2 = 0.0161	Significant

Table 6 - Likelihood Ratio tests for the percentage of private sector participation in PPPs infrastructure projects

Dependent variable: Percentage of private participation	LR tests LOGIT (N=2095)	Overall significance at 95% level
Risk dimensions:		
Political	LR chi2(3) = 2.98 Prob > chi2 = 0.3945	Not significant
Legal	LR chi2(5) = 5.74 Prob > chi2 = 0.3327	Not significant
Social	LR chi2(3) = 2.26 Prob > chi2 = 0.5210	Not significant
Financial	LR chi2(3) = 10.03 Prob > chi2 = 0.0183	Significant
Economic	LR chi2(8) = 16.31 Prob > chi2 = 0.0382	Significant
Dummies:		
Sector	LR chi2(3) = 10.09 Prob > chi2 = 0.0178	Significant
Regions	LR chi2(5) = 11.48 Prob > chi2 = 0.0427	Significant
Time	LR chi2(16) = 15.31 Prob > chi2 = 0.5019	Not significant

Table 7 - Average Marginal Effects for the probability of MDAs participation
in PPPs infrastructure projects

Dependent variable: MDAs participation	Average Marginal Effect (LOGIT)*
Checks (number)	-0.0075
Creditor rights	-0.0213
Contract enforcement days (ln)	0.0456
Empowerment Index	-0.0102
Private credit to GDP	-0.1320
General government balance to GDP	0.0042
Fuel exports	-0.0007
Real GDP per capita (ln)	-0.0484
Population (ln)	-0.0336
International reserves	-0.0118

*Average marginal effects on Prob(mdas=1) obtained after logit

Table 8 - Average Marginal Effects for the percentage of private participation
in PPPs infrastructure projects

Dependent variable: percentage of private participation	Average Marginal Effect (Fractional LOGIT)*
Checks (number)	0.0049
English legal origin dummy	0.0925
Liquid liabilities to GDP	-0.2022
Fuel exports	-0.0012
Real GDP per capita (ln)	0.0382
Population (ln)	-0.0321
MDAs dummy	0.0458
Sub-Saharan Africa dummy	-0.1346

*Average marginal effects obtained after fractional logit