Journal of Commerce & Accounting Research
8 (2) 2019, 79-85
http://publishingindia.com/jcar/

DETERMINANTS OF PUBLIC PRIVATE PARTNERSHIPS IN INFRASTRUCTURE: A STUDY OF DEVELOPING COUNTRIES

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Abstract *Enormous contribution of infrastructure in stimulating economic growth has been recognized both in academics as well as in policy debates all across the globe, and developing countries are not an exception (Tewodaj, 2013; Esfahani and Ramirez 2003; Canning and Pedroni 2008; Aschauer 1989). One of the major bottlenecks observed in growth of developing countries is the huge infrastructure gap i.e. the difference between what is required and what is provided to them with regard to provision of infrastructure. Subsequently, the most of the developing countries lack the necessary and adequate financial resources to fill the infrastructure gap. Hence, Private participation in infrastructure (PPI) is the way forward, and Public Private Partnerships (PPPs) are the best alternative among public provision and privatization (Engel et al., 2011). To engage private participation in infrastructure, it is pertinent for policy think tank of these countries to know about the factors determining the PPPs in Infrastructure. With an objective to identify the determinants of PPPs in Infrastructure, the results of the study using data of the sample courtiers from 1990 to 2016 revealed that countries having stable macro economic conditions are likely to engage more PPPs. Subsequently, it was found that Countries with larger markets with huge purchasing power are in a strong footing to attract Private Participation in Infrastructure. Eventually, the governance has been found affecting the PPPs to a great extent.*

Keywords: *PPP, Infrastructure, Determinants, Developing Countries, Number of PPP Transactions*

JEL Codes Classification: *H54, O18*

INTRODUCTION

Infrastructure is getting increased attention because of the fact that the adequate infrastructure reflects reliability, assurance and market competitiveness of a particular country whereas inadequate infrastructure increases the cost of investing in physical assets (Hernandez, 2000). Subsequently, Infrastructure stock reflects the health of the country as economic growth and well-being are the outcome of Infrastructure Stock (Basillio, 2011). The contribution of infrastructure to economic growth is well recognized both in academic and policy debate (Lakshmanan, 2008) across the globe. Well developed infrastructure assists in delivering key economic services efficiently, extends vital support to productive sectors, generates high productivity and supports strong economic growth.

The primary function of the every government is to provide necessary and adequate infrastructure. However, almost in every developing country, there exists infrastructure deficit i.e. what is needed and what government is able to provide as far as infrastructure is concerned. Increasing population and urbanization are aggravating the situation further, and are putting burgeoning pressure on governments to provide the basic infrastructure facilities.

Being capital intensive in nature, it is critical to make appropriate decisions about the resource allocation and financing with regard to Infrastructure projects (Engel et al., 2011). Since past two decades, it has become almost impossible for the governments to provide public services on their own in an effective and efficient manner (Pessoa, 2006). Subsequently, it has been observed that Public services are frequently seen as ineffective with regard to resource allocation and poor in management (Pessoa, 2008). Grappled with bureaucratic procedures and budgetary constraints, the public sector solely cannot be made responsible for catering infrastructure requirements. The subprime crisis of 2008-11 has affected it further, and has led to cuts in public expenditure, under-maintenance of infrastructure, and under-investment in new infrastructure. Private participation is critical for every country in present circumstances, as it can provide breather to governments' tight budgetary pressure by complementing with contribution of resources, encouraging innovation, enhancing productivity, allowing better risk allocation, increasing value-for-money and improving cost effectiveness. However, particularly in developing nations, private sector involvement has become crucial

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and indispensable in the development of Infrastructure sector, thanks to heavy debt burden, lack of resources and inefficiencies in the delivering the services. Public-private partnerships (PPP) have been found "best-of-both-worlds" alternative to public provision and privatization (Engel et al., 2011). PPPs allow the public sector to capitalize the strength of private sector and moreover, more and more financial resources can be leveraged by involving private sector (Kopp (1997). It has been emphasized that most countries will be better off working out a partnership with the private sector to achieve sustained efficiency gains and minimize fiscal financing requirements (Estache, 2006). Hence, impetus must be given to strengthen PPP regulatory framework.

While many developed and developing countries have created their physical infrastructure successfully through PPP model. But in India, PPP model in the process of infrastructure development has received lacklustre response (Lakshmanan, 2008), and thanks to numerous reasons like unfavorable regulatory environment, inadequate transparency of procedures, inappropriate risk allocation, improper project appraisal, cost and time overruns, overlapping of regulatory independence, under-developed financial markets, dearth of good governance. Moreover, literature on the PPP in developed countries has been available at length, but the same has not been explored in developing countries. Therefore, it is imperative to identify the determinants of successful PPP projects in infrastructure, and the present study is an attempt for the same. The findings of the study are going to help the various stakeholders including policy makers and citizens to make out best out of the PPPs transactions.

REVIEW OF LITERATURE

The present study "Determinants of Public Private Partnerships in Infrastructure: A Study of Developing Countries" is aimed at identifying the factors affecting the PPPs in Infrastructure. Quite a number of studies have revealed that Macroeconomic is very crucial factor for inviting private participation in infrastructure (Hadjimichael et al., 1995; Dailami and Klein, 1997; Kopp, 1997, Bing et al., 2005; Hammami et al., 2006; Secrieru et al., 2009; Sharma, 2012; Kripa, 2013; Zagozdzon, 2013). The variables-market size and purchasing power-both have got support to be qualified as determinants of PPP (Basilio, 2011; Sharma, 2012; Kripa, 2013). Taking cross country dataset, the study of Hammami et al., 2006 has emphasized those Governments that are friendly with Market-oriented policies are better off to attract private firms for infrastructure development. Reside (2009), Reside and Mendoza (2010) and Chan et al. (2010) have validated the impact of politically stable Governments in enabling private firms in infrastructure development. It is evident from the larger volume of studies that countries with strong and effective institutions are in a better position to attract Private Participation (Pistor et al, 2000; Secrieru et al., 2009, Hammami et al., 2006; Basilio, 2011; Zagozdzon, 2013). The studies of Hammami et al. (2006) and Sharma (2012) have confirmed the impact of quality of regulation on private participation in Infrastructure. Pargal, S. (2003) and Lakshmanan (2008) have validated that the presence of independent regulatory bodies has a significant impact on the private investments in Infrastructure. The evidence of importance of the variables-property rights and bureaucratic quality-for promoting investment in PPPs have been found in the studies of Jensen and Blanc-Brude (2005), Banerjee et al. (2006), and Hammami et al. (2006). J. Pérez-D'Oleo et al. (2015) stressed the importance of voice and accountability, government effectiveness, control of corruption related to governance. Pérez-D'Oleo et al. (2015) found that the countries that have improved with regard to regulatory quality and control of corruption gradually are able to attract more investments through PPP. In case of developing countries, the analysis of Hammami et al. (2006), Lakshmanan (2008) and Sharma (2012) has supported that good governance is indispensable for attracting private participation. Highlighting the need to infrastructure, Secrieru et al. (2009) and Galilea and Medda (2010) have established the fact that the experience of the countries in handling PPPs has a significant positive impact in engaging such types of partnerships in future. Because of subprime crisis of 2008-11, there has been cuts in public expenditure, under-maintenance of infrastructure, and under-investment in new infrastructure. With a objective to study the impact of the above mentioned crisis on the determinants of PPP in infrastructure.

OBJECTIVES OF THE STUDY

The focus of the study is to explore the determinants of successful Public Private Partnership (PPP) projects to strengthen public private partnership (PPP) development. The objectives are summarized as below:

- To identify the determinants of PPP in infrastructure projects.
- To investigate the change in determinants of PPP-pre and post-subprime crisis (2008-11).
- To devise a framework for policy and regulatory analysis of PPP.

RESEARCH DESIGN

To accomplish the objectives of the present study, the Research design opted is descriptive in nature. This study is

an attempt to identify the factors that determines the PPPs.

Period of the Study

For the purpose of the study, data has been collected from period 1990–2016.

Scope of the Study

The focus of the study would be on four sectors-energy, transportations, Information and Communication Technologies and water of 139 developing nations.

Data Sources

Secondary data would be used for the purpose of this study. The World Bank's Private Participation in Infrastructure (PPI) database would be used for data pertaining to the study. The PPI database classifies infrastructure projects into four sectors-energy, transportations, Information and Communication Technologies and water. Energy sector comprises electricity generation, transmission, and distribution; and natural gas transmission and distribution. Information and Communication Technologies includes fixed or mobile local telephony, domestic long-distance telephony, and international long-distance telephony. Transportation covers airport runways and terminals; rail way fixed assets, freight, and intercity and local passenger service; toll roads, bridges, highways, and tunnels; and seaport channel dredging and terminals. The Water sector consists of potable water generation and distribution, as well as sewage collection and treatment. The PPI database provides the number of projects in each of these industry sectors as well as the amounts invested in US Dollars (USD) in each project. It constitutes the largest multi-sector panel data set with standardized information for developing countries. On the basis of availability of data, the study is restricted to these four infrastructure sectors across the developing nations.

Universe and Its Description

For the purpose of the study, developing countries (also referred as low, lower middle and upper middle income economies as classified according to the World Bank definition) have been considered as universe. The World Bank's classification of various economies has been done on the basis of GNI (Gross National Income) per capita (calculated using the World Bank Atlas method). For the current fiscal year (2015), the classification is as follows:

- Low-income economies:

  GNI per capita for this category is $1,045 or less and 34 countries have been found in this category.
- Lower-middle-income economies**:**

  GNI per capita for this category ranges from $1,046 to $4,125 and there are 50 counties in this category.
- Upper-middle-income economies:

  GNI per capita for this category ranges from $4,126 to $12,745 and 55 countries have been found in this category.

Universe for the study constitutes of 139 developing countries including Low income, Lower-middle and upper-middle income economies.

Hypotheses Statements

Using an extensive review of literature six hypotheses have been developed, and the description of these are as follows:

Table 1: "Hypotheses Statements, Explanatory Variables and Their Description

Hypotheses Statements	Explanatory Variable	Description
H1: PPP is more widespread in countries having stable macroeconomic conditions.	INF (Annual percentage change of GDP deflator) BROADMONEY (in percent of GDP) INTRESERVE (in percent of GDP)	Lower inflation, More of Broad money and more international reserves are conducive to greater macroeconomic stability.
H2: PPP model have more inclination in larger markets where demand and purchasing power are greater.	ln(POP) GDP	Log of population & GDP per capita are used for measuring market size and purchasing power.
H3: Governments open to market-oriented policies are likely to engage PPPs.	ORIENTATION	Chief executive Party's orientation (indexed as 1=left; 2= center; 3=right). Presence of right wing explains that the governments are opened towards market oriented policies.

Hypotheses Statements	Explanatory Variable	Description
H4: Politically stable Governments are more likely to have PPPs	NUMOPPPARTY	Number of opposition parties would be used for measuring political stability in a particular country. An increase in the number of opposition parties means that government policies will tend to be less opportunistic and therefore, political risks can be controlled in a better manner.
H5: Countries led by strong governance are likely to attract PPPs	GOVERNANCE INDEX	Governance Index has been created to capture this variable.
H6: Countries with previous experience of handling PPP projects are likely to have PPP	EXP	PPP experience explains the experience of handling PPP projects in number of years.

Tools for the Analysis

In order to analyze the data, Panel data analysis tool has been applied to identify the determinants. To investigate the changes in determinants of PPP pre and post subprime crisis (2008-11), the variable-CRISIS-has been captured. It is a dummy variable having either 0 or 1 value (Value 0- If the PPP transaction dates back to year 2008 and 1 mean- PPP transaction took place after the year 2008). The variable number of PPPs in Infrastructure signifies the occurrence of PPP transactions irrespective of the dollar value of each project. The value of the outcome variable contains number of zeros as numbers of countries are not able to get Private Participation in Infrastructure. Hence because of the left skewed nature of the outcome variable as number of values are zeros. Log transformation has been applied to make outcome variable more normally distributed. However, natural logarithmic of zero is undefined and hence, a caution has been kept by adding one in all the values. Hence, outcome variable number of PPPs in Infrastructure has been modified to ln (Total number of PPPs transactions +1). The model equation used for the same is as follows:

$$\text{Ln(NUMPPP plus 1)} = \beta_0 + \beta_1\text{INF} + \beta_2\text{BROAD MONEY} + \beta_3\text{INTRESERVE} + \beta_4\ \text{ln(POP)} + \beta_5\ \text{lnGDPPC} + \beta_6\text{ORIENTATION} + \beta_7\text{NUMOPPPARTY} + \beta_8\ \text{GOVERNANCE INDEX} + \beta_9\text{EXP} + \beta_{10}\text{CRISIS} + \varepsilon$$

The term used in the above equations signify as follows:

- INF - Inflation (annual percentage change of GDP deflator).
- BROAD MONEY – Broad Money
- INTRESERVE – International reserves
- ln(POP) - The variable ln(POP) is natural logarithmic of population.
- GDP - Gross domestic product (GDP) per capita.
- ORIENTATION – This variable explains chief executive party's orientation (indexed as 1=left; 2= center; 3=right). Presence of right wing explains that the governments are opened towards market oriented policies.
- NUMOPPPARTY - number of opposition parties. The variable NUMOPPPARTY indicates the stability of the government.
- GOVERNANCE INDEX: for Governance Index
- EXP - PPP experience (Years)
- CRISIS – It is dummy variable having either 0 or 1 value (Value 0- If the PPP transaction dates back to year 2008 and 1 means- PPP transaction took place after the year 2008)
- NUMPPP plus 1 - Number of PPP transactions in one particular country in a particular year plus one.
- ε - ε is the random error term in the regression equation.

RESULTS AND DISCUSSION

The present study "Determinants of Public Private Partnerships in Infrastructure Projects: Evidence from Developing Countries" is an experiment to explore the determinants of successful Public Private Partnership (PPP) projects to strengthen public – private partnership (PPP) development. With a view to determine the factors affecting PPPs in Infrastructure, various suitable analysis tools have been applied and results are discussed as follows:

Principal Component Analysis (PCA) for Creating Governance Index

With an objective to reduce the six variables of Governance Indicators into smaller number, factor analysis has been applied. The value of KMO test has been found greater than 0.7 explains the adequacy of the data and significance value ($P<0.05$) of Bartlett's test of Sphericity is a testimony to the same too and hence the factor analysis can be conducted using the dataset. After the application of PCA, one component has been extracted and that explains 71.760 percent variation. Eigen value have been greater than one ($4.306>1$) with all the variables and are having more than 0.5 loadings. Hence, the factor extracted itself can be treated as a representative index of all six variables.

To Identify the Determinants of PPP in Infrastructure Projects

The capture the determinants, output variable Number of PPPs in Infrastructure (As a percentage of GDP) has been used in the study, and these are the following results as follows:

Determinants of Number of PPPs in Infrastructure

The variable number of PPP in Infrastructure signifies the number of transactions of PPP irrespective of the dollar value of each project. The basic model has been explained below:

$$\text{Ln(NUMPPP plus 1)} = \beta_0 + \beta_1 \text{INF} + \beta_2 \text{BROAD MONEY} + \beta_3 \text{INTRESERVE} + \beta_4 \ln(\text{POP}) + \beta_5 \text{lnGDPPC} + \beta_6 \text{ORIENTATION} + \beta_7 \text{NUMOPPPARTY} + \beta_8 \text{GOVERNANCE INDEX} + \beta_9 \text{EXP} + \beta_{10} \text{CRISIS} + \varepsilon$$

The dependent variable being discrete count variable, the most suitable estimation regression model is discrete count variable technique (Sharma, 2012). Various alternatives models-Pooled OLS, Poisson, Fixed Effects-GLS and Random Effects-GLS have been applied for the purpose of analysis. The results of the analysis are summarized in the following table as follows:

Table 2

Dependent Variable: Total Number of PPPs Transactions / **Independent Variables**	**Pooled OLS**	**POISSON**	**GLS, FE**	**GLS, RE**
Inflation	-.0056** **(0.046)**	-.0078 (0.154)	-.0071*** **(0.008)**	-.0054** **(0.033)**
Broad Money(Percentage of GDP)	-.0000 (0.409)	-.0002 (0.746)	0.0000 (0.910)	0.0000 (0.787)
International Reserves (Percentage of GDP)	.0381 (0.469)	.1726 (0.111)	.1512*** **(0.003)**	.1068** **(0.027)**
GDP Per Capita (Log)	.0890*** **(0.000)**	.2103*** **(0.007)**	.2863** **(0.049)**	.1417*** **(0.003)**
Population (Log)	.3271*** **(0.000)**	.5136*** **(0.000)**	.4907* **(0.065)**	.2971*** **(0.000)**
Chief Executive Party's Orientation (Index)	.0185 (0.204)	.01448 (0.691)	-.0079 (0.710)	.0066 (0.723)
Number of Opposition Parties in Legislature	-.0020 (0.340)	.0013 (0.701)	.0020 (0.335)	.0015 (0.449)
Governance Index	1.4244*** **(0.000)**	1.7809*** **(0.000)**	0.3513 (0.244)	1.0413*** **(0.000)**
Total PPP Exp (Number)	-.0054 (0.222)	-.00494 (0.651)	-.0178** **(0.029)**	-.0081 (0.105)
Crisis (Dummy)	-.04598 (0.353)	-.1053397 (0.345)	.0021 (0.968)	-.0232 (0.633)
Constant	-5.9384*** **(0.000)**	-11.6770*** **(0.000)**	-9.6174** **(0.040)**	-5.7421*** **(0.000)**
Observations	1475	1475	1475	1475
R-Squared	0.4249		0.3647	0.4150
Pseudo R2	0.4209			
Wald Chi Square	108.14*** **(0.0000)**	232.82*** **(0.0000)**	1.89)** **(0.0421)**	192.99*** **(0.0000)**
Poisson Goodness of Fit Chi-Square	Not Valid	**34.96** **(**Prob >chi2 = **0.000)**	Not Valid	Not Valid

Robust t statistics in parentheses: * signifies at 10 percent: ** signifies at 5 percent: *** signifies at 1 percent

The final results as depicted in Table 2 shows that PPP are supported significantly and are negatively correlated with inflation pointing that lower Inflation value will help in attracting Private Investments in Infrastructure. However, International Reserves (Percentage of GDP) variable is supported partially in two of the alternative models explaining higher value of international reserves helps in attracting Private firms in Infrastructure. Analysis of the results strongly confirm the significance and impact of both variables i.e. GDP per Capita and Population on Private Investments in a country. The results stress upon the fact that the large markets with high GDP Per Capita are in a better condition to engage PPPs. Results validate the immense contribution and significant impact of Governance Index in attracting private firms in Infrastructure. Putting good governance framework at place has become indispensable factor in attracting PPPs in a one particular country. In addition to the above significant variables, the PPP experience variable has been found significant only in one of the alternatives models, and hence lacks to be treated as significant determinant of PPP in Infrastructure. Surprisingly, however, the other variables i.e. Presence of Right Wing Governments and Countries that are politically stable fail to get significance and not able to qualify to be determinants of PPPs in Infrastructure. The following Table 2 highlights the results of various hypotheses as follows:

Table 3:

Alternative Hypothesis	Results (Whether Accepted or Not Accepted)
PPP is more widespread in countries having stable macroeconomic conditions	***Accepted***
PPP model have more inclination in larger markets where demand and purchasing power are greater.	***Accepted***
It is possible for right wing governments (Open to market-oriented policies) to engage PPPs.	***Not Accepted***
PPP is more likely to be present in countries being stable from political point of view.	***Not Accepted***
Countries led by strong governance are likely to attract PPPs	***Accepted***
Countries with previous experience of handling PPP projects are in a better condition to have PPP further	***Not Accepted***

FINDINGS OF THE STUDY

Results of the analysis establish that number of PPP are supported significantly and are negatively correlated with inflation stressing the need of having inflation under control as lower Inflation value will help in attracting Private Investments in Infrastructure. However, International Reserves (Percentage of GDP) variable is supported by two model explains that the higher value of international reserves helps in boosting Private Investments in Infrastructure. The results strongly confirm that the country with large markets and having high GDP Per Capita are likely to engage Private firms. Governance Index has been found an indispensable and significant determinant of PPPs in Infrastructure emphasizing the need to have highest standard of governance. The crisis variable (Dummy) is not able to qualify to make any significant impact of the dependent variable of interest.

LIMITATIONS OF THE STUDY

The present study "Determinants of Public Private Partnerships in Infrastructure: A Study of Developing Countries" is an attempt at identifying the factors affecting the PPPs in Infrastructure. Although a caution has been given throughout the research process to avoid possible mistakes, still, a list of possible caveats that has been found is as follows:

- Original sample size covering all the 139 developing countries was intended to represent all the sample countries; however, because of the paucity of data for a particular set of countries for a particular time periods could possible act as a limitation to generalization. For generalization purpose, the size of the sample countries can be increased by adding developed countries to the sample. Subsequently, there can be contrast of the determinants of PPP across various regions to understand the determinants in a precise manner.
- Because of the unavailability of the data of Institutional dimension, the variables like quality of regulation, independence of various bodies and like are not considered for the present study. The future studies can be done considering other variable like legal factor, regulatory factor to name a few.
- Only four sub-sectors--energy, transportations, Information and Communication Technologies and water- of Infrastructure are considered. However, the other sub-sectors like Railways, Education, and Healthcare etc. could have been included to improve the scope of study and for a better analysis of private investments in infrastructure sector.

PRACTICAL IMPLICATIONS / POLICY SUGGESTIONS

In the light of the various inefficiencies and constraints associated with Public sector, PPP seems to be a viable

and reasonable option for the policy makers in developing countries. As, it is being confirmed by the findings of the present study that stable macroeconomic condition is a pre-requisite and necessary condition inviting Private firms for developing Infrastructure. Hence, the countries needed to control the excess volatility so as to have some macroeconomic stability at place. Subsequently, certain prudential fiscal policy measures can be helpful in containing additional fiscal risks. To maintain currency stability, exports shall be incentivize using certain subsidies and schemes to promote it. Various measures like transparency, disclosure, Control of corruption, Regulatory Quality, Voice and Accountability for the steps taken to improve governance standards shall be applied. These measures shall help the Government in bringing effectiveness in its various functions. Some measures suggested above require legislative and policy changes and others may be possible by just attitudinal change in the citizens. By adopting doing so the country can become successful in attracting Private Participation in Infrastructure projects.

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