
“Effect of Macro Economic Variables On Public Private Partnerships: A Study Of Transportation Sector Of South Asian Countries”

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ABSTRACT

The immense contribution of infrastructure in stimulating economic growth has been recognized very well in academics as well as in policy debates all across the globe, and developing countries are not an exception (e.g. Tewodaj, 2013; Esfahani and Ramirez 2003; Canning and Pedroni 2008; Aschauer 1989). One of the major impediments to growth in South Asian countries is the huge infrastructure gap i.e. the difference between what is required and what is provided to them as far as infrastructure is concerned. These countries lack the financial resources to fill this infrastructure gap. Private participation in infrastructure (PPI) is necessary to augment the Governmental inadequate resources, and Public Private Partnerships (PPP) is the best choice. This research work is a focus to observe the effect of economic variables on PPP transactions in South Asian countries. Using data from the Private Participation in Infrastructure (PPI) database of World Bank for 25 years for the period 1990 to 2015, the study revealed that markets where macro economic conditions are stable are attractive for the public private partnership and Countries with high total reserves are better markets for PPP transactions.

1. INTRODUCTION

There is infrastructure gap in almost every developing country, and rapid economic growth and industrialization are demanding for adequate infrastructure. Further, urbanization is aggravating the problem by making a dent in demand-supply gap further. Because of the inefficiencies and budgets constraints, the governments of these countries are not in a capacity to meet the pressing need of infrastructure.

Infrastructure projects are quite complex, capital intensive and long gestative, and hence not attractive for private players. Hence, a Public private partnership (PPP) seems to be the one of best alternative for improving the infrastructure facilities. PPP is a kind of contractual arrangement where private sector complements to the public sector. Complementarities from private sector can be for the purpose of quality, efficiency or to bridge the resource gap of Public sector (Estache, 2006). Gap may exist from technological, financial or any other point of view. Almost all the developing nations are taking numerous initiatives in this regard.

Various sub-sectors like roads, railways, airports, ports, metro, energy, telecommunication, and water related projects are being developed through PPP arrangements in various parts of world. Despite these initiatives, PPP is not equally successful mechanism in every country. There might be numerous factors that determine the success of PPP in infrastructure projects. Moreover, not all developing countries are able to attract the adequate private partners and the sufficient investments through this route for developing the infrastructure projects. Therefore, the question again boils down to the determinants of PPP in infrastructure projects. With an objective to identify the same, the present study focuses on South Asian countries.

2. REVIEW OF LITERATURE AND HYPOTHESIS DEVELOPMENT

Formally defined, an infrastructure project is considered a PPI “if a private company or investor bears a share of the project’s operating risk” (World Bank 2013). In the most basic sense, PPIs entail some sort of partnership between the public and private sectors through a contractual agreement which aims to facilitate private sector involvement in infrastructure provision so as to increase the infrastructure stock as well as its

quality and performance. Thus, a PPI can exist only in the event that there are complementarities between the public and private sectors, and typically, the contract involves a risk-sharing mechanism between the two entities.

Effectively, for a given infrastructure project the private sector can bring financing and management expertise, and, being profit-driven, efficiency and self-sustainability of infrastructure facilities (resulting from stronger incentives for tariff discipline), and improved quality of services (resulting from consumers' higher willingness to pay for better services). In exchange, the public sector can provide a conducive business environment, access to credit, as well as investor protection (de Bettignies and Ross 2004, Kirkpatrick et al. 2006, Linder 1999).

Hadjimichael et al., 1995 analyzed the economic performance during 1986-93 of sub-Saharan African countries as a group and of selected analytical subgroups of countries. Results of the study indicated macroeconomic stability as an important determinant of private sector involvement.

Dailami and Klein, 1997 explained the role of private infrastructure investment as a vehicle for attracting foreign capital to developing countries. The study examined the determination of credit risk premium on infrastructure projects in the country risk environment of developing countries. Further, quantitative evidence of the importance of macroeconomic and project-specific attributes of project risk were observed. As macroeconomic conditions improve, governments are able to attract better providers and more financing.

Kopp (1997) considered that the risks of macroeconomic conditions and project risk bear directly on the public sector's decision to enter a PPP, and that this should be assumed by a government agency proposing the project. Further, it has been found that 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.

Harris (2003), through a qualitative study of the historical trends of PPI in developing countries, suggests motives for government involvement in PPPs: the governments that sought out PPIs in the early 1990s were those experiencing severe budget strains resulting from their inability to impose commercial and financial discipline to publically owned utility sectors, which in turned faced declining performance and inability to meet the increasing demand. Private firms investing in infrastructure encounter a different set of incentives.

Bing et al., 2005 examined the critical success factors (CSFs) of PPP projects in UK construction industry. Questionnaire survey research examined the relative importance of eighteen CSF and three most important factors-a strong and good private consortium, appropriate risk allocation and available financial market-were found. Factor analysis revealed one of the groupings as favourable economic conditions and available financial market.

Estache, 2006 attempt to analyze the literature on the main current infrastructure policy issues in developing and transition economies. The results of the study indicated 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.

Hammami et al., 2006, details the determinants of PPP in infrastructure. Using PPI database of World Bank, factors- Governments friendly to market size, macroeconomic stability regulatory environment, quality of institutions, strong and effective legal institutions, well protected investor rights-were found as determinants of private involvement in public infrastructure projects.

PPP development requires sustained policy dialogue and support for the development of suitable legal, regulatory, and institutional frameworks and assistance in the development of PPP *projects* (ADB, 2009).

Secrieru et al., 2009 highlights the determinants of PPP in infrastructure projects. Further on, action and validity of these PPPs determinants was evaluated for the Republic of Moldova. Results indicated that the variables-macro-economic stability, institutional quality, government's reputation and experience of private sector in infrastructural projects of PPPs type-were found important determinants of PPP in infrastructure.

Sharma, 2012 undertook an attempt to analyze the factors that determine Public Private Partnership (PPP) in infrastructure by using a unique data set on Private Participation in Infrastructure (PPI) for the period

1990-2008. The factors-market size, macroeconomic stability, quality of regulation and governance were found important in determining PPP in the infrastructure.

Kripa (2013) focused on the determinants of PPP influencing infrastructure development in Albania. For the purpose of the study, existing literature has been reviewed. The author indicated energy as the most important sector receiving PPPs. The variables-macroeconomic stability and size of markets-were found important determinants of PPPs in infrastructure.

Zagozdzon, 2013 identifies the determinants of implementation of PPP in the area of transport infrastructure and analyzes the influence of these factors on the development of partnership in Poland. From the review of literature, three main groups of the determinants of PPP-the government's economic doctrine which included the macroeconomic condition of the economy, the legal system, and the capacity of public institutions-were identified. The analysis confirmed the same and found all three determinants important for the implementation of transport projects in Poland. Strong government support was found important particularly for the development of the Polish PPP market.

Based on the above literature review, the following alternative hypotheses have been devised:

H₀: There is no significant difference in various parameters of economic conditions with respect to different countries

H_{1a}: Countries having large budget deficits and high debt burden are more likely to have PPP.

H_{1b}: PPP is more widespread in countries having stable macroeconomic conditions.

H₂: PPP model have more inclination in larger markets where demand and purchasing power are greater.

3. RESEARCH DESIGN

The present study entitled "**Effect of Macro Economic Variables on Public Private Partnerships: A Study of Transportation Sector of South Asian Countries**" is aimed at identifying the economic determinants of PPP in the sample countries. Research design opted for the study is descriptive in nature.

3.1 PERIOD OF THE STUDY

For the purpose of the study, data is considered for 25 years i.e.1990–2015.

3.2 SCOPE OF THE STUDY

The focus of the study would be on transportation sector, comprising of roads and highways, ports, airports and railways of South Asian nations.

3.3 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, telecommunication and water. 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 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 eight nations, which are India, Maldives, Nepal, Pakistan, Srilanka, Bhutan, Bangladesh and Afghanistan.

3.4 UNIVERSE AND ITS DESCRIPTION

For the purpose of the study, South Asian countries would be considered as universe.

3.5 VARIABLES DEFINITION

For the present study, there are two explained (dependent) variables and six explanatory (independent) variables, which are explained as follows:

a) Explained Variables

Two explained variables used for the study are explained as follows:

1. Number of PPPs:

This is number of PPP transactions in one particular country in a particular year. Further, this variable comprises of four different types on the basis of sector-Number of PPPs in roads, Number of PPPs in ports, Number of PPPs in airports and Number of PPPs in railways.

2. Investment in PPPs:

This is total amount of USD invested in PPP projects in transportation sector.

b) Explanatory Variables

These are the following explanatory variables for the present study as follows

1. Budget Deficit:

For measuring the same, General Government Balance as % of GDP has been used for the study.

2. Inflation:

Annual percentage change of GDP deflator would be used for measuring the variable. The credibility of the public sector's economic policymaking often correlates with the extent of macroeconomic stability, which is a prerequisite for economic development. Lower inflation is conducive to greater macroeconomic stability.

3. Broad Money:

Money supply would be measured as Broad Money as a percent of GDP of a particular country. Controlled money supply leads to greater macroeconomic stability, which will lead to more PPPs.

4. International Reserves:

A country with more international reserves is supposed to be more stable from macroeconomic point of view and hence is expected to have more PPPs viz-a-viz country with less international reserves. For this variable total reserve (log) has been used.

5. Market size:

For this variable population (log) has been used. The variable explains the size of the market of that country. To avoid scaling issues, natural logarithmic of population has been taken.

6. Purchasing Power:

GDP per capita has been used for measuring this variable. This variable explains the purchasing power of the country.

3.6 TOOLS FOR THE ANALYSIS

In order to analyze the data, various statistical tools will be applied. Descriptive analysis, correlation and regression analysis is used for the purpose of analysis as briefly explained below

1. Descriptive analysis

Descriptive statistics will include mean, median, standard deviation and percentiles. Descriptive analysis would be used for the profiling of sample data.

2. ANOVA

Analysis of variance (ANOVA) is used to analyze the differences among group means and their associated procedures (such as "variation" among and between groups). ANOVAs are useful for comparing (testing) three or more means (groups or variables) for statistical significance.

3. Correlation

Spearman (Pearson) correlation between is calculated to determine the relationship of various explanatory and explained variables.

4. Regression

Panel data analysis tool would be applied to identify the determinants. Panel (data) analysis is a statistical method which deals with two and "n"-dimensional (in and by the - cross sectional/times series time) panel data.

4.1 Determinants of Number of PPPs in Infrastructure

Panel data technique has been used for the analysis as explained variable used here is discrete count variable (Number of PPP projects).

The model equation to be used for the same is as follows

$$\text{NUMPPP} = 0 + 1\text{GBAL} + 2\text{INF} + 3\text{MONEYSUPPLY} + 4\text{INTRESERVE} + 5\ln(\text{POP}) + 6\text{GDP} + \mathcal{E} \quad (1)$$

4.2 Determinants of Investments in PPP

Panel data regression model has been used for the analysis purpose as explained variable used is a continuous non-negative number with limits (TOTALINV-Dollar value of investments in PPP transactions).

$$\text{TOTALINV} = 0 + 1\text{GBAL} + 2\text{INF} + 3\text{MONEYSUPPLY} + 4\text{INTRESERVE} + 5(\text{POP}) + 6\text{GDP} + \mathcal{E} \quad (2)$$

The term used in the above equations signify as follows:

1. GBAL- (General Government Balance as % of GDP).
2. INF - Inflation (annual percentage change of GDP deflator).
3. MONEYSUPPLY - Money supply (M2 in percent of GDP).
4. $\log_{10}(\text{INTRESERVE})$ – The variable $\log_{10}(\text{INTRESERVE})$ is logarithmic of International reserves
5. $\log_{10}(\text{POP})$ - The variable $\log_{10}(\text{POP})$ is logarithmic of population.
6. GDP - Gross domestic product (GDP) per capita.
7. NUMPPP - Number of PPP transactions in one particular country
8. TOTALINV - This is total amount of million USD (\$) invested in PPP transactions.
9. \mathcal{E} - It is the random error term in the regression equation.

4. DATA ANALYSIS AND DISCUSSION

The present study entitled “**Effect of Macro Economic Variables on Public Private Partnerships: A Study of Transportation Sector of South Asian Countries**” is an effort to identify the factors or determinants that influence the Public Private Partnership in sample countries.

TABLE 4.1 Custom Tables

		Group				
		India	Nepal	Maldives	Pakistan	Srilanka
log of population	Mean	9.04	7.38	5.48	8.16	7.28
	Standard Deviation	.05	.05	.08	.07	.03
GDP per capita (current US\$)	Mean	764.59	362.74	3778.76	747.63	1566.85
	Standard Deviation	456.68	200.55	2331.07	345.52	1152.98
Inflation, GDP deflator (annual %)	Mean	6.64	8.25	5.22	10.38	9.86
	Standard Deviation	3.00	3.98	3.46	5.59	4.72
Central government debt, total (% of GDP)	Mean	53.24	58.13	39.96	70.13	89.87
	Standard Deviation	4.99	9.30	9.74	9.65	11.61
broad money (% of GDP)	Mean	60.71	56.34	40.93	47.61	38.29
	Standard Deviation	14.69	19.37	10.22	5.48	5.35
Total reserves Ln(includes gold, current US\$)	Mean	25.01	21.08	18.71	22.39	21.64
	Standard Deviation	1.33	.86	1.01	1.02	.77
no. of projects(TOTAL TRANSPORT)	Mean	17.38	.04	.04	.54	.08
	Standard Deviation	21.31	.20	.20	1.07	.27
investment(MILLION US\$)	Mean	3689.83	13.46	18.38	100.57	28.46
	Standard Deviation	6020.30	68.64	93.74	258.94	107.06

From the above table, it can be observed that the mean value and standard deviation for log of population, GDP per capita, inflation, central government debt, broad money, log of total reserves, total no. of projects and total investment with respect to different countries like India, Nepal, Maldives, Pakistan and Srilanka. It can be concluded that the highest mean value of population is in India(9.04), for GDP per capita highest mean value is for Srilanka(1556.85), for Inflation highest mean value is for Pakistan(10.38), for central government debt highest mean value is for Srilanka(89.87), for broad money highest mean value is for India(60.71), for total reserves highest mean value is also for India(25.01), for total no. of projects highest mean value is also for India(17.38) and for total investment highest mean value is also for India(3689.83).

TABLE 4.2 One-way ANOVA

Ho: There is no significant difference in various parameters of economic conditions with respect to different countries

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
log of population	Between Groups	180.001	4	45.000	11897.938	.0001**
	Within Groups	.473	125	.004		
	Total	180.474	129			
GDP per capita (current US\$)	Between Groups	197128648.266	4	49282162.067	34.553	.0001**
	Within Groups	178285273.484	125	1426282.188		
	Total	375413921.750	129			
Inflation, GDP deflator (annual %)	Between Groups	380.857	4	95.214	5.091	.001**
	Within Groups	2113.500	113	18.704		
	Total	2494.357	117			
Central government debt, total (% of GDP)	Between Groups	32286.398	4	8071.600	94.997	.0001**
	Within Groups	9176.381	108	84.966		
	Total	41462.779	112			
broad money (% of GDP)	Between Groups	9686.903	4	2421.726	16.061	.0001**
	Within Groups	18847.849	125	150.783		
	Total	28534.752	129			
Total reserves Ln(includes gold, current US\$)	Between Groups	538.421	4	134.605	130.402	.0001**
	Within Groups	129.030	125	1.032		
	Total	667.451	129			
no. of projects(TOTAL TRANSPORT)	Between Groups	6166.385	4	1541.596	16.921	.0001**
	Within Groups	11388.385	125	91.107		
	Total	17554.769	129			
investment(MILLION US\$)	Between Groups	277178319.488	4	69294579.872	9.535	.0001**
	Within Groups	908400525.188	125	7267204.202		
	Total	1185578844.676	129			

Above Table shows the output of the ANOVA analysis and shows that there is a statistically significant difference between our log of population, GDP per capita, inflation, central government debt, broad money, log of total reserves, total no. of projects and total investment with respect to different countries like India, Nepal, Maldives, Pakistan and Srilanka. It can be observed that the significance value is $p = 0.0001$, which is below 0.05 and, therefore, there is a statistically significant difference in the self-efficacy between the different countries. The null hypothesis is rejected and alternate hypothesis is accepted because p value is less than level of significance (.01).

TABLE 4.3 Pearson Correlation (Combined)

		Correlations							
		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(include s gold, current US\$)	no. of projects(TOTAL TRANSPORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	-.584**	.072	.234	.431**	.894**	.413**	.338**
GDP per capita (current US\$)	Pearson Correlation		1	-.194*	-.305**	.003	-.275**	-.063	-.029
Inflation, GDP deflator (annual %)	Pearson Correlation			1	.305**	-.233*	-.093	-.119	-.063
Central government debt, total (% of GDP)	Pearson Correlation				1	-.237*	.121	-.128	-.117
broad money (% of GDP)	Pearson Correlation					1	.642**	.465**	.438**
Total reserves Ln(includes gold,	Pearson Correlation						1	.563**	.486**
no. of projects(TOTAL	Pearson Correlation							1	.957**
investment(MILLION US\$)	Pearson Correlation								1
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is significant at the 0.05 level (2-tailed).									

Table 4.3 represents the correlation values between the different economic variables. Correlation value measures the strength and direction of linear relationship between two variables. Correlation value exists between +1 to -1. -1 indicating a perfect negative correlation and +1 indicating a perfect positive correlation. Here, the log of population is moderately negatively correlated with GDP per capita and highly positively correlated with log of total reserves. Broad money is moderately positively correlated with log of total reserves, number of total projects and total investment. Log of total reserves is moderately positively correlated with number of total projects and total investment. Number of total projects is highly positively correlated with total investment.

TABLE 4.4 Pearson Correlation (INDIA)

		Correlations ^a							
		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(include s gold, current US\$)	no. of projects(TOTAL TRANSPORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	.910**	-.552**	.393	.967**	.985**	.618**	.586**
GDP per capita (current US\$)	Pearson Correlation		1	-.300	.081	.918**	.875**	.633**	.664**
Inflation, GDP deflator (annual %)	Pearson Correlation			1	-.491*	-.415*	-.513**	-.011	.122
Central government debt, total (% of GDP)	Pearson Correlation				1	.425*	.449	.171	.036
broad money (% of GDP)	Pearson Correlation					1	.968**	.638**	.624**
Total reserves Ln(includes gold,	Pearson Correlation						1	.641**	.594**
no. of projects(TOTAL	Pearson Correlation							1	.952**
investment(MILLION US\$)	Pearson Correlation								1
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is significant at the 0.05 level (2-tailed).									

In table 4.4 log of population is highly positively correlated with GDP per capita, broad money and log of total reserves. Also, it is moderately positively correlated with number of total projects and total investment and negatively correlated with inflation. GDP per capita is highly positively correlated broad money and log

of total reserves, moderately positively correlated with number of total projects and total investment and negatively correlated with inflation. Inflation is negatively correlated with central government debt, broad money and log of total reserves. Central government debt is moderately positively correlated with broad money and log of total reserves. Broad money is highly positively correlated log of total reserves, number of total projects and total investment. Log of total reserves is moderately positively correlated number of total projects and total investment. Number of total projects is highly positively correlated with total investment.

TABLE 4.5 Pearson Correlation (NEPAL)

		Correlations ^a							
		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(include s gold, current US\$)	no. of projects(TOTAL TRANSP ORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	.829**	-.227	-.619**	.923**	.940**	.279	.279
GDP per capita (current US\$)	Pearson Correlation		1	.044	-.890**	.944**	.949**	.387	.387
Inflation, GDP deflator (annual)	Pearson Correlation			1	.085	-.062	-.103	-.163	-.163
Central government	Pearson Correlation				1	-.805**	-.776**	-.614**	-.614**
broad money (% of GDP)	Pearson Correlation					1	.978**	.446*	.446*
Total reserves Ln(include s gold, current US\$)	Pearson Correlation						1	.411*	.411*
no. of projects(TOTAL)	Pearson Correlation							1	1.000**
investment(MILLION US\$)	Pearson Correlation								1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In table 4.5 log of population is highly positively correlated with GDP per capita, broad money and log of total reserves. Also, it is moderately positively correlated with number of total projects and total investment and negatively correlated with inflation and central government debt. GDP per capita is highly positively correlated broad money and log of total reserves, moderately positively correlated with number of total projects and total investment and negatively correlated with central government debt. Inflation is negatively correlated with broad money and log of total reserves, number of total projects and total investment. Central government debt is highly negatively correlated with broad money and log of total reserves, number of total projects and total investment. Broad money is highly positively correlated log of total reserves and moderately positively correlated with number of total projects and total investment. Log of total reserves is moderately positively correlated number of total projects and total investment. Number of total projects is highly positively correlated with total investment.

TABLE 4.6 Pearson Correlation (Maldives)

		Correlations ^a							
		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(include s gold, current US\$)	no. of projects(TOTAL TRANSP ORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	.972**	.524	.225	.924**	.968**	.201	.201
GDP per capita (current US\$)	Pearson Correlation		1	.482	.302	.902**	.912**	.223	.223
Inflation, GDP deflator (annual)	Pearson Correlation			1	.248	.400	.421	-.362	-.362
Central government	Pearson Correlation				1	.431*	.141	.486*	.486*
broad money (% of GDP)	Pearson Correlation					1	.927**	.249	.249
Total reserves Ln(include s gold, current US\$)	Pearson Correlation						1	.203	.203
no. of projects(TOTAL)	Pearson Correlation							1	1.000**
investment(MILLION US\$)	Pearson Correlation								1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In table 4.6 log of population is highly positively correlated with GDP per capita, broad money and log of total reserves. Also, it is moderately positively correlated with inflation and central government debt, number of total projects and total investment. GDP per capita is highly positively correlated broad money and log of total reserves, moderately positively correlated with central government debt, number of total projects and total investment. Inflation is moderately positively correlated with central government debt, broad money and log of total reserves, number of total projects and total investment. Central government debt is moderately positively correlated with broad money and log of total reserves, number of total projects and total investment. Broad money is highly positively correlated log of total reserves and moderately positively correlated with number of total projects and total investment. Log of total reserves is moderately positively correlated number of total projects and total investment. Number of total projects is highly positively correlated with total investment.

TABLE 4.7 Pearson Correlation (Pakistan)

Correlations^a

		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(include s gold, current US\$)	no. of projects(TOTAL TRANSPORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	.924**	-.030	-.712**	.728**	.895**	-.034	.209
GDP per capita (current US\$)	Pearson Correlation		1	.018	-.800**	.735**	.800**	-.114	.192
Inflation, GDP deflator (annual %)	Pearson Correlation			1	-.097	-.040	-.051	-.024	.017
Central government debt, total (% of GDP)	Pearson Correlation				1	-.891**	-.758**	.155	-.270
broad money (% of GDP)	Pearson Correlation					1	.730**	.072	.370
Total reserves Ln(include s gold, current US\$)	Pearson Correlation						1	.067	.287
no. of projects(TOTAL TRANSPORT)	Pearson Correlation							1	.362
investment(MILLION US\$)	Pearson Correlation								1

** . Correlation is significant at the 0.01 level (2-tailed).

In table 4.7 log of population is highly positively correlated with GDP per capita, broad money and log of total reserves. Also, it is moderately positively correlated with total investment and negatively correlated with inflation and central government debt, number of total projects. GDP per capita is highly positively correlated broad money and log of total reserves, moderately positively correlated with total investment and negatively correlated with central government debt, number of total projects. Inflation is negatively correlated with central government debt, broad money and log of total reserves, number of total projects and total investment. Central government debt is negatively correlated with broad money and log of total reserves, number of total projects and moderately positively correlated with total investment. Broad money is highly positively correlated log of total reserves and moderately positively correlated with number of total projects and total investment. Log of total reserves is moderately positively correlated number of total projects and total investment. Number of total projects moderately positively correlated with total investment.

TABLE 4.8 Pearson Correlation (Srilanka)

Correlations^a

		log of population	GDP per capita (current US\$)	Inflation, GDP deflator (annual %)	Central government debt, total (% of GDP)	broad money (% of GDP)	reserves Ln(includes gold, current US\$)	no. of projects(TOTAL TRANSPORT)	investment(MILLION US\$)
log of population	Pearson Correlation	1	.902**	-.265	-.716**	.787**	.918**	-.094	-.077
GDP per capita (current US\$)	Pearson Correlation		1	-.261	-.902**	.685**	.891**	-.185	-.174
Inflation, GDP deflator (annual %)	Pearson Correlation			1	.037	-.632**	-.294	-.059	.042
Central government debt, total (% of GDP)	Pearson Correlation				1	-.435*	-.825**	.253	.274
broad money (% of GDP)	Pearson Correlation					1	.705**	.032	.033
Total reserves Ln(includes gold, current US\$)	Pearson Correlation						1	-.198	-.198
no. of projects(TOTAL TRANSPORT)	Pearson Correlation							1	.939**
investment(MILLION US\$)	Pearson Correlation								1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

In table 4.8 log of population is highly positively correlated with GDP per capita, broad money and log of total reserves. Also, it is negatively correlated with inflation and central government debt, number of total projects and total investment. GDP per capita is highly positively correlated broad money and log of total reserves, negatively correlated with inflation, central government debt, number of total projects and total investment. Inflation is negatively correlated with broad money and log of total reserves, number of total projects. Central government debt is negatively correlated with broad money and log of total reserves and moderately positively correlated with total investment, number of total projects. Broad money is highly positively correlated log of total reserves and moderately positively correlated with number of total projects and total investment. Log of total reserves is negatively correlated number of total projects and total investment. Number of total projects is highly positively correlated with total investment.

Panel data are a type of data collected at different points in time.

TABLE 4.9 VARIANCE INFLATION FACTOR (VIF)

. vif

Variable	VIF	1/VIF
broad money (% of GDP)	2.79	0.358926
Total reserves Ln(includes gold, current US\$)	2.37	0.358926
Central government debt, total (% of GDP)	1.46	0.687131
GDP per capita (current US\$)	1.24	0.808085
Inflation, GDP deflator (annual %)	1.18	0.84729
Mean VIF	1.81	

The variance inflation factor (VIF) was used to detect the problem of Multi co linearity. Computationally, it is defined as the reciprocal of tolerance i.e. $VIF = 1/\text{Tolerance}$. A VIF of 10 and above indicates a problem of multi co linearity. On the basis of the VIF values, it can be said that there is no problem of multi co linearity in this multiple regression and all the parameter estimates are stable.

The table 4.9 shows that the multi co linearity in the different independent variables like broad money, log of total reserves, central government, GDP per capita, Inflation. The variance influence factor is less than 10 which represent the no multi co linearity between the independent variables. Log of population and broad money was highly co relate then multi co linearity is present as variance influence factor is more than 10. Hence, only broad money was taken and log of population was eliminated.

4.1 Case-1: DEPENDENT VARIABLE: NO. OF PROJECTS (Number of PPP Projects)

To identify heteroskedasticity, Breusch-Pagan / Cook-Weisberg test was applied. Heteroskedasticity is present because chi square value is 137.1 and p value is less than .01. Hence, robust standard error technique was applied for removing the heteroskedasticity.

Durbin–Watson test was used to detect the presence of autocorrelation in the residuals from a regression analysis. As a rough rule of thumb, if Durbin–Watson is less than 1.0, there may be cause for alarm. Durbin–Watson = 1.1699865, which represent no auto correlation

TABLE 4.10

No. of projects	Coef	robust std. error	t	P> t	[95% Conf. Interval]	
GDP per capita (current US\$)	-0.0017	0.001721	-0.99	0.326	-0.00512	0.0017191
Inflation, GDP deflator (annual %)	0.4033674	0.232527	1.73	0.086	-0.05852	0.8652532
Central government debt, total (% of GDP)	0.2671856	0.108596	2.46	0.016	0.051472	0.4828991
broad money (% of GDP)	0.14784	0.154912	0.95	0.342	-0.15987	0.455553
Total reserves Ln(includes gold, current US\$)	5.887396	2.060099	2.86	0.005	1.795263	9.979528
Constant	-152.3751	42.30966	-3.6	0.001	-236.418	-68.3322

Using panel data regression fixed effect model, r square within = 0.2892, between = 0.3659, overall = 0.2691 shows that the association or relationship with the dependent variable and independent variables is statistically significant ($F(5,91) = 7.41$, Prob > F = 0.0000).

Total reserve, central government debt and inflation is statistically significant at 10% level of significance. Therefore, the following alternative hypothesis is selected.

H1a: Countries having large budget deficits and high debt burden are more likely to have PPP. **(Accepted)**

H1b: PPP is more widespread in countries having stable macroeconomic conditions. **(Accepted)**

4.2 Case-2: DEPENDENT VARIABLE: (TOTAL INVESTMENT in Million USD invested in PPP transactions in a year)

Breusch-Pagan / Cook-Weisberg test was applied to check for heteroskedasticity. Heteroskedasticity is present because chi square value is 169.27 and p value is less than .01. Hence, robust standard error technique was used to remove the heteroskedasticity.

Durbin–Watson test was used to detect the presence of autocorrelation in the residuals from a regression analysis. As a rough rule of thumb, if Durbin–Watson is less than 1.0, there may be cause for alarm. Durbin–Watson = 1.0337988, which represent no auto correlation.

TABLE 4.11 (DEPENDENT VARIABLE: TOTAL INVESTMENT)

investment(MILLION US\$)	Coef.	robust std. error	z	P> z	[95% Conf. Interval]	
GDP per capita (current US\$)	0.2661931	0.2263873	1.18	0.24	-0.1775178	0.7099039
Inflation, GDP deflator (annual %)	67.78877	122.8593	0.55	0.581	-173.0111	308.5886
Central government debt, total (% of GDP)	7.969666	18.70685	0.43	0.67	-28.69509	44.63442
broad money (% of GDP)	90.8314	85.90495	1.06	0.29	-77.5392	259.202
Total reserves Ln(includes gold, current US\$)	536.3775	204.2961	2.63	0.009	135.9645	-5629.754
Constant	-16803.95	5701.224	-2.95	0.003	-27978.14	-5629.754

Using panel data regression fixed effect model, r square within = 0.2184, between = 0.8488, overall = 0.3611 shows that the association or relationship with the dependent variable and independent variables is statistically significant ($F(5,91) = 7.41$, Prob > F = 0.0000).

Total reserve is only variable that is statistically significant at 5% level of significance. It suggests that markets with larger reserves are the better economies for PPP for the infrastructure development.

5.1 CONCLUSION

The present study attempts to analyze the impact of macro-economic variables on PPP transaction in infrastructure for the sample countries from 1990 to 2015. The analysis of this study has been applied for South Asian countries. This is mainly because the issue is extremely relevant from the policy perspective in these countries and the research for these countries is neglected. The analysis in this study has focussed on various macro-economic variables like governments' budget constraint, size of the market, currency volatility. On the basis of appropriate analysis, it has been found that:

Markets or countries which have stable macro economic conditions are more attractive for PPP for infrastructure development. Empirical evidence also confirmed that macroeconomic stability especially relating to inflation is an important consideration in PPPs. The countries with more reserves are likely to have more PPP. On the other hand, contrary to a general perception, the size of the market is not found to have any significant role in determining PPPs.

5.2 RECOMMENDATIONS

For the present study entitled “**Effect of Macro Economic Variables on Public Private Partnerships: A Study of Transportation Sector of South Asian Countries**” the following recommendations are suggested.

1. The countries should improve the amount of total reserve in order to attract more PPP projects for the infrastructure development.
2. The countries should control the inflation to promote the infrastructure development through PPP
3. The central government debt should also be taken care of and controlled in order to develop infrastructure through PPP.

5.3 LIMITATIONS AND FUTURE RESEARCH ISSUES

The present studies possess limitations as follows:

1. Sample size considered is small and only study of South Asian countries is done which include only eight countries. For generalization purpose, the size of the sample countries can be increased. For the better results, there can be comparison of the determinants of PPP across various regions.
2. Because of the paucity of the data, only economic factors are considered for the study whereas issues like political stability, quality of regulation and governance are not considered. The future studies can be done considering other variable like legal factor, regulatory factor or political stability to name a few.
3. The data of few variables of sample countries was unavailable, and hence posed a hindrance.
4. Only transportation sector is considered for study and sub sectors like electricity, natural gas, water and telecommunication are not considered. For the better results, the other sub-sector can be included for a better view of private investments in infrastructure sector.

5.4 PRACTICAL IMPLICATIONS/ POLICY SUGGESTIONS

In the light of the various inefficiencies and constraints, PPP seems to be a viable and reasonable option for the policy makers in developing countries. As, the findings of the present study suggest that PPP are most likely option in countries with stable macroeconomic condition. Hence, the countries are supposed to control the excess volatility so as to provide safety mechanism in the place. Furthermore, certain prudential fiscal policy measures can be helpful in containing additional fiscal risks. So as to maintain currency stability, efforts must be applied so as to make the environment conducive for exports. To contain inflation, austerity measures must be thought of like controlling of subsidies can be one of the factors. Stable inflation can help in reducing the risk premiums. Since average inflation factor is used to determine many tax rates, hence volatile inflation can severely affect government's cash inflows and outflows. Managing long term as well as short term interest rates to lower figure is a welcoming step in this regard. By adopting all the measures suggested above, the country can become attractive option for PPP projects.

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