



A Comparative Analysis on Public Private Partnership Investment in BRICS Nations

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Introduction:

It is widely accepted that BRICS (Brazil, Russia, India, China and South Africa) nations are the emerging economies where every investor want to invest in various projects. Infrastructure development is one of the major requirements in these countries and this demand supply gap of infrastructure in these countries can be fulfilled with Public Private Partnership. The developed nations like USA, UK have already reached the stage where the investment is requirement for sustainability but in these developing nations there are more prospects of PPP. BRICS nations constitute 40% of the population spread across the globe and already accounted for 25% of global GDP. BRICS countries has shown a tremendous performance in 2008 as well when there was economic crisis all over the world and that is why it can be rightly said that these nations will grow continuously in the coming years as well. The BRICS positions look more favourable if we compare countries GDP using PPP exchange rates. It is envisioned that BRICs will catch up the majority of developed countries as these are focusing on the trade relations between with other nations for better growth prospects together. According to “Goldman Sachs” if these five nations are combined this will become the largest entity on the global stage. Many FDI’s want to establish their ventures in these nations and various investors also consider these nations as a profitable place due the growing and emerging markets of these economies along with the increase in the needs of the population. The paper will focus on the growth prospects via PPP individually as well as collectively and the paper is based on primary data where its shown that with the help of more investment in infrastructure the GDP is growing in last 22 years in BRICS countries. (Minsitry of Finance, 2012)

Research Methodology

The aim of the research is to find how PPP model is helping BRICS nations in various infrastructure sectors in their development. To study the effect on GDP through projects under PPP and Investment as % of GDP, panel data is taken for last 22 years of

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these nations. Various panel regression tests are implemented to check the contemporaneous relationship between number of projects under PPP and total Investment as percentage of GDP with the help of Eviews. Firstly panel least square model is applied with log GDP as the dependent variable and log number of projects and log investment as independent variables. The panel OLS regression equation is represented as:

$$\text{Log (GDP)}_{it} = \alpha + \beta_1 \log(N)_{it} + \beta_2 \log(TI)_{it} + E_{it}$$

After panel OLS regression model fixed and random effects are studied and lastly EGLS model has been applied. In this study two hypothesis are taken

Hypothesis1:

There exists significant impact of number of projects under PPP in the country on the GDP.

Hypothesis 2:

There exists significant impact of Investment as percentage of GDP on the GDP of the country.

Growth Indicators of BRICS Nations

It has been well accepted that BRICS nations are the future economies where growth can be encouraged through increase in investment in infrastructure projects. Every country in BRICS has its own potential and in last few decades the growth trend is increasing which is shown in the below figure. The figure shows that growth trend of China is maximum starting from 4 to 17 billion US\$, while India is second highest and Russia, Brazil growth trend are also increasing but not at the rate of India and China, growth rate of South Africa is least from all the four other countries.

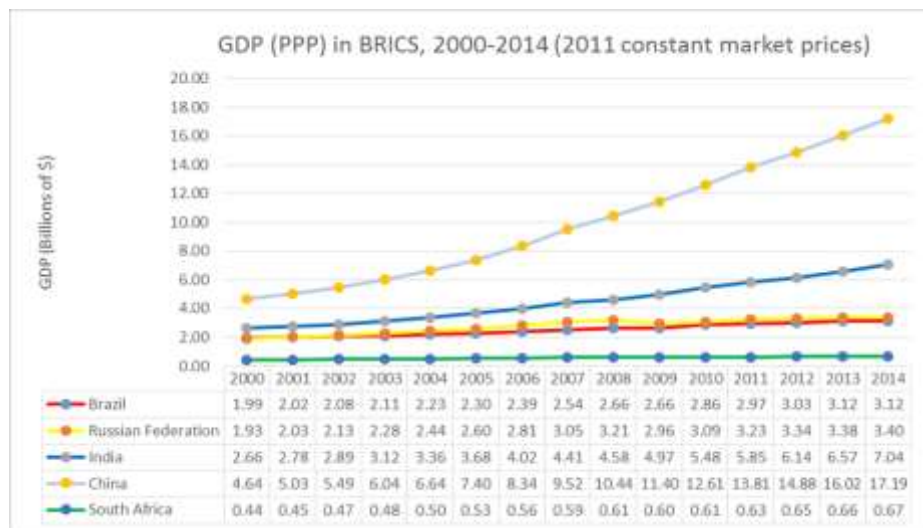


Figure 1, Source: (Statista, 2015)

Private sector plays a vital role in developing the infrastructure in any country. Undoubtedly private sector's main motive is to earn profits but it is also well accepted that private sector has the great potential in terms of bringing investment and Research and Development in any sector. In various countries private sector is helping drastically in the growth and development. This is also shown in the below figure that, that maximum private participation is in China followed by India, Brazil and Russia and if private sector potential is tapped properly like China the other nations can also prosper in the same way.

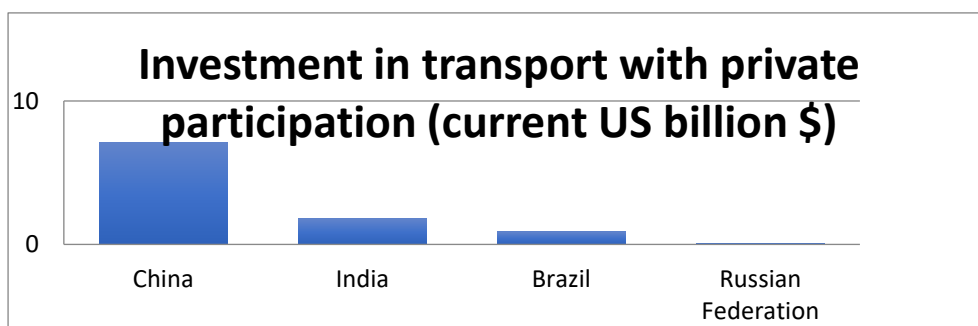


Figure 2, Source: (World Statistics, 2016)

Infrastructure Indicators and Growth of PPP in BRICS countries

The PPI investment among BRICS nations seems to be focused on energy and transport sector. "This is due to the abundant unexploited natural resources in these emerging economies. E.g.: Recently, oil fields have been discovered in Brazil, which has led to more investments in the energy sector."

Testing the hypothesis

As mentioned in Research methodology, to study the relationship between number of projects and Investment as % of GDP two hypotheses are taken in this study:

Hypothesis1:

There exists significant impact of number of projects under PPP in the country on the GDP

Hypothesis 2:

There exists significant impact of Investment as percentage of GDP on the GDP of the country

For proving the hypothesis these tests are performed:

Categories	Brazil	Russia	India	China	South Africa
Income Category	Upper Middle Income	High Income	Lower Middle Income	Upper Middle Income	Upper Middle Income
GNI per capita (2011 PPP \$)	14145	23286	5663	13345	12087
Rankings: Ease of doing Business	125	35	100	78	82
Rankings: HDI	79	48	131	91	119
Electric power consumption (kwh per capita as per year 2013)	2551	6539	765	3773	4315
Projects cancelled or distressed (% of total investment)	1%	0.9%	1%	4%	1%
PPP investment in energy (current US\$)	3796200000	262000000	18000000	31680000	-----
PPP investment in transportation (current US\$)	238400000	79400000	1220600000	745220000	97000000
Type of PPI with largest share of investment	Concession	Greenfield Project	Greenfield Project	Greenfield Project	Greenfield Project

Table 1- Infrastructure Indicators of BRICS countries, Source: (Bank, 2017)

Panel Least Square Model:

For studying the PPP in detail in BRICS a panel data of 22 years consisting of data on GDP (constant 2010 US\$), Investment (% of GDP) and projects under PPP is taken from the official website of World Bank. The relationship to be examined in the study is contemporaneous in nature, which means in this study effort is made in order to analyze the impact of a number of projects under PPP and total investment made during a year on the GDP of the country of the same year. In the study the annual data is collected of five countries namely Brazil, Russia, India, China and South Africa. The annual data is collected for 22 years ranging from 1995 to 2017, in total there are 99 complete observations are available in the study. The nature of the data is balanced panel, hence panel data regression models is applied in order to examine the contemporaneous relationship between number of projects under PPP and total

Investment with the GDP of the country. To start with panel least squares model is applied with log GDP as the dependent variable and log number of projects and log investment as independent variables. The panel OLS regression model can be represented as:

$$\text{Log (GDP)}_{it} = \alpha + \beta_1 \log(N)_{it} + \beta_2 \log(TI)_{it} + E_{it}$$

Where:

i represent the country and t represents the time, α as the intercept and β_1 and β_2 represents the slope coefficient of the regression model, and E_{it} represents the residual term.

The results of the panel OLS model is shown below in table

Dependent Variable: LOG(GDP), Method: Panel Least Squares, Periods included: 22, Cross-sections included: 5, Total panel (unbalanced) observations: 99				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Log (Number of projects)	0.275935	0.040815	6.760556	0.0000
Log (Total investments)	1.065390	0.175371	6.075069	0.0000
C	23.71514	0.525750	45.10722	0.0000
R-squared (0.612112, Adjusted R-squared (0.604031), Akaike info criterion (1.632915), Schwarz criterion (1.711555), Hannan-Quinn criteria (1.664733), F-statistic (75.74721), Prob(F-statistic) = 0.000000				

The results of the regression model indicate that the probability value of t statistics in case of both the variables is found to be less than 5% level of significance. Hence with 95% level of confidence it can be concluded that there exists significant relationship between number of projects under PPP and total investment with the GDP of the country. In addition to this the slope coefficient of both the independent variables is found to be positive indicating the positive relationship between GDP with number of projects under PPP and total investment. In other words it can also be expressed, that with the increase in the number of projects in PPP along with the investment in the country will have a significant positive impact on the GDP of the country.

Testing of fixed and random effects

Since the panel regression model indicates significant relationship between the GDP of the country and the number of projects under PPP and total investment, the effort is also made in this study to apply the fixed effect model and Random effect model and before applying the right model for the analysis, the comparison between F test and Hausman test is done. The fixed effect model tests the significance of heterogeneity of the cross section units in studying the relationship, however the Hausman test; test the null hypothesis that the effects are random in nature. The results of F test and Hausman test helps in deciding the suitable model to be applied on the panel data collected in the study. The results of F test in case of within fixed effect model and Hausman test is shown below in the table:

Table: Results of F test and Hausman test

Redundant Fixed Effects Tests		Correlated Random Effects - Hausman Test	
Test Summary	F test (p value)	Test Summary	Chi-Sq. Statistic (p value)
Cross-section F	62.519 (0.000)	Cross-section random	0.687 (0.7091)
Cross-section Chi-square	130.011 (0.000)		

The results as shown above indicate that the probability value of chi square statistic in case of F test as well as Hausman test is found to be significant i.e. less than 5% level of significance, hence the fixed effect model and random effect model are better than panel OLS regression model. Among the within effect model and random effect model, the random effect model is selected to apply in the study. This is due to the reason that the probability of chi square statistic in Hausman test is found to be less than 5% level of significance, hence it can be concluded that the effects are random in nature. Thus random effect model is assumed to provide better results as compared to fixed effects model on the collected data.

Final random effect model

It is decided in the previous section that random effect model is more suitable in the study in order to analyze the impact of number of projects under PPP and total investment on the GDP of the country. The random effect model is applied using panel EGLS model provided by Swamy and Arora. The results of the random effect model is shown below in table:

Dependent Variable: LOG(GDP), Method: Panel EGLS (Cross-section random effects), Periods included: 22, Cross-sections included: 5, Total panel (unbalanced) observations: 99, Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Log (Number of projects)	0.116	0.045	2.585	0.0112
Log (Total investments)	1.655	0.245	6.753	0.0000
C	22.243	0.797	27.892	0.0000
Rho-Cross section random (85.74%), Rho - Idiosyncratic random (14.26%)				
R-squared (0.489), Adjusted R-squared (0.478), F-statistic (46.012), Prob (F-statistic) = 0.000000				

The results indicate that the proportion of variance due to cross section is found to be 85.74% and due to variance in Idiosyncratic random is 14.26%. The results also indicate that the probability values of t statistic in case of both the independent variable is found to be less than 5% level of significance. Hence with 95% confidence level it can be concluded that there exists significant impact of number of projects under PPP and total investment on the GDP of the country. The slope coefficients of both the variables is found to be positive indicating that both the independent variables namely number of projects under PPP and total investment have a positive impact on the GDP of the country in case of all the countries in the study. The t statistic in the regression model is found to be higher in case of total investment (6.753) as compared to the t statistic in case of number of projects under PPP (2.585). Thus it is concluded that the total investment in the country is found to have larger impact on the GDP as compared to number of projects under PPP. This is due to the fact that the total investment is also higher in terms of magnitude, however the number of projects in PPP only indicate the number and not the amount. Since the study is focusing on the role of projects under PPP on the GDP of the country it can be rightly said that both the factors have significant impact in the growth of these countries.

Conclusion

Infrastructure is the core to the development of any nation and it is now clear that Investment plays a very important role in the development of the nation. Private

participation in infrastructure projects is also increasing every year globally. Private sector brings funds and latest technology but it is the responsibility of the public sector to tap these resources. With the help of investment in PPP the growth of any economy can be increased as proved in our hypothesis. Government should initiate various projects and also try to close the pending projects so that with the help of increased investment the higher growth rate can be attained. As BRICS countries have lot of potential and possess ample of natural resources, which attract the investors from all over the world so PPP can be helpful in the development of these countries.

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