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IMPACT OF FDI IN ROADS & BRIDGES ON REGIONAL DEVELOPMENT: AN ANALYSIS ACROSS SELECT INDIAN REGIONS

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ABSTRACT
This paper, with the help of double-log panel regression model, for the period 2005-2010, has empirically found the impact of Foreign Direct Investment (FDI) in roads & bridges in India on regional development to be very insignificant as well as negligible. In so far as, FDI in roads & bridges started being reported from the year 2005, therefore this six year period (2005-2010) is not enough for FDI in roads & bridges to have significantly contributed to regional development. Moreover, contribution of FDI in roads & bridges on regional development across regions is high for some, which enjoy high per capita income, high industrial output, high skilled labour and larger geographical area with high civic amenities. The same is negative for some, because of already low level of domestic investment. This region-specific difference could be because of difference in political leaderships of respective regions also.

KEYWORDS: FDI in roads & bridges in India, Panel Regression, Heterogeneity among regions.

INTRODUCTION
The primary benefits of transport infrastructure development are, no doubt, increased accessibility and reduced transport cost. Firms can benefit from these developments without actually contributing directly to the project because of the 'free-riding' nature of these types of public capital. One can think of transport infrastructure as being indeed a consequential intermediate input in private production process. Its ample supply at no or low costs to users is therefore conjectured to have a positive impact on cost and productivity of firms. In fact when a good or service is provided by the government, it affects a firm's cost. Clearly, start-up costs are less when public infrastructure is provided and the costs of procurement of materials are less due to improved transportation systems for instance. Moreover the usefulness of privately owned and operated cars and trucks depends on a network of roads and bridges. For example, better road designs, materials and highway maintenance can reduce the wear and tear on privately owned and operated vehicles, thus reducing transportation costs.

The same is true for aircraft, which require airports, and for private ships and barges, which require ports and navigable waterways. Improvement in the quantity and quality of transport infrastructure can reduce the amount or cost of private inputs needed for a given level of output. The reduction in supply costs is true at the firm level and in the aggregate as total output per unit of input increases when government-provided infrastructure results in a more efficient use of existing resources. Thus, in the above context, it can be argued that transport and the general public capital may enhance the productivity of private inward and foreign direct capital and thus their level. Erenburg (1993) further argued that if these types of infrastructure were not publicly provided, the domestic private sector and Multinational Enterprises (MNEs) would operate less efficiently and attempts by them to provide their own networks would result in duplication and a waste of resources.

Fung et al (2005) examine whether hard infrastructure, in the form of more highways and railroads, or soft infrastructure, in the form of more transparent institutions and deeper reforms, leads to more FDI. Their analysis controls for other determinants of FDI such as regional market sizes, human capital, and tax policies. Their data is on FDI from the United States, Japan, Korea, Hong Kong, and Taiwan to regions of China. They find that soft infrastructure is a more important determinant of FDI than hard infrastructure.

More FDI is likely to occur in countries with good physical infrastructure such as bridges, ports, highways, etc. It also seems likely that there are some diminishing returns in infrastructure, at least in infrastructure of a specified type. The first bridge is more important than the second than the third ….. than the hundredth, and so on. Therefore, especially for countries with poor infrastructure, investing in improvements in infrastructure may be important for attracting FDI. Nonetheless, some countries with poor infrastructure may be unattractive hosts for FDI for a variety of other reasons, and even substantial investments in infrastructure might not bring FDI pouring in. But all else equal, a country with more infrastructure would be expected to attract more FDI (as well as more domestic investment).

Government infrastructure is used to refer to a country's political, institutional and legal environment. It captures aspects of legislation, regulation, and legal systems that condition freedom of transacting, security of property rights, and transparency of government and legal processes (Globerman and Shapiro, 2003). Government infrastructure is an important determinant of both FDI inflows and outflows. Not only does government infrastructure attract FDI, but the proper conditions can also stimulate the creation of home-grown MNEs that invest abroad. The biggest gains from improving government infrastructure appear to arise for small developing countries – the benefits of further enhancements may be less for countries already enjoying good governance.

LITERATURE REVIEW

Root and Ahmed (1979) were among the first scholars to establish the positive role of the general infrastructure level on FDI. Schneider and Frey (1985) reexamined the issue for less developing countries and confirmed the results. In their influential paper, Wheeler and Mody (1992) employed a translog specification and uses a panel of 42 countries for the period 1982-1988 also interestingly reported that infrastructure quality (quality of transport, communications and energy infrastructure) exhibit a high degree of statistical significance and thus have large, positive impacts on investment. Loree and Guisinger (1995) constructed an indicator for infrastructure that encompassed measures such as highways, ports, communications and airports using principal components factor analysis and showed that the level of infrastructure did influence the flow of US direct investment. Kinoshita (1998), using survey data to study the locational determinants of foreign direct investment (FDI) by Japanese manufacturing firms in seven Asian countries, subsequently reported that infrastructure encourage firms to invest in a certain country with a reported regression coefficient of 0.26. More recently Cheng and Kwan (2000) confirmed the above for the case of 29 Chinese regions over the period 1985-1995. Kumar (2001) used a composite index of infrastructure availability for the case of 66 countries and concluded that ‘MNEs decision making pertaining to location of product mandates for global or regional markets sourcing is significantly influenced from infrastructure availability (with an infrastructure coefficient varying between 0.6 and 1.5) considerations and that infrastructure development should become an integral part of the strategy to attract FDI inflows in general’.

Studies investigating the role of infrastructure in FDI in the African context have been very scarce and among the rare one features Asiedu (2002) who analysed 34 countries in Sub Saharan Africa over the period 1980-2000. Using the number of telephones per 1000 population to measure infrastructure development and controlling for classical FDI determinants she concluded that countries that improved their infrastructure were “rewarded” with more investments. In fact a one unit increase in infrastructure was estimated to lead to a 1.12 percent increase in FDI/GDP in the 1980s. Sekkat and Veganzones-Varoudakis (2004) estimated a correlation coefficient of 0.45 for the case of Middle East and North African (MENA) countries the 1990s with a lower correlation coefficient of 0.21 for the case of the manufacturing sector.

While most studies validated the importance of infrastructure for FDI, there are also other studies which failed to validate the hypothesis. For instance Quazi (2005), on the other hand, could not established positive and significant relationship between infrastructure and FDI using panel data from 1995-2000 for a sample of seven East Asian countries such as the number of telephones per 1,000 people. The authors however admitted that ‘it is plausible that their proxy variables - the natural log of the number of telephones available per 1,000 people and the adult literacy rates, respectively, perhaps inadequately capture their true effects on FDI’.

MOTIVATION

Multitude of literature suggest that while the role of infrastructure in attracting FDI has received increasing interest from academic scholars of late, yet these studies have focused on the general level of infrastructure and have largely ignored developing country cases like India. This evinced our special interest to go in for study relating to FDI in roads & bridges in India, in particular, to fill in the gap and thus supplementing the growing literature on FDI in infrastructure, in general.

OBJECTIVE

To see the impact of FDI in roads & bridges on regional development, measured in terms of Net State Domestic Product (NSDP).

METHODOLOGY

We have collected FDI data (Rs. mn) from the office of the DIPP as reported to regional offices of RBI and obtained NSDP (Rs. bn) data from Central Statistics Office (CSO) website as on 01-03-12, which has subsequently been converted to Rs. mn. Since data on FDI in roads & bridges development has started being reported from 2005, we have collected data from 2005 till 2010 for the purpose of our study.

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Region-wise FDI Equity (Rs. mn) and NSDP (Rs. mn)

	New Delhi		Mumbai		Kolkata		Hyderabad		Chennai		Bangalore		Bhopal		Kochi	
Year	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**	**FDI**	**NSDP**
2005	1,974.25	4.65675	1,725.47	4.33559	933.30	2.13308	635.43	2.29367	382.98	2.35981	117.44	1.74911	1.95	1.55276	1.00	1.20269
2006	17.72	5.41154	10	5.24137	10	2.42796	2857.6	2.6912	1.5	2.8414	10	2.03819	0.5	1.85199	0.25	1.35104
2007	1,355	6.21924	349.16	6.14071	222.97	2.78412	4,798.36	3.25955	0.5	3.21991	12	2.43028	0.75	2.12265	1.75	1.53981
2008	32.21	7.36209	463.3	6.80173	2	3.16494	4,638.05	3.84005	0.75	3683.2	183.49	2.78538	0.5	2.57592	0.5	1.80134
2009	6,589.81	8.70389	2,220.38	8.17891	5.00	3.77306	1,729.75	4.41784	590.8	4.34813	73.69	3.05586	3.9	2.87707	0.2	2.062
2010	1,271.19	10.1506	21,465.29	9.35222	2	4.41442	3,809.61	5.31139	26.59	5.02561	40	3.60615	57.8	3.34051	0.7	2.46213

Source: *FDI Equity(Rs. mn) data is collected by the researchers from the office of the DIPP as reported to regional offices of RBI. NSDP (Rs. bn) data is obtained from Central Statistics Office (CSO) website as on 01-03-12 and has been converted to Rs. mn by the researchers.*

The states covered under the regions are **New Delhi** (Delhi, part of UP and Haryana), **Mumbai** (Maharashtra, Dadra & Nagar Haveli, Daman & Diu), **Kolkata** (West Bengal, Sikkim, Andaman & Nicobar Island), **Hyderabad** (Andhra Pradesh), **Chennai** (Tamil Nadu, Pondicherry), **Bangalore** (Karnataka), **Bhopal** (Madhya Pradesh, Chattisgarh) and **Kochi** (Kerala, Lakshadweep).

Here we see that the data is of panel nature. In order to see the impact of FDI in roads & bridges on regional development, first we run a pooled regression of log of FDI on log of NSDP, which is equivalent to estimation with neither fixed nor random effects, as given in the following equation. The Eviews 6 output is as shown below;

$LNSDPit= ß_1+ ß_{2*}LFDI_i+ u_{it}$

$$\widehat{LNSDPit} = 1.197897 + 0.041498_* LFDI_i$$

$$SE = (0.247526) \quad (0.049243)$$

$$t = (4.839480)^{***} \quad (0.842720)$$

$$(\text{F-Statistics} = 0.710178) \quad (R^2 = 0.347935)$$

Here we see that though the intercept coefficient is statistically significant but the slope coefficient is not. Since NSDP and FDI are in logarithmic forms (i.e., the model being a double -log panel regression model), so the slope estimate of 0.041498 corresponds to an approximately 4.15% growth in NSDP for 1% growth in FDI. That is to say, FDI has a positive but insignificant impact on state development. But this pooled regression assumes that the intercepts are the same for each region for each year, which could be an inappropriate assumption. Instead, we can estimate a model with cross-section (entity) fixed and period (time) fixed model, which is also known as Least Square Dummy Variable (LSDV) model and will allow us to capture the latent state-specific and year-specific heterogeneity respectively, as given in the following equation. The Eviews 6 output with effects specification cross-section fixed (dummy variables) and period fixed (dummy variables) is also shown below;

$LNSDPit= ß_{1i}+ ß_{2*}LFDI+ u_{it}$

$$\widehat{LNSDPit} = 1.739533 - 0.103093_*LFDI$$

$$SE = (0.365576) \quad (0.089828)$$

$$t = (4.758333)^{***} \quad (-1.147671)$$

$$(\text{F-Statistics} = 2.178545)^{**} \quad (R^2 = 0.454438)$$

Here we see that FDI has a negative impact which is not even statistically significant while the intercept is positive and statistically significant. We can also get to see the state-specific as well as time-specific heterogeneity from the table below;

Cross-section Specific Heterogeneity		**Time Specific Heterogeneity**	
State	**Effect**	**Year**	**Effect**
Delhi	0.819734	2005	-0.398331
Mumbai	0.803404	2006	-0.545538
Kolkata	-0.332513	2007	-0.229418
Hyderabad	0.319017	2008	0.695358
Chennai	0.913471	2009	0.155109
Bangalore	-0.418021	2010	0.322820
Bhopal	-0.827385		
Kochi	-1.277707		

Form the above output, we see that heterogeneity in terms of contribution of FDI on regional development across regions has been captured and this contribution has been obtained to be the highest in case of Chennai, followed by Delhi, Mumbai and Hyderabad, This is because of the reason that these regions enjoy high per capita income and high industrial output, endowed with high skilled labour, equipped with larger land area with high civic amenities. The same has been obtained to be negative in case of Kolkata, Bangalore, Bhopal and Kochi, which is because of already low level of domestic investment (Goldar, 2007). The following tables show some of the facts & figures to substantiate our argument;

Region Per Capita NSDP at Factor Cost (At Current Prices Rs.)								
Year	**New Delhi**	**Mumbai**	**Kolkata**	**Hyderabad**	**Bangalore**	**Bhopal**	**Kochi**	**Chennai**
2005	1,28,739	41624	99,730	28,539	31,239	36,748	36,276	1,02,448
2006	1,48,552	49568	1,13,804	33,135	35,987	43,828	40,419	1,10,961
2007	1,69,948	57218	1,29,449	39,727	42,419	50,320	45,700	1,21,807
2008	1,99,575	62454	1,51,653	47,345	48,084	59,535	53,046	1,33,446
2009	2,33,897	74027	1,86,404	52,814	52,191	63,692	60,264	1,51,705
2010	2,71,688	83,471	2,06,578	62,912	60,946	73,389	71,434	1,71,712

Source: Central Statistics Office (CSO) website as on 01.03.2012

Region	Population Density (/km^2)	Area (sq.km)
Hydrabad	308	2,75,069
New Delhi	12,698	2,86,623
Mumbai	3,232	3,08,316
Kolkata	1,576	1,04,097
Chennai	3,153	1,30,537
Bangalore	319	1,91,791
Bhopal	425	4,44,178
Kochi	2,872	38,895

Source: Population Density: en.wikipedia.org/wiki/List-of-states-and-union-territories-of-India-by-population based on Census 2011 and Area: en.wikipedia.org/wiki/List-of-states-and-territories-of-India-by-area

Heterogeneity in terms of contribution of FDI on regional development across time has also been captured and has been obtained to be the highest in year 2008, followed by 2010 and 2009, whereas year 2005, 2006 and 2007 has negative contribution also. Simultaneously, it is also worth determining that whether fixed effects are necessary or not, as shown below;

Redundant Fixed Effects Tests

Effects Test	Statistic	d.f.
Cross-section F	2.500076**	(7,34)
Cross-section Chi-square	19.931117***	7
Period F	1.826247	(5,34)
Period Chi-square	11.418571**	5
Cross-Section/Period F	2.281130**	(12,34)
Cross-Section/Period Chi-square	28.349693***	12

Three different redundant fixed effects tests are employed, each in both χ^2 and F-test versions, first restricting cross-section fixed effects to zero and subsequently restricting period fixed effects to zero and at last, restricting both types of fixed effects to zero. From the above Eviews 6 output, we see that period fixed effects are not supported by data, which shows similar results like pooled one and it is only cross-section fixed effect that makes the difference. So, period fixed effects are redundant.

Next we go in for random effects (cross-section) model, which is sometimes also known as error component model. Under random effects model, the intercept for each cross-sectional unit are assumed to arise from a common intercept, which is same for all cross-sectional units and over time, plus a random variable that varies over cross-section but is constant over time, as given in the following equation. The Eviews 6 output with effects specification cross-section random and idiosyncratic random is also shown below;

$$LNSDPit = ß_{1i} + ß_{2*}LFDI_i + \varepsilon_i + u_{it}$$

Or, $\widehat{LNSDPit} = 1.323952 + 0.007828 * LFDI + i$

SE = (0.297465) (0.055238)

t = (4.450778)*** (0.142070)

(F-Statistics = 0.019234) (Weighted R^2 = 0.000418)

(Un-weighted R^2 = 0.005207)

Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f
Cross-section random	3.272765*	1

Cross-section random effects test comparisons

Variable	Fixed	Random	Var(Diff.)	Prob.
LFDI	-0.093422	0.007848	0.003134	0.0704

After cross-section random effects model, in order to test whether fixed effect model is preferred over random effect model or not, we apply Hausman test. From the Eviews 6 output given above, we see that Hausman test is marginally insignificant. Therefore, it can be concluded that though cross-section fixed effect model, as given below, is preferred over random effect model but there is no significant difference between them, which is shown in cross-section random effects tests comparison of the Correlated Random Effects - Hausman Test, given above.

$$LNSDPit = ß_{1i} + ß_{2*}LFDI + u_{it}$$

$\widehat{LNSDPit} = 1.703305 - 0.093422_*LFDI$

SE = (0.330710) (0.078644)

t = (5.150451)*** (-1.187909)

(F-Statistics = 2.168974)* (R^2 = 0.307919)

This means that heterogeneity among different regions in terms of contribution to regional development arises out of the common intercept, which is constant over cross-section and over time periods. This is invariably the (short) duration of FDI in roads & bridges, as we all know that for turning FDI in roads & bridges into regional development, it requires a long gestation period. Since FDI in roads & bridges started being reported from the year 2005, six year period (2005-2010) is not enough for FDI to have contributed to regional development. But, since Hausman test is not rejected at 5% level, therefore the other leg (the random variable), which is constant over time but varies over cross-section could feebly be one of the reasons of regional heterogeneity. And this is conjecturally political leadership in respective regions.

Now, we can compare the three models, such as, Pooled OLS Model, Fixed Effect (LSDV) model and Random Effect Model (Error Component Model) in a tabular form, as given below;

Dependent Variable: LNSDP			
	Coefficient (t-ratio) [Standard Error]		
Independent Variable	**OLS**	**FEM**	**REM**
LFDI	0.041498 (0.842720) [0.049243]	0.054028 (1.07)2876 [0.050358]	0.007848 (0.142070) [0.0552338]
Observations	48		
R^2	0.015204	0.173626	0.000418

N.B: *No slope coefficient is significant*

CONCLUSION

The impact of FDI in roads & bridges in India on regional development has been found to be very insignificant and negligible, which is predominantly because of the reason that turning FDI in roads & bridges into regional development requires a long gestation period but, FDI in roads & bridges started being reported from the year 2005 and the six year period (2005-2010) is not enough for FDI to have sufficiently contributed to regional development. Moreover, contribution of FDI in roads & bridges on regional development across regions is the highest in case of Chennai, followed by Delhi, Mumbai and Hyderabad, because of the reason that these regions enjoy high per capita income and high industrial output, endowed with high skilled labour and equipped with larger geographical area with high civic amenities. The same is negative in case of Kolkata, Bangalore, Bhopal and Kochi, because of already low level of domestic investment. This region-specific difference could conjecturally be because of difference in political leaderships of respective regions also.

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