Foreign Direct Investment and Infrastructure Development: Evidence from India

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Abstract: *The availability of developed infrastructural facilities is a sine-qua-non of progress of the economy. Adequate infrastructure is necessary not only to facilitate domestic investment but also to woo foreign investment. In this backdrop, this paper analyzes the role of infrastructure facilities in determining the attractiveness of foreign direct investment in India. Using Vector Auto Regression (VAR) technique, the study aims to analyze the significant infrastructure variables that influenced FDI in India from 1991 to 2010. The results of the analysis lead to the conclusion that among the physical infrastructure variables, internet facilities, roads, rail efficiency and investment in energy influenced FDI over the period of study. However, human development variables, namely, education level and wage rates also effect FDI inflows in India.*

Keywords:

Infrastructure, Rail efficiency, Wage rates, Education, Internet

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I. Introduction

In the present era of Liberalization, Privatization and Globalization (LPG), there is a tremendous scope for increase in the trade and investment across countries all over the world. This trend is more pervasive in developing countries like India with huge domestic market and abundant labor force, making it a preferred foreign investment destination. In 2010, the developing and transition economies received more than half (53%) of the global FDI flows (UNCTAD, 2011), thus mitigating global inequalities by generating surplus incomes and pushing underdeveloped economies on the threshold of progress. The changes in the composition of capital flows have

been synchronous with a shift in emphasis among policymakers in developing countries to attract more FDI.

India is the largest democracy and fourth largest economy in terms of GDP (based on Purchasing Power Parity) in the world. With its consistent growth performance and highly skilled manpower, India provides enormous opportunities for foreign investments. Since 1991, major reforms have been initiated in the field of investment, trade and financial sector. Accordingly, since 1991 India is liberalizing its highly regulated FDI policy to pave way for smooth foreign investment. Enactment of Competition Act, Foreign Exchange Management Act (FEMA), amendments in Intellectual Property Right (IPR) laws and many other reforms undertaken in this connection have made India an attractive destination for international investors.

India is the second most attractive Foreign Direct Investment destination (Kearney, 2007). Also, it is the second most attractive destination among transnational Corporations for FDI in 2007-09 (UNCTAD, 2007). India is ranked eighth among top twenty host countries for FDI in 2009-10. It is also ranked third in hierarchy as top priority host country for FDI for the period 2010-2012 (UNCTAD, 2012). Stable economic growth assisted by viable political governance and liberalized investment regime has facilitated substantial inflows of foreign capital to India since the inception of economic reforms in 1991. Accordingly, the cumulative amount of FDI equity inflows to India increased from US$167 million in 1990-91 to US$ 146 billion in 2010-11 (DIPP, 2011). FDI has also contributed to the economic growth of India (NCAER, 2009; Kaur et.al, 2013). In 1990s, India developed as target destination for outsourcing IT business. In recent years there has been tremendous growth in IT enabled services and business process outsourcing. There has been more than 35% increase in the Indian BPO sector with their investment in the regions like Gurgaon, Chennai, Bangalore and Hyderabad. It is stated that the fundamentals that

make India attractive to foreign investors remain intact but there is a need to identify the determinants of FDI in India to make it more competitive like China and Brazil.From the forgoing, it can be inferred that there are various macroeconomic determinants of FDI. This study is confined to infrastructural development as a determinant of FDI in India. The rest of the paper is divided as: Section II exhibits the review of literature. Section III contains the data and methodology used for the analysis. Section IV provides the analysis of data followed by the concluding remarks.

II. Literature Review

According to the OLI paradigm of Dunning , the presence of ownership-specific competitive (O) advantages in a transnational corporation, the presence of locational advantages (L) in a host country, and the presence of superior commercial benefits internally in a firm (I) are three important set of determinants which influence the FDI inflows. The paper focuses on the location aspect of the FDI.

A study by Qian et.al (2002) of 30 provinces of China reports that FDI determinants move through time. Labor quality and infrastructure are important determinants of the distribution of FDI. High labor quality and good infrastructure attract foreign investors. Also, China's political stability and openness to the foreign world is another important factor for attracting foreign capital. Globerman et.al (2002) analyzed that for developing and developed countries, Governance Infrastructure in the form of institutions and policies is important determinant of FDI inflows and outflows. Moosa and Cardak (2006), in their study of 138 countries, concluded that countries with high degree of openness and low country risk attract more FDI. Sahoo (2006) further concludes that major determinants of FDI in South Asia are market size, labor force

growth, infrastructure index and trade openness. Sung-Hoon Lim (2008), in his study of China, concludes that Investment promotion positively affects the attraction of FDI.

Demirahan and Musca (2008) found that openness, growth rate of GDP per capita and telephone lines have positively influenced FDI while inflation rate and tax rate have negative impact in 38 developing countries over the period 2000-2004. In contrast to above findings, Hsin-Hong and Shou-Ronne found evidence of openness as a negative determinant of FDI in Brazil with market size and inflation rate as the positive determinants. In a study on determinants based on the sectoral investment in FDI, Udoh and Egwaikhide (2008) found significant negative effect of exchange rate volatility and inflation on FDI in Nigeria for the period of 25 years. He further reports that infrastructure development, size of government sector and international competitiveness are the crucial determinants of Nigerian FDI inflows.

The study by Khadaroo and Seetanah (2007) in 33 Sub-Saharan African countries for the period 1984-2002 highlighted the role of transport infrastructure as a major contributing factor in enhancing the relative attractiveness of the countries as compared to other measures of infrastructure. In Central and Eastern European countries, telecommunication and transport infrastructure are of special significance to FDI with regard to location decisions of MNCs (Leibrecht, M. and Riedl, A. (2010), Aleksandra, 2010). The economic determinants of FDI to developing countries and transition economies for the period 1989 to 2006 include inflation rate, interest rate, growth rate and trade openness along with the previous period FDI. The results of Sahoo (2006) on the analysis of determinants in South Asia show that Asian countries must maintain growth momentum to improve market size, improve infrastructure facilities and follow open trade policies to attract FDI.

Research on FDI determinants is mainly focused on economic and policy factors like openness, market size, exchange rate, and inflation rate etc., discussed in the previous section. There exist very few studies which acknowledge the importance of infrastructure on FDI. Studies by Wheeler and Mody (1992), Loree & Guisinger (1995), Asiedu (2002) assert that good infrastructure is a necessary pre-requisite for foreign investors to conduct its operations successfully. Poor infrastructure acts as a fetter to FDI as it increases its costs of operations. In other words, lack of proper infrastructure in the form of inadequate transport facilities, telecommunication services and electricity services decrease productivity and thereby increase cost of doing business in host country.

Good quality and well-developed infrastructure increases the productivity potential of investments in a country and therefore stimulates FDI flows towards the country. Asiedu (2002) and Ancharaz (2003) construed that the number of telephones *per* 1,000 inhabitants is a standard measurement in the literature for infrastructure development.

In their study of Mexico, Mollick et al. (2006) analyzed the role of telecommunications (telephone lines) and transport infrastructure (roads) for FDI and find a positive impact of both types of infrastructure. Gramlich (1994) and Regan (2004) further argue that the relevant infrastructure includes transport, communication and electricity production facilities, as well as transmission facilities for electricity, gas and water. Cheng and Kwan (2000) find support for favorable transport infrastructure being a relevant determinant of FDI into Chinese regions. Goodspeed et al. (2006) in a range of countries found that the number of mainline telephone connections and a composite infrastructure index have a significant positive impact on FDI. The benefit of transportation, not being direct, can be in the form of low freight cost, low cost of

imports and exports through airports and ports. Table 1 summarizes the different variables used as a measure of infrastructure development in the literature.

Insert Table 1 Here

Apart from physical infrastructure, the human development is also considered by labor cost, education level, and literacy rate. The quality of human development is measured by secondary school enrollment ratio or literacy rate. A study by Dhingra and Sidhu (2011) included Human Development Index to measure the efficiency of human capital. It is generally believed that abundance of low cost labour makes the country an attractive destination for FDI. There is no unanimity in the studies regarding the role of wages in attracting FDI. Flamm (1984), Schneider and Frey (1985), Culem (1988), and Shamsuddin (1994) demonstrate that higher wages discourage FDI. Tsai (1994) obtains strong support for the cheap-labour hypothesis over the period 1983 to 1986, but weak support from 1975 to 1978. It is important to recognize that when the cost of labour does not vary much from country to country, it is the skills of the labour force which influence the decisions about FDI location.

III. Data and Research Methodology

This section describes the data used for empirical analysis. The data consists of yearly observations from 1991 to 2010 for infrastructure development. The dependent variable is log of FDI inflows to India taken from World Development Indicators (2010). The variables along with the reason for their inclusion are listed in Table 2.

Insert Table2 Here

We have used Vector Auto Regression (VAR) to analyze the relationship between FDI and financial system development. VAR is a multivariate time series modelling technique which is superior to Auto Regressive Integrated moving average (ARIMA). The term vector implies that we are considering vector of two or more variables and auto regression indicates the presence of dependent variable on the right hand side of the VAR equation. VAR overcomes the assumption of endogenity underlying in ARIMA wherein the actual values are derived from past values of an endogenous variable. The underlying assumption in VAR is that the explanatory variables are exogenous. Along with other variables, the value of dependent variables is explained by its own past values. It is possible to fit a time series model without any explicit idea about the dynamic relationship between the variables by arbitrarily choosing the lagged variables. Since VAR in first difference omits potentially important stationary variables, we have used in level values in order to avoid omitted variable bias (Cuthbertson, 2002). The equation for VAR in regression form for FDI and infrastructure variables is given by:

$$LFDI_t = \alpha_t + a_1 FDI_{t-1} + a_2 FDI_{t-2} + \ldots\ldots\ldots + a_p FDI_{t-p} + \beta_1 LODA_t + \beta_2 LRAILEFF_t + \beta_3 LAIREFF_{it} + \beta_4 LROADS_{it} + \beta_5 LINTRNET_{it} + \beta_6 LEDU_{it} + \beta_7 LWAGE_{it} + \beta_8 LENGYINVST_{it} + e_t$$

Where a_1, a_2 are the coefficient of auto regressive terms of FDI, p is the auto-regression order, α_{it} is the constant,

β is the coefficient for log values of infrastructure variables (Overseas development assistance, Rail efficiency, Air transport efficiency, Roads efficiency, investment in energy, internet facilities, level of education and wage rates). The optimum lag for the analysis is selected using Akaike Information criteria (AIC), Hannan and Quinn information criteria (HQIC) and Schwarz Bayesian information criteria (SBIC) used popularly in the literature.

IV Empirical Results

As already mentioned above, the paper examines the relationship between FDI and level of infrastructure development in India. The log values are taken for the analysis to ensure continuity of data. There are 20 observations with internet users having highest standard deviation followed

Insert Table3 Here

by energy investment and FDI inflows. The results presented in Table 4 show that in study period FDI has high degree of positive correlation with ROADS, RAILEFF, AIREFF, INTRNT and ENGYINVST. The presence of high correlation (0.936) between FDI and INTRNT can be due to the fact that more business process outsourcing companies are making use of internet services to set up their customer support and technical support services in India. In other words, FDI is directly related to the extent of efficiency of internet facilities in India.The optimum lag for the analysis is one for banking sector variables as given by all the three information criteria used for lag selection.

Insert Table 4 Here

Insert Table 5 Here

It can be inferred from the Table 5 that the infrastructure variables namely, ENGYINVST, INTRNT, RAILEFF, WAGE, EDU and ROADS influence FDI significantly over the period of study. It can be stated that higher efficiency of railways and roads facilitate better transportation of goods in India that leads to increased productivity. This encourages foreign investors to set up new units and invest funds in India as it would yield higher returns to them. The presence of internet facilities in the country is also an important result which enhances the setting up of business process outsourcing and knowledge process outsourcing firms in India. However, the negative beta of WAGE implies that higher wage rates make India less competitive for FDI.

Conclusion

The paper attempts to examine the importance of infrastructure variables in attracting FDI to India by providing the data analysis covering a period of 20 years from 1990-1991 to 2009-2010. The economic reforms in 1991 conceived by government of India initiated major changes in the policy perspective and regulatory framework emphasizing the liberal policies and deregulating most of the sectors for foreign investment. The process is still continuing unabated which is evident from the fact that FDI is now permitted with 100% foreign investment in almost all sectors except for five sectors, namely, multi brand retail trading, lottery business, gambling and betting, atomic energy and real estate. The Department of Industrial policy and promotion under

Ministry of Commerce and Industry is now a single window to foreign investors having plans to invest in India mitigating bureaucratic hurdles in smooth inflow of investment.

Apart from various policy and regulatory measures, the presence of adequate infrastructure (physical and human) provides a supportive environment to foreign investors. The results of analysis thus conclude that FDI is influenced by physical infrastructure variables like internet facilities, roads and rail efficiency influenced FDI over the period of study. However, human development variables, namely, education level and wage rates effect FDI inflows in India.

It is, therefore, concluded that improving infrastructure facilities, investment in energy and emphasis on R & D will help rein in foreign investors. Similarly, level of education should be improved through changes in the curriculum, improving industry academia relationships and innovative teaching pedagogies. Lastly, at the macroeconomic level, availability of adequate infrastructure helps bolster the domestic investment environment along with reaping the benefits of growth promoting effect of FDI inflows in India

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Table 1: Infrastructure variables used in the literature

Variable	**Studies which used this variable**
Technological capability	Palit, Amitendu and Nawani, Shounkie (2007)
Human Development Index	Dhingra, N and Sidhu, H.S.(2011)
Literacy Rate	Dhingra, N and Sidhu, H.S.(2011)
Industrial Investment	Dhingra, N and Sidhu, H.S.(2011)
Transport (Road, Rail and Air)	Dhingra, N and Sidhu, H.S.(2011), Bellak, Christian et.al (2007), Leibrecht, M. and Riedl, A. (2010), Aleksandra (2010), Cheng and Kwan (2000), Lim, Ewe-Ghee (2001), Khadaroo, J. and Seetanah, B.(2007)
Education level	Walsh, James P. and Yu, Jiangyan (2010), Sahoo, Pravakar(2006), Kirkpatrick, C. et.al (2006), Khadaroo, J. and Seetanah, B.(2007)
Labour cost	Walsh, James P. and Yu, Jiangyan (2010), Wan, Yuet W.(2008), Camurdan, Burak (2007), Leibrecht, M. and Riedl, A. (2010), Aleksandra (2010), Lim, Ewe-Ghee (2001), Khadaroo, J. and Seetanah, B.(2007), Demirhan, E. and Masca, M. (2008)

Infrastructure development Index	Walsh, James P. and Yu, Jiangyan (2010), Sahoo, Pravakar (2006)
Telephone/Internet	Udoh, E. and Egwaikhide, Festus O.(2008), Bellak, Christian et.al (2007), Leibrecht, M. and Riedl, A. (2010), Aleksandra (2010), Kirkpatrick, C. et.al (2006), Khadaroo, J. and Seetanah, B.(2007), Demirhan, E. and Masca, M. (2008)
Energy and Electricity	Bellak, Christian et.al (2007), Leibrecht, M. and Riedl, A. (2010), Aleksandra (2010), Kirkpatrick, C. et.al (2006)

Table 2: List of Infrastructure variables used in the analysis

Variable	Definition	Reason for inclusion	Expected effect
LODA	Net ODA as a percentage of	Indicates the level of development in the country for a particular purpose.	Positive/Negative

	Gross Capital Formation		
LRAILEFF	Goods transported (million ton-km)	Represents the efficiency of railways in terms of goods transported.	Positive
LAIREFF	Freight (million ton-km)	Represents the efficiency of airways in terms of goods transported.	Positive
LROADS	Roads paved as percentage of total roads	Represents the efficiency of road transport.	Positive
LENGYINVST	Investment in energy	Represent the strength of infrastructure	Positive
LINTRNET	Internet users	Presence of internet facilities	Positive
LEDU	Public spending of education	Represents the development of human resources	Positive
LWAGE	Minimum Wage rate of skilled labour	Indicates cost of labor	Negative

Table 3: Descriptive Statistics of Infrastructure variables

	Mean	Std. Deviation	N
LFDI	9.5414	0.7031	20
LROADS	1.4327	0.0856	20
LINTERNET	6.3869	1.5167	20
LOGODA	0.0622	0.3731	20
LRAILEEF	5.5201	0.1121	20
LAIRTRNSEEF	2.7986	0.1416	20
LENGYINVST	9.1025	0.7240	20
LEDU	5.6658	0.2971	20
LWAGE	3.4063	0.1775	20

Table 4: Correlations of FDI with infrastructure variables

		LFDI	LROADS	LINTERNET	LOGODA	LRAILEEF	LAIRTRNSEEF	LENGYINVT
LFDI	Pearson Correlation	1	.797**	.936**	-.861**	.887**	.825**	.703**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.001
	N	20	20	20	20	20	20	20
LROADS	Pearson Correlation	.797**	1	.711**	-.876**	.930**	.897**	.649**
	Sig. (2-tailed)	.000		.001	.000	.000	.000	.003
	N	20	20	20	20	20	20	20
LINTERN	Pearson Correlation	.936**	.711**	1	-.863**	.795**	.700**	.638**
ET	Sig. (2-tailed)	.000	.001		.000	.000	.001	.003
	N	20	20	20	20	20	20	20
LOGODA	Pearson Correlation	-.861**	-.876**	-.863**	1	-.888**	-.759**	-.718**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.001
	N	20	20	20	20	20	20	20
LRAILEEF	Pearson Correlation	.887**	.930**	.795**	-.888**	1	.921**	.734**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	20	20	20	20	20	20	20
LAIRTRN	Pearson Correlation	.825**	.897**	.700**	-.759**	.921**	1	.757**
SEEF	Sig. (2-tailed)	.000	.000	.001	.000	.000		.000
	N	20	20	20	20	20	20	20
LENGYIN	Pearson Correlation	.703**	.649**	.638**	-.718**	.734**	.757**	1
VT	Sig. (2-tailed)	.001	.003	.003	.001	.000	.000	
	N	20	20	20	20	20	20	20

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

Table 5: Results of VAR for infrastructure variables

Dependent variable LFDI	Coefficient
LINTRNT$_{t-1}$	0.279(0.273)*
LODA $_{t-1}$	-0.155(0.202)
LAIREFF $_{t-1}$	-0.731(0.730)
LRAILEFF $_{t-1}$	5.710(2.850)*
LENGYINVST $_{t-1}$	0.032(0.048)*
LWAGE $_{t-1}$	-7.742(3.312)*
LEDU $_{t-1}$	4.214(1.341)*
LROADS $_{t-1}$	0.488(1.948)*
Constant	-24.073(12.617)
AR(1)	0.492(0.210)*
R-square	0.978
RMSE	0.127
Chi-square	808.73
Prob.>chi2	0.000