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# **Telecommunication Infrastructure Development and FDI into Asian Developing Nations**

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### **Abstract**

*This study strives to evaluate the effects of infrastructure availability and development on foreign direct investment (FDI) in host developing nations. Employing fixed effects panel estimation technique, panel data for 23 Asian developing countries, from 1990-2009 is used with heteroscedasticity corrected standard errors. The results reveal a strong favourable impact of telecom infrastructure (measured by mobile subscriptions) in drawing inward FDI. Therefore, it is concluded that a country with improved infrastructure in general and telecom infrastructure in particular is likely to pull in more FDI. Other variables such as market size, economic development, and currency valuation (measured by exchange rate) appear important in captivating multinational investors, as they exhibit significant coefficients. On the contrary, high-inflation significantly deters inward FDI.*

**Keywords:** FDI, Telecommunication Infrastructure, Panel data

**JEL Classification:** C230, F210, F230

### **1. Introduction**

Developing nations generally face capital scarcity. Their domestic savings are insufficient and access to worldwide financial markets is limited or in-existent (Shah, 2016b). In such conditions, foreign direct investment (FDI) can be one of the vital sources of capital funds. FDI consists of equity funds, earnings that are reinvested and intra-company borrowings (Shah, 2018c). FDI may also be referred to as an equity capital put in foreign countries which provide the most desirable capital funds, promote production techniques, bring in superior administrative skills, provide advertising knowledge and develop worldwide links (Shah, 2011d). Moreover, some studies and analysis illustrate that FDI encourages domestic investment in emerging countries, as asserted by Bosworth, Collins and Reinhart (1999). FDI improves productivity, causes movement of modern technology and also generates employment and increases competition (Kobrin, 2005; Le & Atallah, 2006; Shah, 2012; Shah & Jamil, 2016).

FDI inflows in Asian economies are influenced by various structural components, for instance market dimensions, income level, human resources, level of urbanisation, infrastructure, labour cost, performance requirements and other macroeconomic factors (Shah, 2017d). This study attempts to examine the impact of telecom (mobile/cellular) infrastructure growth on FDI inflows in developing countries from Asia for the time period of 1990-2009. Advanced level telecom infrastructure reduces time wastage, decreases communication and information costs, hence promoting business activities (Shah, 2014b). The swift expansion of the cellular sector in emerging countries has occurred mainly due to the liberalisation in the telecom sector (Shah, 2011e). Consequently, there is lesser reason to presume that this sector is associated with general measures of infrastructure. Modern technological advancement in the telecom sector has been and still is an imperative tool in enabling the multinationals to swiftly communicate data and information from the headquarters to the foreign affiliates or from one subsidiary to another (Shah & Azam, 2018). Telecommunication infrastructure favourably supports domestic growth, links domestic trade markets and is also indispensable for intercontinental trade (Shah & Qayyum, 2015). With the progression of the telecom industry, an innovative market structure, widened enterprise value chains and a low-cost mechanism is possible as argued by Kambil and Short (1994). Prior to the 1990s landline facilities were

available at limited-level. However, the telecom sector innovations in last decade of twentieth century revolutionised the entire mechanism of telecom industry. Due to which wireless, internet service providers and cell phone companies broadened their operational setups. Thus, facilitating worldwide financial transactions, smoother multinational connectivity across nations and promoting economic growth<sup>1</sup>. Because of liberalization in telecom sector the international capital can now move smoothly in shape of FDI<sup>2</sup>. Cell phone industry boomed. Moreover, finest quality services at minimum tariff broadened the market causing economies of scale (Shah, 2017c).

Though, various earlier studies have explored the impact of general telecom and transport infrastructure on inward FDI (see for example, Reynolds, Kenny, Liu & Qiang, 2004; Escribano, Garrido, Peltier & Singh, 2005; Seetanah & Khadaroo, 2007 etc.). This study is distinct from others because it places particular emphasis on the impact of cellular (mobile) infrastructure on inbound FDI. Special attention on the role of telecom/cellular infrastructure in attracting FDI in the past literature is missing<sup>3</sup>. So, it's imperative to evaluate its role. The rest of the research paper is structured as follows: Introduction is followed by literature review and theoretical background in part two. The third part describes data and methodology. The fourth contains estimation concerns. Part five presents results and analysis. Whilst part six concludes.

## 2. Literature Review

Numerous studies have identified market size and development level to be essential FDI attracting factors for instance Nigh (1985) conducted econometric analysis on US manufacturing sector investment from 1954 to 1975, in 24 economies and observed per capita GDP of host nation state as an essential FDI driving factor. Sader (1993) found a strong association between FDI and market size by employing data of 21 emerging economies from 1988 to 1992, through cross country regression analysis. Likewise, Tsai (1994) analysed a sample of 62 nations from 1975 to 1978 and also for 51 nations from 1983 to 1986 and confirmed that a country's larger market-size is responsible for higher FDI. Shamsuddin (1994) obtained a parallel conclusion. Chen (1996) analysed the FDI determinants regionally in China with pooled cross section data and time series analysis over the period of 1987-1991. He argued that market share development favourably affects FDI. Other studies that have identified market size and development level to be crucial FDI attracting factors, includes, for instance Nunnenkamp (1997); Resmini (2000); Chakrabarti (2001); Sun, Tong, and Yu, (2002); Fan, Morck, Xu, and Yeung (2007) and Shah (2011c, 2013 & 2019).

Kravis and Lipsey (1982); Nunes, Oscátegui and Peschiera (2006); Choong and Lam (2010) and Shah (2015) provided evidence confirming importance of trade openness. Borensztein, De Gregorio and Lee (1998) pointed out the significance of human capital expansion or education level stating that qualified personnel is a decisive factor for FDI. Noorbakhsh, Paloni and Youssef (2001) found that human skills are statistically significant and the most central element for improving FDI inflows. Moreover, its worth has increased over time. Mengistu and Adhikary (2011) and Shah (2014a) research have also highlighted the significance of human capital. Reinhart and Rogoff (2003) stressed that inflation tarnish currency's value, because it has negative effect on growth, and consequently adversely affect FDI also. De Wet (2003) proposed that low-level inflation together with other essentials e.g. exalted economic growth can lure international investors and boost inward FDI to Turkey. As a result, low inflation is favoured by countries that support FDI for promoting economic growth. Nonnemberg and De Mendonça (2004); Akinboade, Siebrits and Roussot (2006) and Shah and Zeb (2017) found negative impact of inflation on foreign investors.

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1. See Zahra, Azim and Mahmood (2008).

2. General Agreement of Trade in Services (GATS) brought revolutionary reforms in telecommunications sector.

3. To the best of our knowledge, researchers have used various proxies for telecom infrastructure such as fixed landline connections etc. however this study examined influence of mobile subscriptions on FDI for the first time.

Froot and Stein (1991); Blonigen (1996) and Shah (2016c) observed the impact of exchange rate on FDI. According to them a decline in host currency must augment inward FDI in the host economy whereas, rise in its currency drives out vertical export oriented FDI. Conversely, analysing multinational firms in US, Campa (1993) hypothesised that the host's currency appreciation actually promotes direct investment into the host country, implying that currency appreciation enhances the prospects of future dividend earnings in terms of home currency. Blonigen and Feenstra (1996) noticed a considerable negative association of a country's exchange rate with FDI. Aqeel and Nishat (2004) used error correction and co-integration approaches to unfold and elucidate the preferred FDI indicators in Pakistan for 1961-2003. They claimed that progressive exchange rates encourage FDI, because multinational firms identify it as a positive signal of the economy.

Root and Ahmed (1979) claim about infrastructure's importance for FDI was later on confirmed by studies like Wheeler and Mody (1992); Head and Ries (1996); Kinoshita (1998); Cheng and Kwan (2000) and Shah (2017a). Asiedu (2002) claimed that physical infrastructure is appropriate only for investments based on non-extractive industries. Therefore, with time the host economies must furnish infrastructure of superior quality, as compared to infrastructure existing in preceding years, to facilitate new forms of FDI. Reynolds et al. (2004) found an approving influence of telephone lines in accelerating FDI. Lydon and Williams (2005) found that average FDI inflows in developing economies are better in those countries that contain advance telecommunication networks. Escribano et al. (2005) and Castro (2007) also maintain infrastructure's importance for FDI. Kumar (2006) determined a single combined infrastructure index, which capture availability of energy, telecommunications, information and transport infrastructure for 66 economies from 1982 to 1994. The estimations confirmed that quality infrastructure availability does enhance the attractiveness of an economy for multinational investors, holding other things constant. Seetanah and Khadaroo (2007) analysed infrastructure accessibility as a component of FDI inflows in case of 25 African countries. They found that transport infrastructure availability is a favourable element for the attractiveness of economies considered. Overseas investors are also attracted by various other forms of infrastructure such as telecommunication infrastructure. However, Quazi (2007) declared insignificant impact of infrastructure on inbound FDI. Mengistu and Adhikary (2011) also found that infrastructure (measured by telephone lines per 1000 populace) acts as significant FDI stimulating factor.

### 3. Econometric Model and Data

The possible econometric model is given below as equation (a):

$$FDI_{jt} = f \left[ \begin{array}{l} \text{MarketSize}_{jt} + \text{DevelopmentLevel}_{jt} + \text{HumanCapital}_{jt} + \text{Openness}_{jt} \\ + \text{Economic Stability}_{jt} + \text{Currency Value}_{jt} + \text{Infrastructure}_{jt} + \xi_{jt} \end{array} \right] \quad (a)$$

Where  $\xi$  represents stochastic error term,  $j$  individual countries that vary from 1 to 23 and  $t$  denote the time period that varies from 1990 to 2009. Therefore, we can have a maximum of  $23 \times 20 = 460$  observations for each variable.

Log linearizing equation (a) and putting appropriate proxies for all regressors, we get:

$$\text{LnFDISt}_{jt} = \alpha_0 + \beta_1 \text{LnPOP}_{jt} + \beta_2 \text{LnGDPPC}_{jt} + \beta_3 \text{LnLIT}_{jt} + \beta_4 \text{LnTRD}_{jt} + \beta_5 \text{LnINF}_{jt} + \beta_6 \text{LnEXR}_{jt} + \beta_7 \text{LnTEL}_{jt} + \xi_{jt} \quad (b)$$

Where Ln denotes natural logarithms, LnFDIST is FDI stock measured in US dollars; POP is population used as measure of market size, GDPPC indicates per capita GDP, incorporated for development level and TRD is trade, used for openness. LIT represents literacy rate, used for human capital, INF is inflation, used to capture macroeconomic stability and EXR indicates exchange rate, used for currency valuation. TEL is telecom infrastructure included in the model to examine infrastructure effects. Data regarding FDI,

exchange rate and inflation is extracted from UNCTAD, PWT 7.0 and IMF-IFS<sup>4</sup> respectively. The data on population, trade, GDP per capita and infrastructure is from World Bank, World Development Indicators<sup>5</sup>, whereas, data regarding literacy is obtained from Barro and Lee (2013) education attainment dataset.

### 3.1 Estimation Concerns

The summary of all the descriptive statistics for the variables used in the analysis are given as table 1

*Table 1: Descriptive Statistics*

Variables	Number of observation	Mean	Median	Variance	Minimum	Maximum
LnFDIST	460	21.9575	22.2779	8.5115	11.8495	26.9198
LnPOP	460	17.3272	17.0875	3.1934	13.1081	21.0095
LnGDPPC	460	6.9677	6.8955	1.1815	4.5954	9.9434
LnLIT	460	4.3428	4.4841	0.1110	2.7850	4.6086
LnINF	460	2.2283	2.1890	1.7767	-3.0576	7.8639
LnEXR	460	3.8917	3.7478	7.0517	0.0007	9.7949
LnTEL	460	11.6708	13.0466	30.9265	0.0000	20.4319

Values are rounded off to four decimal places.

Hausman (1978) specification test statistic of 45.69 showed a significant difference, as p-value was less than 1% and hence  $H_0$  is rejected in favour of  $H_1$ , implying that only fixed effect estimator is appropriate (Shah & Khan, 2018). Breush-Pagan/Cook-Weisberg test revealed the presence of heteroscedasticity (Shah, 2017b). Thus, robust standard errors are reported in all the estimations (Shah & Afridi, 2015). Initially, Variance Inflation Factor (VIF) test revealed that multicollinearity is severe (Shah & Khan, 2017). When the trade (openness) variable was dropped the corresponding mean value of VIF reduced to 3.76%, signalling that multicollinearity is no more a problem (Shah, 2009 & Shah, 2018b). Therefore, trade was not incorporated in the final model.

Table 2 reports the correlation matrix showing that LnFDIST has positive correlation with variables LnPOP, LnGDPPC, LnTRD, LnLIT, LnEXR, and LnTEL whereas it has a weak negative correlation with LnINF and LnEXR. Excessive correlation among the explanatory variables also signals the existence of problematic multicollinearity (Shah & Gulelala, 2017).

*Table 2: Correlation Matrix*

Variables	LnFDIST	LnPOP	LnGDPPC	LnTRD	LnLIT	LnINF	LnEXR	LnTEL
LnFDIST	1.000							
LnPOP	0.553	1.000						
LnGDPPC	0.567	-0.184	1.000					
LnTRD	0.912	0.697	0.540	1.000				
LnLIT	0.228	-0.183	0.353	0.186	1.000			
LnINF	-0.309	-0.004	-0.219	-0.198	-0.034	1.000		
LnEXR	-0.009	0.197	-0.376	-0.059	0.016	0.000	1.000	
LnTEL	0.751	0.325	0.451	0.647	0.255	-0.338	0.081	1.000

Values are rounded off to four decimal places.

## 4. Results And Analysis

Model 1 in table 3 exhibits that population (LnPOP) and literacy rate (LnLIT) is not significant. The coefficient of GDP per capita (LnGDPPC) is 1.293 and is strongly significant, which implies that if LnGDPPC increases by 1, it would positively affect FDI. So, the result shows that higher development

4. [www.imf.com](http://www.imf.com)

5. [www.worldbank.org](http://www.worldbank.org)

level attracts FDI. This outcome supports evidence presented by Lunn (1980); Nigh (1985); Resmini (2000); Shah (2011b) and Shah and Faiz (2015), who observed favourable growth effects. Thus, a rapid economic growth presents certain better prospects for profit making and greatly pulls in foreign investments (Shah, 2018a). On the basis of this (development) rationale, it can be said that investors tend to put capital in an economy with better growth prospects (Shah, 2010). Thereby, demonstrating that the recipient country growth outlook affect inward FDI. In the 2<sup>nd</sup> model inflation rate (LnINF) as anticipated is statistically significant at 1% level with a negative sign. The coefficient of LnINF is -0.292, indicating that if inflation increases, FDI inflow would be negatively affected. This outcome confirms Nonnemberg and Mendonça, (2004); Shah (2011a) and Shah and Ali (2016) finding's that high-inflation reduce FDI inflows. Considering the significant negative impact of inflation on FDI, it is evident that high-level inflation hinders inward FDI.

In the 3<sup>rd</sup> model the findings reveal that LnEXR (exchange rate) is statistically significant at 1%. Its coefficient (0.499) implies that if exchange rate decreases by 1, it will increase FDI inflows. Similar findings were reported by Shah (2016a). Model 4 illustrates the significance of LnTEL, being significant at 1%, with a positive coefficient proves that telecom infrastructure favourably effect FDI. This result is consistent with Reynolds et al, (2004); Lydon and Williams (2005) and Shah and Samdani (2015) finding's regarding infrastructure availability. We can say that the presence of communication infrastructure in emerging countries is linked with high-levels of inward FDI. It, therefore, seems appropriate to argue that in addition to growth level and exchange rate, the availability and quality of telecom infrastructure also helps in improving overall investment ambience in the host country and facilitates FDI inflow. These findings recommend that the availability and quality of telecom infrastructure is an essential ingredient of the recipe to attract inbound FDI.

*Table 3 Estimation Results with Fixed Effects*

Variables	Proxy	1	2	3	4
Market Size	LnPOP	2.8426 (2.7002)	3.1185*** (0.9472)	2.8923*** (0.8081)	1.5818** (0.7631)
Development Level	LnGDPPC	1.2917*** (0.3861)	1.1090*** (0.1236)	1.1092*** (0.1182)	0.8122*** (0.1260)
Human Capital	LnLIT	0.3414 (2.0234)	-0.4871 (1.3832)	-1.8196 (1.4346)	-2.0101* (0.9856)
Economic Stability	LnINF		-0.2922*** (0.0862)	-0.1778*** (0.0526)	-0.1331** (0.0480)
Currency Value	LnEXR			0.4986*** (0.1514)	0.2643* (0.1535)
Infrastructure	LnTEL				0.0970*** (0.0247)
No. of Observations		460	460	460	460
R-Squared		0.3263	0.4794	0.3947	0.4967

## 5. Conclusion

Foreign direct investment bridges the gap of regional savings and capital investment, improves technological expertise. Thus, providing assistance in industrial and economic progress in emerging economies (Shah & Khan, 2016). Though, most developing economies have been modifying their policy objectives and strategies to pull in FDI, only a few Asian countries with sizable markets have succeeded so far. The inflow of capital into developing countries is because of a diverse set of location pull factors; however, this paper tried to shed light on the scope of telecom infrastructure development in effecting inward FDI. This research study provides understanding regarding FDI and mobile cellular infrastructure for assisting investors and policy makers in investment decision making regarding the host choice in Asian region. The findings also show that the level of development measured by per-capita GDP in

previous years, being strongly significant, positively influences inbound FDI. Inflation reflecting macroeconomic instability with a strong negative coefficient exhibits negative effects on inward FDI. A country's exchange rate also proved to have an important positive effect, exerting that slow and gradual currency depreciation increases FDI. The benefits of inbound FDI are indispensable and if a country wishes to attain benefits of international investment, it must constantly regulate its economic policies and improve infrastructure facilities to suit the requirements of transnational investors. Thus, we can conclude that the presence of telecommunication infrastructure in developing countries is linked with high-level of inward FDI.

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## Annexures

### Appendix 1: List of Countries

Bahrain	Iran	Nepal	Tajikistan
Bangladesh	Jordan	Pakistan	Thailand
Cambodia	Kazakhstan	Philippines	Turkey
China	Kyrgyz Republic	Sri Lanka	Vietnam
India	Malaysia	Syrian Arab Republic	Yemen Republic
Indonesia	Mongolia	Sri Lanka	