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THE ROLE OF INFRASTRUCTURE IN PROMOTING DOMESTIC INVESTMENT IN PAKISTAN

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Abstract

Infrastructure is an umbrella term used for many activities, as it plays vital role for industrial and overall economic activities. The study examines the historical trends of GDP, infrastructure and investment in Pakistan. The study investigates the empirical impacts of infrastructure on domestic investment from 1975 to 2013. Variables included in the study are gross fixed capital formation, telephone lines, length of roads, inflation, GDP and interest rate; and the ARDL model is applied for estimation of empirical results. These results found the impact of infrastructure on domestic investment which has positive and significant effect. However, telephone lines variable remain insignificant during long-run, while it is significant in the short-run. The study also finds positive and significant relation between the domestic investment and GDP. The impact of interest rate and inflation is negative and significant during short-run on domestic investment but, the impact of inflation remains insignificant during long-run. The findings suggest that special attention should be paid towards infrastructure along with other variables, while formulating investment policies.

Key Words: Infrastructure, Domestic Investment, Interest Rate, Economic Growth.
JEL Classification: H54, E22, E43, O40.

I. Introduction

Infrastructure is a profound determinant of nationhood and a measure of success of a country at national, as well as at global level. It can also be considered an indicator of economic power of to attract substantial private sector investments. Generally, social capital and living standards of citizens are the measures of social infrastructure. The infrastructure can be accumulated over generations or centuries; or it may occur over mere decades as in the case of Arab Gulf and East Asian countries. Infrastructure investments have an important impact on development policy and strategic management of countries, especially during an epoch of economic transition [Sniesha and Simku-

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naite (2015)]. Physical infrastructure generally include public capital, for instance, community buildings such as schools and hospitals, utility services such as water, power and waste services, transport nodes of seaports, airports, rail and roads networks. The availability and reliability of infrastructure facilities are important manifesto to attract private and foreign investors.

The existing literature highlights that domestic investment plays a vital role in improvement of economic growth of the nations and domestic investment helps in development of economy through capital formation. It is one of the significant elements of Gross Domestic Product (GDP) which is used for future production of an economy. There are three types of gross domestic investments: namely, change in inventories, residential investment, and the non-residential investment. Unfortunately, the trend to formulate capital by utilizing these channels is negligible in Pakistan. Therefore, there is an imperative need to inspect the main determinants of gross domestic investment for a developing country like Pakistan, which is epitomized by lack of capital formation, financial instability, high unemployment rate and poverty. Thus, there is a need to identify factors that are essential in progress of domestic investment in Pakistan.

The liberalization process of investment in Pakistan was initiated during 1997 when the board of investment (BOI) opened sectors including service, social, infrastructure and agriculture for domestic and foreign investors. The policy was further liberalized in 2013 by creating conducive business environment for attraction of investment flow in Pakistan. These reforms fortified the investment levels to certain extent but sustainable growth rate could not be achieved, due to unstable political conditions and unreliability of policies. moreover, the terrorist attacks, unpredicted earthquake in 2005, and mainly the flood in 2010, further deteriorated the investment situation in Pakistan.

On the theoretical side, Keynes (1936) provided the basic theory of investment and argued that it depends on real interest rate, uncertainty and profit of firms by discarding the notion that investment depends on technological conditions of capital productivity. Clark (1917) argued that investment has positive relation with demand and income; and as demand and income goes up, investment also increases. This theory is known as the rigid acceleratory theory of investment. According to flexible accelerator theory provided by Chenery (1952), and Koyck (1954), organizations plan to close at once, the small amount of gap between real capital stock and the desired capital stock Jorgenson (1963) provided a general form of accelerator theory and argued that firms will invest till the point where marginal benefit of doing so would overshadow the additional cost. According to Q-theory of Tobin (1969), firms invest in capital stock until the increment in their shares value is greater than increment in replacement cost.

Among the large number of literature, only some analysts have well recognized the contribution of infrastructure accompanied by some other variables in the progress of economic growth through channel of investment. Some of these researchers are Zeb, et al. (2014), Rehman, et al. (2011), and Wheeler and Mody (1992). These re-

searchers opined that investors search for markets where they can find lower cost and higher returns; and this can only be acquired through provision of better quality of infrastructure. The study of Wheeler and Mody (1992) further reveal that infrastructure development is more valuable for countries which are still in the process of development and are trying to be the center of attention for investors. Contrawise, infrastructure is of less importance for developed countries which are already equipped with higher level of infrastructure. The recent studies of Sohail, et. al. (2014), Bibi, et. al. (2012), Ndikumana (2000), and Ribeiro and Teixeria (2001) contribute to the existing literature on domestic investment; but these studies pay no attention to analyzing the impact of infrastructure-investment in the domestic-investment. The current study bridge the gap in the literature by empirically analyzing the impact of infrastructure towards domestic investment alongside the Gross Domestic Product (GDP), interest rate and inflation. The study has following research objectives: to examine the long-run relationship between the infrastructure and domestic investment, to analyze the impact of GDP, inflation and interest rate on domestic investment and to suggest policy implications based on findings of the study.

The remaining part of the study is organized as follows: Section II reviews the historical trends of growth, investment and infrastructure in Pakistan. Section III consist of literature review and Section IV comprises of methodology. Section V discuss the results and Section VI concludes the study.

II. Historical Trends of Growth, Investment and Infrastructure

Investment is said to be the back-bone of any economy as it is necessary for both the developed and developing nations. Investment helps in expansion of productivity level of a country and promotes long-term GDP growth rate [Jongwanich and Kohpaiboon (2008)]. According to Burki (2008), the economy of Pakistan has developed eighteen times larger than it was at the time of independence. Its growth rate was at the peak during the periods of 1960 to 1969, 1977 to 1987 and 2001 to 2007, and till finalizing this paper (2016). For the last sixty years Pakistan has been able to sustain the growth rate at four per cent.

Since its independence, Pakistan is experiencing mostly irregular GDP growth rates. These growth rates deviated from one era to another because in 1970s, nationalization policy involvements of government in commercial activities were high which adversely affected the private sector. Dominance of state possessed organizations unfavorably influenced the financial segment of Pakistan [Ajaz and Elahi (2012)]. The performance of industrial sector was also miserable due to which the government approach towards the role of public sector changed in 1980s, when the military government turned the procedure of nationalization and the private sector started to inject more investment in the economy. However, due to unstable political conditions (during 1990s) the image of Pakistan remained shady in this era as growth rate fell from 6.4

per cent (during 1985-89) to 4.5 per cent (during 1999 to 1994). Sial et al. (2010) explained that because of disease in cotton crop and implementation of international sanctions after the nuclear test in 1998, the participation of public sector remained low during 1990s. He also added that in this period, Pakistan was the only country in the South Asian region with lowest investment to GDP share. Yet an essential attainment of this era was the commencement of privatization and deregulation of public industrial units.

However, during early years of 2000s, stimulation in the process of growth and investment activities were observed. As Ajaz and Elahi (2012)] elaborated, the reason for this stimulation was some of the economic reforms in the sectors of banking, telecommunication; fiscal amendments and trade sector reforms which were also launched in 2000. Certainly, the economic reforms showed a positive impact on investment and the growth in Pakistan. However, to finance expenditures, government relied heavily on borrowings (internal and external) and this practice resulted in higher debts and inflation, which is soaring interest rate burden and the lofty defense spending sucks-up lion's share of the revenues. As a result nothing is left for developmental and social expenditures.

The political circumstances worsened in 2007-08, the new democratic government was elected in 2008, which faced considerable measures of domestic and international challenges. At that time investment rate and GDP growth rate were low; mainly due to terrorist activities and shortage of gas and electricity. However till 2013, Pakistan recovered its GDP to 4.4 per cent and the investment level to 2.80 as a percentage of GDP. Pakistan has enormous potential to grow at much higher level, which is shown by the fact that despite all these difficulties (like energy crisis, law and order situation, and destruction of physical infrastructure) our economy has achieved a significant level of growth rate. But, in order to reach the investment level and self-sustaining growth, there is a need to remove these hurdles and practice outward looking policies (Table 1).

The indicator for telephone growth in a country is tele-density which is measured as 'number of telephone connections per hundred populations'. It is usually expressed that percentage determines the upper limit to subscribers' growth. Saunders, et al. (1994) regarded the teledensity as a significant measure of telecommunication infrastructure for a country. Pakistan Telecommunication Company Limited (PTCL) was founded in 1996 through Pakistan telecommunication ordinance, and is the main company to provide services of land-line telecommunication. PTCL is working under the supervision of Pakistan telecommunication authority since its establishment; and it has achieved remarkable progress since then.

Through the Pakistan Telecom Ordinance 1991, the government laid the first stone for private rivalry and started granting permits to cell-phones and card-operated pay-phones. With this deregulation the PTC was also privatized; but however, it still remained the administrator and controller of land-line phones. Later in 2003, the

government deregulated the telecom-industry completely and this was the end of monopoly of PTCL [Fahad (2010)]. In 1997, after tariff restrictions by the government of Pakistan, the international calls became less costly; and this was a better improvement in the overall setup of telecom-sector. The telecom-sector was deregulated during 2005 to 08 which generated huge investments by some effective telecommunication operators, such as China mobile, telenor, singtel and etisalat, etc. Thus, it paved new ways into the country for FDI creating vast amount of return. It also created significant number of employment in the telecom-sector. These new administrators made substantial infrastructure investments, maintenance and advertising; hence resulting in expansion of cellular services in all over the nation. Further, it made a suitable domain which eventually decreased the call-rates which consequently pulled in more clients towards their system bases [Pakistan cellular industry: SWOT[1],

TABLE 1

Trends of Economic Growth and Investment

Years	Growth and Domestic Investment		Infrastructure	
	Gross Fixed Capital Formation as a % of GDP	GDP Growth (Annual %)	Telephone Lines (per 100 people)	Length of Roads (km)
2001	2.84	1.98	2.21	95409.5
2002	2.92	3.22	2.44	98326.0
2003	2.85	4.84	2.65	105854.5
2004	2.83	7.36	2.90	115193.5
2005	2.86	7.66	3.30	122357.0
2006	2.84	6.17	3.25	130098.0
2007	2.82	4.83	2.93	138447.0
2008	2.83	1.70	2.64	147195.0
2009	2.80	2.83	3.61	156897.0
2010	2.80	1.60	3.51	166584.0
2011	2.83	2.74	3.24	176766.0
2012	2.86	3.50	3.27	186015.0
2013	2.80	4.40	3.49	193069.0

Source: World Development Indicators (WDI).

[1] Strengths, Weaknesses, Opportunities and Threats.

(2009)]. However, due to economic slowdown and high taxes during 2008-09, this sector experienced slow-growth, but it did not vanish because the sector was able to regain its growth in subsequent years. Thereafter, the growth rate in telecom-sector improved to 71.95 per cent in 2013, which demonstrated a growth rate of 2.5 per cent over the same period - a year ago [Ministry of Finance (2013)]. Telecom segment of Pakistan is still in the emerging phase as there are various choices where telecommunication organizations have not even introduced their products, especially in little towns and villages where awareness for this innovation is still to be extended.

Similarly, development of road-network is considered very important for sustained growth of a country. Well-developed road-network is not only the prerequisite for development but it also helps to attain a good economic status in the world economy by integrating regions close to each other [Zietlow (2005)]. Carpeted/uncarpeted roads facilitate the life of individuals by connecting cities, towns, villages, to markets for transportation of goods and travel of people. The importance of roads is clear from the history that after independence, the capital of Pakistan was shifted (in 1961) from Karachi to Islamabad because; Islamabad was connected through proper road-network with all other areas of Pakistan.[2] Currently Pakistan has 19 national high ways, including the motor ways. During the period of 1980 to 1990, there was no significant progress in the ratio of paved-roads. This was because the government of Pakistan kept its focus only to maintain the quality of existing infrastructure. National highway authority (NHA) was established in 1991 and it accounts for 3.5 per cent of Pakistan's entire road network. Since its establishment, NHA received funds (loans) from government for development and up-gradation of roads. Unfortunately, these loans did not prove fruitful at all because of inefficient utilization. Moreover, due to lack of maintenance funds, the quality of roads was not of good quality [Economic Survey of Pakistan (2007)].

The project of Lahore-Islamabad motorway started in 1992 and was completed in 1997. After completion of this mega project this work was continued during the span of 1997 to 2007and thus, the roads-network increased significantly to 261,821 km. According to the economic survey of Pakistan (2007-2008), the road network grew at an average rate of 3 per cent till 2008 [Economic survey of Pakistan (2007-2008)]. One of the major projects of M-9 was approved by the government in the year 2009. This project is also known as super highway project and after its completion in 2012, the vital cities of South Asia were able to access to the port of Karachi, through road-network.[3] From 2012 onward, the data show a slightly increasing trend.

[2] History of Pakistan after Independence. (n.d.) in: Hunza Tours Treks and Safaris. Retrieved from http://www.hunzatours.com/pakistan/pakistan-after-independence.shtml

[3] Pakistan Super Highway, M-9 Project, Pakistan, roadtrafic-technology.com.N.p., n.d. Web, 15 June 2015. <http://www.roadtraffic-technology.com/projects/pakistan-superhighwa/>.

III. Literature Review

There is a rich and diversified literature on relationship among economic growth, infrastructure development and investment within and across the countries [Munnell (1990), Aschauer (1989), Sahoo, et al. (2009), Calderon and Serven (2003)]. Theoretical as well as empirical work, has revealed the impact of infrastructure development on economic growth with positive impact [Esfahani and Ramires (2003), Kamps (2006), Calderon and Serven (2003), Easterly and Rabelo (1993)]. Several studies are dedicated to the notion of infrastructure [Baldwin and Dixon (2008), Fourie (2006), Prud'homme (2004)], its variables Agénor and Moreno-Dodson (2006), Seethepalli, et al. (2008)] and their measurement [Yeaple and Golub (2007), Straub, et al. (2008), Grubesic (2009), Canning and Pedron (2008)].

Result of these studies can be used as a measure to capture the impact of infrastructure investment for a country's development. Infrastructure availability creates conducive environment for investment flow. A large number of economists have examined the empirical relationship among these variables (infrastructure, inflation, market size, human capital and investment). Aschauer (1989) argued that public investment is rather productive; it slowed the productivity level in USA as it decreased the public infrastructure investment. Munnell (1990), Uchimura and Gao (1993), McGuire examined that output elasticity is high for public infrastructure investment. Sturn, et al. (1998) analyzed that many researchers have measured the output elasticity of public investment in infrastructure and found that marginal product of private capital is much lower than the marginal product of public capital [Khan and Reinhart (1990), Shaoo, et al. (2010), Aschauer (1989), Munnel (1990), found that marginal product of public capital is around or equals to the private capital [Munnell (1990)], According to Elberts (1986) the marginal product of public capital is below that of private capital; and in some studies, public investments contributed even negatively [Deverajan, et al., (1996; Prichett (1996), and Hulten and Schwab 1991)].

Zeb, et al. (2014) explored the role of availability of infrastructure, especially with regard to telecommunication which stimulated the foreign direct investment (FDI) in Pakistan from 1990 to 2012. They found that infrastructure availability enhances productivity and economic development, and thus attract higher FDI which confirms the importance of infrastructure in gathering foreign investors. Jan, et al. (2012) examined that co-integration exist between physical infrastructure and economic development and these variables affect economic development significantly and positively, in case of Pakistan. Availability of infrastructure is definitely important for any country to attract FDI and further accelerate the economic development. Imran and Niazi (2011) explored determinants of Total Factor Productivity (TFP) and observed that infrastructure is vital for development. Increase in infrastructure has a constructive outcome on economic development with huge accumulation of infrastructure inventory in the field of electricity, telecommunication, transportation stocks, and water supply required with

a specific end goal to have beneficial outcome on economic development. Predominantly, investment in power generation is prioritized for Pakistan.

Rehman, et al. (2011), found significant and positive impact of infrastructure and the market size on foreign direct investment; whereas, exchange rate affects the FDI, significantly and negatively, in both the short-run and long-run. Faridi, et al. (2011) opined that transport and communication are the two main sectors which influence the economic growth of any country. By enhancing economies of scale it was found that gross fixed capital formation and roads (an indicator of transport infrastructure) are significant source of higher growth rates. Telephone lines (an indicator of telecommunications) are significant cause of decline in GDP of Pakistan due to misuse of this facility. Hashim et. al. (2009) found that investment in telecom-sector contribute positively in Pakistan's economic growth.

The importance of infrastructure in investment portfolios for Australia was identified by Wen and Newell (2007) for the time span of 1995 to 2006. Their results suggest that infrastructure contributes the most high returns to investment in portfolios and their enhancement benefits from the infrastructure segments. Sturm (1998) found that in Netherlands, infrastructure investment contribute positively in the output. Public investment tends to exert positive influence on GDP [Mittnik and Neumann (2001)]. Canning (1998) examined the combing physical infrastructure variables; namely, telephones and telephone-lines, paved roads, roads, electricity generating capacity and found that paved roads and telephones generally promote economic growth in some countries; but, it is undersupplied or oversupplied.

Agenor, et al. (2005) examined that increase in capital stock in itself does not have any positive impact on private investment; rather increasing the quality of infrastructure matters for all the three countries. The authors recommend that policy makers should focus on increasing the quality of public infrastructure instead of only focusing on the quantity. The size of stock infrastructure (significantly positive) impacts the long-term economic growth; and the quantity and quality of infrastructure have a strong negative effect on income inequality [Calderon and Serven (2004)]. This indicates that infrastructure development should be classified in the highest poverty reduction agenda. Globerman and Shapiro (2002) analyzed the role of infrastructure as significant for FDI inflows and outflows. Infrastructure investment does not only attract the capital but also create lots of opportunities for domestic Multinational Corporation (MNC's) which would emerge and invest abroad. Roller and Waverman (2001) also found positive and significant causal association between GDP and telecommunications infrastructure.

Looney (1997) examined that infrastructure remained a passive variable for growth of Pakistan, due to expansion in the non-developmental expenditures and argues that instead of creating investment in a friendly environment for private sector the government should concentrate on its own expenditures which mainly do not contribute in development of infrastructure facilities. Oshikoya (1994) investigated the factors which deter-

mined the domestic private investment and found that lagged debt service ratio, domestic inflation rate, public investment rate, and the real exchange rate have the most virtual effect on the private investment rate. However, domestic inflation rate, credit to private sector, debt service ratio, and the GDP growth rate has major impact on private investment rates. Furthermore, non-infrastructural investments tends to crowd out private investment; whereas, infrastructural public investment complements the domestic private investment. Nearly all studies have reported a significant and positive impact on economic growth, as well as the foreign direct investment in many countries; yet, the researchers neglected to analyze the impact of infrastructure investment on domestic investment. Therefore, this study seeks to fill the gap in the existing literature by identifying the role of infrastructure for domestic investment in a developing country, like Pakistan.

IV. Theoretical Framework

The variables included in the study are gross fixed capital formulation, as a measure of domestic investment, real interest rate, inflation, gross domestic product, telephone mainlines and the length of roads as a measure of infrastructure. Annual data from 1975 to 2013, is used in the study. All data is in the log form and was collected from the world development indicators (2014), and the State Bank of Pakistan (2014).

The econometric form of the model is given as follows:

$$LGFCF_t = \alpha_0 + \alpha_1 (LTL_t) + \alpha_2 (LRD_t) + \alpha_3 (LGDP_t) + \alpha_4 (INF_t) + \alpha_5 (LIR_t) + \mu_t \qquad (1)$$

where, GFCF is the gross fixed capital formation (GFCF) as a percentage of GDP used as a measure of domestic investment. Two proxies for infrastructure variable are used (TL measures telephone mainlines per 100 people, and RD is the length of roads in km). No doubt, there are some other available proxies for measurement of infrastructure, such as the logistics performance index which is quality of trade and transport-related infrastructure (1=low to 5=high), and the electricity generation capacity of an economy; but due to lack of data availability the study is restrict to these two proxies of the infrastructure.[4] INF is inflation which is obtained by taking the growth rate of CPI; GDP is the gross domestic product and IR is the real interest rate which is consistent with the Keynes (1936), who believed that real interest rate is the most essential determinant of investment.

1. ARDL Bound Testing Approach

To examine the relationship between domestic investment, infrastructure, market size, exchange rate, and inflation in this study, newly projected ARDL bound

[4] http://data.worldbank.org/indicator/LP.LPI.INFR.XQ/countries?display=default. The data on Logistics Performance Index for Pakistan is available from 2007 onwards.

testing approach is employed to cointegration as proposed by. It involves the investigating conditional error correction version of the ARDL model. Decision to consider the ARDL is based on the fact that cointegration analyses is unbiased, efficient, and can be applied to a small sample size study [Pesaran, et al. (2001)]. Moreover, the bound testing approach is appropriate for this study because it simultaneously estimates both the short- and long-run components of the model. It also eliminates the problem allied with omitted variables and auto correlations. Lastly, this model can differentiate between the independent and dependent variables [Narayan (2004)].

ARDL methodology comprises of evaluating the following equation:

$$\begin{aligned}\Delta GFCF_t = {} & \beta_0 + \beta_1 TIL_{t-1} + \beta_2 LDA_{t-1} + \beta_3 LRD_{t-1} + \beta_4 GDP_{t-1} + \beta_5 INF_{t-1} + \beta_6 IR_{t-1} + \\ & \sum_{t=0}^{k}\beta_7 \Delta TLI_{t-1} + \sum_{t=0}^{k}\beta_8 \Delta LDA_{t-1} + \sum_{t=0}^{k}\beta_9 \Delta LRD_{t-1} + \sum_{t=0}^{k}\beta_{10} \Delta GDP_{t-1} + \\ & \sum_{t=0}^{k}\beta_{11} \Delta INF_{t-1} + \sum_{t=0}^{k}\beta_{12} \Delta IR_{t-1} + \varepsilon_t\end{aligned} \tag{2}$$

where β_0 is an intercept, Δ is an operator for difference, and ε_t is an error term. All variables are expressed in logarithm form. For estimation of ARDL equation, the selected lag length is maximum 2 for different variables. To check the reliability and accuracy of the model under estimation, different diagnostic tests were applied.[5] Bounds testing technique has been used to test the long-run relationship between GFCF and infrastructure along with the other variables by following Pesaran, et al. (2001). Null hypothesis was tested to implement bound test by considering the unrestricted error correction (UECM) for GFCF and the infrastructure, along with other variables. For this, a joint significance test was performed, which is as follows:

$$H_0 = \beta_0 = \beta_1 = \beta_2 = \ldots \ldots\ldots = \beta_6$$
$$H_1 \neq \beta_0 \neq \beta_1 \neq \beta_2 \neq \ldots\ldots\ldots\ldots \neq \beta_6$$

This technique of bounds testing is based on F-statistics. The null hypothesis states that there is no co-integration between variables included in the model without considering the order of integration, whether it is I(0) or I(1) and asymptotic distribution of F statistics is non-standard. To check significance level, Pesaran et al. (2001) computed two sets of critical values. Set one assumes that all variables have I(0) order of integration while the other set assumes I(1) order of integration. If estimated F-Statistics surpasses the upper critical bounds value, then H_0 is rejected, and if value of F-statistics remain below the lower critical bounds value, it suggests no co-integration.

[5] Such as LM test for serial correlation, ARCH test for heteroscedasticity, Normality test and CUSUMSQ for structural stability.

V. Results and Discussion

1. Unit Root Test Results

The results of unit root indicates that all variables are integrated of order one or I(1) except inflation and interest rate, as they are stationary at level. This implies that ARDL bounds testing approach is suitable to cointegration for empirical estimation of association between domestic investment and infrastructure, along with other variables.

TABLE 2

Result of ADF Unit Root Test

Variable	Level	First Difference	1%	5%	10%	Order of Integration
SLGFCF	-1.975181	-4.994814	-3.621023	-2.943427	-2.610263	I(1)
LGDP	-0.872057	-5.077543	-3.621023	-2.943427	-2.610263	I(1)
TL	0.086335	-6.252969	-3.626784	-2.945842	-2.611531	I(1)
LRD	-1.057446	-4.325266	-3.626784	-2.943427	-2.611531	I(1)
LINF	-4.481057	--	-3.615500	-2.941145	-2.609066	I(0)
LIR	-2.703677	--	-3.621020	-2.943427	-2.610263	I(0)

Source: Authors' calculations.

2. Results of the ARDL Bound Testing Approach to Cointegration

The ARDL bound testing approach towards cointegration results shows that the optimal number of lags is one based on AIK. As suggested by Pesaran, et al. (2001) this approach is compared with the value of F-statistics against critical values. Table 3 shows the calculated value of F statistics which is 4.8099, higher than the upper bound critical value at one per cent level of significance implying that there is indeed a long-run relationship among variables in the model.

TABLE 3

F-Statistics

F-Statistics	95 per cent		90 per cent	
	lower bound	upper bound	lower bound	upper bound
4.8099	2.9804	4.3987	2.5078	3.6997

Source: Authors' calculations.

Table 4 reveals the cointegration specification and number of lags selected on the basis of AIC. Each variable is taken as dependent variable and its value of F-stat is compared to critical bounds values. The outcome in the table indicate that only one cointegration or long-run relationship between GFCF and its independent variables is as the value of F-statistics which lies above the critical bound value tabulated by Narayan (2005); where H_0 is rejected at 5 per cent level indicating a long-run relation which exist among variables included in the study.

TABLE 4

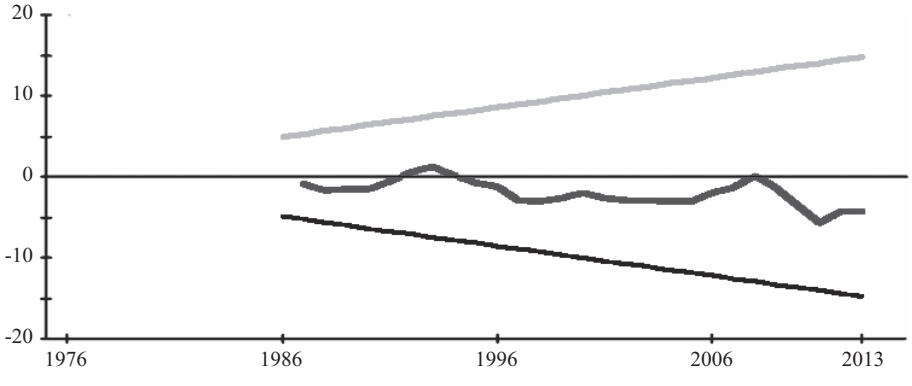
Co-integration Specification

Specification No.	Lag	F-statistics	Decision
LGFCF	1	4.8099	Cointegration
LGDP	1	1.2522	No cointegration
LRD	0	1.4341	No cointegration
TL	1	3.0081	No cointegration

Source: Authors' calculations.

a) Cumulative Sum of Recursive Residuals

Brown, et al. (1975) proposed that structural stability of the model can be examined by cumulative sum (CUSUM) of the recursive residual test. Figure 1 reveals that plots of CUSUM stay within the lines, and confirms that the model is stable and correctly specified. The selected model seems to be robust and good in estimating the short-run and long-run association between the considered determinants and domestic investment.



Note: The straight lines represent critical bounds at 5% significance level.

FIGURE 1

3. The Long-Run and Short-Run Results

Table 5 shows the long-run estimates of model (1). The coefficient of GDP is statistically significant and positively related to domestic investment. It implies that with one per cent increase (decrease) the GDP will result in 0.768 per cent increase (decrease), in the domestic investment. These results are also supported by Zeb, et al. (2014), Mughal and Akram (2011), and Wheeler and Moody (1992). The positive relation between GDP and domestic investment indicates that investors give more concentration to GDP factor before making any investment decision because it results in economies of scales, tariff reduction, more access to markets (within and across countries). Inflation has negative impact on domestic investment in Pakistan. More specifically, one per cent increase (decrease) in inflation will result in 0.07 per cent decrease (increase) in domestic investment. Inflation has a negative persuade on profitability of investment because it augments users' cost of capital. These results are also supported by Ambaye, et al. (2013) and Hall (1982). Imprudent monetary and fiscal policies results in high inflation rate, excessive money supply, poorly managed exchange rate regime and the budget deficits. It further causes macroeconomic instability which might disturb domestic investment in a country. On the other hand, inflation also reduces the purchasing power of consumers and discourages savings which may deteriorate the investment. It is also a well known fact that economy needs a positive level of savings to back investment which help to boost the economic growth. Inflation also causes ambiguity in future prices, exchange rate, and interest rate which further creates unsuitable environ-

TABLE 5

Long-Run Estimates of the Model

Dependent Variable LGFCF		
Regressor	Coefficient	T-Stats [Prob]
GDP	0.768***	10.997 [0.000]
INF	-0.07	-2.5260 [0.017]
TL	0.479	0.8264 [0.416]
IR	-0.038*	-1.6853 [0.103]
LRD	0.183*	1.9634 [0.060]
Diagnostics Test Statistics [P-Values]		
χ^2 (Serial correlation)	1.63110 [0.202]	
χ^2 (Functional form)	0.85715 [0.355]	
χ^2 (Normality)	0.90303 [0.637]	
χ^2 (Heterosecdasticity)	0.62937 [0.428]	

Note: ***, * denotes values are significant at 1 % and 10 % level of significance.
Source: Authors' calculations.

ment for businesses and thus, makes it harder for investors to plan for future. Similarly, the negative association of interest rate and the domestic investment is in accordance with the Keynes theory of investment which states that higher rate of interest enhances the cost of borrowing and discourages investment in the country.

Finally this study incorporate, two proxies of infrastructure; namely, the length of roads and telephone mainlines, but only the length of roads (LRD) proves a significant contributor of domestic investment in Pakistan. With one per cent increase (decrease) the LRD will result in 0.183 per cent increase (decrease) in domestic investment. These results are also supported by Mengistu (2009), Rehman et al. (2011), Asiedu (2002), Zeb et al. (2014). One possible rationale behind this positive nexus is that availability of roads facility can be considered as an important factor for enhancing the level of investment because investors are naturally hesitant to invest in a country where basic requirements, such as inadequate transportation facilities, are not proper; whereas, the telephone mainlines (TL) does not appear statistically significant in the long-run. It is now known that telephone lines are a crucial component of communication facilities which may play an important role in the domestic investment. But however, the insignificant contribution of the TL shows that markets in Pakistan are not fully integrated within and across countries in the long-run.

Results of the diagnostic tests are reported in the lower part of the Table 5. The findings indicate that data is normally distributed as the value of χ^2 shows no evidence of residual serial correlation. The Ramsey's RESET test confirms that there functional form is correctly specified. Likewise, the χ^2 tests show no evidence of heteroscedasticity.

TABLE 6

The Short Run Estimates

Dependent Variable ΔGFCF		
Regressor	Coefficient	T-Ratio [prob]
ΔLGDP	0.808	5.778 [0.000]
ΔINF	-0.003	-2.348 [0.025]
ΔTL1	1.211	1.699 [0.099]
ΔLIR	-0.026	-1.938 [0.062]
ΔLRD	0.106	1.907 [0.066]
ECM(-1)	-0.578	-4.808 [0.000]
Diagnostic Test Statistics [P-value]		
R^2	0.85699	
Adjusted R^2	0.81102	
F-statistics	27.9644 [0.000]	

Source: Authors' calculations.

The short-run estimates of the model (1) are reported in the Table 6. Results reveal that in short run, both proxies variables of infrastructure (Length of roads and telephone mainlines) are statistically significant and positively related to the domestic investment as indicated by Faridi, et. al. (2011); while all other variables, are statistically significant and their signs are consistent, with their long run counterparts.

Furthermore, the ECM coefficient demonstrates as to how rapidly/gradually the dependent variable come back to the equilibrium level. The error correction term ECM (-1) is statistically significant with negative sign at one percent level, signifying that long-run equilibrium can be achieved. The coefficient of ECM shows that divergence of the domestic investment (LGFCF) from the long-run path is corrected by around 57 per cent over the following year.

VI. Conclusion

Investment is said to be the back-bone of an economy as it is necessary for both the developed and developing nations. Development of roads network is very important for sustained growth of every country, as roads network connects cities and towns, with remote areas and villages. The agriculture provides input to industrial sector and development of roads network, which enhances the chances of industrial development in the country. Roads network has developed nearly in the entire Pakistan, but much more work is needed with lapse of time for maintenance of old roads and construction of new roads too. Telecom segment of Pakistan, until now is in the emerging phase as there are various ranges where telecommunication organizations are not yet introduced; especially in little towns and villages where awareness in regards for innovation has altogether is being extended. Hence, more telecom facilities should be provided in villages and remote areas so that mass population of these areas can be facilitated and benefits for expanding business at national and international level is achieved.

The impact of infrastructure along with other variables on domestic investment has been analyzed in the study. The result of unit root test suggest to applying the ARDL estimation technique. Several diagnostic tests were also used in the study. The results indicate that infrastructure is positively related to domestic investment in the short-run. However, the variable of TL remains insignificant in the long-run. This might be because in Pakistan, the focus is mostly towards quantity, rather than improving the quality. GDP is positively and significantly related to domestic investment, during both the short- and long-term. Inflation and interest rate are both negative; and have significant impact on investment. However, the impact of inflation remain insignificant during the long-run. Serious steps are required to improve capital formation in the country. The government should focus to invest on infrastructure and maintenance of existing infrastructure, the aim should not be only to promote investment but also to boost economic growth. The policy makers needs to pay special attention to infrastructure alongside other variables while formulating investment policies. They should have

control on interest rate in order to boost investments in the country as it has negative association with domestic investment. The government should take measures to enhance GDP which in return boost the domestic investments.

Sector wise disaggregation of infrastructure variables might provide more detailed mechanism through which infrastructure affects the level of investment in Pakistan. Therefore, the present study provides a scope for future researchers to extend the infrastructure and investment nexus through disaggregation of infrastructure variables for all sectors of the economy.

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