Bulletin of Business and Economics
ISSN - 2409 - 9368
http://rfh.org.pk/jur/magazine-category/bbe

CPEC: ANALYZING THE MEDIATING ROLE OF INFRASTRUCTURE FOR REGIONAL ECONOMIC INTEGRATION

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ABSTRACT

Regional economic integration (REI) is an arrangement between the economies of common regions to encourage unrestricted trade, capital flows, regional peace, macroeconomic cooperation through linking infrastructure and a common set of rules. Although, REI is constituted by several factors, yet the fundamental factor in international trade. China Pakistan Economic Corridor (CPEC) is the emerging discourse among global researchers as well as policymakers in Pakistan and China. CPEC offers huge capital inflows, grand physical infrastructure projects and a flow of skilled workforce to Pakistan. Empirical evidence has proved the significant contribution of infrastructure towards economic growth yet the role of infrastructure in promoting REI is veiled. The current study postulates that CPEC can play a pivotal role while elevating REI through infrastructure development in Pakistan. we have empirically tested the data from 1972 to 2019 and used trade openness as a key indicator of REI. For infrastructure, a composite index has been formulated. Empirical analysis of our study confirms that REI is sensitive to infrastructure; infrastructure positively affects REI. Based on empirical evidence, we propose that projects under CPEC are likely to contribute positively towards increased REI. Further, the success of this project is linked with the adaptability of Pakistan with the challenges. A sound political governance is the key element for CPEC to be accomplished and deliver its fruits. Pakistan needs to focus on political harmony and consistent development policies. Besides, control over rate of rate of inflation and a suitable exchange rate can also mend the road for smoothening the process of REI.

Keywords: CPEC, Regional economic integration, Principal component analysis, Co-integration and VECM
JEL Code: F02, F15

I. INTRODUCTION

The friendly relationship between Pakistan and China is established in 1951 when Pakistan become the first country to recognize China as the People's Republic of China. Since then both countries have had brotherly relations. These two countries are not connected through friendship only but also share the common geographical region along with the Karakorum Highway commonly known as China-Pakistan Friendship Highway. It is a connecting highway stretching from Hasan Abdal in Punjab to Khunjerab pass in Gilgit Baltistan (GB) extending to the Xinjiang in China (known as Xinjiang Uyghur Autonomous Region, XUAR). The Karakorum Highway is redeveloping since 2000 while an internal itinerary is linked to Gwadar port and other ports of Karachi (Javaid, 2016). The idea of CPEC first discoursed in 2013 when Chinese primer Li Keqiang visited Pakistan (Sial, 2014). The general notion behind CPEC was establishing an operational Gwadar port above and deep down the sea simultaneously; linking Gwadar to Kashgar through a network of infrastructure projects (including highways and link roads, power projects, oil and gas pipelines and links of optical fiber) (Aoyama, 2016). Through this economic corridor, the international trade between the Middle East, China and Africa are going to benefit more in terms of reduction in 12000 KM of the itinerary for oil supply (Sial, 2014). However, we cannot disregard the addition of mega infrastructure projects in Pakistan upgrading the economy for better economic integration opportunities, regional conjunction and establishing well-disposed economic zones (Jaleel et al., 2019). CPEC would also open huge markets and allow foreign investments from world economies particularly for Pakistan. Besides, techno giant China can further facilitate the process of tracing and discovering the hidden treasures of natural resources in Baluchistan (Irshad and Xin, 2014). In addition, CPCE also increases the chances of mutual security collaborations against terrorism and extremism in sensitive regions of both countries; the

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province of Xinjiang and Baluchistan. This is also likely to regulate the growing influence of the United States in Asia (Abid and Ashfaq, 2015; Esteban, 2016; Sulehri and Ali, 2020; Sajid and Ali, 2018; Audi et al., 2021; Senturk and Ali, 2021; Kassem et al., 2019).

CPEC is an array of short-term, medium-term and long-term projects anticipated to be implemented by 2017, 2025 and 2030 respectively. These projects are emphasizing filling the energy gap in Pakistan; 21000 MGW of energy is anticipated to be added to the national grid through these projects (Khan, 2014). Through CPEC, China is devoting its greatest venture with Pakistan, which is initially 46 billion dollars, but the actual worth of extensive projects is estimated at 62 billion dollars. This amount is more than 20 percent of our nominal GDP (Stevens, 2015). A large share of the investment is used to cater to the mounting energy demand in Pakistan; 34 billion dollars whereas 12 billion dollars are reserved for developing transport infrastructure (Hussain & Hussain, 2017 and Wolf, 2018). The development of physical infrastructure can be vital in promoting regional connectivity and mutual prosperity at the same time (Hali et al., 2015 and Jaleel et al., 2019). The current study is an attempt to empirically find the contribution of infrastructure in promoting regional economic integration (REI) with a special focus on CPEC. The study is further divided into the following sections: section 2 reviews the relevant literature; section 3 consists of model specification and discussion of results and section 4 concludes the study with brief policy implications.

II. REVIEW OF LITERATURE

Gravity equation (1962) states that the trade volume between two countries is directly proportional to the GDP of the economies and inversely proportional to the distance between the two economies; reduction in the distance through improved road network would tend to boost the bilateral trade between economies. This theory can also be elaborated in modern times as the availability of infrastructure can enhance the mutual trade of goods and services. European economies have been evaluated in terms of improved trade as a result of the provision of infrastructure services by Bougheas et al., (1999). The study discussed the diminishing cost patterns as a result of infrastructure availability. By employing an augmented Ricardian model of international trade, the study concludes that the magnitude of trade is positively associated with the provision of infrastructure services. Increasing transportation expenditures cause poor execution of the trade. Limo & Venables, (2001) found that poor road networks were accounted for 60 percent and 40 percent rise in transportation cost inland lock and coastal areas respectively.

REI through improved infrastructure services amplifies international trade. Fujimura (2004) discussed the case of central Asia and Mekong where REI was surged due to better transport services. Further, reach to new markets, access to investment opportunities, formation of regional economic relationships based on mutual interests and enhanced bilateral trade are the direct gains from REI through infrastructure improvement. African economies have been tested for the relationship between infrastructure services and REI by Ndulu (2006). The study first examined the contribution of infrastructure in enhancing the REI and then observed their mutual effects on economic stability. The study attributed free trade as the most significant component for REI alongside the availability of public infrastructure for the African region. For European economies, the role of public infrastructure, institutional performance, colonial history and geographical location are tested for international trade practices by Francois and Manchin (2007). An extended version of the Gravity model for the period 1988-2002 has been used in the study. Panel data methodology has been employed for empirical estimation. The study combined various infrastructure indicators through the principal component method and constructed an index of infrastructure. The findings of the study reveal that the availability of infrastructure services and institutional performance are critical factors for the export performance of the economies. Further, these two factors are even more significant for sustainable economic development. Not only the provision of domestic infrastructure is essential for trade but a developed cross-border infrastructure can promote trade relationships with the regional economies (Bhattacharyay, 2009). In this regard, the case of ASEAN countries has been examined. The functional role of public infrastructure (including transportation, communication and power infrastructure) for international trade has been probed. The study finds that the economic welfare in terms of improved trade can be optimized through the provision of cross-border infrastructure services. Empirical economic literature endorses the positive contribution of infrastructure towards growth domestically (Fan et al., 2002; Seethepalli et al., 2008; Palei, 2015; Jan et al., 2012; Ramzan, 2020 and Shoukat & Ahmad, 2016). But mutual infrastructure projects between economies also help mend the road towards prosperity through increased foreign inflows, trade volume, workers mobility and technological advancements (Lopez et al., 2009). Perez and Wilson (2012) suggested that the provision of soft and hard infrastructure services significantly improves the export volume of a transitional economy. The study considered the data of 114 countries including transitional, developing and poor countries. The study suggests that the availability of infrastructure services can improve the benefits of trade. In addition, hard infrastructure is more contributing than soft in poor countries. Hansan et al., (2015) examined the various aspects of the economic development of Africa. The study proposes various internal and external conditions for development in the long run. One particular factor is the provision and quality of developed infrastructure services. The study further relates the growing regional connectivity with infrastructure services as a contingent factor for the development of the African region.

Bishak et al., (2018) analyzed the impact of transport infrastructure in particular railroads on the export performance of the selected developing countries. The study identified transport infrastructure as the real and most effective source of connectivity in the era of globalization. Empirical analysis of the study found a positive impact of transport infrastructure on the export performance of underdeveloped countries. Gao et al., (2020) conducted a study to analyze the macroeconomic development in Pakistan with a special focus on CPEC. The study suggests that the position of Pakistan in this project is very strong. In case of China, the major gain will be benefiting through shorter trade routes but Pakistan can extract multiple benefits due to its geographical location and long-term friendship with China. Pakistan and China are potential trade collaborators for as long as four decades. Both economies have contracted and executed various bilateral trade agreements like The China–Pakistan Free Trade Agreement (CPFTA) and Free Trade Agreement for trade in Services. Consequently, trade volume between these economies has shown a persistent rise over time; in 2013, Pak-China trade volume climbed to 9.2 billion US dollars whereas it was only 4.1 billion dollars back in 2007. In addition, Pakistan has shown tremendous export performance and our exports have risen from 124 percent in 2007 to 400 percent in 2013 (Government of Pakistan (GoP), 2014). Although the friendship knot between Pakistan and China is continuously supporting the economies to grow yet the under-provision of public infrastructure services in Pakistan can slow down the process of growth. Public infrastructure services are below the required level (Shoukat et al., 2017 and Sabir & Shamshir, 2020). To meet the demand for public infrastructure, Pakistan must allocate 5.5 % of its GDP for Power infrastructure, 1.23% of GDP for transport infrastructure and 0.71 % of GDP for the telecommunication sector until 2022 (Andrés et al., 2013). A close probe into literature shows that infrastructure services are positively affecting REI. In addition, most of the economic literature on CPEC is theoretical. To the best of our knowledge, the provision of infrastructure for promoting REI has not been empirically tested for Pakistan yet. The current study aims to bridge this gap by taking into account the effect of the multifaced index of infrastructure on REI in the case of Pakistan. The detailed methodology regarding the selection of variables and econometric methodology has been discussed in the next section.

III. EMPIRICAL ANALYSIS AND MODEL SPECIFICATION

To determine the mediating role of infrastructure in regional economic integration in the context of CPEC, we follow the work of Fankem (2017) and Ali and Mingque (2018). Following mathematical model can be used to incorporate the mediating role of infrastructure in promoting REI:

REI= f (Public infrastructure, Inflation, Foreign capital inflow, Exchange rate, Political regime)

We can utilize the following econometric specification of the model for empirical analysis:

$$REI_t = \beta_0 + \beta_1 PPI_t + \beta_2 CPI_t + \beta_3 FCI_t + \beta_4 ER_t + \beta_5 PR_t + \mu_t \qquad \textbf{(1)}$$

Where REI stands for regional economic integration measured by trade openness, PPI is public physical infrastructure measured by a composite index of public physical infrastructure (explained in the next section), CPI represents inflation based on consumer price index. FCI stands for foreign capital inflows or foreign direct investment. ER and PR stand for exchange rate and political regime respectively. ER is the annual average of Pak. Rupee to US dollar exchange rate. Polity2 is used as the proxy of the political regime. The subscript t represents the series data used in the study for the period 1972 to 2019. Data has been collected from secondary sources like WDI-2020 and various issues of the Pakistan Economic Survey.

III.I. CONSTRUCTION OF PUBLIC PHYSICAL INFRASTRUCTURE INDEX (PPI)

For the construction of the public physical infrastructure index (PPI), multiple indicators like energy, communication and transportation are used. Oil (OIL) and electricity consumption (EC) are considered energy indicators. For communication number of telephone lines (TL) and the number of post offices (PO) are considered. Length of roads (LR) in kilometers is used as a transportation indicator. Principal Component Analysis (PCA) is an appropriate technique for index construction and data reduction. Sometimes the variables of interest are highly correlated with each other. PCA method provides us uncorrelated principal components of the variables which might be correlated to each other. First, we checked correlation among multiple indicators to be for the construction of a composite index. The results of the correlation matrix displayed in the following table-1 show that a very high correlation exists between the indicators of public physical infrastructure.

Table-1 Correlations Matrix of Public Physical Infrastructure Indicators

Indicators	OIL	EC	TL	PO	LR
OIL	1.0000				
EC	0.9221	1.0000			
TL	0.8758	0.9248	1.0000		
PO	0.7342	0.7149	0.9565	1.0000	
LR	0.9777	0.9565	0.9338	0.7149	1.0000

Keeping in mind the high correlation among PPI indicators and to avoid the issue of multicollinearity, we applied the PCA method. In the PCA method, only a correlation matrix is used (Chatfield and Collins, 1980). Based on the ordinary correlations, Eigenvalues are presented in Table-2. The first principal component (PC1) has the eigenvalue of 5.3 which explains the 86 percent variance in the indicators used for PPI. Figure-1 presents scree plots of eigenvalues and Figure-2 displays the scree plots of eigenvalue differences.

Table-2 Proportions of Eigenvalues of Indicators used for the Construction of PPI

PCs	Values	Simple Proportion	Cumulative Proportion
1	5.3065	0.8521	0.8523
2	0.5395	0.1065	0.9587
3	0.0849	0.0157	0.9665
4	0.0603	0.0118	0.9729
5	0.0089	0.0017	0.9856

Figure-1. Plot of Eigenvalues

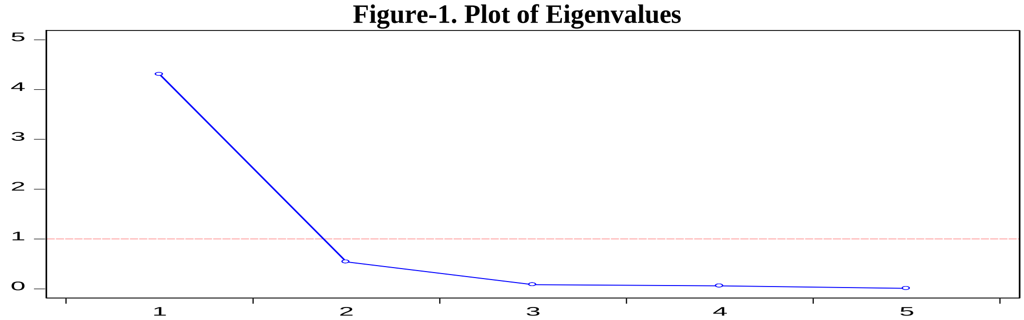
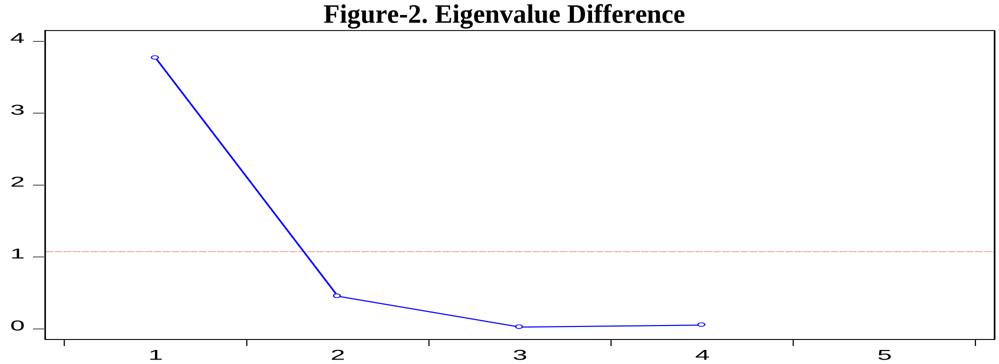


Figure-2. Eigenvalue Difference



Scree plots in Figure-1 and Figure-2 indicate PCA is suitable to construct a composite indicator PPI we can observe a sharp decline from the first principal component (PC1) to the second principal component (PC2). We also normalized the data of PPIs by subtracting the minimum value from the maximum value and then dividing by the difference of maximum and minimum value. Then we multiplied these normalized with their relevant PC1 to give them weight. In the end, the resulting values are then aggregated into a composite index of public physical infrastructure PPI.

III.II. THE UNIT ROOT PROBLEM AND ORDER OF INTEGRATION

This study uses the time series data; therefore, it is important to check the stationarity of data and order of integration for further analysis. Augmented Dicky Fuller (ADF) test for unit root is widely used in empirical analysis. We have applied the same test and the results are presented in the following Table-3.

Table-3 ADF Unit Root Test

	At Level		At First Difference	
Variables	ADF test Stat.	Probability	ADF test Stat.	Probability
REI_t	-1.7212	0.7034	-4.1214 **	0.0132
PPI_t	0.2943	0.8976	-6.1483*	0.0000
CPI_t	-2.2152	0.4937	-3.7986**	0.0361
FCI_t	-2.8171	0.2213	-3.8673**	0.0129
ER_t	-0.5957	0.9284	-3.4537**	0.0323
PR_t	-1.9238	0.5967	-5.6387*	0.0000

* and ** represent 1% and 5% significance level respectively

ADF test statistics and probability values presented in Table-3 show that all variables are non-stationary at level, therefore it clear that the unit root problem exists in the time series data. However, when the series is differenced one, they become stationary and the order of integration is also determined that is I(1). It becomes clear by observing the ADF test statistics in Table-3. Based on the same order of integration, Johansen's co-integration methodology is suitable to find the relationships among the variables in the long run. Before applying the Johansen co-integration, the optimal lag length must be determined. The Table-4 below displays the results of different lag selection criteria like Akaike Information Criterion (AIC), the general-to-specific sequential Likelihood Ratio test (LR) and Hannan-Quinn Criterion (HQC).

Table-4 Results of Different VAR Lag Order Selection Criteria

Lag	AIC	LR	HQC
0	68.5421	NA	68.7621
1	58.7952	406.6427	58.9156
2	58.9783	35.6431	59.8923
3	57.6874*	73.3361*	58.6841*

* indicates lag order selected by the criterion

The statistics (Table-4) of all three criteria mentioned above suggest three lags as optimal lag length for Johansen co-integration through VAR methodology. To determine long-run relationships, the results of Johansen co-integration are displayed in table Table-5.

Table-5 Results Trace Statistics and Max-Eigen Statistics Co-integration

No. of Co-integ. Vectors	Trace Test Statistics	Critical Value	Probability
None*	21.1215	95.7537	0.0001
At most 2*	121.4873	69.8189	0.0001
At most 3*	65.2135	47.8561	0.0002
At most 4*	36.2931	29.7971	0.0039
At most 5	14.3251	15.4947	0.07261
No. of Co-integ. Vectors	Max-Eigen Test Statistics	Critical Value	Probability
None*	81.6821	40.0776	0.0001
At most 2*	51.8743	33.8769	0.0023
At most 3*	29.1387	27.5843	0.0229
At most 4*	21.6437	21.1316	0.0410
At most 5	12.3621	14.2646	0.0823

*represents a 5% level of significance for rejecting the null hypothesis

According to Trace as well as in Max-Eigen statistics, there are four co-integrating vectors which are the proof of the existence of a long-run relationship between regional integration and public physical infrastructure. The following Table-6 displays the estimated coefficients for the long-run relationship. Empirical results in Table-6 show that the provision of public physical infrastructure has a significant and positive effect on regional economic integration. For the construction of the public physical infrastructure index, we have used multiple indicators like energy, communication and transportation. The uprising and mediating role of all these indicators to enhance the economic activities, especially for national and international trade is well established. Our results are in line with these studies (see for example Fujimura, 2004; Perez and Wilson, 2012; Raihan, 2012; Francois, 2013 and Sheikh et al., 2021). Foreign capital inflows also showed a positive impact on regional economic integration. Foreign capital inflows increase domestic investment and exports resulting in GDP and therefore imports also, which leads to regional economic integration. A stable political regime creates trust and hope for international investors. Political regime (PR), as the result indicate, is also important and has a positive impact on regional economic integration. Inflation (CPI) and exchange rate (ER) showed a negative impact on regional economic integration. It can be justified because both of the variables decrease the purchasing power and discourage imports and regional economic integration.

Table-6. Coefficients for the Long-run Relationships (Based on First Integrating Vector)

Dependent Variable: REI			
Variables Names	Coefficients	Standard Errors	t-statistics
PPI_t	3.8152	1.4816	2.5750
CPI_t	-0.5342	0.1593	-3.3534
FCI_t	0.2136	0.0749	2.8518
ER_t	-0.1273	0.0344	-3.7017
PR_t	0.2859	0.0684	4.1780
	R-squared	0.6572	
	F-statistic	8.0815	
	Probability	0.0000	
	D-W stat	1.6312	

After the confirmation of the long-run relationship, we applied the Vector Error Correction Mechanism (VECM) for short-run dynamics. The results of the short-run analysis are displayed in Table-7. In the short run, only inflation (CPI) indicated a positive and significant impact on REI. All other variables remained insignificant for REI. However, the first lag of error correction term (ECT_{-1}) is statistically significant, which confirms the long-run relationship among the variables of interest.

Table-7. Results for Dynamics in the Short-run (Dependent Variable ΔREI_t)

Variable	Coefficient	Standard Error	t-statistics
Constant	0.5743	1.1345	0.5062
ΔREI_{t-1}	0.1264	0.2153	0.5871
ΔPPI_{t-1}	12.2152	8.3247	1.4673
ΔPPI_{t-2}	9.2012	8.6536	1.0633
ΔPPI_{t-3}	-11.4381	7.7116	-1.4832
ΔCPI_{t-1}	0.2187	0.1054	2.0750
ΔCPI_{t-2}	0.0854	0.3342	0.2555
ΔCPI_{t-2}	0.1247	0.0754	1.6538
ΔFCI_{t-1}	-0.4367	0.4537	-0.9625
ΔER_{t-1}	0.1287	0.2911	0.4421
ΔER_{t-2}	0.3765	0.2985	1.2614
ΔPR_{t-1}	-0.0543	0.0432	-1.2578
ΔPR_{t-2}	0.7653	0.7856	0.9742
ECT_{t-1}	-0.5983	0.1684	-3.5529
R-squared		0.6543	
Adjusted R-squared		0.3262	
D. W. Stat.		2.3002	

We have also checked the suitability of the short-run model through diagnostic tests. Table-8 shows the results of these tests. It can be observed that the short model is rightly specified and the residuals are normally distributed (see the Ramsey RESET and F-stat. and Jurque-Bera stat. respectively). Breusch-Pagan-Godfrey, ARCH and Breush-Godfrey LM F-stat show that there is no issue of heteroskedasticity or serial correlation in the estimated model.

Table-8. Diagnostic Tests (Short-Run Model)

Name of Tests	F-Statistics	Probability
Normality (Jurque-Bera)	0.6431 (J.B. Stat.)	0.8231
Specification Error (Ramsey RESET)	0.2150	0.6972
Heteroskedasticity (ARCH)	0.5437	0.6315
Heteroskedasticity (Breusch-Pagan-Godfrey)	2.0537	0.1384
Serial Correlation (Breush-Godfrey LM)	0.2537	0.7635

To check whether the coefficients are stable or not, CUSUM and CUSUMsq are verified and the plots of CUSUM and CUSUMsq are displayed in the following Figure-3 and Figure-4 respectively. At a 5 percent level of significance, both plots of CUSUM and CUSUMsq are within the critical boundaries or strait lines which represent the critical boundaries at 5 percent level of significance. This explains that the regression model is correctively specified.

Figure-3. The plot of CUSUM

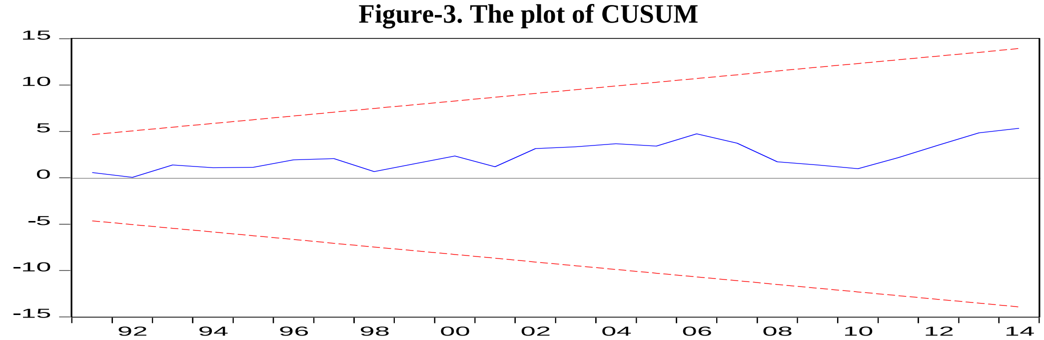
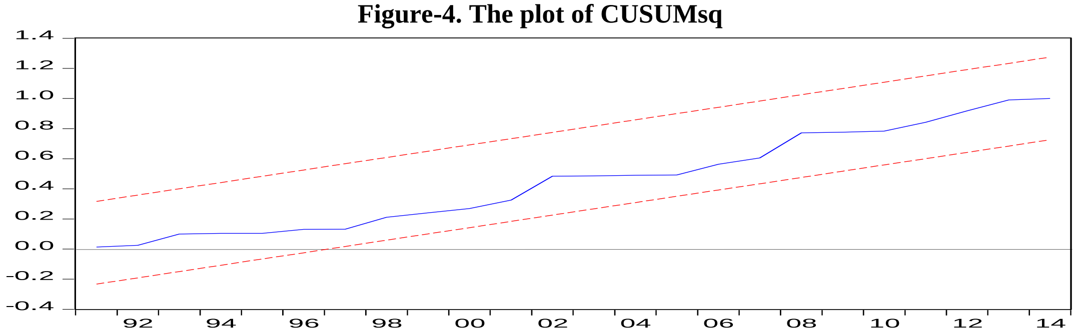


Figure-4. The plot of CUSUMsq



IV. CONCLUSION AND POLICY RECOMMENDATIONS

The present study has empirically tested the relationship between public infrastructure and REI in the long as well as in the short run. REI is measured through trade openness and for public infrastructure, we have constructed a multi-dimensional index of infrastructure for a composite analysis of infrastructure services. Other supporting variables are exchange rate, CPI, foreign capital inflows and political regime. The study employed time series annual data from 1972 to 2019 for Pakistan. After checking for the existence of the unit root, the study employed Johansen's cointegration technique for long-run results and VECM for the short-run results. The empirical results confirmed the long-run relationship; public infrastructure is positively and significantly affecting REI in the long run. First lag of ECT (-1) is statistically significant that also endorse the presence of a long-run relationship. All other supporting variables are significant and positively affect REI except CPI and exchange rate. Infrastructure services in Pakistan remained undersupplied since inception. The importance of domestic as well as cross-border investments in infrastructure cannot be denied in the globalized era. Since infrastructure development affects REI positively, our study suggests that the public sector must plunge in to bridge the gap between supply and demand. Public infrastructure projects would not only over the shortage but also help to create new jobs, easy access to the markets and encourage domestic investors. To accelerate this process, CPCE can prove to be a catalyst. The success of this project is linked with the adaptability of Pakistan to the challenges. Sound political governance is the key element for CPEC to be accomplished and deliver its fruits. Pakistan needs to focus on political harmony and consistent development policies. Besides, control over the rate of inflation and a suitable exchange rate can also mend the road for smoothening the process of REI.

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