

## **FACTORS DETERMINING ECONOMIC GROWTH IN PAKISTAN: An ARDL Bound Testing with General to Specific Approach**

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### **Abstract**

This is an empirical study which follows general to specific approach for finding relevant macroeconomic variables affecting Pakistan's economic growth. Annualized data between 1976 and 2014, and the auto regressive distributed lag is employed for conducting the analysis. The main findings of this study are consumer price index, gross fixed capital formation, gross national expenditures, remittance and credit extended to private sector which has importance from growth perspective. Gross fixed capital formation and remittance are positively associated with economic growth of a country. Consumer price index, gross national expenditures and domestic credit extended to private sector hamper the long-run growth process. Based on empirical findings, it is recommended to relevant authorities to augment the gross fixed capital formation, attract foreign remittance, control inflation, reduce government expenditures and alleviate government intervention in financial market for achieving the long-run economic growth.

*Key Words:* ARDL, Non-Stationarity, Real Exchange Rate.

*JEL Classification:* E21, E31, E51, F24, F41.

### **I. Introduction**

It has long been debated by the growth economists as to what determines the economic growth. This issue is more pertinent for developing countries, particularly the countries like Pakistan, which are faced with all kind of socio-economic problems as there is a wide spread poverty in such regions. Almost thirty-nine per cent of Pakistanis are living in multinational poverty [Multinational Poverty in Pakistan (2016)]. Pakistan's human development index value for the year 2015 was 0.55 which ranks 147th among 188 countries [UNDP-HDR (2016)]. The country is under huge debt burden as its debt to gross domestic product ratio stand at 66.5 per cent which is well above the globally recognised sustainable level of 65 per cent. Approximately six per cent of

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labor force is unemployed [Pakistan Economic Survey (2015-16)]. The country's trade deficit has been widening and has reached to US\$ 23.38 billion during July 2016 to March 2017. Such development obstructs the economic growth and thus, lowers living standards of people of the country. Sustainable long-run economic growth is a key to resolve all these issues and thus ensure reasonable standards of living for common people of the country.

There are substantial numbers of empirical studies that have focused growth determinants in Pakistan. Most often the determinants of economic growth used in these studies are fiscal policy variables, domestic and external debt, domestic investment, foreign direct investment, human capital, trade openness, imports, exports, government expenditures, financial market indicators, inflation, savings, remittance, literacy rate, domestic credit and the real broad money [Ahmad and Wajid (2013), Atique and Malik (2012), Azam and Khattak (2009), Iqbal and Zahid (1998), Rahman and Salahuddin (2010), Sajid and Sarfraz (2008), Shaheen, et al. (2011), and Tahir, et al. (2015)]. However, none of these studies have simultaneously evaluated the effect of all macroeconomic factors, determined from the empirical literature on growth around globe and on growth process of the country. The present study bridges this gap; by first, the major macroeconomic indicators affecting economic growth are identified from empirical growth literature around the world, and then, general to specific approach is adopted for finding as to which of these macroeconomic indicators are relevantly determinants of growth in Pakistan. Second, contrary to the earlier empirical studies, this study uses the up to date data. The results indicate that consumer price index, human capital, gross national expenditures, remittance and the domestic credit to private sector are relevant determinants affecting economic growth of the country, both in short-run and long-run. Broad money is significant determinant of economic growth only in the short-run.

The remaining part of the paper proceeds as follows; the earlier empirical literature that focus the factors affecting economic growth around the world is reviewed in Section II. In Section III, the data, its sources and construction of variables are given. Section IV which discusses the model. Estimation method and results are discussed in Section V and finally, conclusion and necessary steps for augmenting growth in the country are given in Section VI.

## **II. Literature Review**

Both the empirical and theoretical literature has long been discussed as an issue of economic growth. First of all, Adam Smith emphasized the importance of economic growth followed by Solow growth model that argued the value of labor, capital and technology in determining economic activity in a country. Barro (1991) developed an endogenous growth theory where growth was taken as endogenous, instead of determining it outside the system. Empirical literature on the other hand has used different data sets, different methodologies across different countries for finding relevant deter-

minants of economic growth. Iqbal and Zahid (1998) used simple growth model and the multivariate regression and found primary education, stock of physical capital and trade openness having significant positive effect on growth in Pakistan. However, budget deficit and external debt were found to be negatively associated with economic growth. Based on empirical findings, the authors suggested the pursuit of sensible long-run sustainable policies for augmenting economic growth in the country. Barro (2003) estimated the extended neo-classical growth model for a panel of 87 countries and obtained the rule of law, investment and terms of trade with positive effect on growth while fertility rate, inflation and government expenditure retarded economic growth of these countries. Anaman (2004) also evaluated the determinants of economic growth in Solow growth framework and found that export growth, labor growth and investment to GDP ratio had significant positive effect on growth in Brunei Darussalam. On the other hand, the Asian financial crisis affected the economic growth negatively.

As far as the relative size of government expenditures is concerned, it affects growth in cubic function. Huge and moderate government expenditures hamper and the augmented economic growth, respectively. Shahbaz, et al. (2008) using the log-linear model and Autoregressive Distributed Lag approach, found positive effect of credit to private sector, foreign direct investment and inflow of remittance on economic growth of Pakistan. High inflation and trade openness however, were negatively associated with the country growth. Azam and Khattak (2009) also evaluated the determinants of growth in Pakistan using extended version of Solow growth model and the ordinary least square approach. The results revealed significant and positive effect of domestic investment, foreign inflows and trade openness on growth of the country. However, human capital turned out to be negatively correlated with growth. Tawiri (2010) focused Libya and applied Johanson Cointegration Technique (1998) and the Granger causality test for finding relevant determinants of economic growth in Cob Douglas production framework. He concluded that domestic investment is more elastic determinant of economic growth than the labor force. Causality results revealed, one way causality, running from investment to economic growth.

Salahuddin (2010) applied autoregressive distributed lags approach and error correction model for finding market related determinants of economic growth in Pakistan. The author found significant positive effect of foreign direct investment, human capital, market capitalization, financial development and stock market liquidity on economic growth of the country. However, financial instability and inflation affected the economic growth negatively. Tolo (2011) used the fixed effect model and focused the factors affecting growth in 23 emerging market economies. Empirical evidence show that agricultural export, fiscal balance, gross fixed capital formation, population growth, inflation rate, total foreign trade, trade balance and current account balance are significant determinants of economic growth in the panel of these emerging market economies. Ismihani (2012) evaluated the impact of knowledge index on economic growth of Turkey by using economic structure (regime) of economy, education, do-

mestic innovation and communication infrastructure for constructing the knowledge index. Both, the Johansen cointegration and fully modified least square yield the same results, i.e., knowledge index and capital labor ratio have major and positive impact on Turkish economic growth. Ullah, et al. (2013) also focused on determinants of economic growth in ARDL and error correction framework, in Pakistan. They gathered empirical evidence which showed that gross fixed capital formation, literacy rate, remittance and real foreign direct investment are relevant determinants of economic growth in the country. Havi, et al. (2013) focused on factors that determined economic growth in Ghana, using neo-classical growth model. The results obtained from Johansen cointegration method showed physical capital, labor force, foreign direct investment, foreign aid, consumer price index, government expenditures and military rule which are relevant factors determining per capita real GDP in the country. Ahmad and Wajid (2013) utilized endogenous growth model and ARDL approach for evaluating the impact of fiscal policy variables on growth process of the country. The results indicate neutral impact of non-productive expenditures and non-distortionary taxation, positive impact of productive expenditures and, human capital and negative association of distortionary taxes on growth process in Pakistan.

Augmented Solow growth model, static multivariate regression and error correction method was applied by Ajide (2014) for evaluating the effect of Frazer Economic Freedom index on economic growth in Nigeria. The results showed that labor, life expectancy, degree of openness and economic freedom have significant effect on economic growth of the country. Component based data of economic freedom index showed size of the government and freedom of trade having significant negative and positive impact on economic activities in Nigeria. Musayev (2014) re-examined the potential sources of positive association between military expenditures and growth using generalized method of moment on dynamic panel data of eighty-nine countries. The results indicated that military expenditures retard the economic growth. However once, corruption levels are taken into account the military expenditures would not hamper the economic growth of countries facing internal threats, and the countries abundant in natural resources. Abdalla and Abdelbaki (2014) utilized the cointegration and vector error correction method for finding out determinants of economic growth, separately for Gulf Cooperation Council (GCC) member countries. The results reveal that main determinants of economic growth in Bahrain are foreign direct investment, and the gross capital formation. Exports and gross capital formation mainly determined growth in Qatar, Kuwait and Saudi Arabia and, exports and foreign direct investment in the United Arab Emirates. For Oman, there was a complete absence of any cointegrating vector among the variables. Radu (2015) focused the interplay between economics and politics, and its effects on economic growth of Central and East European (CEE) countries. Based on empirical evidence obtained from the application of three stage least square on panel data of twelve countries, the author concluded no direct link between economic growth and political factors, and the significant positive association of eco-

conomic variables with economic growth of these countries. Mbulawa (2015) examined the association between institutional quality and economic growth of South African Development Community (SADC) countries. Using generalized method of moments (GMM) on dynamic panel data model, the author concludes that indirect effect of institutional quality on economic growth (as institutional quality) works through trade openness, gross fixed capital formation, financial openness, human capital and savings ratio. These variables are relevant determinants of economic growth if supported by quality institutions, otherwise growth is retarded if institution which fail to provide required support for augmenting growth in member countries. Onyango and Were (2015) used endogenous growth model and fixed effect method on unbalanced panel data for evaluating the determinants of per capita GDP growth of East African Community (EAC) member countries.<sup>1</sup> Fixed effect results reveal that only broad money and foreign direct investment determined growth in GDP per capita in these countries.

Alodadi and Benhin (2015) focused the relevancy of non-oil sectors in determining economic growth in Saudi Arabia in Johansen cointegration and error correction framework. The results indicated that apart from religious tourism, rest of the variables have significant role in determining Saudi Arabian economic growth. Religious tourism was insignificant in overall growth and significant when non-oil sectors were isolated. Hamdan (2015) used Augmented Solow Growth Model and the Johanson cointegration approach for determining factors affecting economic growth of Palestine. Based on empirical evidence he concluded that gross fixed capital formation, foreign direct investment and foreign trade have significant effect on economic growth of Palestine. Mohammad and Ehikioya (2015) relied on Johanson cointegration for testing the impact of macroeconomic determinants on economic growth in Nigeria. They concluded that given stable inflation conditions, physical capital, foreign direct investment and government expenditures were the main determinants of economic growth in Nigeria. Ghazanchyan, et al. (2015) focused the factors affecting growth of 25 Asian countries using unbalanced panel data and three and five year's annual average data for the period 1980 to 2012.<sup>2</sup> They applied generalized method of moments and feasible generalized least square methods of estimation to overcome endogeneity and group heteroscedasticity. The results indicated that investment (both public and private, reduced financial risk, higher foreign direct investment, flexible exchange rate regime and financial crisis) are relevant determinants of growth in sample countries. Ramanayake and Lee (2015) focused the factors determining growth in developing countries, particularly emphasizing the importance of international integration variables. The results of generalized method of moments, cross-section and fixed effect method indicate the robust estimates of export growth and export specialization while estimates of traditional variables like trade openness and FDI were insignificant. Upreti (2015)

<sup>1</sup> Kenya, Tanzania, Uganda, Rwanda and Burundi are EAC member countries.

<sup>2</sup> Average data was used to overcome bias in annual data that arises due to business cycle effects.

used the modified Barro (1901) growth model for identifying factors affecting economic growth of 76 developing countries. The results obtained by use of multivariate ordinary least square method on cross country data from 1995, 2000, 2005 and 2010 shows that exports, natural resources, longer life expectancy, and higher investment are the relevant determinants of per capita GDP growth in these countries.

The review of empirical literature reveals that significant determinants of an overall economic growth around the world are primary education, stock of physical capital, trade openness, budget deficit, rule of law, investment, terms of trade, fertility, inflation, government expenditures, exports, labor, private sector credit, remittances, human capital, financial development, stock market liquidity, agricultural exports, fiscal balance, gross fixed capital formation, population growth, current account balance, knowledge index, foreign aid, military rule, productive expenditures, economic freedom, size of government, military expenditures, quality institutions, broad money, religious tourism, flexible exchange rate and natural resources.

### III. Annualized Data

This study, uses the Annualized data from 1976 to 2014 which is taken from the World Bank-World Development Indicators. The choice of sample is based on two factors: (a) disintegration of the country in December, 1971, and, (b) data on most variables was available after 1975. External debt is used as per cent of gross national income; and the net foreign direct investment, gross fixed capital formation, gross national expenditures, remittances, domestic credit to private sector, exports of goods and services, and broad money, are normalized by GDP to avoid multi-collinearity. Adjustment of foreign price to domestic price ratio with nominal exchange rate resulted in real exchange rate. Since data on most variables shows strong trend; therefore, it is used in log form. Log transformation makes the linear exponential function because log function and exponential are inversely related to each other [Asteriou and Price (2007)]. Finally, the log transformation allows to interpret estimated parameters in terms of elasticities.

### IV. Model

Solow growth model is augmented for identifying the factors affecting economic growth in Pakistan. Basic Solow model which links output growth to human and physical capital is further extended to find the impact of other macroeconomic indicators on growth process of the country<sup>3</sup> where  $y_t$  = growth in real GDP,  $cpi_t$  = inflation,  $ed_t$  = external debt as per cent of gross national income,  $fdi_t$  = net foreign direct investment,  $k_t$  = gross fixed capital formation,  $gne_t$  gross national expenditures,  $remt_t$  = personal

<sup>3</sup> Average data was used to overcome bias in annual data that arises due to business cycle effects.

remittances received,  $fd_t$  = domestic credit,  $m_{2t}$  = broad money,  $q_t$  = real exchange rate and  $to_t$  = trade openness;  $\varepsilon_t$  is stochastic disturbance with zero mean and constant variance;  $\Delta$  represents first difference operator;  $\beta 1_i$  to  $\beta 11_i$ , show short-run dynamics of the model and  $\beta 13$  to  $\beta 21$  are estimates of long-run cointegrating vector. Wald or F-Statistics is applied for null of long-run relationship among the variables.

Computed Wald or F-statistic which is greater than their upper bound critical values, imply the long-run association among variables (1). Calculated Wald or F-statistic between the upper and lower bound critical values, suggest inconclusive results. Null of no cointegration on the other hand is accepted if lower bound critical values exceed the calculated Wald or F-statistics.

## V. Estimation Method and Results

This study utilizes the auto regressive distributed lag approach for identifying factors cointegrated with economic growth, in the country. The method is preferred over other long-run estimation procedures because it does not require testing the integrating order of variables, performs better in small sample size and estimates both the long-run and short run relationship, simultaneously. Although, the ARDL does not require checking of integrating order of variables, yet it is important to do so because critical F-statistics given by Pesaran, et al. (2001) becomes invalid for the second difference stationary variables [Oyakhilomen and Zibah (2014)]. Augmented Dickey Fuller (ADF) test results are given in Table A-1, Appendix-2, shows that gross domestic product is at level stationary in both specifications at five per cent significance level; foreign direct investment is constant and stationary at ten per cent and constant plus the trends are stationary in level at five per cent significance level. Broad money is level stationary in both specifications at ten per cent significance level. Consumer price index, real exchange rate and broad money are constant stationary in level at ten per cent significance level.<sup>4</sup> Rests of the variables are non-stationary in levels and stationary at first difference in both specifications at five per cent significance level.

The ARDL approach is used for finding presence of long-run cointegrating relationship among the variables. As a first step, F-statistic is calculated using the two lags determined by Akaike Information Criterion. Appendix-2, Table A-2, shows that calculated F-statistics exceeds upper bound one per cent critical values for model one and five per cent critical values for model two, respectively; hence it provide empirical evidence for rejecting null of no cointegration among variables.<sup>5</sup> Appendix-2, Table A-3 shows the estimated coefficient of long-run cointegrating vector.<sup>6</sup> General to specific approach is adopted for finding relevant factors affecting economic growth in Pakistan. According to this approach, Appendix-1 Equation (A-1) was estimated in general form

<sup>4</sup> Refer to Appendix-2, Table A-1 for ADF test results.

<sup>5</sup> See, Appendix-2, Table A-2 for estimates of F-statistic.

<sup>6</sup> See, Appendix-2, Table A-3 for estimates of long-run cointegrating vectors.

and parameters which appeared insignificant were dropped and then the equation was re-estimated.<sup>7</sup> This process continued till the parsimonious model with all estimated parameters significant was obtained. The results revealed significant positive association of gross fixed capital formation and remittances with growth process of the country. The real exchange rate estimate was positive and significant at ten per cent significance level. Model two showed estimates of equation one, once insignificant variables obtained in model one are dropped. The results indicate that an increase in gross fixed capital formation and remittance cause economic growth in the country. Consumer price index, gross national expenditures, and credit extended to private sector on the other hand, retarded the growth process. Model two is called parsimonious because estimates of all variables included in it were significant.

Positive estimates of gross fixed capital formation implied that a rise in country's capital formation cause economic growth. This occurs because a rise in gross capital formation raises physical stock of a country and thus affects the economic growth positively [Plossner (1992)]. Indirectly, an increase in capital formation encourages the technological progress and thus, affects economic growth in the same direction [Levine and Renelt (1992)]. Remittances have positive effect on recipient country's economic activities; it augments savings and help enhancing both the physical and human capital. Therefore indirectly, remittances contribute to economic growth by enhancing consumption expenditures. Inflation affects economic growth, negatively. An increase in price variability results uncertainty among investors about profitability of their future projects. This reduces investment inflows and hence, slow-down the economic activity. Rise in prices reduce competitiveness of exportable goods in the international market, and thus, hampers economic growth. Directly, an increase in price level reduce purchasing power of money and thus cause reduction in economic growth by reducing demand for goods and services produced. Gross national expenditures represent the total domestic expenditures less exports. There are two ways by which the gross national expenditures affect the economic growth. Directly, a rise in total expenditures should cause economic growth in the country and indirectly, they have negative effect on growth. A rise in gross national expenditure has little to save and invest which hampers the build-up of capital in the country. This has negative consequences for country's growth which seems plausible in this study.<sup>8</sup> Negative estimate of domestic credit may reflect government fixing interest rate ceiling and directing domestic credit to government priority sectors. Directed credit policy by such a government may reduce capital accumulation and productivity growth in the country.

Estimates of short-run dynamic relationship obtained from error correction version of ARDL model are given in Appendix-2, Table A-4.<sup>9</sup> It is evident from the table that consumer price index, gross national expenditures, one period lagged remittance, credit

<sup>7</sup> Refer to Appendix-1 for Equation (A-1).

<sup>8</sup> Refer to Ram (1987) for effect of growth on structure of domestic absorption.

<sup>9</sup> Refer to Appendix-2, Table A-4 for error correction model estimates.

extended to private sector, broad money up to two lags; significantly impact the short-run economic growth, human capital, remittance and one period lagged private sector credit affect economic growth of the country, positively. Consumer price index, human capital, gross national expenditures and credit extended to private sector affect economic growth negatively, both in the short-run and long-run; and remittance is positively associated with growth in both periods. However, one period lagged remittance and private sector credit contradicts their long-run and short-run effects. One period lagged estimates of remittance and private sector growth exert negative and positive effects on growth of the country. The speed of adjustment to restore equilibrium in dynamic model is measured by error correction term ( $\alpha$ ). Significant negative estimate of error correction term implies attainability of long-run equilibrium. Its estimate range from minus 1.59 in model one to minus 1.35 in model two, suggesting speedy adjustment of deviation from long-run equilibrium within one year. Furthermore, residual tests show that both the short- and long-run estimated models satisfy residual properties. The residuals, from both models have normal distribution and are free from autocorrelation and heteroscedasticity issues.

Cumulative sum of recursive (CUSUM) and cumulative sum square (CUSUMSQ) of residuals are used for testing stability of both the long-run and short-run estimates of the model.<sup>10</sup> These tests find parameter instability if cumulative sum goes outside 5 per cent critical bounds [Farhani (2012)]. It is apparent from Appendix-2, Figures A-1 and A-2 that cumulative sum does not violate the upper and lower bounds five per cent critical values.<sup>11</sup> Hence, it is concluded that both the long- and short-run estimates are stable and there is no structural break during the taken sample period.

## VI. Conclusion and Recommendations

This paper follows, general to specific approach for finding factors determining both the short-run and long-run growth process of the country. The annual data from 1976 to 2014 was used for conducting the analysis. The choice of sample period was constrained by country disintegration in December 1971 and the availability of data on most of the variables after 1975. Empirical evidence obtained the following general to specific approach which shows that consumer price index, gross fixed capital formation, gross national expenditure, remittance and credit extended to private sector determine growth process of the country in long-run.

However, in short-run consumer price index, gross fixed capital formation, gross national expenditures, one period lagged remittance, credit extended to private sector and broad money, are relevant determinants. Based on the empirical evidence, it is strongly recommended that government should control the rise in prices, take steps

<sup>10</sup> Brown, et al. (1975) introduced CUSUM test.

<sup>11</sup> Refer to Appendix-2, for Figures A-1 and A-2.

for reducing gross national expenditures and stop intervening in financial market for setting up interest rate and directing domestic credit to government priority sectors, and should make efforts for building up physical capital and augment inflow of foreign remittances for achieving sustainable long-run economic growth in the country.

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**APPENDICES****APPENDIX-1****Augmented Solow Growth Model**

$$\begin{aligned}
\Delta y_t = & \beta^0 + \sum_{i=1}^n \beta_{1i} \Delta y_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta cpi_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta edt_{t-i} + \sum_{i=1}^p \beta_{4i} \Delta fdi_{t-i} + \sum_{i=1}^p \beta_{5i} \Delta k_{t-i} \\
& + \sum_{i=1}^p \beta_{6i} \Delta gne_{t-i} + \sum_{i=1}^p \beta_7 \Delta rem_{t-i} + \sum_{i=1}^p \beta_{8i} \Delta fd_{t-i} + \sum_{i=1}^p \beta_9 \Delta to_{t-i} + \sum_{i=1}^p \beta_{10} \Delta m_{2t-i} \\
& + \sum_{i=1}^p \beta_{11i} \Delta q_{t-i} + \beta_{12} y_{t-1} + \beta_{13} cpi_{t-1} + \beta_{14} ed_{t-1} + \beta_{15} fdi_{t-1} + \beta_{16} k_{t-1} + \beta_{17} gne_{t-1} \\
& + \beta_{18} rem_{t-1} + \beta_{19} fd_{t-1} + \beta_{20} to_{t-1} + \beta_{21} m_{2t-1} + \beta_{22} q_{t-1} + \varepsilon_t
\end{aligned} \tag{A-1}$$

The null hypothesis tested is:

$$H_0 : \beta_{13}, \beta_{14}, \beta_{15}, \beta_{16}, \beta_{17}, \beta_{18}, \beta_{19}, \beta_{20}, \beta_{21} = 0 \text{ against the alternative hypothesis}$$

$$H_a : \beta_{13} \neq \beta_{14} \neq \beta_{15} \neq \beta_{16} \neq \beta_{17} \neq \beta_{18} \neq \beta_{19} \neq \beta_{20} \neq \beta_{21} \neq 0$$

## APPENDIX-2

**TABLE A-1**  
Augmented Dickey Fuller Test

Variables	Levels		First Difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
$y_t$	-4.04 <sup>a</sup>	-4.65 <sup>a</sup>	-9.21 <sup>a</sup>	-9.08 <sup>a</sup>
$cpi_t$	-2.86	-2.76	-7.44 <sup>a</sup>	-7.36 <sup>a</sup>
$ed_t$	-0.76	-1.16	-4.83 <sup>a</sup>	-4.81 <sup>a</sup>
$fdi_t$	-2.79 <sup>b</sup>	-5.30 <sup>a</sup>	-5.40 <sup>a</sup>	-4.47 <sup>a</sup>
$k_t$	-1.47	-2.39	-5.92 <sup>a</sup>	-5.83 <sup>a</sup>
$gne_t$	-1.80	-1.92	-6.78 <sup>a</sup>	-6.72 <sup>a</sup>
$rem_t$	-1.44	-1.58	-5.77 <sup>a</sup>	-5.71 <sup>a</sup>
$fd_t$	-0.86	-1.25	-5.29 <sup>a</sup>	-5.57 <sup>a</sup>
$m_{2t}$	-3.37 <sup>b</sup>	-3.29 <sup>b</sup>	-5.59 <sup>a</sup>	-5.64 <sup>a</sup>
$q_t$	-2.76 <sup>b</sup>	-3.10	-7.00 <sup>a</sup>	-6.90 <sup>b</sup>
$to_t$	-3.10 <sup>b</sup>	-2.97	-7.45 <sup>a</sup>	-7.55 <sup>a</sup>
10 % critical values	-2.60	-3.19	-2.61	-3.20
1% critical values	-3.61	-4.21	-3.62	-4.22

Note:  $y_t$ ,  $cpi_t$ ,  $ed_t$ ,  $fdi_t$ ,  $k_t$ ,  $gne_t$ ,  $rem_t$ ,  $fd_t$ ,  $m_{2t}$ ,  $q_t$  and  $to_t$  represent overall economic growth, consumer price index, external debt, net foreign direct investment, gross fixed capital formation, gross national expenditures, personal remittances received, domestic credit to private sector, trade openness, broad money and real exchange rate. Superscripts *a* and *b* show the significance of the estimated parameter at one and ten per cent significance level respectively.

Source: Authors' Calculation.

**TABLE A-2**  
F-statistic of Cointegration Relationship

Calculated F.statistic	Model 1				Model 2			
	4.55				3.99			
	Narayan (2004)		Pesaran & Hashim (1999)		Narayan (2004)		Pesaran & Hashim (1999)	
Significance Level	LB	UB	LB	UB	LB	UB	LB	UB
1 per cent	2.41	3.61	2.63	3.94	2.88	3.99	3.29	4.56
5 per cent	1.98	3.04	2.16	3.32	2.27	3.28	2.6	3.75
10 per cent	1.76	2.77	1.92	3.02	1.99	2.94	2.27	3.36

Note: LB and UB indicate lower bound and upper bound critical values, respectively.

Source: Authors' Calculation.

**TABLE A-3**  
Long-Run Estimates

Variables	Model 1	Model 2
$cpi_t$	-0.21(-0.77)	-0.41(-3.28) <sup>a</sup>
$ed_t$	0.94(1.04)	
$fdi_t$	-0.01(-0.08)	
$k_t$	2.84(2.90) <sup>a</sup>	3.65(4.63) <sup>a</sup>
$gne_t$	-5.58(-1.48) <sup>a</sup>	-9.48(-3.35) <sup>a</sup>
$rem_t$	1.34(2.94) <sup>a</sup>	1.28(5.54) <sup>a</sup>
$fd_t$	-0.52(-0.58) <sup>a</sup>	-1.70(-2.41) <sup>a</sup>
$m_{2t}$	2.40(1.34)	
$q_t$	0.47(1.80)	
$to_t$	-0.51(-0.39)	
<i>Diagnostic Tests</i>		
F- statistic LM Test	2.76(0.11)	0.47(0.62)
F- statistic ARCH	1.73(0.19)	0.57(0.45)
F- statistic White Test	1.76(0.15)	0.96(0.51)
Jarque-Bera Test	1.10(0.57)	0.13(0.93)
R <sup>2</sup>	0.89	0.73
$\bar{R}^2$	0.68	0.57

Note: *a* and *b* shows significance of estimated parameters at five and ten per cent significance level respectively. Calculated t values are given in parentheses.

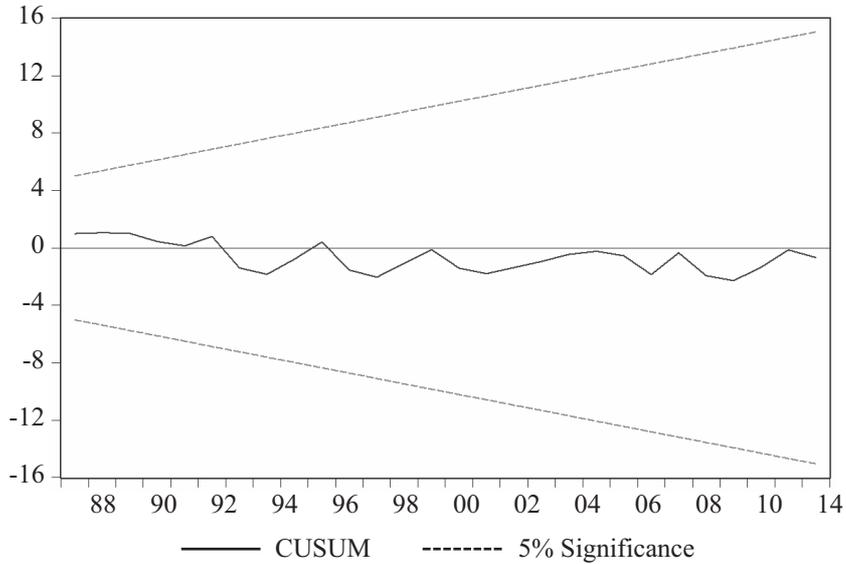
Source: Authors' Calculation.

**TABLE A-4**  
Error Correction Model

Variables	Model 1	Model 2
$\Delta cpi_t$	-0.65(-4.08) <sup>a</sup>	-0.50(-2.87) <sup>a</sup>
$\Delta cpi_{t-1}$	-0.82(-3.25)	
$\Delta ed_t$	-2.45(-3.25) <sup>a</sup>	
$\Delta fdi_t$	0.27(2.65) <sup>a</sup>	
$\Delta fdi_{t-1}$	0.28(-2.39) <sup>a</sup>	
$\Delta k_t$	4.38(5.14) <sup>a</sup>	4.87(4.14) <sup>a</sup>
$\Delta gne_t$	-10.18(-3.36) <sup>a</sup>	-6.40(-2.09) <sup>a</sup>
$\Delta rem_t$	0.55(2.48) <sup>a</sup>	0.31(1.16)
$\Delta rem_{t-1}$	-1.28(-4.65) <sup>a</sup>	-0.59(-2.19) <sup>a</sup>
$\Delta fd_t$	-0.80(-0.96)	-0.32(-0.33)
$\Delta fd_{t-1}$		1.72(1.89) <sup>b</sup>
$\Delta to_t$	0.24(-0.30)	
$\Delta to_{t-1}$	-1.78(-2.66) <sup>a</sup>	
$\Delta m_{2t}$	-1.98(-1.97)	-2.52(-2.05) <sup>a</sup>
$\Delta m_{2t-1}$	-3.78(-4.05)	-4.36(-3.10) <sup>a</sup>
$\Delta q_t$	-0.08(-0.65)	
$\Delta q_{t-1}$	-0.33(-2.56) <sup>b</sup>	
$\Delta ect_{(t-1)}$	-1.59(-11.20) <sup>b</sup>	-1.35(-8.32) <sup>a</sup>
<b>Diagnostic Tests</b>		
F- statistic LM Test	0.64(0.56)	0.48(0.62)
F- statistic ARCH	2.35(0.13)	2.13(0.15)
F- statistic White Test	0.83(0.66)	1.18(0.34)
Jarque-Bera Test	0.94(0.73)	1.57(0.45)
R <sup>2</sup>	0.94	0.91
$\bar{R}^2$	0.73	0.68

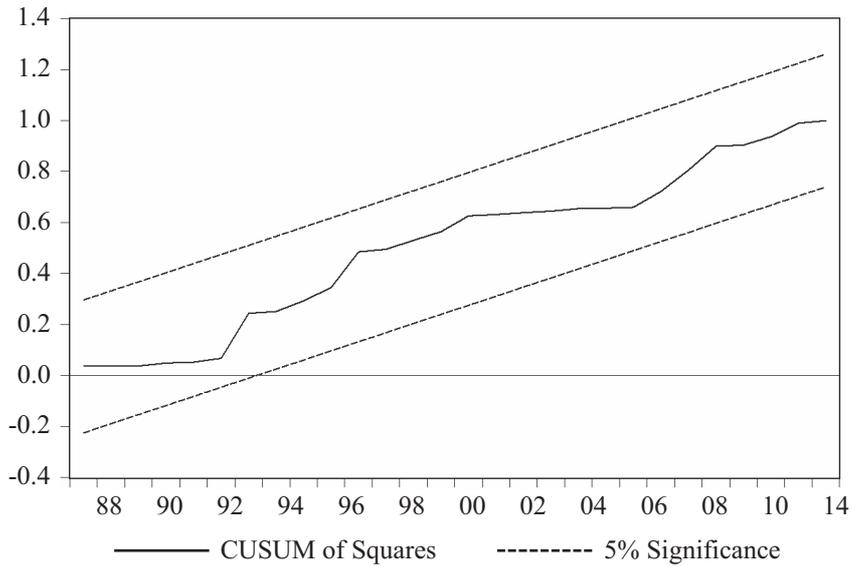
Note: *a* and *b* shows significance of estimated parameters at five and ten per cent significance level respectively. Calculated t values are given in parentheses.

Source: Authors' Calculation.



Source: Authors' Calculation.

**FIGURE A-1**  
Cumulative Sum of Recursive Residuals



Source: Authors' Calculation.

**FIGURE A-2**  
Cumulative Sum of Square of Recursive Residuals