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Investigating Investment, Inflation, Trade-Openness and Economic Progress Nexus for Pakistan

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Abstract

Since inflation and trade openness rate is considered as a critical measure of an economy's health, this article analyzes the relation of Economic growth with Investment, Inflation and Trade Openness of Pakistan for 1970- 2019. The policy guidelines from the analysis include the promotion of policies to increase Investment and Tradeopenness in short and long-terms. The study used ARDL bound-testing for long-term and Un-restricted-Error Correction techniques to discover short-term interrelation amongst a selection of variables. Results of the study revealed inflation negatively related to economic performance and positively linked to Investment and TradeOpenness. Findings of enquiry suggested the government should focus more on investment friendly policies in the country.

Key Words: Foreign Direct Investment, Investment, Gross Domestic Product, Economic Growth, Trade Openness, Inflation, Cointegration, ARDL, Pakistan

Introduction

Economics is a branch of Social Science linked to many aspects of our lives and has important effects on the well-being of all people. Within economics, human well-being is significantly contingent on the process of growth. Growth indicates a positive change in magnitude sustained over-a-period-of-time. e. g. growth in height and weight, population growth etc. From a macroeconomic perspective, growth might be defined as an increase in potential-output over the long run in a country. This increase in potential output is reflected by rising GDP and GDP per capita that reveals the improving living standards of a nation. The closed economy nature of the growth modelling significantly limits its capacity to precisely depict contemporary real-world situations related to growth. Absence of openness may be one of the causes that numerous less developed nations had low levels of output-per-capita, low growth rates, and even the stagnant-standard of living over time.

The key factors that promote growth in any country include Investment, Foreign Direct Investment and Trade openness. Investment is buying of goods not for consumption today. The process of economic growth and investment/ capital formation is interconnected. Both “neo-classical and Marxists emphasized capital accumulation as an engine of growth”. The countries with higher investment/GDP ratio have higher GDP growth (World Bank, 1989).

Inflation is an important part of macroeconomic activity. In closed economies, according to Romer (1989) showed a tendency “to have higher inflation. He argued that central banks in economies that are more open to trade find currency fluctuations caused by money surprises and more frequent shocks necessitating the exercise more restraint than their closed economy counterparts. Several studies have tested Romer’s argument in different ways and have supported the conventional view of the negative association amongst trade openness and inflation”.

High and sustained economic growth is typically seen as necessary for the overall prosperity of a nation. It contributes to uplifting the living standards of a nation. It enhances aggregate demand, provides more funds for public sector development programs, encourages investment in new businesses, and increases international trade. Given the importance attached to economic growth, it is not surprising that there have been and continues to be sustained attempts to develop a

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theoretical understanding. Various empirical studies have investigated Trade openness and growth nexus for different regions or countries. These studies have employed different data sets and methodologies to assess empirical support for this theory. The outcome of these studies remains, however, inconclusive. This study has significance within academic discussions because it assesses the evidence for trade openness and because it pays explicit recognition to the presence of international trade.

Objectives and Hypothesis of the Study

- To identify the influence of Investment, Tradeopenness and Inflation on economic progress
- To suggest suitable policy implications

H_0 : There is no effect of Investment, Tradeopenness and Inflation on economic progress

H_1 : There is the effect of Investment, Tradeopenness and Inflation on economic progress.

The current paper had been divided into 5 sections, namely, "Introduction, Literature Review, Data and methodology, results and finally, conclusion and policy" implication respectively.

Literature Review

There exist extensive literature on the interconnection between Investment; Tradeopenness; and inflation on economic progress in different ways for different countries. Romer's discoveries were critically reinvestigated by Terra (1998) using regression analysis for 20 countries divided into four groups on the basis of indebtedness. "Negative but significant link among inflation and openness was reported for severely indebted countries in Latin America".

Using three-monthly data from 1984-85 to 2004-05, Joshi and Acharya (2010) explored that increased openness creates favorable atmosphere for inflation reduction. Additionally, trade openness has contributed significantly to dis-inflation process; the decline in the world inflation rate has also been a significant environmental factor for this decline. The study also found that relationship had grown stronger, in terms of a structural break, since 1989, when the trade liberalization started showing macroeconomic effects.

Romer's hypothesis testing had been investigated using Pakistan data in a study by [Mukhtar \(2010\)](#). The study found that international-trade in case of trade-liberalization leads to declining prices. Using multivariate cointegrating and "Vector-Error-Correction-Model on data from 1960-2007" the reported presence of a long-term negative association amongst inflation and Tradeopenness, confirming the validity of Romer's hypothesis for Pakistan.

The influence of Tradeopenness on economic progress for Cote d'Ivoire had been investigated by [Keho \(2017\)](#). "He used Autoregressive-Distributed-Lag-bounds test to cointegration and the Toda and Yamamoto Granger causality tests" on data sample 1965-2014. The "results indicated that trade-openness had positive effects on economic growth both in the short and long-run conducive in stimulating economic growth. Another research study using Regression analysis and Johansen's Co-integration tests" are used to trace the long-run relationship of GDP and variables, including trade-openness. According to a study, there happen to be a long term positive association among GDP and selected variables ([Ramzan et al., 2013](#)).

Existing literature recognizes the importance of international trade in achieving convergence across economies (see, e.g. [Leamer, 1988](#); [Neusser, 1991](#); [Sachs and Warner, 1995](#); [Piazolo, 1995](#); [Harrison, 1996](#); [Slaughter, 1997](#); [Iqbal and Zahid, 1998](#); [Anoruo and Ahmad, 1999](#); Ben-David and Kimhi, 2000; [Giles, 2001](#); [Kemal et al, 2002](#); [Din et al, 2003](#); [Yanikkaya, 2003](#); [Ghose, 2004](#); [Dawson and Sen, 2007](#) and [Squalli and Wilson, 2011](#)). These studies conclude that openness enhances convergence. However, [Giles \(2001\)](#), employing 1950-1992 data for New Zealand with her trading partners Japan, United-Kingdom and United. States. of America; finds limited evidence of convergence. However, Lee (1993) has reported a negative association between trade and growth for a set of nations. The existing literature, however, mainly examines the role of international trade in attaining per capita output convergence.

Within "neoclassical framework, the sole determinant of long-run growth in output per capita is the rate at which exogenous technology progress takes place. This means that interaction with other countries can have no effect on an economy's long-run rate of growth. However, there may still be some effects of openness on the long-run welfare, and in the transition to the steady-state ([Aghion and Howitt, 1998; pp. 366](#)). Two points are worth mentioning, firstly in an open-economy version neoclassical model; international flows of capital raise the rate of convergence to the steady-state"—theoretically, trade effects growth via capital flows and productivity channels. Trade has been less effective in influencing growth via capital flows among countries as empirical evidence

does not support this theory. A very important channel through which trade has affected the growth in productivity since exposure to global competition motivates efficiency in production. Trade increases the growth, which implies more income, more consumption and more savings; thus, changes in the steady-state. If trade openness can affect growth in income, consumption and investment, then it can potentially influence economic growth. This theoretical link establishes the grounds for empirical analysis (Aghion and Howitt, 1998; pp. 365). The trade openness and economic growth nexus in existing literature find trade openness as an engine of economic growth (see Khan, 2006). Openness enhances productivity; firstly, “specialization and competitiveness”. Secondly, making way for economies of scale and lastly, it makes available more efficient techniques of production to compete in the world. This provides another important theoretical basis for the endogeneity of technological progress which is not possible in case of a closed economy Solow model (Aghion and Howitt, 1998; pp.366; Din *et al.*, (2003); and Squali and Wilson (2011).

Besides these, there exist studies that have explored partially the aspects of the nexus considered in the present study. Some have emphasized the role of factors like Globalization, environmental and unemployment, banking sector developments, foreign and private domestic investment while others have discussed inclusiveness of growth (Olowe and Oluwafolakemi, 2014; Daly *et al.*, 2017; Rauf *et al.*, 2017; Khan and Daly, 2018; Anwar *et al.*, 2019; Khan *et al.*, 2019). This paper uses the latest time-series data available and adopts proper remedial measures for model specification and to take into account the presence of structural breaks.

Methodology and Data

We use secondary data to obtain the study of international finance statics & Government finance statistic year book published by world development indicators. Annual time-series data from 1970 - 2019 have been used.

A simple model was used to examine the effects of Investment, Tradeopenness and inflation on the economic growth of Pakistan. Functional-form of our theoretical model is;

$$(\text{Gross Domestic Product}) = f(\text{investment, trade openness, inflation}) \quad (1)$$

Definition of Variables

Investment (GFCF) annual%

Investment is the purchase of goods meant for the future to create wealth.

Inflation-GDP deflator (annual %)

GDP deflator has proxied inflation, “a measure of the level of prices of all-new, domestically produced, final goods and services” in a country.

Trade (% of GDP)

“Trade is the sum of exports and imports of goods and services; measured as a share of gross domestic product”.

GDP growth (annual %)

It is measured as the “Annual percentage growth rate of GDP at market prices based on constant local currency. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources”.

The econometric model for study including variables of the study can be written as follows;

$$Y_t = \beta_0 + \beta_1 Inv_t + \beta_2 TrOP_t + \beta_3 Inf_t + \varepsilon_t \quad (2)$$

Where

Y_t = Gross Domestic Product

Inv_t = investment

$TrOP_t$ = Trade Openness

Inf_t = Inflation

$\beta_0, \beta_1, \beta_2$ and β_3 are coefficients

Estimation Results

During “last three decades, methods of estimation of economic relationships and modelling fluctuations in economic activity have been subjected to fundamental changes. The method of

estimation of the standard regression model, Ordinary Least Square (OLS) method, is based on the assumption that the means and variances of these variables being tested are constant over time. Variables whose means and variances change over time are known as non-stationary and are called unit root variables" if their first differences are stationary. The Ordinary Least Squares (OLS) method may give misleading inferences incorporating non-stationary variables in estimating regression equations. If variables are non-stationary, estimation of any relationship between their levels should be based on the cointegration approach. The existence of unit roots in series is a pre-condition to the existence of a cointegration relationship. Originally, [Dickey-Fuller \(1979\)](#) and Augmented [Dickey-Fuller \(1979\)](#) test were widely used to test for unit-roots.

The analysis involves the following three steps.

- Augmented Dickey-Fuller (ADF) Test
- Lag length selection
- Cointegration test

Diagnostic Tests

To "check the constancy of long-run coefficients, Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) plots are employed as suggested by Brown *et al.*, (1975). The study reported diagnostic tests for serial correlation, functional form and heteroscedasticity tests. The study utilizes Lagrange-Multiplier (LM) test for serial-correlation. The null hypothesis of LM test is that there is no serial correlation and also LM test statistic is asymptotically distributed as chi-square. LM test is a better choice when there is a correct identification of variables. This test is developed by Breusch-Pagan and has the advantage that it is sensitive to the normality assumption. While the white test is used for analyzing heteroscedasticity. Jarque-Bera test is utilized to test the normality of the model, where the skewness and kurtosis of OLS residuals are computed, and it is a test of joint hypothesis where the null hypothesis is that the residuals are normally distributed, and alternate hypothesis is vice versa. Moreover, for analyzing the functional form of the model, Ramsay's RESET test is" applied.

The "second step tests the presence of long-run relationships between the variables through ARDL technique. The third step is to carry out ARDL bound tests. The ARDL approach to cointegration developed by Pesaran *et al.*, (2001) is used to depict the long-run relationship among the variables.

The ARDL bounds testing approach to cointegration is based on the following error-correction" model:

$$\Delta Y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 INV_{t-1} + \alpha_3 TrOp_{t-1} + \alpha_4 Inf_{t-1} + \sum_{i=1}^m \gamma_{1i} \Delta Y_{t-i} + \sum_{i=0}^n \gamma_{2i} Inv_{t-i} + \sum_{i=0}^n \gamma_{3i} Trop_{t-i} + \sum_{i=0}^n \gamma_{4i} Inf_{t-i} + e_t \quad (9)$$

Where " Δ " is the difference operator. Equation (9) is estimated using each variable as the dependent variable. The presence of a long-run relationship is tested by restricting coefficients of lagged level variables equal to zero. That is, the null hypothesis of no long-run relationship is $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$. This hypothesis is tested through an F-test. The asymptotic critical values are provided by Pesaran *et al.*, (2001) for large sample sizes. However, these critical values may not be appropriate for our case, which has 50 observations".

This section presents the empirical analysis in detail. The data is analyzed through the "Augmented Dickey-Fuller (ADF) test". The study then proceeds with the interpretation of results estimated through Bound test for cointegration.

Table1. "Augmented Dickey-Fuller (ADF) Test Result"

"Variable"	Level		1 st Difference	
	Intercept	Trend & intercept	Intercept	Trend & Intercept
GDP _t	0.0647	-1.2534	-5.60**	
INF _t	-2.0325	-2.4740	-5.09**	
GFCF _t	-2.2136	-2.1696	-5.99**	
TrOP _t	-3.3741	-1.0540**		

Note: "**" shows significance at 5% level."

Table 1 present the results of ADF-test for all variables. It is found that trade openness is stationary at the level and therefore, integrated of order-zero or 1(0). All other variables are non-stationary at the level. According to the Box-Jenkins (1975) methodology, the other variables can be made stationary by taking the difference. By following this approach, all other variables became

stationary at the first difference by including intercept and then intercept and trend and therefore are integrated of order one or 1 (1).

Lag Length Selection Criteria

As the variables have mixed-order of integration, the most appropriate process to find out short and long terms association amongst variables is ARDL technique. The initial phase in the ARDL approach is the selection of suitable lag length. Table 2 shows the different measure for optimum lag selection criterion.

Table 2. “Selection of lag length.”

“LAG	LR	FPE	AIC	SC	HQ
0	NA	7.325049	19.01850	19.2183	19.11010
1	551.9324	2.47e-06	4.093277	5.866600*	4.734454
2	74.52492*	1.07e-06*	3.133095*	6.426410*	4.23853**

“Note: * indicates selection of lag length by each criterion.”

In the above table, SC suggested only one lag while AIC, FRE and HQ suggested two lags. The AIC selected 2 lags for estimation because the sample size is small.

Co-Integration

After selection of lag-length; the next step was to find the long-run relationship among variables through ARDL bound testing using Wald-test (F-test) coefficients restriction test. The “null hypothesis for Wald test (F-test) is there is no long-run relationship, and the alternative hypothesis is there is a long relationship. The computed F-test value is contrasted with the upper and lower bound critical values that are calculated by Pesaran *et al.*, (2001)”.

Table 3. “ARDL Bound test Approach for Co Integration.”

“Computed F- statistic	20.9108	
Critical bound	Lower bound	Upper bound
Critical bound’s value at 1 percent	2.75	3.79
Critical bound’s value at 5 percent	3.12	4.25”

“Note: results based on sample 1970-2019.”

The table-3 presents “results of the bound test. The result shows that the estimated value of F-test is greater than the upper limit value at 5% level of significance, which suggests that there exist long-run-co-integration. When there is a long-run relationship among variables, the next step is to evaluate the long-run coefficients. Along with the long-run coefficients”, ECM is applied to examine the short-run coefficient. The results showed that the majority of the variables had anticipated the significant relationship with the dependent variable, as shown in table 4.

Table 4. “Dependent variable is GDP (Gross Domestic Product)

“Variable	Long Run Coefficients	Short Runs Coefficients
GDP _t	1.1917**	0.89120**
INF _t	-2.6835*	6.4167
GFCF _t	-0.1307**	0.8012**
TO _t	0.00186	0.00125
R ²	0.66	0.65
DW-Statistic	2.0167	2.0101
ECM		-0.672**”

“Note: *, **, *** significance at the 1%, 5% and 10% level respectively and values in Parentheses are probabilities”.

Table 4 presents the evaluated consequences of the empirical model. The results of the study found Gross Domestic Product is negatively and significantly related to the INF both in short and long terms at 5% level. On average, 1% increase in GDP results in 1.19% decrease in the INF in short and long run and 0.81% decrease in the short run. The results indicate that an increase in GDP will definitely lead to the improvement of the welfare of the people.

The GFCF_t, substitute measure for investment in significant and positively related to GDP both in terms at 5% level of significance. 1% increase in gross fixed capital formation leads to 0.80% rise in GDP rate in short-run and 0.13% rise in the long run. Investment has always been an increased

GDP rate in Pakistan. Investment in new projects creates job opportunities among the people that lead to increased GDP in Pakistan. The results show that "Tradeopenness statistically insignificant with the GDP both in short and long terms.

Estimated "value of Error Correction Term, the rate of alteration back to the long-run balance enters in the model with the negative sign and is statistically significant at 5% level that shows convergence towards a long run at the rate of" 67%.

Diagnostic Test

The ARDL model also assessed diagnostic tests to check the "Goodness-of-fit of empirical model" given table 4.5 below:

Table 5. Diagnostic Tests

"A: Serial Correlation	0.0083 (0.929)
B: Functional Form	0.0574 (0.811)
C: Normality	1.7326 (0.420)
D: Heteroscedasticity	3.019 (0.082)"

A: "Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values of

C: Based on a test pf skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values".

The estimation of LM test illustrates no issue of serial correlation at the selected lag length of 2. The estimation of normality shows the model is normally distributed. The estimation of the White test and Ramsay Reset demonstrated no "problem of heteroscedasticity" and misspecification in the model.

After obtaining the estimated results of VAR, the study utilizes the inverse "root of characteristics AR polynomial for the stability of model". AR root graph is shown in Figure 1 which indicates that "inverse roots of AR characteristic polynomial are all inside the unit circle, which means that VAR model is stationary as all roots lie inside the unit circle". This is important in the sense that if the VAR is not stationary than the impulse response is not valid.

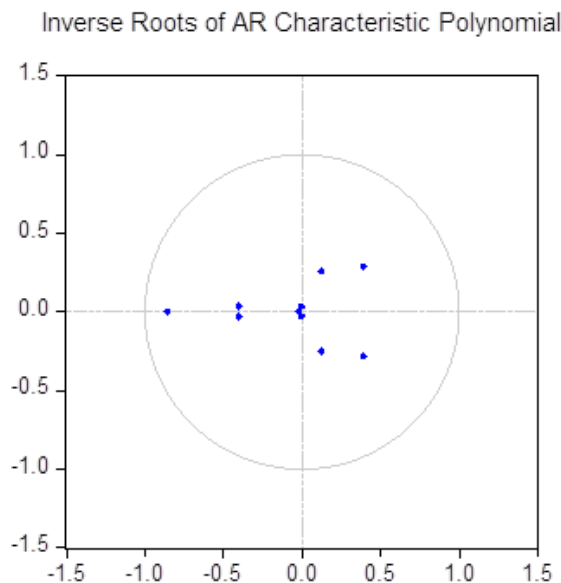


Figure 1: Inverse Roots of AR Characteristic polynomial

Residuals Diagnostic Test

As “mentioned above, because of the nature of time series data, CUSUM and CUSUM (Q) test for the presence of any possible structural breaks has been used. This is shown by the plot in the following figure 2 and 3.

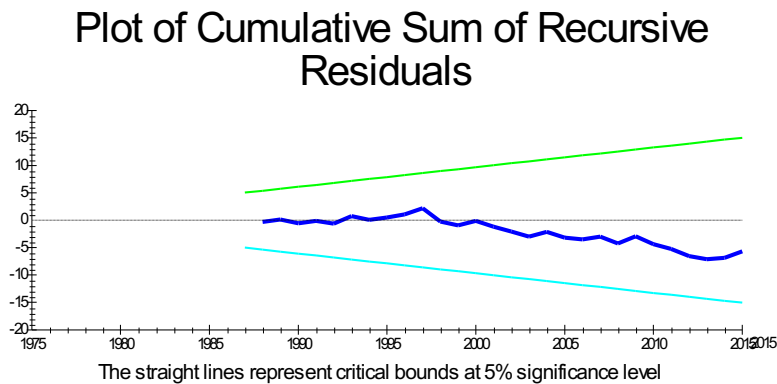


Figure 2:Residuals Plot of Cumulative Sum of Recursive

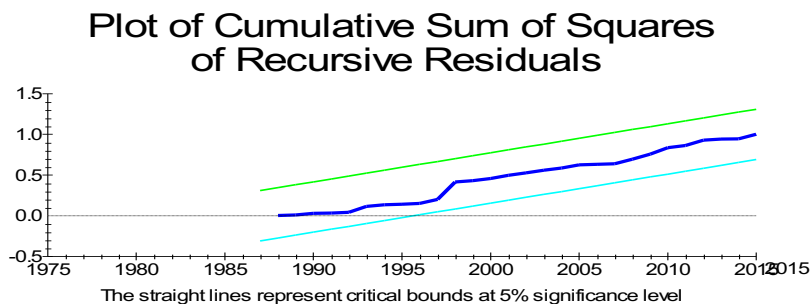


Figure 3: Plot of Cumulative Sum of Squares of Recursive residuals.”

Conclusion and Policy Implications

The ambition of the present contribution was to explore the influence of Investment, Tradeopenness and Inflation on economic growth. To check this relationship, Pesaran and Shin (2001) ARDL technique has been used to inquire about the existence of a long term interrelation amongst GDP, Investment, Tradeopenness and inflation. Using Time series data from 1970-2019, results showed a positive and significant relation amongst Investment, Tradeopenness and GDP and negative relationship among inflation and trade openness.

The important implications include, amongst others that government should focus on promoting Investment and Tradeopenness while step should be taken to curb the inflation rate.

Future study may focus on reinvestigation of nexus considered here, including more macroeconomic variables and taking into account any possibility of structural breaks.

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