The Role of Exports, Inflation and Investment on Economic Growth in Pakistan (1980-2009)

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Abstract: This study investigates the relationship between exports, inflation, investment and economic growth for Pakistan. A long-run relationship between the variables has been found by applying Johansen's Co-integration Technique after finding the series I(1). The Error Correction Model (ECM) has been applied to streamline the short-run and long run impacts of the variables on economic growth. In general, the results revealed that exports and investment both have a significant positive impact on economic growth. However, inflation has a significant negative impact on economic growth in the short-run. In the long-run, if there is one percent increase in the total investment, economic growth increases by almost 0.179 percent, while inflation has a negative impact on economic growth by almost 0.032 percent. This analysis demonstrates that, in the long-run, exports led growth hypothesis does not hold in Pakistan, as exports are reported as insignificant factor to advance economic growth. The ECM results indicate the convergence of the model and it's implying that about 68% adjustments takes place every year. This analysis will held decision makers in developing strategies and policies to accelerate economic growth, exports and investment.

Keywords: Exports, Inflation, Investment, Economic growth, Cointegration, Pakistan
JEL Classification: C32, D92

1. Introduction

Economic development is the dream of every society in the world and economic growth is fundamental to economic development. There are many factors to contribute economic growth. Exports, investments and inflation are considered as one of the important factors among them. Economists particularly, have long reason to wonder whether inflation is generally conducive or detrimental to the economic growth. There are still substantial disagreement among the empirical researchers about how quantitatively important are the growth depressing effects of inflation and at what levels of inflation these effects begin to appear.

Some economists have been concerned by rates of inflation of three or four percent while others have been unconcerned by rates of twenty or thirty percent. Taking for instance, Mallik and Chowdhury (2001) shows that low inflation is positively correlated to economic growth in a particular country. However, Gylfason (1999) indicate that an increase in inflation from 5 to 50 percent a year from one country to another reduces the growth of GDP. In addition, Hodge (2006) found that inflation drags down growth in South Africa over the longer period of time. Lim (2004) on the other hand, highlight the need for inflation management in order to attain short run stabilization as well as long-term inflation goals for the South East Asian Central Banks (SEACEN) countries.

Various other studies have been conducted in order to materialize their impact. Some of the significant studies are referred below i.e., Kravis (1970), Michaely (1977) and Bhagwati (1978) used the Spearman's rank correlations test in order to explore the relationship between exports and economic growth. Whereas Balassa (1978, 1985), Tyler (1981), Kavoussi (1984), Ram (1987), Heitger (1987), Fosu (1990) and Lussier (1993) studied exports and economic growth relationship by using ordinary least squares (OLS) on cross sectional data. Erfani (1999) examined the causal relationship between economic performance and exports over the period of 1965 to 1995 for several developing countries in Asia and Latin America. The result showed the significant positive relationship between export and economic growth. This study also provides the evidence about the hypothesis that exports lead to higher output. Subasat (2002) searched the empirical linkages between exports and economic growth. The analysis suggested the more export oriented countries like middle-income countries grow faster then the relatively less export oriented countries .The study also showed that export promotion does not have any significant impact on economic growth for low and high income countries.

Other studies i.e., Vohra (2001) showed the relationship between the export and growth

in India, Pakistan, Philippines, Malaysia, and Thailand for 1973 to 1993. The empirical results reveal that exports have a positive and significant impact on economic growth. This study also showed the importance of liberal market policies by pursuing export expansion strategies and by attracting foreign investments. Shirazi (2004) studied the short run and long run relationship among real export, real import and economic growth on the basis of Co-integration and Multivariate Granger causality for the period 1960 to 2003.This study showed a long-run relationship among import, export and economic growth and found unidirectional causality from export to output while did not find any significant causality between import and export. Rana (1985) estimates an export-augmented production function for 14 Asian developing countries including Bangladesh. The evidence supports that exports contribute positively to economic growth. Ahmed et al. (2000) investigate the relationship between exports, economic growth and foreign debt for Bangladesh, India, Pakistan and Sri Lanka by using a trivariate causality framework. The study rejects the export-led growth hypothesis for all the countries (except for Bangladesh) included in the sample. Kemal et al. (2002) investigate export-led hypothesis for five South Asian Countries including Pakistan, India, Bangladesh, Srilanka and Nepal. The study finds a strong support for long-run causality from export to GDP for Pakistan and India, and bi-directional causality is found for Bangladesh, Nepal and Sri Lanka. The study also finds short-run causality from exports to GDP for Bangladesh and Sri Lanka, and reverses short-run causation from GDP to exports for India and Nepal.

There is considerable evidence that investment is one of the most important determinants of long-term growth (Barro 1991; Levine and Renelt 1992). It has often been suggested that a stable macroeconomic environment promotes growth by providing a more conducive environment for private investment. This issue has been directly addressed in the growth literature in the work by Fischer (1991, 1993); Easterly and Rebelo (1993); Frenkel and Khan (1990); and Bleaney (1996). Hasan (1990) finds a positive relationship between inflation and economic growth for the period 1972 to 1981 in the context of Pakistan. Khan and Saqib (1993) use a simultaneous equation model and find a strong relationship between export performance and economic growth in Pakistan. Mutairi (1993) finds no support for the period 1959-91, while Khan et al. (1995) find strong evidence of bi-directional causality between export growth and economic growth for Pakistan. Malik and Tashfeen (2007) studied the short run and long run relationship among real export, real import and economic growth on the basis of co-integration and multivariate Granger causality.

The above discussion confirms strong linkages between economic growth, investment, exports and inflation. The objective of this paper is to examine the role of exports, inflation and total investment on economic growth of Pakistan by using time series data from 1980-2009. The more specific objectives are:

i. To estimate whether there is a long-run relationship between economic growth, exports, inflation and investment in Pakistan.
ii. To estimate the long-run and short-run effects of exports, inflation and investment on economic growth in Pakistan.

Co-integration technique is used for analysis. In this study a sophisticated econometric technique with additional tests of forecasting framework is used to examine the effect of changes in inflation on unemployment rate over a 10 years period.

This paper is organized in five sections. Section 2 provides data source and methodological framework. The empirical results are presented in Section 3, while the final section concludes the study.

2. Data Source and Methodological Framework

The data were taken from the IFS (International Financial Statistics), the WDI (World Development Indicators) and the Economic Survey of Pakistan (2010-2011) for the period 1980-2009. All variables are in natural logarithm form. In this research, the Johansen's co-integration technique is employed to find a long-run relationship between the variables. The following model is estimated:

$$DLn(GDP) = \alpha_O DLn(X) + \alpha_1 DLn(INV) + \alpha_2 DLn(CPI) + \alpha_3 Ln(GDP(-1)) + \alpha_4 Ln(X(-1)) + \alpha_5 Ln(INV(-1)) + \alpha_6 Ln(CPI(-1)) + \varepsilon ...(1)$$

Where;

Ln	= Natural Logarithm
GDP	= Gross Domestic Product (%)
X	= Exports (%)
INV	= Total Investment (%)
CPI	= Consumer Price Index (%)
ε	= Error Term
D	= First Difference

The following steps will be taken to investigate the impact of the independent variables on the GDP. In testing time-series properties and co-integration evidence, the preliminary step in analysis is to establish the degree of integration of each variable. The steps to find if the levels of differences of a series are stationary lead to substantially different conclusions. Hence, tests of non-stationarity (that is, unit roots) are the usual practice today. Engle-Granger (1987) define a non-stationary time series to an integrated of order 'd' if it becomes stationary after being differentiated 'd' time. This notion is normally denoted by I(d).

The test for co-integration consists of two steps: first, the individual series are tested for a common order of integration. If the series are integrated and are of the same order, it implies co-integration. The Augmented Dickey Fuller (ADF) test is used to test the stationarity of the series. The ADF test is a standard unit root test: it analyzes the order of integration of the data series. These statistics are calculated with a constant, and a constant plus time trend, and these tests have a null hypothesis of non-stationarity against an alternative of stationarity. The ADF test to check the stationarity series is based on the following equation:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha_i \sum_{t=1}^{m} \Delta y_{t-1} + \varepsilon_t ...(2)$$

where ε_t is a pure white noise error term and

$\Delta y_{t-1} = (y_{t-1} - y_{t-2})$,

$\Delta y_{t-2} = (y_{t-2} - y_{t-3})$, etc.

It is an empirical fact that many macroeconomic variables appear to be integrated of order'd' [or I(d) in the terminology of Engle and Granger (1987)] so that their changes are stationary. Hence, if GDP, X, INV and CPI are each I(d), then it may be true that any linear combination of these variables will also be I(d). When it is established that all of these variables are I(d), this study then proceeds to determine the order of integration of the series for the analysis of the long-run relationships between the dependent variables. To examine the long-run relationship among the variables, they must be co-integrated. Two or more variables are said to be co-integrated if their linear combination is integrated to any order less than 'd'. The co-integration test provides the basis for tracing the long-run relationship. Two tests for co-integration have been given in the literature review (Engle and Granger 1987; Johansen and Juselius 1990).

In the multivariate case, if the I(1) variables are linked by more than one co-integrating vector, the Engle-Granger procedure is not applicable. The test for co-integration used here is the likelihood ratio put forward by Johansen and Juselius (1990), indicating that the maximum likelihood method is more appropriate in a multivariate system. Therefore, this method is used in this study to identify the number of co-integrated vectors in the model. The Johansen and Juselius method has been developed in part by the literature available in the field and reduced rank regression, and the co-integrating vector 'r' is defined by Johansen as the maximum Eigen-value and trace test. There is 'r' or more co-integrating vectors. Johansen and Juselius (1990) and Johansen (1991) propose that the multivariate co-integration methodology can be defined as:

$$Ln(GDP_t) = Ln(X, INV, CPI) ...(3)$$

which is a vector of $P = 3$ elements. Considering the following autoregressive representation:

$$GDP_t = \pi_\circ + \sum_{T=1}^{K} \pi_i GDP_{t-1} + \mu_t$$

Johansen's method involves the estimation of the above equation by the maximum likelihood technique, and the testing of the hypothesis H_o; $(\pi = \Psi\xi)$ of 'r' co-integrating relationships, where 'r' is the rank or the matrix $\pi(0 \angle r \angle P), \Psi$ is the matrix of weights with which the variable enters co-integrating relationships and ξ is the matrix of co-integrating vectors. The null hypothesis of non-cointegration among variables is rejected when the estimated likelihood test statistic $\phi_i \{= -n \sum_{t=r+1}^{p} \ln(1 - \hat{\lambda}_i\}$ exceeds its critical value. Given estimates of the Eigen-value $(\hat{\lambda}_i)$ the Eigen-vector (ξ_i) and the weights (Ψ_i), we can find out whether or not the variables in the vector (GDP_t) are co-integrated in one or more long-run relationships among the dependent variables.

If the time series are I(1), then one could run regressions in their first differences. However, when we take first differences, we lose the long-run relationship that is stored in the data. This implies that one needs to use variables in levels as well. The advantage of the Error Correction Model (ECM) is that it incorporates variables both in their levels and first differences. In doing this, ECM captures the short-run disequilibrium situations as well as the long run equilibrium adjustments between the variables. An ECM term having a negative (-) sign and a value between 0 and 1 indicates a convergence of the model towards a long-run equilibrium and shows how much percentage adjustment takes place every year.

3. Empirical Analysis

Since the present study is an attempt to identify the links between the economic growth and their independent variables of Pakistan, we estimate whether a statistically significant relationship exists between economic growth and their explanatory variables both in the long run as well as in the short run. The preliminary step in this analysis is to establish the degree of integration of each variable. To get reliable results for equation 1, the implicit assumption is that the variables in equation 1 are I(1) and co-integrated. We test for the existence of a unit root in the level and the first difference of each variable in our sample using the Augmented Dickey Fuller (ADF) test. The ADF test statistics check the stationarity of series. The results in Table 1 reveal that all other variables are non-stationary in their level data. However, stationarity is found in the first differencing level of the variables: GDP, CPI, X, and INV.

Table 1: ADF - Unit Root Estimation

	L		1st Difference	
Variables	**Constant**	**Constant and Trend**	**Constant**	**Constant and Trend**
GDP	-1.921 (0)	-1.486 (0)	-4.241*(0)	-4.134*(0)
CPI	-2.071 (0)	-1.917 (0)	-6.211*(0)	-6.503*(0)
X	-1.882 (0)	-1.146 (0)	-5.194*(0)	-5.316*(0)
INV	4.539 (0)	1.446 (0)	-2.380 (0)	-3.661** (0)

Key: GDP = Gross Domestic Product, CPI = Consumer Price Index; X = Exports and INV = Investment

Note: The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis is based on MacKinnon critical values. The lag length are selected based on SIC criteria. *, ** and *** indicate the rejection of the null hypothesis of non-stationary at 1%, 5% and 10% significant level, respectively.

Next we examine the relationship between the GDP and their independent variables using the Multivariate Co-integration Methodology proposed by Johansen & Juselius (1990) and Joahnsen (1991). The following co-integrating vectors have been determined using the above test.

Table 2: Cointegration Test Results (Model 2)

HO	H1	TEST STATISTIC	0.05 CRITICAL VALUES
λ trace		Λ TRACE	
r=0*	r>0	67.54161	53.12
r≤1	r>1	34.14658	34.91
r≤2	r>2	17.79155	19.96
r≤3	r>3	7.596948	9.24

This study starts with the null hypothesis of no co-integration *(r=0)* among the variables. It is found that the trace statistic of 67.54 exceeds the 95 per cent critical value (53.12) of the λ trace statistic. It is possible to reject the null hypothesis *(r=0)* of no co-integration vector in favor of the general alternative $r > 0$. The null hypotheses of $r > 1, r > 2, r > 3$ cannot be rejected at 5 per cent level of confidence. Consequently, we conclude that there is 1 co-integration relationships involving the variables GDP, X, INV and CPI. Now we take model 3 to check the cointegration vector.

Table 3: Cointegration Test Results (Model 3)

HO	H 1	TEST STATISTIC	0.05 CRITICAL VALUES
λ trace		Λ TRACE	
r=0*	r> 0	65.5382	47.21
r≤1*	r> 1	32.15516	29.68
r≤2*	r> 2	15.96405	15.41
r≤3*	r> 3	6.083624	3.76

In Table 3, we starts with the null hypothesis of no co-integration *(r=0)* among the variables. It is found that the trace statistic of 65.54 exceeds the 95 per cent critical value (47.21) of the λ trace statistic. It is possible to reject the null hypothesis *(r=0)* of no co-integration vector in favor of the general alternative $r > 0$. The null hypotheses of $r > 1, r > 2, r > 3$ are also rejected at 5 per cent level of significance. Consequently, we conclude that there are 4 co-integration relationships involving the variables GDP, X, INV and CPI. Similarly, we bring model 4 for further investigation for cointegration vector.

Table 4: Cointegration Test Results (Model 4)

HO	H1	TEST STATISTIC	0.05 CRITICAL VALUES
λ trace		Λ TRACE	
r=0*	r>0	66.34501	62.99
r≤1	r>1	32.3509	42.44
r≤2	r>2	16.1579	25.32
r≤3	r>3	6.091184	12.25

Table 4 indicates that there is only one cointegrating vector as the trace statistic of 66.35 exceeds the 95 per cent critical value (62.99) of the λ trace statistic. It is possible to reject the null hypothesis *(r=0)* of no co-integration vector in favor of the general alternative $r > 0$. The null hypotheses of $r > 1, r > 2, r > 3$ cannot be rejected at 5 per cent level of confidence. Consequently, we conclude that there is an only 1 co-integration relationship involving the variables GDP, X, INV and CPI. In the next step, we combined the trace statistics for all three models together in order to choose which model is appropriate. The results are shown in Table 5.

Table 5: The Pantula Principle Test

r	n-r	model 2	model 3	model 4
0	4	67.54161**	65.5382**	66.34501*
1	3	34.14658	32.15516*	32.3509
2	2	17.79155	15.96405*	16.1579
3	1	7.596948	6.083624*	6.091184

From the above results it is shown that model 3 is appropriate because there are greater numbers of cointegrating vectors as compared to other models results. In order to check the stability of the long-run relationship between the GDP and the independent variables, we assess the Error Correction Model.

Table 6 a): Empirical Results of the Error Correction Model

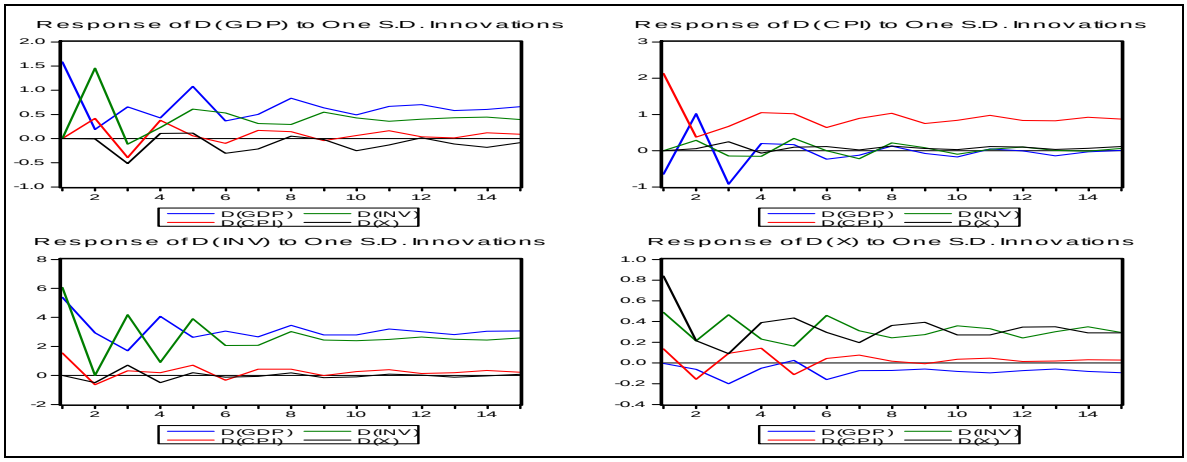
Dependent Variable: D (GDP)

Variables	Short run elasticities (p-value)
C	9.051 (0.1091)
D(X)	0.511* (0.0480)
D(INV)	0.033* (0.0251)
D(CPI)	-0.147* (0.0239)

(*) shows significant probability values at 5 % level of C.I

By looking at short run elasticities it is shown that if there is one percent increase in exports and total investment, economic growth increases by almost 0.511 and 0.033 percent respectively. However, inflation has a significant and negative impact on economic growth in the short-run. This

Figure 1: Impulse Response of GDP to One-standard Deviation Shocks in exports, investment and inflation



result validates the hypothesis of "export led growth" in Pakistan. In the long-run, total investment increases economic growth by almost 0.179 percent while, inflation reduces economic growth by almost 0.032 percent. However, "exports led growth hypothesis" are invalid in the long-run (see Table 6, b).

Table 6 (b): Long Run Elasticities

Variable	Long run elasticities (p-values)
GDP(-1)	-1.034* (0.0552)
X(-1)	0.392 (0.2826)
INV(-1)	0.179* (0.0223)
CPI(-1)	-0.032* (0.0221)

(*) shows significant probability values at 5%level of C.I

The ECM results indicated that the ECM term has a negative sign and its value lies between 0 and 1, hence showing the convergence of the model and implying that about 68% adjustment takes place every year.

Table 6 (c): Error Correction Term

ECM	-0.68
R-squared	0.8171
Adjusted R-squared	0.6545
Durbin-Watson stat	1.9777
F-statistic	5.0254
Prob.(F-statistic)	0.0132

The empirical results, given in Table 6 (c), appear to be very good in terms of the usual diagnostic statistics. The value of R^2 adjusted indicates that 65.45% variation in dependent variable has been explained by variations in independent variables. F value is higher than its critical value suggesting a good overall significance of the estimated model. Therefore, fitness of the model is acceptable empirically. The Durbin Watson Test is almost equal to 2, therefore, there has no such problem of serial correlation in the model. Detecting Granger causality is restricted to within sample tests which are useful in describing the plausible Granger exogenity or endogenity of the dependent variable in the sample period but are unable to deduce the degree of exogenity of the variables beyond the sample period. To examine this issue, we consider the generalized impulse response functions. Figure 1 presents the impulse response functions. The figures plot the response of the GDP to shocks in X, INV and CPI.

A shock in the GDP has a positive and increasing effect on total investment while mixed effect has captured from exports and inflation over 15 year period. Similarly, a shock to exports has a positive and increasing effect on GDP, while investment and inflation has detrended results over subsequent years. Total investment has a positive impact on GDP and exports while detrended result has shown in the inflationary variable. Finally, inflation has a positive impact on exports and investment while negative impact on GDP over a 15 year period. These are shown in Table7.

Table 7: Impulse Response Shocks

VARIABLES	SHOCK TO	RESPONSE OF	TIME PERIOD	EFFECT/BEHAVIOR
GDP EXPORTS INFLATION INVESTMENT	GDP	1. EXPORTS	15 YEARS	Mixed effect
		2. INVESTMENT	15 YEARS	Positive and increasing over time
		3. INFLATION	15 YEARS	Mixed effect
GDP EXPORTS INFLATION INVESTMENT	EXPORTS	1. GDP	15 YEARS	Positive and increasing over time
		2. INVESTMENT	15 YEARS	Mixed effect
		3. INFLATION	15 YEARS	Mixed effect
GDP EXPORTS INFLATION INVESTMENT	INVESTMENT	1.EXPORTS	15 YEARS	Positive and increasing over time
		2.GDP	15 YEARS	Positive and increasing over time
		3.INFLATION	15 YEARS	Mixed effect
GDP EXPORTS INFLATION INVESTMENT	INFLATION	1. EXPORTS	15 YEARS	Positive and increasing over time
		2. INVESTMENT	15 YEARS	Positive and increasing over time
		3. GDP	15 YEARS	Negative effect

4. Conclusion

This paper empirically investigates the role of export, investment and inflation on economic growth in Pakistan by using Johansen's Cointegration Technique for 1980-2009 periods. The empirical results reveal that all the variables are integrated at order 1 i.e., I(1) classification. Second, we finds stable cointegrating vector amongst these variables in Pakistan. Third, the normalization of the long run equation indicates that the inflation brings negative impact while exports and investment brings positive impact on Pakistan economy throughout the estimation period. However, in the long-run, exports would be insignificant variable.

As a nation, we should encourage a larger scale of export promotion activities to enhance the economic growth. It will create numerous job opportunities which increase the per-capita earnings and standard of living. We also find that negative impact of inflation in country proven that inflationary state is not favorable to the growth of the nation. In view of this, the government should take necessary steps to reduce inflationary pressure. With the complexity of the global economy, it is clear that the formulation of appropriate policies would not only promote economic growth but the macroeconomic stability, which is the main thrust of the management of an economy.

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