INTERNATIONAL TRADE, INVESTMENT AND ECONOMIC GROWTH: EVIDENCE FROM PAKISTAN

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ABSTRACT: This paper has explored causality relationship between growth rate of GDP (as dependent variable) and growth rates of exports, imports, openness, domestic investment and labour (as explanatory variables) in alternative equations. Traditionally, much of the literature on economic growth has looked at the relationship between economic growth and growth rate of exports among other determinants of growth. Very few studies have tried to estimate the relationship between economic growth and growth rate of imports and/or of openness (i.e. exports plus imports). We developed a model relating the growth rate of GDP to the growth rates of openness (exports plus imports), domestic investment and population. Then we used annual time series data on GDP growth rate, and growth rate of imports, exports, openness, domestic investment and population. The data were first, tested for unit root using Phillips-Perron (1988) test and then the empirical relationship between GDP growth rate and growth rates of other variables was estimated using OLS with AR(1). The main finding of the study is that openness and imports do not matter for economic growth in Pakistan, whereas growth rate of exports, domestic investment and population do affect positively the growth rate of GDP.

1. INTRODUCTION

The paper is focused to explore how openness and the growth of domestic investment contribute to the growth of GDP in Pakistan. There is an ample body of literature, which explored the relationship between exports and economic growth but as per our knowledge there is hardly any study that has looked at the relationship between growth of openness and economic growth (Sinha and Sinha (1996)) . We define openness as the ratio of trade to gross domestic product, (GDP) i.e. exports plus imports divided by GDP. How openness can explain growth of a country? Openness promotes economic growth through two channels: exports and imports. Role of exports in economic growth has been a popular topic among economics researchers. There are three ways in which economic growth can be related to exports. First, although growth of manufacturing is crucial to economic growth, but without exports the surplus output cannot be fully absorbed if domestic demand is very low. Thus exports can provide an outlet for surplus output of manufacturing sector and generate income (Colombatto, 1990). Second, exports help long run growth because it leads to greater technical progress and enhance savings (Krueger, 1978). It also helps in improving credit ratings of a country by generating foreign exchange and thus makes getting foreign loans easier. Third, export promotion policies improve total factor productivity (Balassa, 1978) too.

A large majority of the researchers talk about trade policies but in their discussion they focus exclusively on exports policies only. However, the role of imports remained neglected or appropriate attention has not been paid to this aspect. There is an implicit belief that a faster growth rate of imports is bad but that of exports a good thing for economic growth of a country. Economics literature in

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general, looks to follow the same line: issues of trade are always, necessarily, taken to mean issues of exports. The only studies to our knowledge that explicitly look at imports as growth promoters are limited to Ram (1990), Sinha & Sinha (2001-02), and Rizavi (1996). Ram looks at the relationship between growth rate of imports and growth rate of real GDP in many developing countries using an augmented production function approach. He finds a positive relationship between economic growth and imports in a limited number of countries. Sinha & Sinha (2001-02) look at the relationship between GDP growth rate and growth rate of openness (i.e. volume of trade, exports plus imports) in a number of developing Asian countries[2] . They find significant relationship between GDP growth and growth of openness in case of most of the countries but insignificant in case of others[3]. Rizavi (1996) sees at the relationship between levels of GDP, openness, imports and exports separately using time series data for Pakistan for the period 1972-73 to 1987-88. He finds statistically significant relationship between GDP as dependent variable, and openness, exports and imports separately.

Imports can play an important role for economic growth of a less developed country, (LDC), if these consist of capital goods and machinery. These items accelerate economic growth. However, imports do not always promote economic growth especially when these comprise consumable goods only. They need to be used carefully. Following Sinha & Sinha (2001-02), in addition to imports, growth of investment and growth of population have also been included as additional explanatory variables as they also play an important role in promoting growth. In view of the non-availability of reliable data regarding labor force we have used population as a proxy for the labor force. Solow-Swan model makes growth of GDP a function of growth of investment and the growth of population as well, which can be added as explanatory variables.

We have mentioned earlier that most of previous studies look solely at the relationship between exports and economic growth. Earlier studies investigating the relationship between exports and economic growth include Emery (1967), Michaely (1977), Balassa (1978), Krueger (1978) and Feder (1982). Many other studies have also dealt with the subject. Some of these focus on multi-countries while others concentrate on a single country. A few examples of recent studies include Ahmed and Harnhirun (1995), Dollar (1992), Frankel, Romer and Cyrus (1995), Harrison (1995), Krueger (1990), Sengupta (1994), and van den Berg and Schmidt (1994). An excellent review of the many previous studies can be found in Edwards (1993).

Qaisrani (1996) used a multiple regression equation to test the causality relation between economic growth and exports instability. He could not find statistically significant relation between GDP growth and exports instability. Chaudhary and Qaisrani (2002) also used a multiple regression to test the relationship among trade instability, investment and economic growth in case of

[2] The countries included were Bangladesh, China, Hong Kong, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Malaysia, Myanmar, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, and Thailand.

[3] The relation between GDP growth and growth of openness in case of Bangladesh, China,Hong Kong, Iran, Iraq, Israel, Japan, Myanmar, Pakistan, and Singapore was found to be statistically significant. However, in case of India, Indonesia, Jordan, Philippines, and South Korea the relation was found to be insignificant.

Pakistan. They found that short-term exports instability has no significant impact on economic growth in Pakistan. Chaudhary and Naveed (2003) see at the impact of export earnings and capital instability on economic growth in case of South Asian countries.[4] In case of Pakistan, they found that exports instability and capital instability both hamper economic growth. However, the magnitude of capital instability was larger than exports instability. Aurangzeb (2003) applied co-integration and multivariate causality test to trade, investment and growth in Pakistan. His findings supported the hypothesis that exports cause GDP growth.

The above analysis makes it clear none of the studies, in case of Pakistan, has tried to explicitly test the relationship between output growth and growth of imports. It is, therefore, imperative to test the hypothesis whether imports growth causes economic growth in Pakistan? The present study is focused to test the same hypothesis.

The rest of the paper is organized as follows. The model for testing the relationship between growth rate of GDP (the dependent variable) and growth rates of investment, trade, and population (the explanatory variables) is developed in part II. Part III describes data sources and methodology. In Part IV we discuss empirical results. Finally in part V conclusion and policy implications are given.

2. THE MODEL

We define a continuous time production function of the economy as follows[5].

$$Y(t) = F(K(t), N(t)) \tag{1}$$

Where Y(t) is real GDP; K(t) and N(t) are, respectively, the capital stock and the labor input in person-hours in efficiency units all being functions of time. The function F is assumed to be homogeneous of degree 1 in K and L. This is the continuous time formulation of the standard Ramsay-Solow-Swan model.

Assuming linear homogeneity of F we write it in intensive form as follows:

$$Y(t)/N(t) = f(K(t)/N(t)) \tag{1}'$$

Capital stock accumulates as a proportion of investment in GDP adjusted for depreciation at the constant rate, δ.

This is the simplest formulation of Solow (1956).

$$dK_{(t)}/dt = sY_{(t)} - \delta K_{(t)} \tag{2}$$

It is assumed that population gorws at a constant exogenous rate n:

$$dL_{(t)}/dt = nL_{(t)} \tag{3}$$

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[4] The countries included in the study are: Bangladesh, India, Pakistan, and Sri Lanka.

[5] We have adopted the model used by Sinha & Sinha (2001-02) after making minor modifications in it.

We assume labor productivity/technology changes with improvements in per capita capital stock K/L. This is an extension of Arrow's (1962) learning by doing model where α is the coefficient of learning by doing. It also captures the spirit of endogenous growth model of Romer (1986). It is assumed that α is influenced by imports and exports. Two separate sets of reasons can be forwarded in support of the claim that imports and exports (or trade) induce a higher value of α. First, improved imported technology stimulates output growth (see Bardhan and Lewis(1970)). Feder (1982) shows how exports can produce a higher level of productivity. Second, exports can proxy a purely domestic source stemming from local technological improvement. On the other hand a foreign source of knowledge related to innovations generated in other countries can be proxied by imports (see Edwards (1992) for more details on the rationale of using exports and imports as proxies in this context).

Let R(t) denote trade (that is, real exports plus real imports). In our model, the parameter α encapsulates all of the effects of imports and exports on output growth.

$$dT(t)/dt = \alpha(dR_{(t)}/dt)K_{(t)}/L_{(t)} + \lambda T_{(t)} \qquad (4)$$

Equation (4) explains the rate of technological change. In the standard neoclassical growth model, the technological change is assumed to be exogenous. If technology is assumed to be exogenous then equation (4) reduces to:

$$dT_{(t)}/dt = \lambda T_{(t)} \qquad (4)'$$

This is equivalent to assuming that the value of α is zero in (4). In this sense, (4) is a generalization of Solow-Swan neoclassical model (Solow (1956), Swan (1956)).

In addition, we use the following identities:

$N_{(t)}=T_{(t)}L_{(t)}$ (5)

Equation (5) relates population to effective labor.

$k(t) = K_{(t)}/N_{(t)}$ (6)

Equation (6) defines capital intensity. Substitution of (1) into(2) gives us:

$dK_{(t)}/dt = sNf(k_{(t)}) - \delta K_{(t)}$ which simplifies to:

$$[dK_{(t)}/dt]/K_{(t)} = sf(k_{(t)})/k_{(t)} - \delta \qquad (7)$$

Equation (7) relates the rate of change of cpital stock to per capita capital stock.

Differentiating equation (5), we get:

$dN_{(t)}/dt = L_{(t)}dT_{(t)}/dt + T_{(t)}dL_{(t)}/dt$:

Which after rearranging gives us:

$$[dN_{(t)}/dt]/N_{(t)} = [L_{(t)}/N_{(t)}]dT_{(t)}/dt + [T_{(t)}/N_{(t)}]dL_{(t)}/dt \quad (8)$$

Substitution of (3) and (4) in the right hand side of (8), gives us:

$$[dN_{(t)}/dt]/N_{(t)} = [L_{(t)}/N_{(t)}][\alpha(dR_{(t)}/dt)K_{(t)}/L_{(t)} + \lambda T_{(t)}] + [T_{(t)}/N_{(t)}]nL_{(t)}$$

Using the identity: $N_{(t)} = T_{(t)}L_{(t)}$ in the above equation, we can rewrite it:

$$[dN_{(t)}/dt/N_{(t)} = \alpha(dR_{(t)}/dt)k(t) + \lambda + n \quad (9)$$

Differentiation of equation (6) with respect to t gives us:

$$dk_{(t)}/dt = \{N_{(t)}[dK_{(t)}/dt] - K_{(t)}[dN_{(t)}/dt]\}/(N_{(t)})^2$$

This gives the following expression for

$$[dK_{(t)}/dt]/k_{(t)} = [dk_{(t)}/dt]/K_{(t)} - [dN_{(t)}/dt]/N_{(t)} \quad (10)$$

Substitution of(7) and (9) into (10), gives us:

$$[dK_{(t)}/dt]/k_{(t)} = sf(k_{(t)})/k_{(t)} - \alpha(dR_{(t)}/dt)k_{(t)} - \lambda - n - \delta;$$

On the other hand, using (1') we get:

$$Y_{(t)} = N_{(t)}f(k_{(t)}) \quad (11)$$

Using (5) in (11) we get:

$$Y_{(t)} = T_{(t)}L_{(t)}f(k_{(t)}) \quad (12)$$

Taking total differential of (12) gives us:

$$dY_{(t)}/dt = [dT_{(t)}/dt]L_{(t)}f(k_{(t)}) + T_{(t)}f(k_{(t)})[dL_{(t)}/dt] + T_{(t)}L_{(t)}f(k_{(t)})dk_{(t)}/dt$$

Simplifying right hand side and dividing both sides by $Y_{(t)}$ we get:

$$[dY_{(t)}/dt]/Y_{(t)} = \alpha(dR_{(t)}/dt)K_{(t)}f(k_{(t)})/N_{(t)}f(k_{(t)}) + \lambda T_{(t)}L_{(t)}f(k_{(t)})/N_{(t)}$$

$$f(k(t)) + T_{(t)}f(k_{(t)})nL_{(t)}/N(t)f(k_{(t)}) + T_{(t)}L_{(t)}f(k_{(t)})[dk_{(t)}/dt]/N_{(t)}f(k_{(t)})\,or,$$

$$[dY_{(t)}/dt]/Y_{(t)} = \alpha(dR_{(t)}/dt)k_{(t)} + \lambda + n + f(k_{(t)})[dk_{(t)}/dt]/f(k_{(t)})$$

.....(13)

Assuming that Inada (1963) condition holds for the per capita production function f in equation (1'), it can be shown that a steady state solution k* to (13) exists. Villanueva (1994) has explored that non-steady state properties of (13). As in a steady state $dk_{(t)}/dt=0$, therefore, we can write (13) as:

$$[dY_{(t)}/dt]/Y_{(t)} = \alpha(dR_{(t)}/dt)k^*_{(t)} + \lambda + n \quad (14)$$

A general functional formulation of (14) would be:

$$[dy(t)/dt]/Y(t) = g(\alpha(dR_{(t)}/dt), n, k, \lambda) \quad (15)$$

Equation (15) says that growth rate of DGP is a function of the (a) the learning function, (b) that rate of growth of investment rate and (c) the growth rate of population. As the learning rate is a function of the growth rate of trade (exports plus imports in real terms), we can write a linear version of (15) as:

$$g_{yt} = a_{00} + a_{01}g_{xmt} + aoz_{git} + a_{03}g_{nt} + \varepsilon_{0t} \quad (16\text{-}0)$$

where g_{yt} represents the growth rate of real GDP, g_{xmt} the growth rate of openness (export plus imports), g_{it} the growth rate of real investment, and g_{nt} the population growth rate. We will use this version of our model for empirical analysis.

Apart from equation (16-0) we will also estimate the following variants of (16-0):

$$g_{yt} = a_{10} + a_{12}g_{it} + a_{13}g_{nt} + a_{14}g_{xt} + a_{15}g_{mt} + \varepsilon_{1t} \quad (16\text{-}1)$$

$$g_{yt} = a_{20} + a_{22}g_{it} + a_{23}g_{nt} + a_{24}g_{xt} + \varepsilon_{2t} \quad (16\text{-}2)$$

$$g_{yt} = a_{30} + a_{32}g_{it} + a_{33}g_{nt} + a_{35}g_{mt}\varepsilon_{3t} \quad (16\text{-}3)$$

III. DATA SOURCES AND METHODOLOGY

Annual data for GDP, domestic investment, exports, imports and population for the period 1970-71 to 2002-03 were taken from Table 3 from the following website address of Federal Bureau of Statistics:

http://www.statpak.gov.pk/depts/fbs/statistics/national_accounts/table3.pdf.

We represent the degree of openness by the sum of exports and imports. All the variables are taken at constant market prices, as the data on sectoral shares of GDP at constant factor costs are not available.

Annual growth rates of the relevant variables were calculated using the formula:

$$gyt = [(Y_t - Y_{t-1})/Y_{t-1}]*100$$

Where gyt represents the growth rate of variable Y. Y_t and Y_{t-1} stand for current and previous values of Y. All the variables were taken in real terms with 1980-81 as the base year.

We tested the variables for stationarity using the Phillips-Perron (1988) test before attempting empirical estimates. The test is well suited for analysing time series whose differences may follow mixed ARMA (p,q) processes of unknown order in that the test statistic incorporates a nonparametric allowance for serial correlation in testing the regression. Consider the following equation:

$$y_t = c_0 + c_1 y_{t-1} + c_2(t - T/2) + v_t \quad (17)$$

Where T is the number of observations and V_t is the error term. The null hypothesis of a unit root is that: $c_1=1$. The unit root test can be applied

including the trend term if the researcher is confident that the series follows a linear trend. The results of PP (Phillips-Perron, 1988) test are reported in the appendix. We applied the PP test to all the relevant variables alternatively including and excluding the trend term. All the variables (except g_{nt}) were found to be stationary irrespective of the fact whether the trend term was included or not in the test equation. The population growth rate g_{nt} was found to be stationary with a linear trend only. After making sure that all the variables are stationary the variants of the model of equation (16-0) were estimated using OLS incorporating the AR(1) process.

IV. EMPIRICAL RESULTS

The regression results are reported in Table-1. Estimates of all the equations show that coefficients of all the variables are positive as predicted by economic theory.

The estimation of equation 16-0 shows that degree of openness matters for economic growth. In this equation the only statistically significant coefficient is that of openness. The other determinants of growth i.e. investment growth, and population growth are not statistically significant. The value of adjusted R^2 is also very low which indicates that the model does not best fit to the data.

Equation (16-1) was estimated using growth rates of exports and imports as separate arguments. The estimates reveal that all the variables (except imports) significantly affect the output growth. The value of adjusted R^2 showed improvement. The coefficient of imports was almost zero. Its value was 0.005 only. It means that imports growth does not matter for growth in Pakistan. In the estimation of equation (16-2) we dropped the term representing growth rate of imports. In this case all the coefficients were statistically significant at 1 per cent or 5 per cent level of significance. The value of adjusted R^2 was the highest among all the equations signifying that this equation best explains the GDP growth rate in Pakistan. The relative contributions of exports growth and investment growth were almost equal. The coefficient on the variables was 0.096. The contribution of population growth to output growth was much higher. The coefficient has the value of 1.51.

Table-1. Regression Results

Dependent Variable: g_{yt} Regression Coefficients					
Variable/Equation	16-0	16-1	16-2	16-3	16-2A
Constant	1.854	0.147	0.095	3.319**	0.192
	(1.180)	(0.107)	(0.071)	(2.111)	(0.125)
g_{xt}	-	0.095*	0.096*	-	0.064*
		(3.844)	(3.981)		(2.473)
g_{mt}	-	0.005	-	0.010	-
		(0.169)		(0.256)	
g_{xmt}	0.098** (2.093)	-	-	-	-
g_{it}	0.075	0.92**	0.095**	0.101	0.057
	(1.372)	(1.85)	(2.074)	(1.637)	(1.033)
g_{nt}	.886	1.481*	1.505**	0.474	1.673*
	(1.586)	(2.993)	(3.123)	(0.821)	(3.129)
AR(1)	0.092	-0.1997	-0.213	0.210	-
	(0.541)	(-1.103)	(-1.199)	(1.229)	
Adjusted R^2	0.21	0.33	0.36	0.08	0.24
Durbin-Watson Statistics	1.97	2.07	2.08	2.01	1.90
F-Statistics	3.05**	3.996*	5.18**	1.63	4.21*

* Significant at 1 %

* Significant at 5%

Note: t-values are given in parentheses

In the estimation of equation (16-3) we included the growth rate of imports and excluded the growth rate of exports. In this case coefficients on none of the variables (except the constant term) were statistically significant. This reveals that the model, which excludes exports growth and includes imports growth worst fits to empirical data. The value of adjusted R^2 was the least among all the equations. This also indicates that a very important variable (i.e. exports growth rate) has been ignored.

Finally, we re-estimated equation (16-2) excluding the AR(1) term. In this case the values of coefficients on both the exports and investment drastically fell and the coefficient on investment was rendered insignificant. The value of Adjusted R^2 also fell from 0.36 to 0.24. This tells that we cannot drop the AR(1) term from the list of explanatory variables.

A comparison of our results with those of Sinha & Sinha (2001-02) for Asian countries is as under. The coefficient of openness in Sinha and Sinha (2001-02) in case of Pakistan was .146 and that of ours in equation (16-0) is 0.098. Both are statistically significant. The reason for the difference in the coefficients between two studies lies in the difference in data sets used. Sinha & Sinha (2001-02) used data over the period 1950-91. I used that data over the period 1972-2003. The coefficients on domestic investment growth and population growth are not positive in our study and are both negative in Sinha & Sinha (2001-02). However the coefficients in both studies are statistically insignificant.

Rizavi (1996) regressed level of GDP on levels of domestic investment, exports imports openness and current and one period lagged real expenditure on education in alternative equations. He found all the explanatory variables to be significantly affecting the level of GDP in Pakistan. As per our results growth rate of imports has no statistically significant affect on GDP growth rate. However, all other variables including growth rates of exports, openness, domestic investment and population all are found to be significantly positively affecting the GDP growth rate in Pakistan.

V. CONCLUSION AND POLICY IMPLICATIONS

The main purpose of the paper has been to study the effects of growth of openness, domestic investment, and population on the growth of GDP for Pakistan. In most of the previous studies economic growth is related to exports growth only. But this may create a missing variable bias in such studies because investment is clearly an important factor affecting economic growth. Next, we used Phillips-Perron unit tests on the data to find out whether the data are stationary or not. All the variables are found to be stationary. Economic theory predicts that the growth rate of GDP will be positively related to the growth rates of openness, domestic investment and population. Our results are consistent with economic theory and also support findings of earlier studies. Our estimates also reveal that growth rate of imports has no bearing on the growth rate of GDP. Contrary to this, growth rates of exports, investment and population do have significant bearing on GDP growth rate in Pakistan. Thus, generally speaking, we find support for the popular proposition that the growth rate of GDP is positively related to the growth rates of exports, domestic investment, and population. This indicates

that in modeling the growth rate of GDP we can ignore the imports and focus on exports along with other determinants of growth. Our policy suggestion is that Pakistan should promote domestic investment and exports through a broad spectrum of incentives.

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APPENDIX

Phillips - Perron Unit Root Tests

Variable	With Trend	Without Trend
g_{vt}	-5.1948*	-4.8023*
	(-4.2826)	(-3.6576)
g_{xt}	-5.8362*	-5.8730*
	(-4.2826)	-3.6576
g_{mt}	-5.4605*	-4.9946*
	(-4.2826)	(-3.6576)
g_{xmt}	-5.1692*	-5.2388*
	(-4.2826)	(-3.6576
g_{it}	-5.4137*	-4.7249*
	(-4.2826)	(-3.6576)
$g_{n}t$	-6.4146*	-3.2878**
	(-4.2826)	(-2.9591)

* significant at1% level

** significant at 5% level

Note: Critical values (from Mackinnon (1991)) at 1% level are given in parentheses. The critical value for coefficient of g_{nt} without trend is given at 5% level because the coefficient was not significant at 1% level.