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Assessment of key determinants for economic growth in Pakistan

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Abstract. *This study actually attempts to investigate economic growth determinants in case of Pakistan for the period of 1980 to 2009. The autoregressive distributed lag (ARDL) and error correction model (ECM) have employed to investigate the long run and short run parameters between economic growth and its major determinants. Prior the stated approaches has confirmed through ADF test that all of the variables are integrated first order i.e. I (1). The results from ARDL show that there is co-integration between economic growth and explanatory variables that are real domestic investment, foreign investment, export, remittances and literacy rate. The estimated long run elasticities of economic growth with respect to domestic investment, foreign investment, exports, remittances and literacy rate were found as, 0.121, 0.026, 0.020, 0.065 and 0.224. Further, results depict that the error coefficient term is -0.67 and significant, suggest 67 percent adjustment in a year.*

Keywords: economic growth, Time Series Data, ARDL, Pakistan.

JEL Classification: E21.
REL Classification: 8E.

I. Introduction

In literature, the per capita income is commonly applicable economic growth representative. There should be no doubt that a progressive development of economic indicators promotes the economic growth of a country. Economic indicators are too many, for instance saving, domestic investment, foreign investment, inflation, real export, real imports, real exchange rate, foreign remittances, factor productivity, and literacy rate etc. However, this study chose key growth indicators that are gross fixed capital formation/real domestic investment, literacy rate/human capital, foreign remittances, real foreign direct investment, and real exports.

Since, investment is considered the life blood for economic growth of a country. Investment leads to create employment opportunities, increase the production in goods and services and then accelerate the national income. The educational skill has its own importance to promote the economic growth. According to endogenous growth models, human capital is more important than physical for economic growth acceleration. For developing country like Pakistan, foreign investment must be considered in growth model because foreign investment can easily bridge the saving investment gap in case of country domestic capital shortage. Worker remittances cannot be neglected, as from the year 1980 worker remittances contributes a large share of Pakistan's foreign exchange reserves. Finally, exports are necessary for favoring trade balance, increasing foreign exchange reserves, and for open economy is the engine of growth.

Partially, these key variables are modeled in fundamental growth equations to guess for their role in Pakistan's economic growth. For instance Iqbal and Zahid (1998) and Azam and Ahmed (2010), stress upon on human capital in economic development of the country. In later study also suggests that expenditure on education and health is imperative to improve the national human capital and hence economic growth. Din et al. (2003) provides evidence of long run equilibrium relationship between trade openness and economic growth of the country. Remittances are being modeled in Pakistan economic growth model by Ali (2011).

Thus, this study stress upon on comprehensive analysis, offer new and relatively inclusive evidence regarding the economic growth and its major determinants specific to Pakistan. For the purpose, study is completed as following, after introduction Section-II gives an overview of literature review, Section-III discusses model and methodology, Section-IV summarize data sources, Section-V represents empirical findings of the study and the last Section-VI concludes the study.

II. Literature review

The role of the economic indicators affecting economic development has been long debated in economic literature. Since the publication of Adam Smith's "Wealth of Nations" in 1776 to the present era economists contributed a lot to economic development and its determinants. With the passage of time, economists have specified various factors that affecting economic development of a country. Studies of diverse nature have investigated the economic growth determinants, regardless of different conceptual and methodological point of views. However, no discussion has reached to the consensus to find out that which dimensions of the economic indicators matter most.

Extensive studies have inquired into the factors that determine economic growth. The neoclassical growth models highlight that savings and investment ratio is an important determinant of short run economic growth and technological progress in the long run Solow (1956). Further, Romer (1986) and Lucas (1988) developed in their studies endogenous growth models where assumed that technology is endogenous rather than exogenous and human capital is basic to economic growth.

Taking data for the period of 1960-1985, Barro (1991) examined for the impact of physical stock and human capital on economic growth of 98 countries. He related the real per capita GDP to human capital and other potential determining variables. The author found that the output was positively and significantly determined by human capital, as proxied by both primary and secondary education enrolment. Another study of Graff (1995) tested the role of human capital in explaining growth rate of some 114 countries taking the data from 1965 to 1985. Generally, found that the accumulation of physical capital, human capital as well as technological progress all to be the significant determinants of the economic growth process. Jenkins (1995) for the UK economy, uses annual data from 1971-1992 and in results confirms the finding that the investment in human capital instigates to increase productivity. Similarly, Asteriou and Agiomirgianakis (2001) for the Greece economy explore the relationship between formal education and gross domestic product. In results finds the significant relationship between the two and further depicts that the causality runs through education variables to economic growth.

Empirical literatures are innumerable that have stressed upon the relationship between remittances and economic growth. Among, too many have admitted the facts that economic growth and remittances are positively related, e.g. Stark and Lucas (1988), Taylor (1992) and Faini (2002). The Jongwanich (2007) supports mix results about the impact of worker's remittances on economic growth and on poverty reduction. In results express that through the increase of poor's' income

remittances on poverty alleviation has a significant impact in developing economies.

Lucas (2005) cites numerous case studies, where have shown that in countries like, India, Morocco and Pakistan remittances had helped to speed up investment. Glytsos (2002) for seven Mediterranean countries has modeled the indirect and direct effects of remittances on incomes and hence on investment, and consequently discovered that investment promoted with remittances in total six out of the seven countries. For transition economies of Eastern Europe using the data of 1990-1999, León-Ledesma and Piracha (2004) findings shows that remittances had influenced positively employment and productivity either directly or indirectly through its impact on investment. Fayissa and Nsiah (2010) used an unbalanced panel data spanning from 1980 to 2005 for the aggregate impact of remittances on the economic growth of eighteen Latin American Countries and found that remittances have a positive and significant effect on their economic development.

The links of foreign direct investment and economic growth have been presented in many empirical studies. Among many, few reviewed here for understanding the association between two variables. Falki (2009) and Gudaro et al. (2010) have conducted studies to investigate for the impact of FDI on economic growth in Pakistan. Former, based the analysis on the theory of endogenous growth and a regression analysis, in results support that FDI had a negative and significant effect on the economic growth of the country. The later study for the period of 1981 to 2010, investigate for the positive and significant impact of FDI on gross domestic product of the country.

Similarly, Ahmad et al. (2012) in their study using co-integration and error correction techniques investigates for the relationship between FDI and economic growth. Model of the study takes gross domestic product dependent while FDI, capital formation and labour force as explanatory variables. In results, suggest that FDI and economic growth of the country are positively related in short as well as long run.

Considering the issue, Adam and Tweneboah (2009), conducted study for Ghana and concluded that FDI in Ghana had a positive and significant impact the economic growth of the country. Moreover, Abbas et al. (2011) examined for the influence of FDI on the GDP's of SAARC member nations. They employed multiple regression models using data for the period of 2001 to 2010. They found that the respective models in these countries supported a positive relationship between FDI and gross domestic product. Abdul Khaliq (2007) study too support for the positive impact of FDI on economic growth in case of Indonesia from 1997 to 2006.

III. Model and methodology

Model of the Study: Broadly, in this study a model of growth determinants was developed to execute the long run analysis for Pakistan's economic growth and its various determinants. Based on studies of Iqbal and Zahid (1998), Shahbaz et al. (2008), Afzal (2009) and Zaman et al. (2010) uses the below model expressing the relationship between economic growth and various economic variables having impact on economic growth:

$$LnRYPC = \beta o + \beta_1 lnRGFCF + \beta_2 lnLit + \beta_3 lnRem + \beta_4 lnRFDI +$$

$$+ \beta_5 lnRX + e \quad (1)$$

Where,
ln = Natural Logarithm
RYPC = Real Gross Domestic Product per Capita,
RGFCF = Real Gross Fixed Capital Formation,
Lit = Literacy Rate,
Rem = Remittances,
RFDI = Real Foreign Direct Investment,
RX = Real Export,

Moreover, β_1, β_2, β_3, β_4 and β_5 are coefficients of the independent variables and their expected sign are assumed as, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$ and $\beta_5 > 0$. The estimate of βo (constant) may be either positive or negative. The last term e is white noise error term.

Methodology: Based on the model, the purpose of the study is to provide the long run as well as short run estimates. The co-integration provides a convenient methodology for this purpose. Though the techniques are multi for co-integration analysis but the ARDL is preferred here because of its priority over the co-integration approaches used by Engle and Granger (1987) and Johansen and Juselius (1990). Particularly, the ARDL or Bound test is more appropriate for small sample study and the test can be run irrespective of the pre test of unit roots, where the technique is originally developed in Pesaran et al. (2001).

Using ARDL, initially estimate the Unrestricted Error Correction Model and then use the Wald Test to find out either there is co-integration among variables in model or not. For equation (1), the error correction representation of ARDL model then can be written as follows:

$$\Delta lnRYPC_t = C + \sum_{i=1}^{m} \alpha_i \, \Delta lnRYPC_{t-i} + \sum_{i=0}^{n} \beta_i \, \Delta lnRGFCF_{t-i} + \sum_{i=0}^{o} \gamma_i \, \Delta lnLit_{t-i} + \sum_{i=0}^{p} \theta_i \, \Delta lnRem_{t-i} + \sum_{i=0}^{q} \sigma_i \, \Delta lnRFDI_{t-i} + \sum_{i=0}^{r} \varphi_i \, \Delta lnRX_{t-i} + \delta_1 lnRYPC_{t-1} + \delta_2 lnRGFCF_{t-1} + \delta_3 lnLit_{t-1} + \delta_4 lnRem_{t-1} + \delta_5 lnRFDI_{t-1} + \delta_6 lnRX_{t-1} + \mu_t \quad (2)$$

Accordingly, for the presence of co-integration tested the null and alternative hypothesis as:

$H_0 = \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \sigma_5 = \sigma_6 = 0$ No-Cointegration

$H_0 = \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \sigma_5 = \sigma_6 \neq 0$ Co-integration

Note that the study of Pesaran et al. (2001) provides upper and lower bound set of critical values. We have to calculate the Wald-test or F-statistics for the coefficients of level lagged variables in equation (2). If the computed F-statistics exceeds the upper bound value as given by Pesaran et al. (2001), then it suggests the acceptance of alternative hypothesis of co-integration.

Once the presence of co-integration between dependent and independent variables is confirmed then we move to estimate the long run coefficients of growth model and the associated ARDL of error correction model for short run coefficients. In both the long run and short run model the lag length are specified on the basis of Schwartz Bayesian Criteria. However for convenience in earliest, test of order for each variable is conducted by using Augmented Dickey- fuller (ADF) test to check the stationarity. ARDL framework does not require the pre-testing of variables, but the unit root test can help to determine whether ARDL model should be used or not. Econometric packages Microfit and EViews are used for estimation purpose and to check unit root testing for stationarity.

IV. Data and data source

This research study takes six variables to develop growth model for Pakistan. GDP per capita is the dependent variable as was also used by Shahbaz et al. (2008) and many others. Gross fixed capital formation, literacy rate, remittances, FDI and exports are the determinants of economic growth as used partially by Iqbal and Zahid (1998), Shahbaz et al. (2008), Afzal (2009) and Zaman et al.

(2010). GDP per capita, gross fixed capital formation (GFCF), foreign direct investment (FDI) and exports (X) were converted into real form using GDP deflators. Literacy is taken in its growth rate form and remittances in million. In order to make model and to test the hypothesis the study requires assembling of data related to the concern indicators and economic growth. For this purpose, secondary statistical data sources are utilized. The data were collected from Pakistan Economic Survey various issues and Hand Book of Statistics, October 2010, see last two references. The data is annual and spans the period of 1980 to 2009.

IV. Empirical results

Unit Root Test Results: Unit root is tested by ADF test to check the stationarity of the variables in the specified model. The results of the tests are given in the Table 1 at level and in Table 2 at first difference.

In table1es the results of Unit Root test are presented in the form of t-tests values along with their p-values for all six variables of the model. All the results of ADF tests are given at level. These are further classified into three categories. These are the results with intercept, with intercept and trend and with none. The results show that all variables are non-stationary at level.

After testing unit roots at level, again it is tested at first difference. These results are given in Table 2. The results in Table 2 are again classified into three categories. In the first category the results are given in the form of the values of t-test along with their p-values. All the variables are stationary with intercept. The real gross fixed capital formation is stationary at 5% and all the other five variables are stationary at 1%. In the second category the results of all the variables are given with intercept and trend. All the five variables are stationary at 1% except real GFCF which is non stationary. In the third category the results of t-test along with their p-values are given with none i.e. neither with intercept nor trend. Real GDP per capita is stationary at five percent and all the others variables are at one percent except the literacy rate which is non-stationary. Conclusively, we can say that all the variables are integrated to order of one i.e. I (1).

Table 1. Augmented Dickey Fuller Test Results at Level

Variables	With Intercept		With Intercept & Trend		None	
	T-test	p-values	T-test	p-values	T-test	p-values
lnRGDPPC	-0.1442	0.935	-1.495	0.8080	8.006	1.0000
lnRGFCF	-1.4073	0.5644	-3.1512	0.1146	2.394	0.9947
lnLIT	-1.663	0.4354	0.807	0.9996	0.8836	0.8939
lnREMIT	0.799	0.9923	-0.560	0.9740	3.209	0.999
lnRFDI	-1.063	0.7163	-2.855	0.1906	0.992	0.9109
lnRX	0.139	0.9753	-1.928	0.614	2.678	0.9973

Table 2. *Augmented Dickey Fuller Test Results at First Difference*

Variables	With Intercept		With Intercept & Trend		None	
	T-test	p-values	T-test	p-values	T-test	p-values
lnRGDPPC	-4.505*	0.0013	-4.437*	0.007	-2.221**	0.0277
lnRGFCF	-2.9986**	0.0473	-2.9051	0.1760	-2.7609*	0.0076
lnLIT	-3.860*	0.0066	-4.877*	0.0028	-0.858	0.3349
lnREMIT	-4.267*	0.0024	-4.582*	0.0055	-3.569*	0.0009
lnRFDI	-5.348*	0.0002	-5.154*	0.0014	-4.868*	0.0000
lnRX	-5.412*	0.0001	-5.409*	0.0008	-4.154*	0.0002

Note: * and ** denotes 1 percent and 5 percent level.

Co-integration/Long Run Analysis: In selected long run ARDL (2, 0, 0, 1, 1, 0) model, the maximum lag length is set out by using Schwarz Bayesian Criteria (SBC). The Schwarz Bayesian Criteria for the selected long run ARDL is 80.12 minimum as compared to any other estimated ARDLs. The normalized long run coefficient estimates are reported in Table 3:

Table 3. *Estimated Long Run Coefficients of Economic Growth Using the ARDL Approach*

Selected Model is ARDL (2, 0, 0, 1, 1, 0) based on Schwarz Bayesian Criterion Dependent Variable = lnRGDPPC			
Regressors (Log)	Coefficients	Standard Errors	T-ratio (p-values)
Constant	7.2157	0.1493	48.321 (0.000)*
RGFCF	0.1212	0.0342	3.535 (0.002)*
LITER	0.2241	0.0510	4.394 (0.000)*
REMIT	0.0650	0.0097	6.710 (0.000)*
RFDI	0.0260	0.0103	2.531 (0.021)**
RX	0.0203	0.0298	0.681 (0.504)

Note: * & ** represents 1 and 5 percent level of significant respectively

In Table 3, the coefficients of the independent variables show the percentage change in the dependent variable due to change in independent variables. One percent change in real gross fixed capital formation has to change real GDP of the country positively by 0.1212 percent. The literacy rate has to increase economic growth by 0.224 percent. The results also show positive relation between economic growth and foreign investment i.e. FDI. The coefficient of FDI is 0.026. Concerning the effects of real exports on economic growth, there is positive and insignificant relation between the two. All of the estimated coefficients have positive signs, which showing that all the five independent variables (real gross fixed capital formation, literacy rate, remittances, real foreign direct investment and real exports) positively effects the dependent variable (real GDP per capita) in long run.

Error Correction Term: Next to the long run coefficient estimates, the above selected ARDL (2, 0, 0, 1, 1, 0) is used to get the error correction term (ECT). In final step to estimate for the coefficient of error correction term as well as short run effects of the variables, here must need to develop Error Correction Model

(ECM). In this study based on SBC (Schwarz Bayesian Criteria) lag selection criterion, the selected ECM becomes as given in equation 3:

$$\Delta lnRYPC_t = C + \alpha_1 \Delta lnRYPC_{t-1} + \beta_1 \Delta lnRGFCF_{t-1} + \beta_2 \Delta lnLit_{t-1} + \beta_3 \Delta lnRem_{t-1} + \beta_4 \Delta lnRFDI_{t-1} + \beta_5 \Delta lnRX_{t-1} + \delta ECT_{t-1} \quad (3)$$

Table 4 provides results for equation 3.

Table 4. *Error Correction Representation of the Selected ARDL*

Error Correction Representation for the Selected Short Run ARDL (2, 0, 0, 1, 1, 0)			
Dependent Variable = ΔlnRGDPPC			
Regressors	**Coefficients**	**Standard Errors**	**T-ratio (p-values)**
Constant	4.8397	0.6617	7.3142 (0.000)*
ΔlnRGDPPC	-0.3266	0.1514	-2.1568 (0.043)**
ΔlnRGFCF	0.0813	0.0245	3.4039 (0.003)*
ΔlnLITER	0.1503	0.0442	3.4039 (0.003)*
ΔlnREMIT	-0.0013	0.0103	-0.1284 (0.899)
ΔlnRFDI	-0.0070	0.0067	-1.0396 (0.311)
ΔlnRX	0.0136	0.0198	0.6854 (0.501)
ECT_{t-1}	-0.6707	0.0888	-7.5508 (0.000)*
R-Squared 0.81		Adjusted R-Squared 0.72	
AIC 86.787		SBC 80.126	
F-Stat 11.059 (0.000)		DW-statistic 2.3795	

Note: Δ denotes difference and ln natural logarithm. * and ** represent 1 and 5 percent level of significance.

In Table 4 real gross fixed capital formation, literacy rate and real exports are positively related with real GDP per capita, while remittances and real FDI have negative relationship with the dependent variable real GDP per capita in short run. T-ratios in the table interpret that real GDP per capita is significant at 5%, real gross fixed capital formation and literacy rate are significant at 1% level of significance, while remittances, real FDI and real exports are insignificant. The value of error correction term (ECT) is -0.67072 in between 0 and -1 showing valid speed of adjustment/conversion to equilibrium. R^2 is the coefficient of determination and defines the proportion of total variations in dependent variable. If R^2 =1 shows the perfect variation and if R^2 = 0 means that the independent variable has no explanatory power on the dependent variable. In the above ECM model the given value of R^2 is 0.81 explaining 81% goodness of fit that is the model properly explains the real GDP per capita of Pakistan. Similarly, the value of adjusted R^2 = 0.72 explains 72% goodness of fit. The value of F-statistic is 11.059 with its Probability (0.0000) interprets that the overall model is fit.

VI. Conclusion

The present study attempts to investigate the relationship between various macroeconomic indicators and economic growth in Pakistan during the period of 1980-2009. It covers six different economic variables, which are real GDP per capita, real gross fixed capital formation, literacy rate, remittances, real foreign direct investment and real exports. Where real GDP per capita is dependent variable and real gross fixed capital formation, literacy rate, remittances, real foreign direct investment and real exports are independent variables. The aim is to measure for the long run effects of enlisted variables on Pakistan economic growth. Moreover, it also explains short run elasticity estimates and speed of adjustment.

Prior to the ARDL test analysis, the ADF test was carried out to check for stationary and non stationary level of the variables. After finding at level all the variables are non-stationary and become stationary at first difference. In another words, at level variables are of I (1) order and at first difference are of I (0) order. The unit root results are common in different models of ADF test. As for as have shown in table (1) and (2). ARDL and Error Correction models (ECM) have employed to specify the long run and short run relationship among the variables. Whereas in long run all of the variables coefficients are significant instead of real export. The coefficients have expected signs. Domestic investment and literacy rate effects are 12 percent and 22 percent respectively in the long run. Both variable coefficients are statistically significant at 1 percent level. Similarly, the effects of FDI (significant at 5 percent) and remittances (significant at 1 percent) are too positive on country economic growth but lesser than that of domestic investment and literacy rate effects.

Finally, the error correction model has estimated to capture the short run effects of domestic investment, literacy rate, foreign investment and remittances on economic growth, where have only domestic investment and literacy rate emerged as importance determinants of economic growth model for Pakistan. The ECM for selected ARDL of lag order 2 expresses that real gross fixed capital formation, literacy rate and real exports are positively related with real GDP per capita, while remittances and real FDI have negative relationship with the dependent variable. T-ratios interpret that real GDP per capita, real gross fixed capital formation and literacy rate are significant, while remittances, real FDI and real exports are insignificant in short run. In the analysis real gross fixed capital formation and literacy rate appear the two prominent indicators of the economic growth of Pakistan as both are significant and have positive relationship with real GDP per capita in long run as well as in short run. The value of error correction term (ECT) is in between 0-1 and significant, endorse the co-integration among variables.

Moreover, indicates that deviation occurs in short run return to its long run equilibrium with speed of 67 percent.

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