Effect of Public and Private Investment on Economic Growth in Bangladesh: An econometric Analysis*

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SECTION I

1.0 Introduction:

The relative productivities of public and private investment in less developed countries (LDCs) are obviously an important issue. The impact of public and private investment on economic growth has attracted renewed attention in recent years. The worldwide shift towards a growth strategy underscoring market forces and private sector leadership prior to the ongoing global financial and economic crisis led to a curtailment of the public sector from production and to a redefinition of its role in the development process in many countries. Under the guiding principle, the public sector should concentrate its resources in areas where it supports, rather than crowd out the private sector [see, Luis (1996)]. In academic cycles, the macroeconomic impact of public and private investment on economic growth was brought to center stage by Aschauer (1989a, b), who analyzed the impact of public capital accumulation on US private investment and output empirically, and found a sizable positive effect in both cases. Aschauer's work was followed by a rapidly growing literature reexamined his results – the results of which remain controversial - from both micro and macroeconomic perspectives [see, Gramlich (1994) for extensive review] and an extension of his analysis to other countries [e.g., Berndt and Hansson (1992), Argimon et. al. (1995)]. Rahaman et.al (2005) found that the marginal productivity of private and public investment is different in Bangladesh. In addition, private investment plays a much larger role in the growth process of Bangladesh.

This study adopted an approach suggested by Khan and Reinhart (1990) and Nazmi and Ramirez (1997 and 2003). It revisits empirically the impact of public and private investment on economic growth. The study develops a simple analytical model embodying the distinction between public and private investment and implements it using aggregate public and private gross capital formation data for Bangladesh during 1972-73 to 2010-11 period. The empirical implementation then followed a co-integration approach that makes use of long-run and short-run analysis.

The key findings of the study concluded that there is a short-run and long-run relationship between public and private investment and economic growth in Bangladesh. This implies that public and private investment impact positively economic growth in the short and long run process. In addition, it confirms that private investment is more effective in the long run then public investment. The results of short run dynamics reveals that, the error correction term (ECM) is negative and significant (-0.36), which means that 36% of the disequilibrium will be adjusted annually and approximately after 3 (three) years short term dynamics will reach at equilibrium level. It implies that the gestation period of most of the public and private capital investment in Bangladesh is three years.

Such findings could serve as an important reference for designing investment policies in Bangladesh. Compared to the findings of the existing literature, the elasticity of public investment is found quantitatively (?) lower. The best way to ensure that the public investment programs make significant contribution to growth is by getting its composition right through close attention to its rate of return and complementing with private investment. This in turn requires clear delineation of the roles of the public and private sectors as well as strengthening the institutional framework within which the public investment program is formulated and implemented.

The rest of the study is arranged as follows, section two discusses relevant literature, section three focuses patterns of economic growth, public and private gross capital formation in Bangladesh, section four presents a review of growth experience of South Asian countries. The next section presents the theoretical framework and model specification followed by the basic model that is developed in section six. Section seven describes data description and methodology; section eight discusses empirical estimations, and section nine covers discussion of regression results. The last section summarizes the findings and suggests some recommendation.

SECTION II

2.0 Literature Review:

Empirical studies on the relationship between public and private investments and economic growth are quite extensive. Much of the research was stimulated by the empirical studies of Eberts (1986), Aschauer (1989a, 1989b) and Munnell (1990) on the relationship between government investments on economic infrastructure, and economic growth at national, regional and state levels. All these studies found a statistically significant positive relationship between public investment and economic growth. These studies sparked up remarkable interest on relationship between growth and investment. Subsequent studies conducted in this area, either using a single-equation (Aschauer 1989a) or a cross-section analysis (Easterly and Rebelo 1993) indicates a positive effect of public investment on growth.

MacMillan and Smyth (1994) estimated the VAR models using both levels and first differences of the variables and concluded that public capital has negligible impacts on output. Raymond (1998) reexamined the issue using annual observations in United States data from 1948 to 1993. Employing both integration and cointegration tests, he concluded that public capital seemed positively related to output, labor and private capital in the long run. The results also suggested and inferred that innovations in public capital could have long-lasting effects.

Nazmi and Ramirez (1997) analyzed the impact on economic growth of public and private investment spending. They concluded that public investment expenditures had a positive and significant effect on output growth. At the same time, public investment's impact on economic growth was statistically identical to the impact of private capital spending. The contribution of public investment to output expansion however came at the expense of private investment as indicating a significant crowding out effect.

Other empirical studies found positive effects of public capital spending, particularly infrastructural spending, on private investment, productivity and growth [see,Pereira (2000, 2001a and 2001b); and Mittnik and Neumann (2001)]. These studies suggest that a decrease in public capital spending could be harmful for economic growth. Currently there are two related strands of research on the role of public capital spending in capital accumulation and economic growth. The first one focuses on the public investment spending and private investment nexus.

Mustafa et al. (2002) found some evidence of crowding-out effect of total public investment on private investment; there was no significant effect of public infrastructural investment on private investment in the long-run. However, they found some evidence of complementarities between private and public investment over the short and medium-run. Their results suggest that the chronic macroeconomic instability seems to become a serious impediment to the public investment, and has shattered, or even reversed, the long-run complementarities.

Rahaman et. al (2005) found that private and public investments do appear to have different effect on the long-economic growth of Bangladesh. In other words, the marginal productivity of private and public investment is differing in Bangladesh. Further private investment plays a much larger and thus more important role in the growth process of Bangladesh.

A number of recent studies on the determinants of economic growth highlight the importance of total factor productivity, such as Easterly and Levine (2000), who explain that the salient features of countries' growth experience cannot be explained by factor accumulation alone. Several factors impact on changes in total factor productivity, including changes in technology and externalities, changes in the sectoral composition of production, and organizational changes such as the adoption of lower cost production methods. It is likely that among these factors the improved access to knowledge capital that has come about with globalization has had the most important influence over the past few years.

Why is technology important? Dollar [1993] wrote "there are a number of pieces of evidence indicating that successful developing countries have borrowed technology from

the more advanced economies". Krugman's view is correct in the short and mid-terms. But in the long term, TFP is the main factor of growth. In this sense, Solow is right and his 1956 model is basically a long term growth model. Even if these results seem widespread in the empirical literature on growth accounting, there is no theoretical model explaining the optimal shift of a country from the first stage (accumulation) to the second stage (assimilation) of development. In order to encompass these different aspects we assume the existence of a threshold effect from which new technologies begin to have an impact on Total Factors Productivity (TFP).

Threshold effect is also used by Le Van and Saglam [2004] who show that a developing country can restrain to invest in technology if the initial knowledge amount of the country and the quality of knowledge technology are low or if the level of fixed costs of the production technology is high. Capital accumulation and innovative activity take place within a two sector growth model. The first sector produces a consumption good using physical capital and non-skilled labor according to a Cobb-Douglas production function. Technological progress in the consumption sector is driven by the research activity that takes place in the second sector. Research activity which produces new technologies requires technological capital and skilled labor along the line of a Cobb-Douglas production function.

Other empirical evidences show that growth in developing economies bases mainly on physical capital accumulation while growth in developed economies motivated essentially by human capital and technological progress. This result is rooted in the assumption of diminishing marginal returns on capital accumulation that induce a catching-up process compatible with conditional convergence. Lau and Park [2003] also suggest that in the first stage of development, economic growth is generally based on physical accumulation rather than technological progress. Greater gains in TFP are possible only during the second stage of development. More precisely, Lau and Park show there was no technical progress for Hong Kong, Korea, Singapore, Taiwan, Indonesia, Malaysia, and Thailand until 1985.

SECTION III

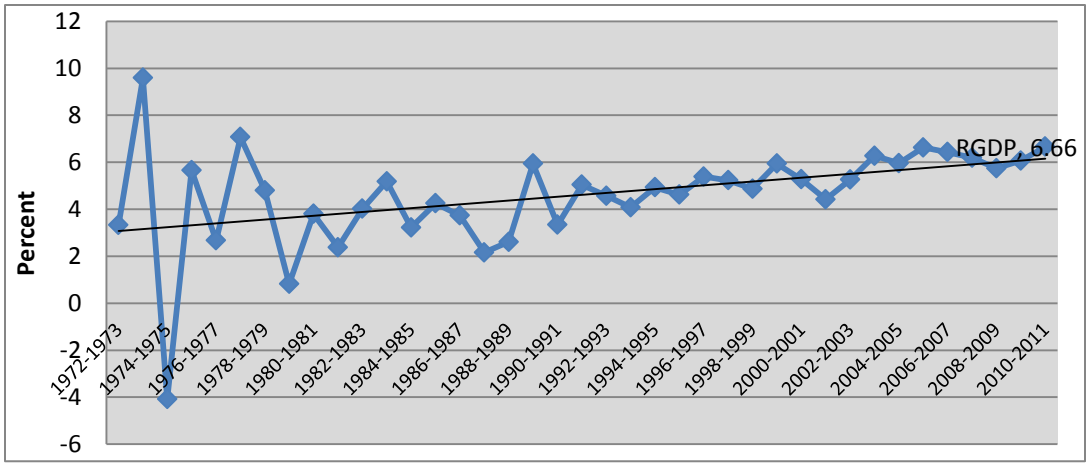
3.0 Patterns of Economic Growth, Public and Private Gross Capital Formation in Bangladesh:

After suffering major setbacks in levels during the Liberation War and a slowdown in growth in its aftermath, Bangladesh's economy has accelerated since the end of the 1980s. The economy of Bangladesh has experienced an average of 4% plus growth per annum throughout the 1990s. Even during the year of devastating floods (FY1999), the economy grew by 4.9%. Average GDP growth in the 1990s (FY1991-2000) was 4.78%, which was one

percentage point higher than that of the previous decade (i.e. 3.74% in FY1981-90). The second half of the 1990s demonstrated a more impressive growth performance (5.29%, FY1996-2000) in comparison to the first half (4.49% for FY1991-95).

According to the revised estimates, GDP growth rate in FY2011 was 5.16%. The experience of the 1990s has given rise to the hope that the real GDP growth in the coming years will be higher than what has already been achieved. Bangladesh experienced solid average annual growth of 6.3 percent between 2004 and 2008. In fiscal 2009, despite the global financial crisis, Bangladesh recorded 5.9 percent real GDP growth, only a 0.3 percentage point decline from 6.2 percent growth in fiscal 2008. This was due in large part to the generally sound macroeconomic policies implemented by the government over the period.

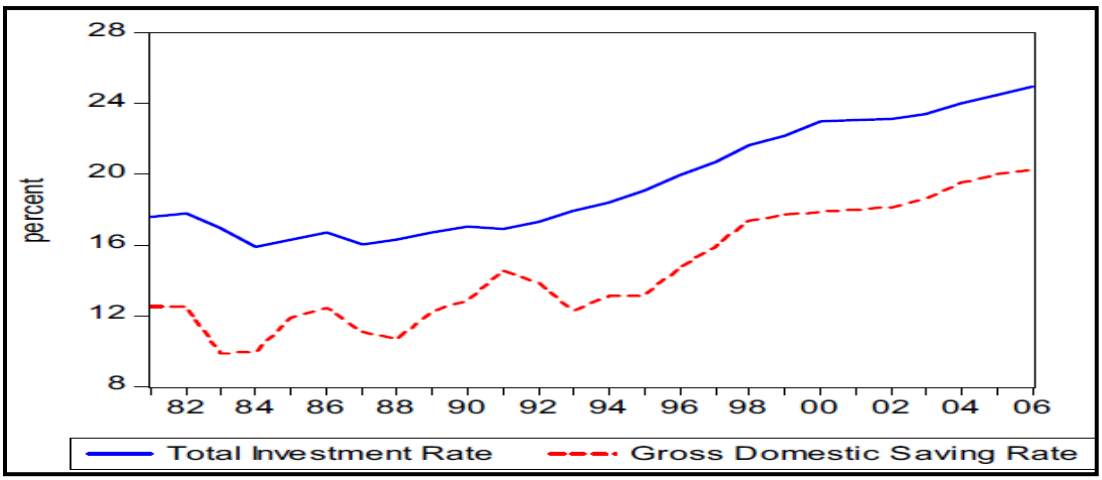
Figure 1: Historical trend of real GDP growth rate



The growth of GDP has been accelerating in each successive period since the early 1990s. Three factors go into picking up the pace of growth. The two that have played role since 1990 are physical capital and human capital, the later measured in terms of the quality of the workforce and their skills level. Although labor expansion is important as a growth source, it does not explain the growth variation across countries; driving the difference across countries are capital accumulation and productivity improvements. In developing countries, the growth in the labor force apparently does not exert a significant effect on the growth of output (Khan and Reinhart (1990)); it is almost as same in Pakistan, India, and Bangladesh. The third factor, the efficiency of production technology, as measured by the total factor productivity (TFP), also contributed by growing at a slightly faster pace than in the 1980s.

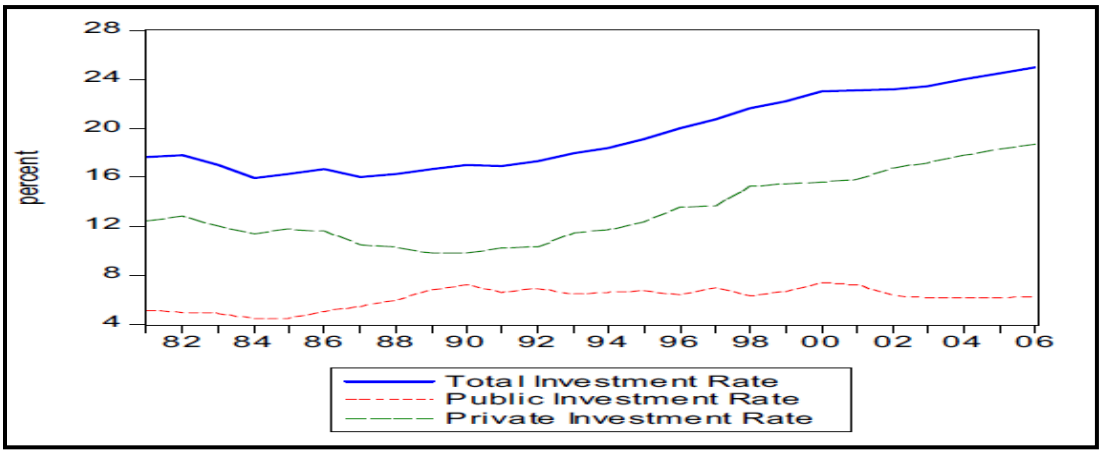
A long-standing view of the macro-economic dynamics of the growth process was that increasing savings when transformed into productive investment would help achieve an economic "take-off". The pick-up in physical capital accumulation-a 6.6 percent average growth rate over 1991-2006, compared to 4.0 percent in the preceding decade-was led by private investment and financed principally by higher domestic savings. Furthermore, the increase in the investment-to-GDP ratio has been almost entirely due to the dynamism in private investment, with the investment in the public sector remaining almost unchanged as a proportion of GDP. Both investment and saving rates have steadily improved, thus paving the way for superior growth performance. Meanwhile, due to robust and sustained growth in export earnings and the accompanying increase in imports, there has been a rapid increase in the trade openness of the economy (that is, the combined ratio of imports and exports to GDP).

Figure 2: Trends in Investment and Savings



Relaxing of several restrictions on private investment in the industrial Policies of 1991 and 1992 including licensing requirements for private investment and opening up of telecommunications, power generations and domestic air transport to the private sector. Partly in response to this stimulus, private investment, having declined from 11.8 percent of GDP 9.8 percent between FY 1985-90, increased to 12.4 percent by FY1995. The initial surge in private investment and the improvement in TFP (the efficiency to which capital and labor are used to produce output) growth that supported the growth acceleration in the 1990s were propelled by broad based market oriented reforms to encourage private investment both in manufacturing and service sector, macro stabilization measure as well as human capital investment specially public expenditure on health and education.

Figure 3: Public- Private Breakdown of Investment



Trends in investment in Bangladesh show a decline in public sector participation, compared to the private sector in the country's economic activities. This is a clear reflection of government policy to gradually withdraw government intervention and encourage the private sector in all spheres of economic activity. The success of the government in this area is reflected in the share of private sector investment in GDP, which increased to 19.5 percent in 2010-11 from 11.8 percent in 1993-94. On the other hand, public investment decreased from 6.6 percent in 1993-94 to 5.3 percent in 2010-11.

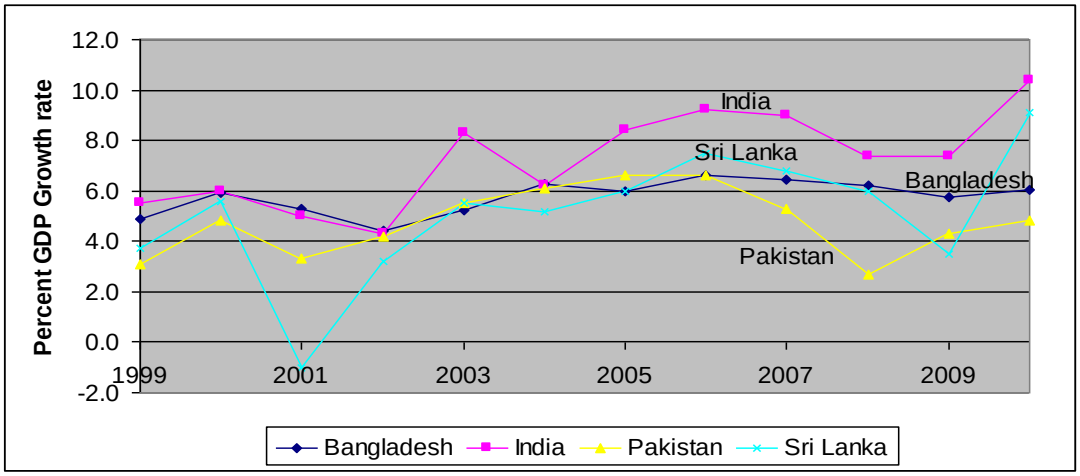
Another significant characteristic of the last decade is the reduced fluctuation in the country's annual economic growth. In the past, large variation in the growth rate, among others, was a significant factor that inhibited greater investment flow and reduced its productivity in Bangladesh. In short, the economy has now become more resilient having diversified sources of growth along with greater capacity to deal with short-term fluctuations.

SECTION IV

4.0 Growth Experience of South Asian Countries

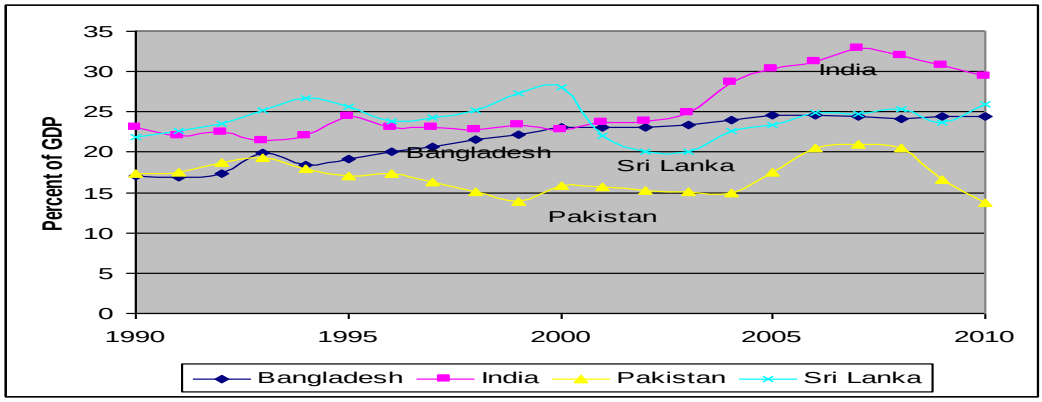
The last two decades have seen reasonable economic growth in most South Asian countries. In India, which accounts for about three-quarters of the population of the subcontinent, real per capita gross domestic product increased by 3.4 percent a year between 1981 and 1991 and by 4.2 percent annually over the next ten years? The implication is that average incomes roughly doubled over the two decades. Nepal and Sri Lanka performed somewhat better on this count, while Bangladesh lagged in the 1980s but picked up in the 1990s. Pakistan was not able to keep the growth momentum. This is also reflected in higher coefficient of variation indicating higher instability in the growth experience of Pakistan.

Figure 4: Historical GDP Growth Rate of South Asian Countries



Pakistan grew at about the same rate as India in the 1980s but very slowly in the 1990s. Since independence, economic growth rates have been impressive but also fluctuated widely. These fluctuations have occurred largely because successive governments had policy shifts by emphasizing different sectors through changes in subsidies, regulations and state ownership of industry. Higher population growth, lower rate of capital formation, and higher rate of debt accumulation may be the main reasons for slowdown in economic growth during 2000s in Pakistan. In India, the contribution of capital in economic growth is quite high and growth performance improved steadily over time. In 1980s, India benefited from domestic policy changes as well as a large expanding domestic market and good harvests offsetting the negative impact of fluctuation in the global economy. The higher rates of investment of the last decade have not generated more expansion of industry, but have instead been associated with an apparent explosion in services. Though, the past decade has been one of rapid economic growth but the more important human development indicators have not been improving equally rapidly.

Figure 5: Historical Investment GDP Ratio of South Asian Countries



In South Asian countries, total factor productivity growth, a measure of improvements in competitiveness, was high in 1960s, declined in 1970s and improves afterwards. In the case of Bangladesh, as expected, growth was slow in 1980s but improved afterwards. The rise in TFP seems to coincide with the period of liberalization in most of the South Asian countries. India and Bangladesh show higher TFP growth. In Pakistan TFP growth was significant until 1980s but has deteriorated in 1990s. It has rebounded since 2001 until world recession in 2008.

These observations highlight the critical importance of total factor productivity in the growth accounting. It is experimentally proven that the share of human capital and expenditure for new technology in total investment in developing economies shows the increasing trend and human capital increasingly is becoming more important than two others (capital accumulation and labor).

SECTION V

5.0 Theoretical Framework and Model Specification:

The neoclassical growth model framework of Solow (1956) has been puts and variables adopted in this study. The model has been extensively used by, among others, Ram (1978), Khan and Reinhart (1990) and Nazmi and Ramirez (1997 and 2003) to determine the impact of public and private investment on long-term economic growth in developing countries. The framework of the growth model take as its starting point an aggregate production function of Cobb-Douglas function which related to output to factors inputs and variable referred to as total factor productivity.

$$Y = A\, f(K, L) \quad \ldots\ldots (1)$$

Where, A is the technological shift parameter which is generally assumed to be exogenous.

Y is the level of output

K is the stock of physical capital

L is the labor force

F is the potential aggregate output.

In a labor surplus country like Bangladesh it is reasonable to assume that at the margin, growth of labor force has no effect on aggregate output. Therefore, aggregate potential production function has been assumed as follows:

$$GDP = \alpha\, f(K^{p}, K^{g}) \quad \ldots\ldots (2)$$

Where, GDP= gross domestic product

K^p= Gross private capital formation

K^g= Gross public capital formation

Specifying the production function in log linear form with an error term u_t, the following equation can be written

$$LGDP = \alpha_0 + \alpha_1 LK^p + \alpha_2 LK^g + u_t \quad \text{...(3)}$$

Where, α_0= the constant term is assumed to capture the growth of productivity as well as other left-out exogenous variables.

α_1= is the elasticity of output with respect to private capital formation

α_2= is the elasticity of output with respect to public capital formation

If the effects on growth of private sector investment and public sector investment are the same, this would imply the respective elasticities are equal ($\alpha_1 = \alpha_2$). On the other hand if private investment is more efficient and productive at the margin than is the public sector investment, as argue by the market based reforms, then we would expect $\alpha_1 > \alpha_2$.

It is expected the elasticity parameters $\alpha_0 > 0$, $\alpha_1 > 0$ and $\alpha_2 > 0$

This lead to the specification of a general error correction model (ECM) of the aggregate production function of the following form

$$\Delta LGDP_t = \alpha_0 + \alpha_{1i} \sum_{i=5}^{n} \Delta LGDP_{t-i} + \alpha_2 \Delta LK^p{}_t + \alpha_{3i} \sum_{i=5}^{n} \Delta LK^p{}_{t-i} + \alpha_4 \Delta K^g + \alpha_{5i} \sum_{i=5}^{n} \Delta LK^g{}_{t-i}$$

$$+EC_{t-1} \quad \text{.. (4)}$$

Where, EC_{t-1} is the error correction leg one time

SECTION VI

6.0 Data Source, Data Description and Methodology

6.1 Data Source, Data Description

All data are collected from the World Development Indicators (WDI) of World Bank and International Financial Statistic (IFS) of IMF data set. To keep the data set consistent, we restricted our data series for a period of 39 years spanning from 1972/73 to 2010/11 as quarterly data for the selected country are not available. We ignore the data set from 1971

to 1972 because the data for the pre 1972 period are suspected to be noisy due to sudden political disruption (military coup), economic shocks and post war reconstruction due to very low economic activity in the early stage of independence of the country during that period. All data are entered in the form of annual averages for each period so that the effect of random factors does not dominate the estimates.

The variables LGDP, LK^p and LK^g in the model are taken as gross domestic product, gross capital formation in public sector and gross capital formation in private sector. Variables are then converted into natural logarithmic form. The data set contains 39 observations which are larger than minimum number requirement for statistical analysis.

6.2 Methodology:

After verifying the stationary properties of our data series individually we investigate whether there exists a long run relationship among real GDP growth rate, gross capital formation in public sector and gross capital formation in private sector. We considered Engle and Granger's (1987) two step procedure. In this procedure, we use Augmented Dickey-Fuller (ADF) test and Phillips and Perron (1988) test (PP) for verifying unit roots of the error term. The reason behind using PP test is that it uses less restrict assumptions about the behavior of the test equation's error term. Since serial correlation and heteroscedasticity is a major concern of the time series data and these two properties should be corrected before drawing any inference or applying any technique for further analysis. PP test is relevant in this regard because it gives corrected results for those series which suffers from serial correlation and heteroscedasticity properties. If we get error terms with I (0) properties then the series in question are said to be co-integrated. Lastly, we use the error correction model to examine the variables adjust the discrepancy to the long run equilibrium. In scenario 2, we also incorporate dummy and interaction dummy variables in our proposed model so as to capture the impact of government policy on private and public sector capital formation before and after the period of 1990/91.

SECTION VII

7.0 Econometric Analysis and Empirical Results

7.1 Stationary Test

We begin our analysis by examining the time-series properties of the series LGDP, LK^p and LK^g. To this end, stationary properties of the relevant variables have been verified by performing Augmented Dickey-Fuller (ADF) statistic (Said and Dickey (1984)) to test for unit root null, and Kwiatkowski- Phillips-Schmidt-Shin (KPSS) statistics (Kwiatkowski et al. (1992)) to test for no-unit root null. In implementing ADF and KPSS unit root test, each

variable is regressed with and without a trend variable. If the trend variable was not significant, it was dropped. The Schwarz Information Criteria determines nine legs for the calculation of ADF statistics including both trend and intercept. The results of unit root test are shown in Table 1. From the results, we can argue that the variables under consideration are well characterized as non-stationary or I (1) processes.

Table 1: Results of Unit Root Tests

Test	Trend Assumption	Level/First differenced	GDP	K^p	K^g
ADF	Constant	Level	-4.763255***	-2.031894	-6.6331168***
	Constant and Trend	Level	-5.827528***	-2.911837	-16.86239***
KPSS	Constant	Level	0.743697***	0.762430*	0.751174***
	Constant and Trend	Level	0.170843**	0.159489*	0.197446**

Note: 1%, 5% and 10% significance level are denoted by (***), (**) and (*) respectively

7.2 Engle-Granger Test

We now turn to apply the two-step approach proposed by Engle and Granger (1987) to examine whether the empirical evidence is consistent with co-integration relationship implied by the theory. In particular, we employ the augmented Dickey-Fuller test recommended by Engle and Granger and a tailored version of the Phillips and Perron (1988) the MZa test proposed by Stock (1991) to test whether the residuals from equation (5) are stationary. Since the number of observation we used in our model is limited to 39 only, the least square estimates of the co-integrating vector will give substantially biased estimates (see Banerjee et al. (1986)). Besides, simple least square estimation ofour model equation does not permit legitimate hypothesis testing of the estimated parameters of the co-integrating vector. But we performed least square estimation of our model equation in order to test the null hypothesis of no co-integration among the variables of real GDP growth rate, gross capital formation in private sector and gross capital formation in public sector.

The results of the co-integration tests are reported in Table 2. We reject the null hypothesis of no co-integration at 1% level of significance in both Augmented Engle Granger and Phillips and Peron tests which is strong evidence of having co-integration among the variables. The rejection of null hypothesis also implies that the empirical preference shocks are I(0) processes. Since the error term of the variables with different

combinations is stationary, we can make inference that the variables will move together and never diverge in the long run they might show some divergence from time to time.

Table 2: Residual Based Single equation Tests for Cointegration
(Sample: 1972/73-2010/11)

Variables	AEG lag	AEG t-statistic	MZ_a Statistic
LGDP, LK^p,LK^g	9	-5.403701***	-5.365024***

Note: 1%, significance level is denoted by (***).

Error Correction Term shows the short term dynamics adjustments with the long term equilibrium relationship. The ECM term is negative and significant, which indicates that approximately 36% of the disequilibrium will be adjusted.

SECTION VIII

8.0 Discussion of Results

8.I OLS Regression and Error Correction Model:

Table-3 presents the estimation results of the static model, which represent the long-run model. This gives long-run relationship between economic growth and public and private gross capital formation. It is seen from the graphical representation of the variables that GDP series has been increasing smoothly but not linearly. On the other hand, explanatory variables have been smoothly and linearly increasing over 1972/73-2010/11. To capture this propriety of the variables in our proposed model, we used linear trend and quadratic trend as explanatory variable. Now the question arises, if any of these is appropriate. It is also important to ask if any of these trends really fits the data. Often, no simple trend will fit the data perfectly. If we plot the line of the trend (either linear, quadratic or a combination) as a line over the data, how well does the data fit the line? There are no real rules for determining how good a fit is necessary; we have to use judgment.

The estimation indicates and confirms that public and private investment, have long run positive impact on economic growth.

Table 3: The Estimated Long-Run Static Model

LGDP = 2.341+0.702*LK^p+ + 0.064* LK^g - 0.019*T - 2.642e-05*T2

Dependent Variable: LGDP

Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LK^p	0.702544	0.073334	9.580097	0.0000
LK^g	0.064455	0.019719	3.268646	0.0025
T	-0.018570	0.009373	-1.981294	0.0557
T2	-2.64E-05	0.000139	-0.190113	0.8504
C	2.341724	0.176353	13.27864	0.0000
R-squared	0.987143	Mean dependent var		5.082413
Adjusted R-squared	0.985630	S.D. dependent var		0.337873
S.E. of regression	0.040502	Akaike info criterion		-3.455725
Sum squared resid	0.055774	Schwarz criterion		-3.242448
Log likelihood	72.38664	Hannan-Quinn criter.		-3.379203
F-statistic	652.6191	Durbin-Watson stat		1.758254
Prob(F-statistic)	0.000000			

The above variables are all significant at 1 percent and 5 percent significant level except quadratic time trend variable which is insignificant. This supports the theoretical and empirical findings. To determine whether public investment is more effective then private investment the two coefficients were compared based on the format adopted by Khan and Reinhard (1990). Looking at the regression result in Table-3, it indicates that private investment coefficient is larger than public investment coefficient. Therefore it can be claimed that private investment is more effective in the long run then public investment in Bangladesh. The goodness of fit of the model is good, because the R-squared and adjusted R-squared are 0.987143 and 0.985630 percent respectively.

Total factor productivity coefficient is significant at 1% level in the long run. Approximately 76 percent share of growth is explained by the public and private investment and the remaining 24 percent of growth is explained by the total factor of productivity. Several factors impact on changes in total factor productivity such as changes in technology and externalities, changes in the sectoral composition of production, trade openness. The coefficient of TFP justified the empirical findings explained throughout this paper. At present stage of economic development in Bangladesh, capital accumulation captures the larger share of growth accounting. However, technological infusion has not occurred much

during our development process. TFP did not contribute much due to low contribution of manufacturing and service sector in the economy, lack of skill enhancement program to increase the labor productivity of unskilled labor, insufficient public and private participation for improving HDI (human development indicators) by spending on health and education. In fact, Bangladesh is passing through the transition stage of development and has started to increase its investment to human capital development in order to produce high skilled workers.

The diagnostic tests including Breusch-Godfrey serial correlation LM test, Jacque-Bera-normality test and white heteroskedasticitytest reveals no signs of misspecification. All the tests revealed that the model has the desired econometric properties, namely, it has a correct functional form and the model's residuals are serially uncorrelated, normally distributed and homocedastic. Therefore, the results reported can be claimed as valid and reliable.

This result of the Error Correction Model (ECM) presented in Table 4. The estimation indicates and confirms that private investments are significant and have positive short-run impact on economic growth.

Table 4: The Estimated Error Correction Model

Dependent Variable: DLGDP
Sample (adjusted): 8 39
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLGDP(-1)	0.597545	0.063843	9.359570	0.0000
DLGDP(-2)	-0.262303	0.067174	-3.904816	0.0021
DLGDP(-3)	0.273934	0.053452	5.124863	0.0003
DLGDP(-4)	-0.127739	0.027226	-4.691756	0.0005
DLGDP(-5)	0.160971	0.019856	8.106794	0.0000
DLK^{p}	0.084602	0.029967	2.823207	0.0154
DLK^{p}(-1)	0.019758	0.032716	0.603920	0.5571
DLK^{p}(-2)	-0.029608	0.032415	-0.913419	0.3790
DLK^{p}(-3)	0.004124	0.020812	0.198151	0.0462
DLK^{p}(-4)	0.040846	0.021553	-1.895130	0.0824
DLK^{p}(-5)	0.039506	0.016344	-2.417108	0.0325
DLK^{g}	-0.012660	0.014670	-0.862949	0.4051
DLK^{g}(-1)	0.040709	0.014364	2.834157	0.0151
DLK^{g}(-2)	0.002085	0.014246	0.146326	0.8861
DLK^{g}(-3)	0.011456	0.010824	1.058327	0.0307
DLK^{g}(-4)	0.005695	0.008772	0.649232	0.5284
DLK^{g}(-5)	0.027992	0.008156	3.432132	0.0050
DT2	0.000158	3.15E-05	5.033323	0.0003
EC(-1)	-0.360734	0.037661	-2.674746	0.0202
C	-0.003882	0.003579	-1.084903	0.2993
R-squared	0.952221	Mean dependent var		0.024859
Adjusted R-squared	0.876571	S.D. dependent var		0.015013

S.E. of regression	0.005274	Sum squared resid	0.000334
Durbin-Watson stat	1.675307	Long-run variance	2.27E-06

In short run, Total Factor of Productivity is negative and is not significant. This is mainly due to lack of technological infusion and adoption capacity of the newly arrived technological know-how to the growth process in the short run. The benefit of the human capital investment also cannot be materializing within short run at this early stage of development.

Augmenting the ECM model to include lagged variables provide further insight into the relationship between GDP growth and gross capital formation (both public and private investment). GDP growth rate responds to its own lagged values as well as to lagged variables of both public and private investments, meaning that the coefficients of lagged variables display persistence and responsiveness to the economic business cycle in the short run. By persistence, we mean the correlation between past and current GDP growth; in other words, does GDP growth have momentum such that periods of positive growth are followed by further growth while declines tend to be followed by further declines? The persistence and responsiveness framework points to a sustainable fiscal position of the Bangladeshi economy.

Incorporating lagged investment suggest that though capital formation both in public sector and private sector provides an impetus to economic growth, growth may take on a momentum of its own such that periods of poor investment in turn provides in poor economic growth and vice-versa. Both DLK^{p} and DLK^{g} have insignificant effect on growth at two and four year lag. This resulted lower growth rate corresponding to previous year.

In the short run error Correction output, Economic growth of one period lag is found to have its most noticeable impact on current GDP growth rate. The intensity of impact is found to be gradually decreasing with increase of lag period. The magnitude of impact with three and five lag is 0.273934 and 0.160971 respectively. It implies DLGDP(-5) has less impact on DLGDP than DLGDP(-3). Again DGDP (-2) and DLGDP (-4) have significant negative impact on DLGDP during FY2008-09 and FY2006-07. It implies real economic of Bangladesh was responsive to business cycle shock. During FY2008-09 and FY2006-07 GDP growth rate of Bangladesh was 5.7 and 6.4 (at constant price) respectively which were 05 and 0.2 percentage point lower than the previous year. During these two periods economy of Bangladesh experienced both internal (military democracy) and external shock (worldwide recession).

Public investment in the first lag has a positive coefficient and is statistically significant at 1 percent level. This implies that public investment in first lag have positive short run impact on economic growth. On the other hand, private investment in the first leg does not have any significant impact on economic growth. In addition, both public and private investments in third and fifth lags have positive coefficients and are statistically significant at 5 percent significant levels. This infers that capital formation in both sectors in third and fifth lags has short run positive impact on economic growth. And most importantly, this

could also suggest that it probably takes considerable duration for both public and private investment to reach an equilibrium state in the short run.
The ECM estimated coefficient is estimated at -0.36 and it is statistically significant at 5 percent significant level, it has the correct sign and therefore suggests that any shock which diverge the economy from the steady state can converge to the long-run equilibrium path. In conclusion the goodness of the model is good given that the R-square and R-square adjusted is 91.41 percent and 88.96 percent respectively (Table 4).

The diagnostic tests of the model reveal that the model does not suffer from misspecification. The robustness of the model has been confirmed by several diagnostic tests such as Breusch-Godfrey serial correlation LM test, Jacque-Bera normality test and other specification test. All the tests revealed that the model has the desired econometric properties, namely, it has a correct functional form and the model's residuals are serially uncorrelated, normally distributed and homocedastic. Therefore, the results reported are valid for reliable interpretation.

SECTION IX

9.0 Summary of Findings and Recommendations

9.I Summary of Findings

The main objective of this study is to improve the understanding of the impact of private and public investment on economic growth and point to policy measures aimed at further strengthening economic growth in Bangladesh. In this regard, the study analyzed the impact of public and private investment on economic growth in Bangladesh. The methodology adopted is the new neo-classical growth model of Cobb Doglous Production Function utilizing the error correction model (ECM). The model is implemented empirically utilized macroeconomic data for Bangladesh from 1972/73 to 2010/11 period. The empirical implementation follow a co-integration approach that makes use of long-run and short-run analysis. The unit analysis tests conducted confirm that both variables are stationary in first difference and the co-integration tests also confirm the existence of long term relationship between the variables. The findings of the study concluded that there exist a short-run and long-run relationship between public and private investment and economic growth in Bangladesh. This implies that public and private investment impact positively economic growth in the short and long run process. In addition it confirms that private investment is more effective in the long run then public investment.

Another main finding of the study confirms that, the error correction term (ECM) is negative and significant (-0.36), which indicates that 36% of the disequilibrium will be adjusted annually and approximately after 3 (three) years short term dynamics will reach

at equilibrium level. It implies that the gestation period of most of the public and private capital investment in Bangladesh is three years.

9.2 Recommendations:

The main conclusion drawn in this paper relates to the crucial role economic policy has in influencing economic growth, mainly when developing countries are the concern. Based upon the Cobb Doglous Production Function growth model summarized above, at least three dimensions deserve comment.

First: Promoting Private Sector

The results of the study have useful implication for Bangladesh. One important recommendation to boost up the economic growth in Bangladesh is to put more emphasis on private investment. . Therefore, the Bangladeshi authority must place emphasis on this variable to enhance and stimulate economic growth in Bangladesh. One of the ways to achieve this policy objective is to create more wealth or to generate more employment.

Second: Total factor of Productivity:

One of the major drivers of growth in the transition economy like Bangladesh is TFP. Cross-country analyses find that high-growth economies are driven both by growth in their inputs as well as sustained growth in their productivity. The interesting aspect of this conclusion is not that productivity growth has to be extremely high, but simply sustained over a long period. Despite the recent increasing trend in the total factor productivity growth in Bangladesh, the contribution of productivity growth to the overall growth of the economy is low, and that growth has been input-driven rather than productivity-driven. When looking at the TFP growth experiences of other countries, one finds that factors such as human capital development, physical capital development (including infrastructure), financial development, technology absorption, and openness (especially in terms of openness to imports) have a significant impact of TFP growth. Until focuses on these issues, it will be challenging for Bangladesh to achieve sustainable growth. Enhance productivity could be another effective policy objective to accelerate future economic growth. Similarly, effective policies for ensuring technological progress and efficiency in resource utilizationacross sectors will be critical.

Third: Technological Infusion:

One of the fundamental questions that arise across all economies is how much of economic growth is caused by growth in physical and human capital and how much is caused by factors such as technology and institutional change. Though there is controversy about the positive impact of increased physical and human capital on growth,

most economists feel that sustained high growth is dependent on sustained technological and institutional growth.

Fourth: Shifting the Sectoral Balance from Agriculture to Manufacturing and Services

Among the private sector investments, the manufacturing sector has been the major drivers of GDP growth in Bangladesh. Continued dynamism in the manufacturing sector would be important for Bangladesh's transition to middle-income status. To unleash the full potential of the manufacturing sector and to achieve greater diversification, it would be critical that the competitiveness of Bangladeshi manufacturing sector be strengthen considerably.

The relative importance of tradable and non-tradable sectors, despite changes due to structural shifts, are such that still the non-tradable sectors like services, construction, small-scale industry and other demand-driven activities are important contributors to economic growth in Bangladesh. This suggests that future growth policies in the country, at least in the medium term, should simultaneously focus on accelerating the growth of both tradable and non-tradable sectors rather than focusing exclusively on a tradable sector-led growth.

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