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Does Investment Stimulate Economic Growth in Bangladesh? An Empirical Analysis

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Abstract

This paper examines the significant role of investment in the economic growth process of Bangladesh. The study revisits empirically the impact of investment on economic growth. The study applies Ordinary Least Square (OLS) Method for using data from FY1983 to FY2017 period to investigate the responsiveness of investment to GDP growth. The key finding of the study depicts that there is a positive relationship between investment and economic growth in Bangladesh. The results enable us to estimate the desired level of investment to achieve a target for GDP growth. It also reveals that there is a gap of investment to achieve a targeted level of growth in Bangladesh and suggests to increase investment gradually to the desired level.

Keywords: Investment, GDP growth, Growth models, Ordinary least squares method, Bangladesh.

JEL Classification: C32, E22, E23, O53, O57.

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1. Introduction

The phenomenal economic growth rate that Bangladesh has achieved has drawn the attention of economists, experts and international donor agencies. Bangladesh has already achieved the status of lower middle class and is expecting upper middle-class status by 2021 as visualized by the Government Vision 2021. The government of Bangladesh has already formulated the Seventh Five Year Plan for 2016-2020 to accelerate 6.0 percent growth to 8.0 percent by FY2020. As per view of the Planning Commission, total investment (both public and private) needs to increase from 28.9% to 34.4% of GDP by FY2020 to achieve this higher growth rate. Bangladesh government emphasizes rightly on private investment in attaining the targeted higher growth rate because of share of private investment is around 77.44 percent of total investment. In the recent years, the government has also been attentive on public investment along with private investment. That is why public investment has been rising gradually from 4.50% in FY2008 to 7.41% of GDP in FY2017, whereas private investment has been relatively hovering around 22-23% of GDP. However, in this perspective we attempt to reexamine the relationship between investment and GDP growth and way out of accelerating investment to reach in optimum economic growth in Bangladesh.

The remainder of paper is structured as follows. After introduction the second section describes the literature review, the third section depicts the patterns and trends of economic growth, investment and savings in Bangladesh. The fourth section reviews theoretical framework for relationship between growth and investment. The fifth section presents trends in growth and investment in selected Asian countries. The sixth section shows methodology and data. The seventh section shows empirical results of the study. The last section concludes policy implications.

2. Literature Review

A considerable number of studies have been carried out on investment and economic growth of various countries using different samples, methodologies and procedures. Most of the studies have found substantial positive causal relationship between investment and economic growth with few exceptions.

Eberts (1986), Aschauer (1989a, 1989b) and Munnell (1990) show the relationship between government investments on economic infrastructure, and economic growth at national, regional and state levels. They find a statistically significant positive relationship between public investment and economic growth. These studies spark up remarkable interest on relationship between growth and investment.

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

Rahaman et. al (2005) found that private and public investment 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 different in Bangladesh. Further private investment plays a much larger and thus more important role in the growth process of Bangladesh.

According to Haque (2013) 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 on economic growth in the short and long run process. In addition, it confirms that private investment is more effective in the long run than public investment. Another 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 three years, short term dynamics will reach at an equilibrium level. It implies that the gestation period of most of the public and private capital investment in Bangladesh is three years.

Gazali (2010) shows the relationship of domestic investment and economic growth in Pakistan. The empirical findings of his paper indicate FDI, domestic capital stock, and economic growth have long run relationship and the causality analysis shows bidirectional causality between FDI and domestic investment. A unidirectional causality is found between FDI and economic growth and all these findings show that FDI supports both domestic investment and economic growth in Pakistan.

A study conducted by Nasir and Saima (2010) observed that the coefficient of investment /GDP ratio is 0.65 which indicates that a 1 percentage point increase in investment will cause a 0.65 percentage point increase in GDP growth in Pakistan.

Investment is the most important channel through which financial market affects economic growth (Li, 2006). Inflation, a tax on real balance, reduces real returns to savings which in turn causes an informational friction afflicting the financial system. These financial market frictions result in credit rationing and thus limit the availability of investment and finally this reduction in investment adversely impacts economic growth.

Financial market development is positively linked with the level of investment (King and Levine, 1993; Levine and Zervos, 1998 and Atje and Jovanovic, 1993).

Raymond (1998) reexamined the issue using annual observations in United States data from 1948 to 1993. Employing both integration and cointegration tests, he concludes that public capital seems positively related to output, labor and private capital in the long run. The results also suggest and infer that innovations in public capital could have long-lasting effects.

According to Barro (1995) reduction in economic growth is occurred due to reduction in the propensity to investment that is outcome of inflation. He further shows that an increase in average inflation by 10 percentage points per year cause reduction in the ratio of investment to GDP by 0.4-0.6 percentage points and this reduction in investment reduces the real per capita GDP by 0.2-0.3 percentage points per year. So inflation reduces the level of investment and hence reduction in investment adversely affects economic growth.

Other empirical studies find positive effects of public capital spending, particularly infrastructural spending, on private investment, productivity and growth [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.

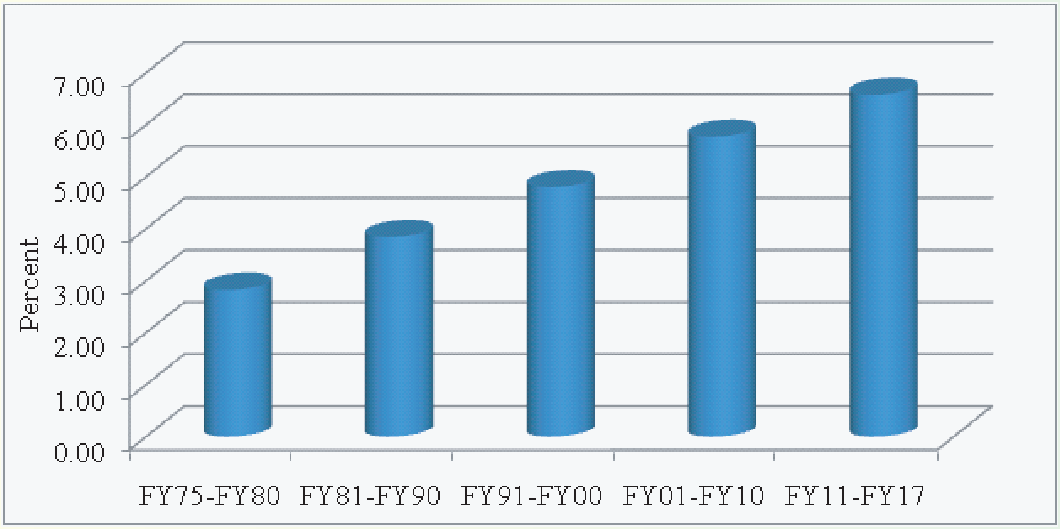
In the context of Bangladesh, there is no considerable number of studies. Hafiz and Hasan (2016) explored the causal relationship between public investments and economic growth in the case of Bangladesh for the period of 1976 - 2014 using a Vector Autoregression Model (VAR). The model also included private investment, inflation, real interest rate, money supply, and foreign direct investment. Their ECM model estimates indicated the existence of a long-run relationship between public investment and economic growth. According to the Granger Causality Test, this study shows that there exists no short run causal relationship between public investment and economic growth.

However, our paper will visit this relationship applying OLS method in order to find the magnitude of responsiveness of investment to GDP growth which is remained unexplored.

3. The Patterns and Trends of Economic Growth, Investment and Savings

Bangladesh economy has been experiencing gradual acceleration in GDP growth for decades together. After liberation major observations are- economic growth had a fluctuating trend till FY1980. In this decade, the highest growth was 7.10 percent in FY1978 and the lowest was 4.10 percent in FY1975.The average growth rate of this decade stood at 2.82 percent. In the 1980s the fluctuating tendency of the growth became relaxed where the maximum growth rate recorded at 6.60 percent in FY1990 and minimum was only 1.20 percent in FY1982. The average growth rate was somewhat higher (3.84 percent) than the previous decade. The next two decades- 1990s and 2000s experienced an average growth of 4.80 percent and 5.77 percent respectively which were more inspiring than previous two decades. In the current decade, the average growth stood at 6.58 percent (Graph 1).

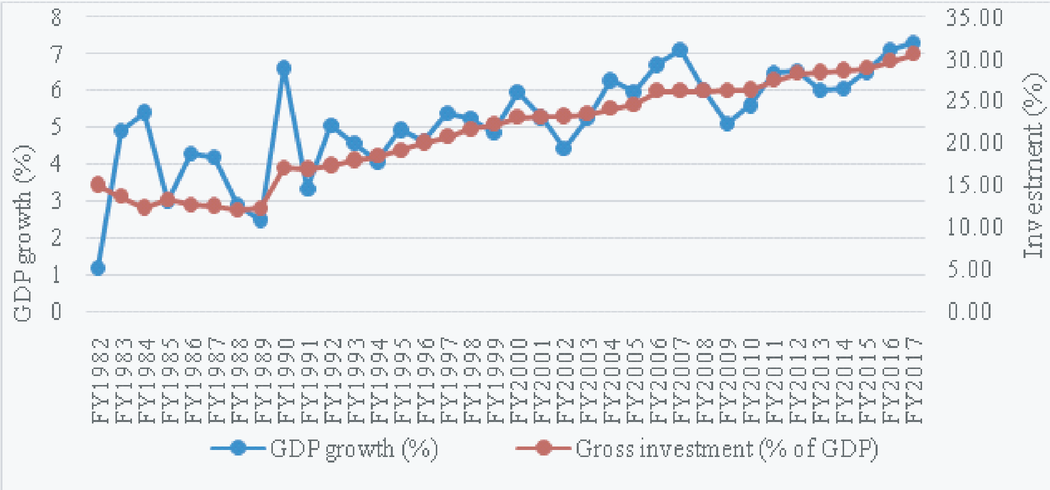
Graph 1: Average GDP Growth in Bangladesh



Source: Bangladesh Bureau of Statistics

Graph 2 shows the historical trend of GDP growth and investment from FY1975-FY2017. According to the estimates of Bangladesh Bureau of Statistics, the Bangladesh's economy grew by 7.1 percent in FY2016 exceeding 7.0 percent growth target and 6.0 percent growth trajectory. This robust growth was mainly attributed to industry and service sectors. In the recent years, Bangladesh Bank has been implementing a cautious and pro-growth monetary policy stance that encourages investment through the strategy of selective easing to support 7.0 percent growth target which has already been achieved.

Graph 2: Trends in GDP Growth and Investment in Bangladesh



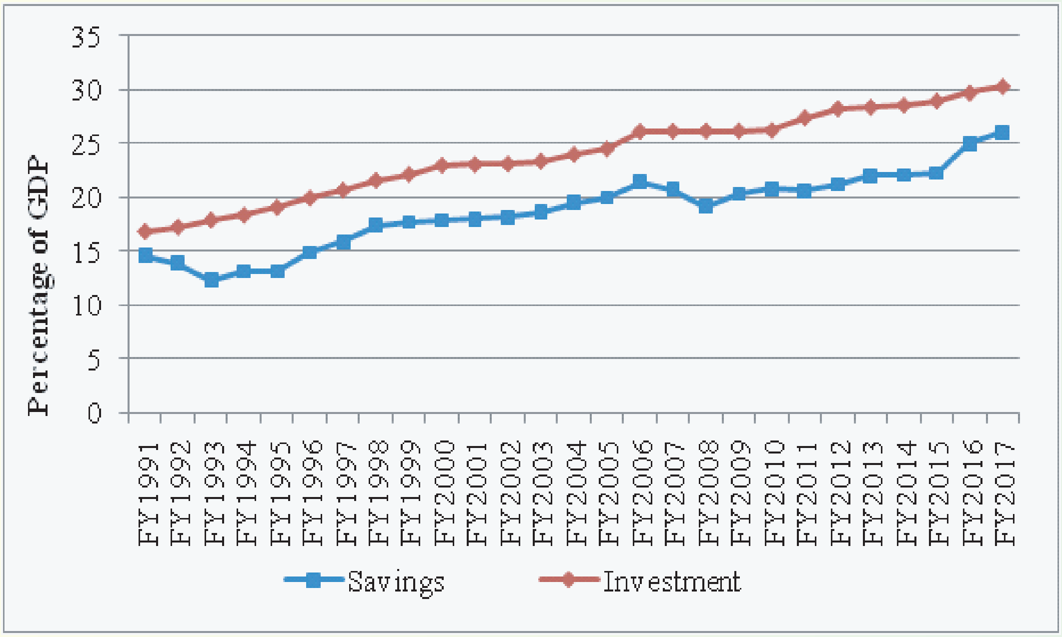
Source: Bangladesh Bureau of Statistics

The World Bank (2007 and 2012) revealed the fact that the most important determinant of growth in Bangladesh has been capital accumulation. The recent higher GDP growth has been possible due mainly to among others, steadily higher investment particularly private investment which has generated from accelerated savings. The investment has fueled the expansion of production in agriculture, manufacturing (particularly garments), infrastructure and human development. These have contributed to the acceleration in economic activities in Bangladesh.

In FY1980, total investment as share of GDP stood at 15.29 percent as compared to only 3.0 percent in FY1973. Investment increased steadily for years together and reached at 17.05 percent and 23.02 percent of GDP in FY1990 and FY2000 respectively. Latest data show that investment increased to 30.51 percent of GDP in FY2017 which was 26.25 percent of GDP in FY2010.

Domestic savings was very insignificant before 1980s. In FY1981, savings was only 3.22 percent of GDP which stood at 12.86 percent of GDP in FY1990. After that it increased to 17.88 percent and 20.81 percent of GDP in FY2000 and FY2010 respectively. Latest data show that domestic saving increased to 25.3 percent of GDP in FY2017 from 22.2 percent of GDP in FY2015. The investment-savings relationship is shown in Graph 3.

Graph3: Trends in Savings and Investment in Bangladesh



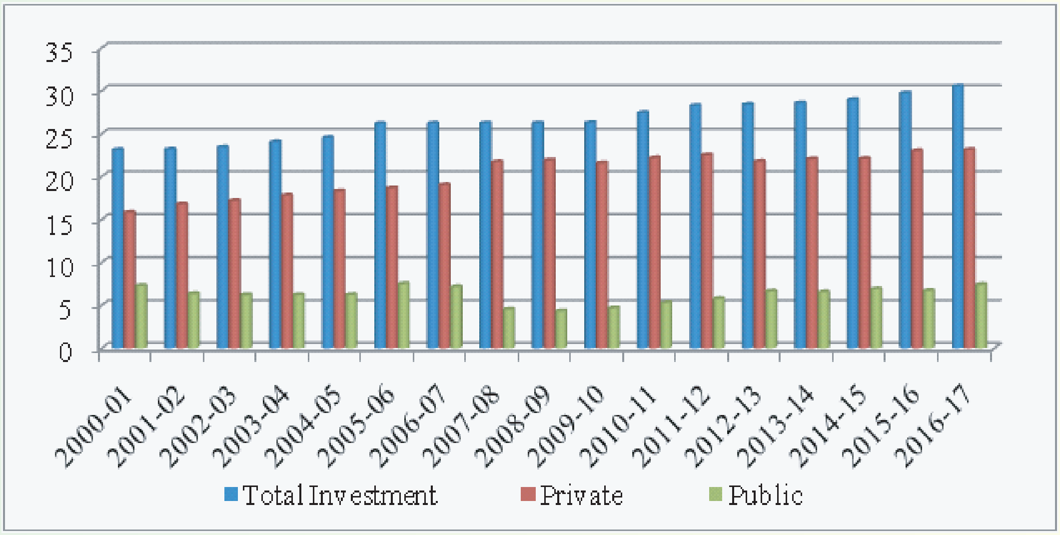
Source: Bangladesh Bureau of Statistics

After liberation, the investment was facilitated mostly by official aid. In the early 1990's, national savings financed much of the investment. It is observed that national savings has exceeded investment slightly in the recent years.

For a long time, different factors have played a positive role in acceleration of investment and savings. These are-macroeconomic environment (including fiscal, monetary and exchange rate policies), considerable increase in financial deepening (M2/GDP ratio), expansion of national saving, progressive investment deregulation, etc. Though a long term track record of investment drive was made in both private and public sectors, the recent pictures are worrisome.

The share of public investment in GDP increased a little bit from 6.7 in FY2016 to 7.4 percent in FY2017 while the share of private investment in GDP rose from 23.0 to 23.1 percent over the same period (Graph 4).

Graph 4: Investment - Public and Private in Bangladesh



Source: Bangladesh Bureau of Statistics

In the past 7 years (from FY2011-FY2017), both investments seem to be stagnant, because the private and public investment hovered over 22.0 and 6.0 percent of GDP respectively. For example, private investment was 23.1 percent of GDP in FY2017 while it was 22.16 percent of GDP in FY2011. Similarly, Public investment stood at 7.41 percent of GDP in FY2017 which was 6.64 percent of GDP in FY2013.This may be attributed to supersede the domestic investment by national savings which is suggestive of an incentive problem and other demand side limitations.

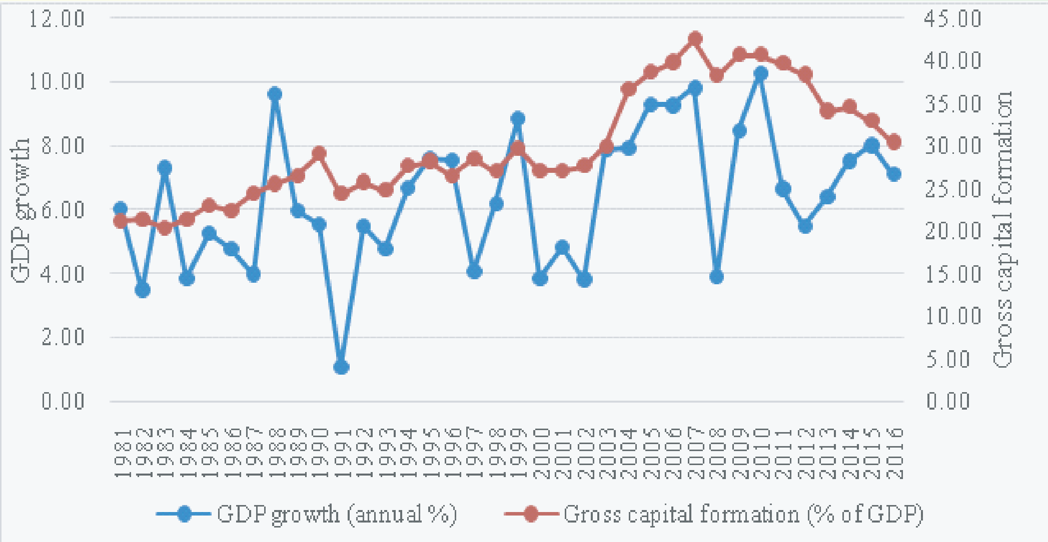
The incompetence of the government agencies, rampant corruptions and money laundering to overseas countries are considered as major barriers to private sector investment in Bangladesh. Lack of quality public investment is one of the reasons behind the inadequate flow of private investment. In spite of the emphasis on public investment by the Government, a fruitful result is not seen primarily because of a lack of quality development works and poor capacity of public agencies. Last year, the missing of some high-profile persons, terrorist attacks like attack in the Holy Artisan at Gulshan in Dhaka city, secret killings of foreigners and law enforcing agencies were also giving bad messages to the local and foreign investors. The Government has been failing to utilize its potentiality for bringing more investments due to lack of energy security, transportation bottlenecks, scarcity of land, bureaucratic complexities and necessary policy reforms, which are the main factors on the way to attract private investments. Therefore, if Bangladesh needs to accelerate its investment drive, particularly, private investment significantly in the next few years, it will be possible to achieve expected economic growth.

4. Trends in GDP Growth and Gross Capital Accumulation in Selected Asian Countries

From the historic trends in investment and GDP growth in some leading growth generating Asian countries like India, China, Thailand, Malaysia and South Korea show that the relationship between investment and GDP growth is positive. The experiences from the selected five growth leading countries show that higher investment (% of GDP) yields higher level of growth.

In India investment (gross capital formation) as percentage of GDP had an increasing trend during 1981 to 2007 and the trend was falling afterwards. However, India's GDP growth rates were somewhat fluctuating in the entire period of 1981 to 2016. However, during the high period of continued GDP growths in India during 2003 to 2007, it is found that India's investment-GDP ratio were very high. Investment increased from 30% of GDP in 2003 to 42% of GDP in 2009 and GDP growth rose from 7.86% to 9.8% during the same period. During 2008 to 2016 investment (as % of GDP) declined and GDP growths were fluctuating with a declining trend (Graph 5).

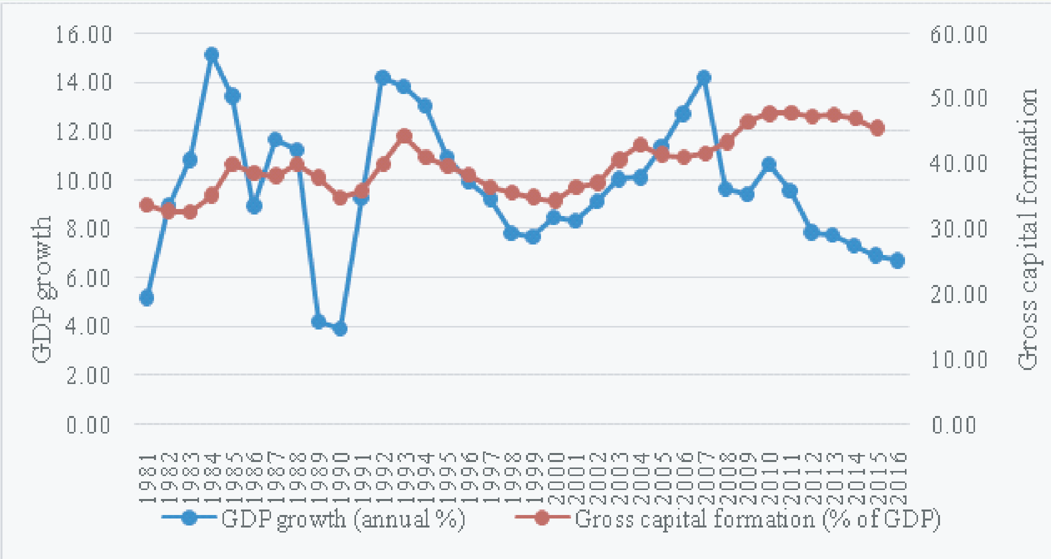
Graph 5: Trends in GDP Growth and Investment in India



Source: World Bank Database

China maintained an investment (% of GDP) above 32% during 1981 to 2016. Following a high GDP growth of 14.22% in 1992 with an investment of 40% of GDP, growth became slowdown continually to 7.67% in 1999 with a declining trend in investment of 35% of GDP. During 2000 to 2007, China's GDP growth again showed an upward trend with higher level of investment and GDP growth reached at 14.23% in 2007 with an investment of 41.46% of GDP. During 2008 to 2015, investment rose and reached at 45.40% of GDP in 2015, but GDP growth rate fell down gradually and reached at 6.9% at the same time (Graph 6).

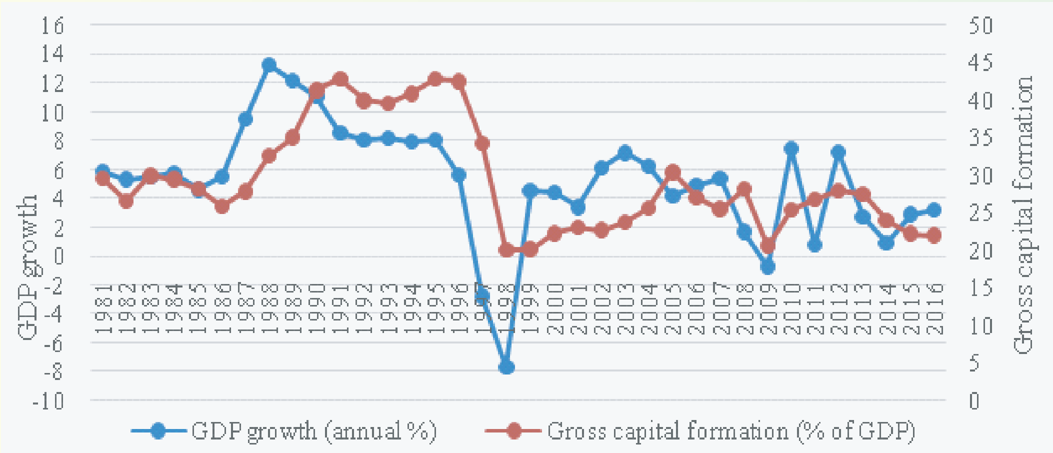
Graph 6: Trends in GDP Growth and Investment in China



Source: World Bank Database

In Thailand, it is found that investment rose from 27.87% of GDP to 42.84% of GDP during periods of the high growth of GDP from 1986 to 1991. Resultantly, GDP growth increased from 5.53% to 13.29% during the same period. Thailand maintained a high level of GDP growth above 8% till 1996. Thailand's economy hit severely in 1997 and onwards due to Asian Crises. Following the Asian Crises both investment and GDP growth fell down (Graph 7)

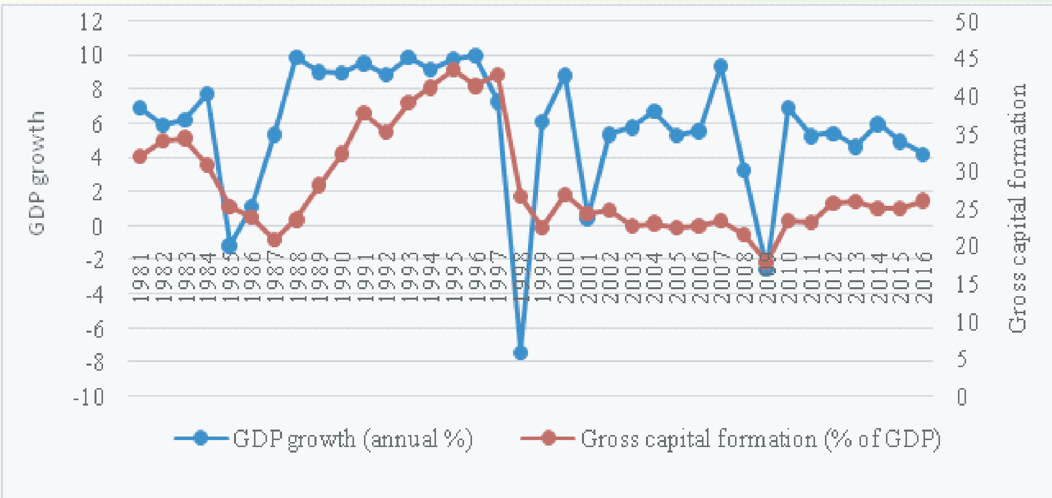
Graph 7: Trends in GDP Growth and Investment in Thailand



Source: World Bank Database

Like Thailand's economy, Malaysia's economy had been growing until Asian Crises in 1997. During 1986 to 1996, Malaysia's investment rose from 23.83% of GDP to 41.47% of GDP and GDP growth increased markedly from 1.15% to 10%. Malaysia's economy was hit by the Asian crises and the economy grew a negative 7.63% in 1998. After the Asian Crises Malaysia's investment fell down significantly between 20-25% of GDP and GDP growth remained on an average 4-5% (Graph 8).

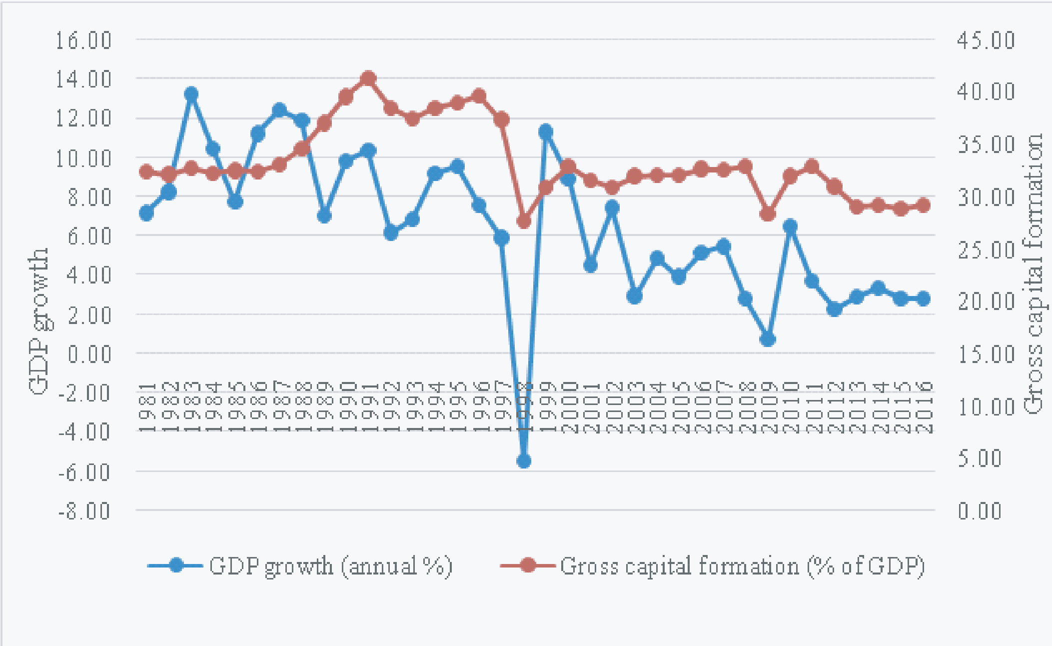
Graph 8: Trends in GDP Growth and Investment in Malaysia



Source: World Bank Database

In South Korea the economy was growing well during 1981-1991. During the period, investment increased from 32.45% of GDP to 41.37% of GDP and GDP growth increased from 7.18% to 10.35%. In the following five years till Asian Crises (1992-1997) the economy maintained persistent investment and growth performance. At that period investment remained on an average of 38.44% of GDP and GDP growth on an average of 7.55%. South Korea's growth drastically dropped to negative 5.47% in 1998 as an immediate impact of Asian Crises. Since 1998 and onwards, South Korean's economy regained, but slowed the growth path. The economy's investment was ranged from 30 to 35% of GDP and GDP growth remained on an average 4-5% (Graph 9).

Graph 9: Trends in GDP Growth and Investment in South Korea



Source: World Bank Database

5. Theoretical Framework for Growth and Investment Relationship

The British Sir Roy Harrod (1939) and American Economist Evsey Domar introduced a very popular and well known model namely Harrod-Domar Growth Model where they show that GDP growth is driven by investment (I) and the capital output ratio *(k)* measured by *(K/y)*.The lower rate of *k* and higher rate of *I* means higher rate of output growth *(y)*. Here *I* depends upon national savings rate *(s)* which encourage higher rate of

I. The equation for Harrod-Domar growth model can be derived in the following ways.

Output is a function of capital stock. Symbolically, we can write

$$y = f(K) \tag{1}$$

Assuming that the marginal product of capital is constant. Therefore, the production function shows constant returns to scale which indicates that marginal and average products of capital are equal.

$$\frac{dy}{dK} = \frac{Y}{K} = \frac{1}{\frac{K}{y}} = \frac{1}{k} \tag{2}$$

Equation (2) shows that the marginal product of capital is the reciprocal of capital output ratio (k). Rearranging equation (2) we get,

$$dy = \frac{1}{k}(dK) \tag{3}$$

Dividing by y in both sides of equation (3) we get,

$$\frac{dy}{y} = \frac{(dK)}{ky} = \frac{I}{ky} \tag{4}$$

Assuming that investment equals savings, i.e. $I = S$, the equation (4) can be rewritten as

$$\dot{y} = \frac{S}{ky} = \frac{s}{k} \tag{5}$$

where $\dot{y}$ denotes GDP or output growth rate, *s* denotes savings-GDP ratio or savings rate i.e. $\frac{S}{y}$

From the equation (5), it can be found that when an economy has a saving rate, *s*, of 20 percent and a capital output ratio, *k*, of 4, GDP growth will be 5 percent per year. To achieve growth double, it needs either saving rate to be 40 percent or k to behalf. Here the challenge is to increase capital *(K)* and its productivity $(\frac{1}{k})$.

Thereafter, due to some limitations of this simplified Model, this was replaced by Neo-classical growth model by Robert Solow where he identified three factors of output growth *(y)* -increase in the stock of capital *(K)*, increase in stock of labor force *(L)* and change in technology (Ω). So, the production function is defined as

$$y = f(K, L, \Omega) \tag{6}$$

Equation (6) can be written in growth form as follows:

$$\frac{dy}{y} = f\left(\frac{\partial K}{K}, \frac{\partial L}{L}, \frac{\partial \Omega}{\Omega}\right) \tag{7}$$

where $\frac{\partial\Omega}{\Omega}$ is change of technology which is exogenously determined, thus the equation (7) becomes

$$\frac{dy}{y} = f\left(\frac{\partial K}{K}\ \frac{\partial L}{L}\right) \tag{8}$$

From equation (8), it can be viewed that in order to increase growth of output (y), it needs to increase growth of either capital stock *(K)* or labor stock *(L)*. In this Model, an increase in *K*, increases labor productivity with fixed labor supply and output growth temporarily. An increase in *K* overtime with fixed labor supply occurs diminishing return and growth effects disappear in the long term. When *K* and *L* go upward then *y* also upturns, the output per worker remains fixed. But technological progress which is exogenously determined can increase the productivity of the factors of production, *K* and *L*.

6. Methodology and Data

To find the relationship between GDP growth and investment empirically, the most appropriate growth model is neo-classical growth model stated in equation (8). Because the model includes more factors of production influencing the growth compared to Harrod-Domar model. But for Bangladesh perspective, data on neither capital nor labor is available. Therefore, we cannot estimate equation (8).

However, there are many studies in which Harrod-Domar model is estimated. Few of them are mentioned below. Siraj and Bengali (2007) used Harrod-Domar model to estimate the relationship between GDP, national savings and capital output ratio in the following ways:

$$y = f(s,k) \tag{9}$$

where y denotes for GDP and s for national savings and k for capital output ratio. Sumer (2012) used Harrod-Domar model to estimate the relationship between GDP and investment in following ways:

$$y = f(i) \tag{10}$$

where y denotes for GDP and i for investment

In the light of the above estimating Harrod-Domar growth models, we can drive a suitable growth model differently for Bangladesh in the following ways.

We rewrite the equation (4) as

$$\frac{dy}{y} = \frac{I}{ky}$$

Alternatively, we write

$$\dot{y} = \frac{1}{k}\, i \tag{11}$$

where i stands for investment-GDP ratio, $\frac{I}{y}$ or investment rate and $(\frac{1}{k})$ denotes marginal productivity of capital.

Equation (11) shows the relationship between GDP growth and investment rate. It gives us the source of formulating a linear regression model for growth. Thus we can state our estimating equation as follows:

$$\dot{y}_t = \alpha + \beta i_t + u_t \tag{12}$$

where β = coefficient of Investment-GDP ratio or responsiveness of investment rate to GDP growth, and α = constant (all other variables which affect GDP growth).

Equation (12) uses annual data for the period from FY1982 to FY2017. The source of data on GDP growth rate and investment-GDP ratio is Bangladesh Bureau of Statistics (BBS).

All the variables in equation (12) are in linear form. While choosing an ordinary least square (OLS) method, it is often very useful to see nature of data i.e. whether there is a unit root. There are two most popular unit root tests - Phillip Parron (PP) and augmented Dickey-Fuller (ADF). The ADF test adjusts Dickey-Fuller test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand while PP test uses nonparametric statistical methods to take care of serial correlation in the error terms without adding the lagged difference terms (Gujrati, 2003). We use both unit root tests for all variables. If unit root tests show that all variables have no unit root at the levels, then the variables are considered as stationary i.e. I (0).

We also test the Granger causality tests to find whether the relationship between growth and investment is unidirectional and causality comes from which variable.

7. Empirical Results and Findings

The correlation coefficient between GDP growth rate and investment-GDP ratio is 0.79 (Table 1 in the appendix) which is highly significant. It indicates that there is a positive strong significant relationship between GDP growth and investment-GDP ratio.

The results of Granger causality tests for lags 1 through 3 for the variables- GDP growth and investment-GDP ratio are shown in Table 2 in the appendix. Results show that causality come from investment-GDP ratio to GDP growth significantly at all lags.

Moreover, there is unidirectional causal relationship at lags. Therefore, we conclude that causality comes basically from investment-GDP ratio to GDP growth. The results of unit root tests with data on investment-GDP ratio and GDP growth (Table 3 in the appendix) show that both variables are stationary at levels. Therefore, we applied OLS method for estimating our econometric model stated in equation (12) and regression results are summarized in Table 5 in the appendix. Te estimated equation is shown as follows:

$$\dot{y} = 1.328^{**} + 0.181^{*}\, i \qquad (13)$$

(3.29) (6.89)

Adj R^2 : 0.57 *F*-Statistic : 47.51

Note: Figures in the parentheses show *t*-values. * and ** show 1% and 5% levels of significance.

From equation (13) we found that positive and significant relationship between GDP growth rate and investment-GDP ratio.

From the diagnostic tests for estimated equation (13) shown in Table 4, we found that there exists heteroscedasticity in residuals. So, we corrected it through applying heteroskedasticity and autocorrelation consistent (HAC) covariance estimation.

The results of HAC covariance estimation is shown below.

$$\dot{y} = 1.328^{**} + 0.181^{*}\, i \qquad (14)$$

(2.72) (8.71)

Adj R^2 : 0.57 *F*-Statistic : 47.51

Note: Figures in the parentheses show t-values. * and ** show 1% and 5% levels of significance.

The results of HAC covariance estimation corrected only standard errors and thus t-values. We find that all coefficients of equation (14) are statistically significant. We see that investment-GDP ratio has a positive impact on GDP growth. The magnitude of the coefficient of investment-GDP ratio is not very high, it is only 0.181 indicating that if other factors remained constant, only 1 percentage point increase of investment-GDP ratio will increase GDP growth by 0.181 percentage points.

Moreover, adjusted R^2 (0.57) shows that the model is a modest goodness of fit. Therefore, the results can be accepted for interpretation.

7. Conclusion

In the sixth five-year plan (2010-2015) of Bangladesh, it was targeted to achieve 8 percent GDP growth with an investment rate of 32 percent of GDP by FY2015, which was not realized. The actual GDP growth rate and investment (% GDP) in FY2015 stood at 6.6% and 28.9% respectively. Moreover, actual GDP growth rates fell below the targets in the 6th five-year plan. However, in the seventh five-year plan, Bangladesh projects to achieve 8.0 percent GDP growth with an investment of 34.4% of GDP by FY2020. In this regard, the economies of selected countries, grew by 8% in the past had needed investment above 35% of GDP. Our findings show that to achieve a sustainable of 8.0 percent GDP growth, investment needs to increase gradually to 36.85% of GDP by FY2020. Since capital is not the only factor of production, the other important factor of production, labor and its productivity may play influential role in increasing output growth with a relatively low level of investment. In addition, technology, innovation, infrastructure facilities, investment environment, etc. are regarded as influential factors on GDP growth. As the labor productivity in Bangladesh remains below than those in selected countries, even the South Asian average (World Bank Database, 2014), it is a challenge for Bangladesh's economy to achieve a high GDP growth with relatively a low level of investment. Therefore, the paper suggests that Bangladesh needs to increase investment gradually to a desired level to achieve an optimum growth in the economy of Bangladesh.

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Table 1 Correlation analysis

Pair variables	Coefficient	Test Statistic	Probabilities	Obervations	Conclusion
$\dot{y}$ and i	0.76	6.89	0.00	36	Positive significant relationship
	Note : $\dot{y}$ = Real GDP growth and I = Investment-GDP ratio				

Table 2 Pairwise Granger Causality Tests

Test Hypothesis	F-statistics in Lags		
	1	2	3
i does not Granger Cause $\dot{y}$	19.50 (0.00)	5.65 (0.01)	4.11 (0.02)
$\dot{y}$ does not Granger Cause i	0.01 (0.93)	0.34 (0.71)	0.44 (0.73)
Observations	36	36	36

Note: Figures in the parenthesis are p-values used to decide on causality at the 5% significance level.

Table 3 Unit Root Tests

Variables (in level)	ADF Test		Phillips -Peron Test		Decision
	With intercept	With intercept and trend	With intercept	With intercept and trend	
$\dot{y}$	-1.57 (0.49)	**-4.98 (0.00)**	-3.37 (0.00)	**-8.94(0.00)**	I(0)
i	-0.38 (0.98)	**-3.72 (0.03)**	-0.38 (0.98)	**-3.71 (0.03)**	I(0)

Note: Figures in the parenthesis are p-values used to decide on unit roots at the 5% significance level. The decision on the basis on the figures marked as bold.

Table 4 Diagnostic tests for equation (13)

Test for	Test Statistic	Probabilities	Conclusion
1. Normality (JB test)	6.70	0.04	Residuals are not normally distributed.
2. Breusch -Godfrey Serial Correlation (LM Test)	2.85	0.07	No Autocorrelation
3. Heteroscedasticity White (cross terms) White (No cross terms)	 2.74 5.37	 0.08 0.03	Heteroskedasticity exists.

Table 5 Results of Regression of GDP growth (y)

Regressors/other estimators	Model 1	Model 2 (HAC covariance)
Constant	1.328** (2.29)	1.328** (2.72)
i	0.181* (6.89)	0.181* (8.71)
Adj.R^2	0.57	0.57
F-statistic	47.51	47.51
Observations	36	36

Note: Figures in the parenthesis are *t*-values. * and ** show that coefficients are significant at 1% and 5% levels.