

Private Investment Demand Function in Bangladesh: An ARDL Approach

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ABSTRACT

Investment, as an addition to the existing physical stock of capital, contributes to the growth of Bangladesh economy in a decisive way. Therefore, factors that determine the private investment need to be studied in order to frame policies to manage them so as to achieve the desired capital stock for the economy to accomplish the much higher GDP growth objective in coming years. The study, thus, is an attempt to estimate the private investment demand function of Bangladesh.

It employs the ARDL bounds testing approach to investigate the relationship between private investment spending and its regressors, namely, real income, rental cost of capital, foreign direct investment and exchange rate relying on data for the period 1980-2017.

The study identifies a long-run equilibrium relationship between private investment spending and its determinants. The determinants are found to have conventional signs- while a rise in real income boosts private investment spending, a rise in the rental cost of capital hurts it. While most of the earlier studies compared the relative role of public and private investment in economic growth of Bangladesh, studies on the factors that determine the countries investment spending is very few. Moreover, majority of the studies in the latter group focuses on determinants of gross investment in Bangladesh, while the study focuses on the domestic private investment taking most recent years' data in the sample period.

Key words: Private Investment, Capital Stock, ARDL Bounds Test, Bangladesh

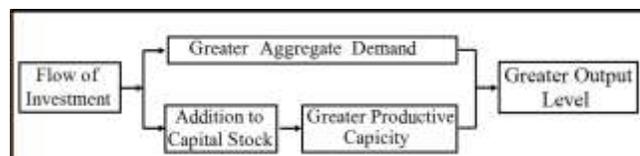
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INTRODUCTION

Economic growth of an economy largely depends on the development of productive capacity of the economy. Being an addition to the existing physical stock of capital, investment builds this productive capacity and hence contributes to the growth of an economy in a decisive way. Capital can be increased both qualitatively and quantitatively, and these increase in capital increases labor productivity which has a direct impact on economic growth. Economists view investment spending as the most volatile component of aggregate demand and hence liable for change in output level in alternating periods of

the business cycle (Baumol & Blinder, 2015; Dornbusch et al., 2011). The dual role that investment plays in the course of development of an economy is shown in figure 1. Along with fostering capital accumulation, it enhances aggregate demand and thereby leads to greater output level.

Figure 1: Role of Investment in Output Growth



Private investment, generally referred to as the purchase of capital assets by private entrepreneurs with anticipation of generating profit, fosters industrial growth and thereby generates income and employment opportunity in an economy (Mamun and Islam, 2010). A good number of studies investigate the impact of investment on economic growth and suggest that the investment incurred by the private sector has much higher impact on economic growth than that of public investment (Munnell, 1990; Khan and Reinhart 1990; Khan and Kumar, 1997).

The economy of Bangladesh experiences a sustained increase in the growth rate of GDP. The growth rate of GDP that was 1.06 percent in the 1970s increased to 6.6 percent in the 2010s. On the other hand, its private investment rises from 3.73 percent to 22.6 percent of GDP over the same period. Therefore, private investment seems to have a considerable impact on GDP growth of Bangladesh economy. Rahman (2016) also identifies that private investment exerts a greater impact on the growth of GDP per capita than public investment in Bangladesh. Therefore, factors that determine the private investment need to be studied in order to frame policies to manage them so as to achieve the desired capital stock for the economy to accomplish the much higher GDP growth

objective in coming years. With this backdrop, the study is an attempt to investigate the factors that determine the domestic private investment spending of Bangladesh.

INVESTMENT COMPOSITION & GROWTH PERFORMANCE

GDP growth performance in Bangladesh has been good. The highest Growth is averaged as 7.42% per annum over the period 2016-2018. It was 3.85% in the 1980s, 4.61% in 1990s and 5.58 in 2000s. Our objective is to raise it to the 8-9% range by 2021. Growth has been reinforced by the revival in private investment; which increased by 15% annually, increasing its part in GDP from 22.16% in 2011 to 23.26% in 2018. The share of public investment in the meantime is increased from 5.25% to about 8% (see table 2). The growth rate over 6 percent throughout the current decade is accompanied by investment growth in the private sector thanks to the incredible development of its stock market (Mamun et al., (2018).

The composition of growth of investment has been shown in table 01. The composition of investment growth has undergone changes during the last one and half decades. As shown in Table, the annual growth rate of private investment declined after 1998 with recovery from 2001 to 2006.

Table 1: The Composition of Growth of Investment

Year	Total Investment	Public Investment	Private Investment	Growth of total Investment	Growth of Public Investment	Growth of Private Investment
2011	2511.3	481.5	2029.8	19.968	29.158	17.977
2012	2982.3	608	2374.2	18.755	26.272	16.967
2013	3403.7	796.2	2607.5	14.130	30.954	9.826
2014	3839.9	879.9	2960	12.815	10.512	13.519
2015	4378.6	1033.9	3344.7	14.029	17.502	12.997
2016	5138.4	1154.9	3983.5	17.353	11.703	19.099
2017	6028.3	1464.7	4563.6	17.319	26.825	14.563
2018	7029.4	1794.2	5235.2	16.607	22.496	14.716

Source: Bangladesh Economic Review, 2018.

Therefore, a complementary association between private and public investment have been noticed and thereby an acceleration of the growth of total investment can be a critical driving force to sustained economic growth.

Again, higher investment-GDP ratio leads to high economic growth, which is still lower in Bangladesh, but it is gradually rising. The investment-GDP ratio is rising sharply especially in the private sector, it was 3.73% in the 1970s and in the period 2010s it stops at 16.94%. On the contrary, in the public sector, the investment/GDP ratio is still moving around 6.8%.

Though the share of total investment in GDP goes on rising, public investment has a little role in the rise. Therefore, it is the private investment that pays the vital role in raising the share of total investment in GDP. Moreover, as the investment-GDP ratio is noticeably

growing in the public sector, therefore we can conclude that an acceleration of investment and especially private investment is essential for fostering economic growth.

Table 2: Investment-GDP ratio, An Indicator of Economic Growth

Period	Total Investment as percent of GDP	Private Investment as percent of GDP	Public Investment as percent of GDP
1970s	10.64	3.73	6.91
1980s	13.10	6.97	6.13
1990s	18.60	9.78	8.82
2000s	25.39	20.09	5.30
2010s	29.46	22.60	6.85

Source: Bangladesh Economic Review, 2018

DATA AND METHODOLOGY

Data Sources

The study examines the determinants of investment spending. Following the Neoclassical theory of investment, two major determinants of private investment spending are rental cost of capital (i.e., the interest rate) and income level of an economy. Higher interest rate reduces investment spending raising the opportunity cost while higher income level of an economy leads to higher investment. Harrison & McMillan (2003) and Markusen & Venables (1999) accept foreign direct investment (FDI) as one of the crucial factors of domestic investment while Ali (2013) accepts exchange rate. Hence, the study considers domestic real income level measured in terms of real GDP, real interest rate, foreign direct investment and exchange rate as the major influential factors of domestic investment based on available literature survey. The study depends on annual time series data through 1981-2017. There are different sources of the variables. Table-3 offers basic explanations of selected variables together with their sources.

Table 3: Variables, Explanations and Sources

Variable	Explanation	Source
INV	Domestic Private Investment	Bangladesh Economic Review, Various Issues
Y	Real GDP	World Development Indicators, World Bank, 2016
r	Real Interest Rate: Inflation-adjusted lending interest rate	
FDI	Foreign Direct Investment	
E	Exchange Rate: Local currency for per unit U.S. dollar	

Model and Methodology

In order to identify the long term determinants of domestic private investment spending, the study will check whether there prevail any long-run cointegrating relationships among time series variables. It can be done applying the Johansen’s (1988) approach to cointegration and ARDL or Bounds testing methodology offered by Pesaran and Shin (1999). The approach of Johansen is applicable when all the time series variables are integrated at order one and the sample size should be sufficiently large in order to avoid small sample bias. On the other hand, ARDL Bounds Testing approach can be applied even if the series are integrated at order zero or order one or a combination of both and the estimators obtained are less sensitive to the sample size (Pesaran et al., 2001). Therefore, order of integration of the series need to be tested so as to identify the appropriate method of detecting long-run cointegration relationship among the variables.

The conventional techniques named ADF (Augmented Dickey-Fuller) and PP (Phillips Perron) Unit Root Tests are commonly used to detect the stationarity of the time series variables. Outcomes of the tests are shown below in table-4. As per test results, domestic private investment, real income shown by real GDP and foreign direct investment are stationary at first difference. Therefore, these three variables follow I(1) processes. Though the PP test finds the exchange rate is stationary at level, visual check suggests that it is non-stationary. Finally, the real interest rate is stationary at level, that is, it is an I(0) scheme. Regression at level of the variables will be spurious in the presence of I(1) series and in this case the variables have to pass the cointegration test. Since the case we are handling contains both I(0) and I(1) variables and the sample size is relatively small, employing the ARDL Bounds Testing approach will be suitable for researching the long run cointegrating relationship among the variables.

Table 4: ADF and PP Tests for Stationarity

Variables	Test in	Includes	ADF		PP	
			t-statistic	p-value	t-statistic	p-value
lnI	Level	Intercept	2.247	1.000	1.988	1.000
		Trend, Intercept	-3.802	0.032	-1.416	0.839
	First Difference	Intercept	-5.171	0.000*	-5.372	0.000*
		Trend, Intercept	-2.723	0.236	-6.011	0.000*
lnY	Level	Intercept	6.523	1.000	9.367	1.000
		Trend, Intercept	-0.849	0.951	-0.837	0.952
	First Difference	Intercept	-4.211	0.002*	-4.347	0.002*
		Trend, Intercept	-6.171	0.000*	-7.627	0.000*
i	Level	Intercept	-3.764	0.007*	-3.692	0.009*
		Trend, Intercept	-3.264	0.092**	-3.593	0.045*
lnFDI	Level	Intercept	-1.243	0.643	-0.705	0.833
		Trend, Intercept	-1.729	0.716	-2.613	0.277
	First Difference	Intercept	-1.584	0.478	-7.562	0.000*
		Trend, Intercept	-5.787	0.000*	-7.455	0.000*
lnE	Level	Intercept	-2.520	0.120	-3.901	0.005*
		Trend, Intercept	-1.681	0.738	-3.785	0.029*
	First Difference	Intercept	-4.831	0.000*	-6.109	0.000*
		Trend, Intercept	-5.598	0.000*	-13.259	0.000*

The functional relationship between private domestic investment spending and its determinants derived from the literature survey,

namely, real domestic income, real interest rate, foreign direct investment and exchange rate, can be given as follows-

$$\ln INV = f(\ln Y, r, \ln FDI, \ln E) \tag{1}$$

The cointegrating regression model in the long-run and the ARDL model according to the traditional ECM for cointegrating variables will be as follows-

$$\ln INV_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 r_t + \alpha_3 \ln FDI_t + \alpha_4 \ln E_t + u_t \tag{2}$$

$$\Delta \ln INV_t = \phi + \sum \varphi_i \Delta \ln INV_{t-i} + \sum \gamma_j \Delta \ln Y_{t-j} + \sum \eta_k \Delta r_{t-k} + \sum \lambda_l \Delta \ln FDI_{t-l} + \sum \mu_m \Delta \ln E_{t-m} + \theta ECT_{t-1} + e_t \tag{3}$$

Here, the error-correction term (ECT) is the series of OLS residuals derived from the long run model (2). The real domestic income is proxied by real GDP. Real GDP, foreign direct investment and exchange rate depreciation reflected by an increase in the exchange rate is expected to have positive impacts on domestic private investment while higher real interest rate of dispirits entrepreneurs to borrow and to invest. Thus, the plausible signs of the coefficients, in the long run, are $\alpha_1 > 0$, $\alpha_2 < 0$, $\alpha_3 > 0$, $\alpha_4 > 0$.

EMPIRICAL RESULTS AND DISCUSSION

The ARDL Bounds Tests is applied in order to examine if there is a long-run relationship among the variables. Table 5 shows the results of Bounds test. As the computed value of F-statistics exceeds the critical upper bond values, the null hypothesis of ‘no long-run relationships exist’ is not accepted and hence the variables are cointegrated in the long-run, meaning that no long-term information is lost if regression is performed at their levels.

Table 5: Bound test result

Variable	F-statistics	Critical Value Bounds*		
		Significance	Lower Bound	Upper Bound
Investment Spending	6.376117	10%	2.2	3.09
		5%	2.56	3.49
		2.50%	2.88	3.87
		1%	3.29	4.37

Note: Pesaran Critical Values

Table 7: Long-run Model for Domestic Private Investment

$\ln I_t =$	-5.082	$+ 1.227 \ln Y_t$	$- 0.005 I_t$	$+ 0.021 \ln FDI_t$	$+ 0.257 \ln E_t + e_t$
Se	0.351	0.053	0.002	0.005	0.083
t	-14.473*	22.947*	-2.951*	4.177*	3.110*

Note: * indicates coefficients are significant at 1 percent significance level

With regard to the long-run relationship (equation 2) between private domestic investment and its determinants as shown in table 7, the estimated coefficients of the variables have signs theoretically expected and highly significant at 1 percent confidence level. The responsiveness of domestic private investment

The existence of a cointegrating relationship in the long-run allows us to estimate the dynamics in the short-run and the adjustment to the long-run equilibrium. Based on AIC (Akaike Information Criteria), an ARDL (1,2,0,1,2) model is appropriate for the estimation of long-run cointegrating relationship. The model is stable and free from the problem of serial correlation which justifies the results of Bounds test. Table 6 offers the dynamic short-run error correction model for ARDL (1,2,0,1,2) scheme. A negative significant coefficient attached to the error-correction term ECTt-1 measures the speed at which short-run errors are adjusted towards the equilibrium in the long-run. The obtained coefficient of the ECT is negative and statistically significant which is ‘-0.588’ meaning that any deviation in domestic private investment in the short-run adjusted at the rate of 58.8 percent per annum to its long-run equilibrium value.

Table 6: Error-correction Estimate for ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(lnY)	0.581	0.233	2.491	0.021
D(lnY(-1))	-0.353	0.250	-1.410	0.173
D(lnFDI)	0.005	0.003	1.740	0.097
D(lnE)	0.134	0.077	1.743	0.092
D(lnE(-1))	-0.111	0.064	-1.741	0.100
ECT(-1)	-0.588	0.085	-6.882	0.000

to 1 percent change in real income is 1.23 percent and positive. Islam (2003) measures the investment sensitivity to interest rate and also identifies similar result in terms of direction. The interest rate sensitivity of investment is 0.005 percent which is inverse. A 1 percent decrease in real interest rate lessens domestic private investment by 0.005

percent. FDI inflow is complementary to domestic investment. Depreciation of real effective exchange rate promotes domestic entrepreneurs to invest more enhancing competitiveness confirmed by the positive coefficient of the exchange rate.

POLICY IMPLICATIONS AND CONCLUSION

The study supports the view that easing credit constraint by reducing the rental cost of capital, i.e., the interest rate can be a way to attract more investment in Bangladesh economy. According to the WDI, cross country comparison indicates that real interest rate is relatively high in Bangladesh which has an ominous impact on private investment and therefore on the growth of the economy. The study also confirms that income growth can draw more private investment in Bangladesh economy. In current years, Bangladesh receives substantial FDI in its infrastructure sector. Efficient physical infrastructure is still one of the major hitches of the economy. Hence, FDI in infrastructure plays an important role in tempting more private investment in the economy. The complementary role of FDI on private investment directs policymakers to set comprehensive policies for long-term investment both from home and abroad and maintain economic growth for advancing towards desired goals of the economy.

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