CROWDING *IN* OR *OUT*? AN ANALYSIS OF THE EFFECTS OF PUBLIC BORROWINGS FROM DOMESTIC SOURCES IN BANGLADESH

Md. Abul Basher
TahreenTahrima Chowdhury
Jahangir Alam

Bangladesh Institute of Development Studies

www.bids.org.bd

CROWDING *IN* OR *OUT*? AN ANALYSIS OF THE EFFECTS OF PUBLIC BORROWINGS FROM DOMESTIC SOURCES IN BANGLADESH

Md. Abul Basher
TahreenTahrima Chowdhury
Jahangir Alam

Crowding in or out? An Analysis of the Effects of Public
Borrowings from Domestic Sources in Bangladesh

Md. Abul Basher
Research Fellow, BIDS

Tahreen Tahrima Chowdhury
Research Associate, BIDS

Jahangir Alam
Research Assistant

CONTENTS

List of Tables and Graphs

ACRONYMS AND ABBREVIATIONS

ACF	Autocorrelation Function
ADF	Augmented Dickey Fuller
AIC	Akaike's information criterion
AR	Autoregressive
ARMA	Autoregressive Moving Average
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BIDS	Bangladesh Institute of Development Studies
CUSUM	Cumulative sum of the recursive residuals
FY	Fiscal Year
GDP	Gross Domestic Product
HP	Hodrick-Prescot
IMF	International Monetary Fund
IRF	Impulse Response Function
MA	Moving Average
OLS	Ordinary Least Squares
PACF	Partial Autoregressive Function
PB	Public Borrowing
PI	Public Investment
REF	Research Endowment Fund
SFYP	Sixth Five Year Plan
SVAR	Structural Vector Auto-regression
US	United States
VAR	Vector Auto-regression
WB	World Bank

FOREWORD

This research study was funded by the BIDS Research Endowment Fund (REF) which provides a window for the BIDS researchers to conduct policy oriented research on priority development challenges facing Bangladesh.

In 2009, BIDS received Tk. 200 million from the government to create the REF to carry out policy research at the Institute. The creation of BIDS-REF has significantly enhanced our scope of conducting institutional research. Under the BIDS-REF, several research studies have been initiated with the expectation that this will enable the researchers to bring their knowledge into the mainstream of development research and evidence-based policy making in the country through conducting policy relevant works.

These research studies are included in the Annual Research Programmes (ARPs) of BIDS which are prepared every year through a rigorous and participatory process in consultation with the government, civil society, private sector and other concerned stakeholders. As such, several of these studies are undertaken in response to emerging challenges and/or at the request of the government and other agencies.

This is for the first time that BIDS is publishing the BIDS-REF study reports as a part of its commitment to establishing transparency and accountability to its stakeholders including fellow researchers and policymakers who are working towards promoting evidence based policies in Bangladesh. I hope the study report will be useful to all stakeholders concerned with the theory and practice of development in general and of Bangladesh in particular.

I would like to express my deep appreciation to all my colleagues in BIDS who have cooperated and contributed to the preparation and publication of these research studies. I would also like to express my deep gratitude to the Hon'ble Minister of Planning and Chairman of BIDS Board of Trustees and its distinguished members who are providing continuous guidance and support to BIDS in the effort to further concretising its long term vision of being part of a process that places BIDS firmly on the level of engagement in furthering better research and better policy leading to better Bangladesh.

July 2014   Mustafa K. Mujeri
                                                                    Director General

Executive Summary

Public borrowing has become a central topic of the current policy discourse in Bangladesh. The widely held popular view is that public sector credit limits the availability of credit to private sector. However, this view is not based on the findings of any methodical research. BIDS recently conducted a study with the support of its research endowment fund to assess whether public borrowing promotes or hinders private investment. Using an econometric model that represents a long-run relationship between private investment, perception about economic performance, price of machineries and raw materials, capital stock of the previous year, liquidity situation, public borrowing, GDP, private investment of the previous year, and growth of world economy, the study evaluates the impact of public borrowing on private investment.

The study assumes that private investment essentially responds to the difference between the desired and actual capital stock. Given the infrastructural deficit, limited access to finance and other constraints, the adjustment of the gap between desired and stock of capital cannot be instantaneous. The desired level of capital stock depends on the expected profitability of investment, which depends on a number of external and domestic factors including public investment, which, in turn, partly depends on public borrowing. The impact of public borrowing on private investment has been empirically examined by using this framework. Data used in the study are collected from different secondary sources. They include Ministry of Finance, World Bank, International Monetary Fund (IMF), and Bangladesh Bank. We derive a number of indices for our analysis by using the secondary data. Based on the availability of data, the sample period for this study covers from 1987 to 2011.

An econometric model was estimated by using the detrended value of the relevant macroeconomic variables that possess a unit root process. To assess whether the estimated relationship involves any structural break(s), the study uses CUSUM and CUSMUM-square tests. Finally, to assess the persistence of public borrowing the study uses the vector auto regression (VAR) model.

The main findings of the study show that instead of driving out, public borrowings in fact drive in more private investment. This finding is statistically significant. The results of the structural break test suggest that public borrowings had never drove away the private investment in Bangladesh, not even in the years when these were on the higher side and a lot of speculation was made about their negative impacts. According to this study, public borrowing in Bangladesh continues promoting private investment in more than one subsequent year.

The findings of this study have a number of policy implications:

i.   The finding that public borrowing does not crowd out private investment suggests that government should not shy away from financing infrastructure

through borrowing. With current trend of public borrowing, no trade-off between provision of infrastructure and private investment is implied.

ii. Being unnerved by the criticisms by many experts for borrowing "too much" from domestic sources, Government sometimes contemplates to borrow at commercial rates from international financial market by issuing sovereign bond. However, the findings of this study imply that there is no ground for such a policy shift as long as cost of borrowing from domestic sources is less than the cost of commercial borrowing from international financial market.

iii. The result of the study suggests that the estimated causal relationship between private investment and public borrowing, the later crowding in the former, remained stable for the period 1987-2011. In other words, public borrowing in none of the years of the sample period has been "too high" to induce a structural break in the estimated relationship and to crowd out the private investment. During this period, public borrowing accounted for about 2.5 per cent of GDP during some years. Therefore, it can be argued that government can safely borrow up to 2.5 per cent of GDP from the domestic sources, if not more, without worrying about crowding out effect of public borrowing.

iv. Finally, the findings of this study suggest that public borrowing requires about three years affecting the private investment. This indicates some level of inefficiency of public spending. To ensure the highest possible benefit of public borrowing, government needs to take action to increase the efficiency by promoting timely implementation of public projects.

CHAPTER 1
INTRODUCTION

Bangladesh managed to graduate to a higher growth trajectory in recent years. GDP growth over FY2000-2010 averaged a robust 5.8 per cent, registering a 1 percentage point increase over FY1990-1999. For the last five fiscal years, FY2008-2012, average growth of GDP stood to be 6.2 per cent. Buoyed by the demonstrated growth resilience to different shocks, Government aspires to increase it to 8 per cent by 2015 and further to 10 per cent by 2021 in its 'Vision 2021' to become a middle income country within a decade.

According to government's sixth five year plan (SFYP), public investment has to be increased from its current level of 3.68 per cent of GDP in FY2012 to 7.5 per cent in FY2015 to accelerate the GDP growth to its target level. This target reflects the recognition of the infrastructural deficit that has become a main hindrance to economic growth in Bangladesh.

In pursuit of the growth targets, government has been implementing expansionary budget in recent years where the growth of total expenditure outpaced the growth of revenue collection. The deficit financing has been rising as a result. In particular, the size of budget during the last two fiscal years grew by about 26 per cent and deficit financing has increased from 3.7 per cent of GDP in FY2010 to 5.1 per cent in FY2012 (Table1.1).

Table 1.1
Budget Deficit (as percentage of GDP) and Its Financing

	FY2008	FY2009	FY2010	FY2011	FY2012
Budget deficit	6.2	4.0	3.98	4.52	5.1
Sources of financing of budget deficit					
Net domestic borrowing	3.7	2.2	2.5	3.3	3.8
Net external borrowing	1.7	1.0	1.0	0.7	0.9
External grant	0.8	0.8	0.5	0.52	0.4
Size (in billion Taka) and distribution of domestic credit					
Total credit	444.09	398.75	516.62	933.12	843.96
Share of private borrowing (in %)	73.62	62.22	85.96	76.01	79.25
Share of public borrowing (in %)	26.38	37.78	14.04	23.99	20.75

Source: *Bangladesh Economic Review 2012* (p.266), for FY2012, BB *Monthly update*, August 2012.

Deficit financing in Bangladesh so far has not become a major concern from the viewpoint of overall debt-sustainability of the country. However, deficits are mostly financed by domestic borrowing from commercial banks as scope for concessionary external borrowing is shrinking over time. Total external financing (net external borrowing plus external grant) accounted for about 2.5 per cent of GDP in FY2008, and declined continuously since then. It accounted for only 1.3 per cent of GDP in FY2012, resulting in an increased dependence on public borrowing from domestic sources.

Although the stimulating effects of public investment are indisputable, the overall impact of public borrowing to finance it is not unambiguous. The debate whether public borrowing helps or hinders economic growth by increasing private investment has its origin in the Classical versus Keynesian dichotomy. The classical view, which assumes operation of the economy at the production possibility frontier, argues that public borrowings to finance public investment reduce the resources available to the private sector. If the resources are limited and fully employed, then government can claim more of it only by somehow denying it to the private sector. Hence, the private investment decreases. If the classical view is true, it would highlight serious drawback of traditional Keynesian notion of deficit-financing fiscal policy for economic stimulation in Bangladesh.

If the productivity of public and private investment is at par, public borrowing-financed investment by government would imply a zero-sum game. If private investment is more productive than the public borrowing, according to classical view, public borrowing-financed investment by government would imply a net loss. Only if public investment is more productive than private investment, public borrowing-financed investment by government would imply a net gain even in classical case.

The Keynesian view, as opposed to classical view, argues that public investment, even when financed by public borrowing, can crowd in more private investment by reducing the cost of production and increasing productivity. This school of thought assumes availability of unutilised resources as the private sector fails to invest up to the optimum level due to lack of publicly provided utilities and infrastructure. As a result, any increase of publicly provided utilities and infrastructure would increase private investment.

Whether public borrowings promote or hinder private investment is an empirical question. The stimulating effects of investment made by the government by using public borrowing may vary with the level of public investment (Barro 1990, Devarajan *et al*. 1996, and Kneller *et al.* 1999). In order to take an informed policy decision regarding borrowing-financed public investment, it is important to know whether it crowds in or out private investment. This is one of the reasons why public borrowing has emerged as a central focus of concern in economic policy debate in Bangladesh, attracting anxious attention from a variety of constituencies.

However, the recent speculations of many economists that public borrowings are crowding out private investment are based on conjecture, not on any research. However, as a result of these speculations, government is contemplating to issue sovereign bonds to collect resources from external sources at commercial rates. Such an action may create even more adverse effects in overall economy. Considering the urgency of assessing the impact of public borrowing on private investment, the current study investigates this issue empirically.

The main objective of this study is to quantitatively assess the impact of public borrowing from domestic sources on private investment in Bangladesh. The study also assesses whether the impacts of public borrowing are instantaneous or come into effects with lag. In particular, the study evaluates the length of time that public borrowings take to impact the private investment. By using the available longitudinal data, the study evaluates whether the transmission mechanism of the effects of public borrowings on private investment is linear or time-varying. In addition, some policy imperatives are highlighted in the light of the findings of this study.

1.1 Structure of the Report

Following the introduction, chapter 2 describes the prior analyses pertinent to our study. Chapter 3 focuses on the dynamics of private investment and public borrowing in Bangladesh. Chapter 4 presents the methodology while chapter 5 provides the empirical model and data. Chapter 6 analyses the results and chapter 7 provides policy imperatives. Finally, chapter 8 concludes the report.

CHAPTER 2
LITERATURE REVIEW

Despite the importance of crowding out effect of public borrowing on private investment in the context of policy implications for Bangladesh, no single country study has been carried out except Majumder (2007). This study investigates the crowding-out effect of public borrowing on private investment in Bangladesh context. An investment function with three independent variables, namely public borrowing, GDP and interest rate, has been estimated by analysing the unit root test, co-integration test and the error correction model. The study, however, depicted the evidence of crowding in effect rather than corroborating the crowding out hypothesis. In the long-run, GDP and public borrowing seem to have statistically significant impact on private investment, whereas the impact of interest rate on the same is found to be statistically not significant.

Miguel (1994) in his study on Mexico found public investment causing a crowding-in rather than a crowding-out effect on private investment. A similar result was found by Bazaumana (2004) in the case of Senegal. He drew on the Johansen co-integration techniques and bound test approach to estimate long-run private investment function.

Ahmed and Miller (1999) tried to explore the effects of disaggregated government expenditure on investment employing fixed- and random-effect methods in the context of some developed and developing countries. One of the results of their study was that government expenditure on transport and communication induced crowding in effect in developing countries while expenditure on social security and welfare reduces private investment in both developed and developing countries. Cruz and Teixeira (1999) examined a temporal framework with Brazilian data for 1947-1990 and showed that crowding-out effect occurred due to public investment in the short-run, a reversal appeared in the long-run.

Mitra (2006) had the same conclusion as Cruz and Teixeira (1999), analysing the evidence from India. Indian case was also examined by Serven (1996). He discussed the separate impacts of public capital for infrastructure and the same for non-infrastructure on private capital and found that public capital for non-infrastructure crowded-out private capital in both the short and long run but other type of public capital crowded-out in the short-run and crowded-in in the long-run.

The study by Emran and Farazi (2009) involved a cross-country evidence of the existence of crowding out effect of public borrowing. The study attempted to provide robust estimates of the causal effect of government borrowing on private credit using panel data on 60 developing countries for 32 years and instruments based on the structure of the political system. The results show that there is a significant crowding out effect of

government borrowing from the domestic banks on private credit. The evidence is consistent with a "lazy bank" model of bank behaviour in developing countries supporting the crowding out hypothesis where the higher government borrowing discourages the banks from lending to the risky private sector, and stifles their incentives to seek out new profitable investment opportunities in the private sector. However, interest rate in case of bank lending to private and public sector differs, the later being higher than the former. It actually obliges to lend more to private sector following any borrowing to the public sector to compensate for fall in income.

Khan (2009) explored the effect of public borrowing on private investment by testing the crowding out hypothesis in Pakistan. Despite the presumption of the prevalence of the crowding out phenomenon, the study concluded the existence of crowding-in effect. Fayed (2012) found strong evidence of crowding out effect of public borrowing in the long-run. The paper attempted to depict the "quantity channel" of crowding out of private investment in Egypt by focusing on the volume of private credit using a co-integration approach considering private credit as dependent and government borrowing, industrial production (as proxy of GDP), financial intermediation, institutional quality, and lending interest rate as explanatory variables.

Maana,Owino and Mutai (2008) found no evidence of crowding out effect of public borrowing in Kenya. The study uses a simple model regressing private sector lending on domestic debt (both variables were expressed as a percentage of broad money M3) using ordinary least squares technique, and monthly data covering the period 1996 to 2007.

The findings of these studies are mixed. Apart from methodological heterogeneity and country specificity, one main caveat in the existing literature is that a mere positive causality regardless of its strength is perceived as a crowding in impact of public borrowing, i.e., if public spending by 1 dollar increases by private investment even by less than 1 dollar, it is considered as a case of crowding in. This study, however, perceives crowding in impact only if public spending by 1 dollar increases private investment by more than 1 dollar.

CHAPTER 3

PUBLIC BORROWING AND PRIVATE INVESTMENT IN BANGLADESH

There is no negative relationship between the public borrowing and private investment observed during the last decade to argue that the former crowds out the later. In general, a positive correlation is observed between private investment (pri_inv) and public borrowing (pb) (see Graph 3.1). Private investment has secularly increased despite non-linear dynamics of public borrowing. Graph 3.2 presents the private-investment-public borrowing ratio (R).

Graph 3.1: Public Borrowing and Private Investment (in crore BDT) in Bangladesh during FY2001-FY2011
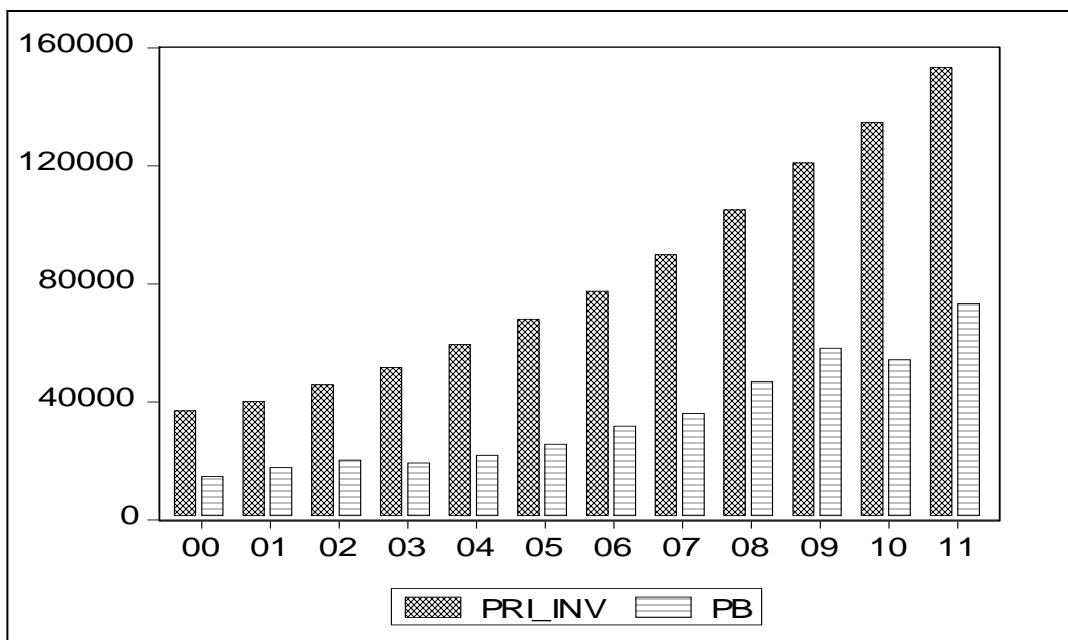
As can be seen from Graph 3.2, the private investment-public borrowing ratio varies across years within about 30 per cent band. The mean of this ratio appears to be 2.41, with a standard deviation of 0.22. All these mean that although no negative correlation is observed between public borrowing and private investment, a positive causality between them is not conclusive either from their dynamics during FY2001-FY2011.

Graph 3.2: Private Investment-Public Borrowing Ratio (R) in Bangladesh during FY2001-FY2011
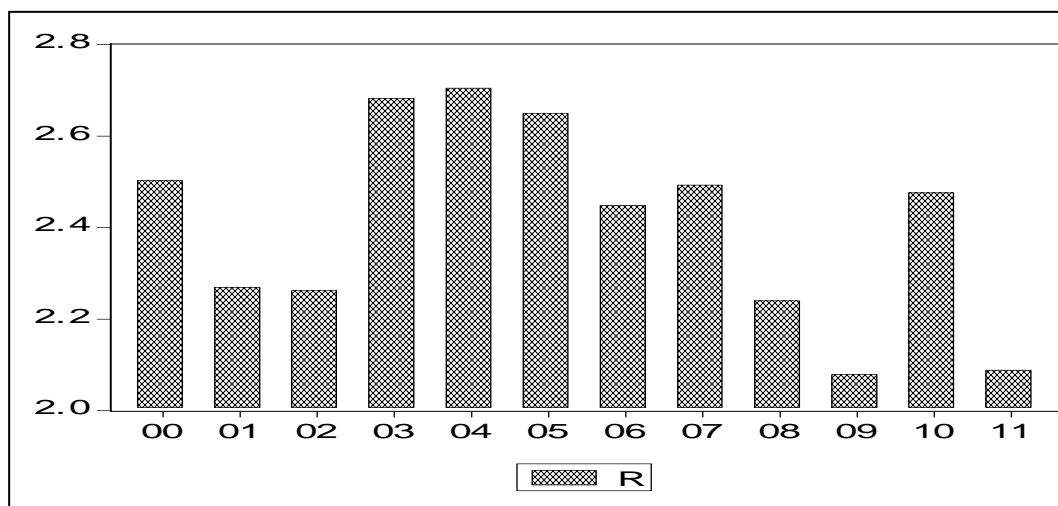
Public borrowing has three different sources: central bank and commercial banks, and non-bank. While the borrowing from the central bank does not directly affect the availability of funds in the commercial banks, other two sources affect it in varying extent. Therefore, composition of public borrowing is also an important determinant of the relationship between private investment and public borrowing. Table 3.1 shows the composition of public borrowing during FY2001-FY2011. As can be seen from this table, it is difficult to identify a systematic pattern in the composition of public borrowing in different years. This is probably one of the reasons why it is difficult to identify a systematic pattern in the relationship between public borrowing and private investment.

Credits from commercial banks account for about 40 per cent of total private investment. While the loanable fund in the banks (which depends on public borrowing amongst with other factors) is a significant supply-side determinant, interest rate is also a significant demand-side determinant.

Table 3.1
Composition of Public Borrowing (in billion BDT) during FY2001-FY2011

Year	Central Bank	Commercial Bank	Non-Bank	Total
2000-01	20.1	9	42.1	71.2
2001-02	27.3	-1.6	47.1	72.8
2002-03	-25.9	16.1	47.9	38.1
2003-04	16.5	10.2	46.6	73.3
2004-05	38.2	-1.4	29.7	66.5
2005-06	93.5	-33.1	31	91.4
2006-07	9.1	35.1	46.8	91
2007-08	0.7	108.9	31.4	141.0
2008-09	29.6	83.2	56.0	168.7
2009-10	-66.3	28.4	124.2	86.3
2010-11	97.3	93.1	30.3	220.7

Source*: Bangladesh Economic Review 2012.*

However, no systematic relationship can be identified from these two determinants. Private credit as a share of GDP has consistently increased since FY2001. Interest rate has not moved much, mainly due to ceiling imposed by the government from time to time. Share of private credits in GDP has increased in some occasions defying the increase in interest rate. This primarily indicates that credit to private sector in Bangladesh probably is not interest rate constrained.

A close look on the composition of total investment reveals that construction sector accounts for more than 75 per cent of total investment, followed by machinery and equipment, which accounts for about 16 per cent, and transport, which accounts for about 6 per cent of total investment (Table 3.2). Thus, share of private investment in construction sector to total investment is the key source of change in the pattern of private investment. However, this share seems to decline over time from 66 per cent in FY2009 to 61 per cent in FY2011. Though there is an increase of the share of transport sector, the increase is still not sufficient to offset the decrease in investment in construction sector.

Table 3.2
Sectoral Composition of Investment

Categories	2006-07	2007-08	2008-09	2009-10	2010-2011
Construction	76.23	77.96	78.71	77.33	75.41
Private	61.65	64.66	66.18	63.93	61.21
Public	14.58	13.31	12.53	13.39	14.36
Machinery & equipment	16.76	15.61	14.99	15.22	16.91
Private	10.98	10.29	10.04	9.97	11.60
Public	5.78	5.32	4.95	5.26	5.31
Transport & equipment	6.83	6.26	6.13	7.28	7.52
Private	5.11	4.59	4.47	5.56	5.85
Public	1.72	1.67	1.64	1.72	1.67
Breeding stock & plantation	0.17	0.17	0.16	0.17	0.17

Source: Own calculation by using data from Bangladesh Bureau of Statistics.

The qualitative analyses of data do not reveal any systematic relationship between public borrowing and private investment. This underscores the importance of a multivariate analysis of this relationship.

CHAPTER 4

METHODOLOGY

4.1 Model Specification

The analysis begins from the identity stating that total investment of a country as the sum of public investment (I_g) and private investment (I_p):

$$I_t = I_{g,t} + I_{p,t} \tag{1}$$

For a given level of total tax revenue, external financing and non-discretionary expenditure of the government, public investment in year 't', $I_{g,t}$ will depend on public borrowing (PB) and GDP of the country:

$$I_{g,t} = \alpha_1 + \alpha_2 PB_t + \alpha_3 G_t \tag{2}$$

Adhering to Rama (1993), the present study also assumes that private investment is essentially a stock adjustment variable responding to the difference between the desired and actual capital stock. Given the infrastructural deficit, limited access to finance and other constraints, the adjustment of the gap between desired and actual stock of capital cannot be instantaneous. Therefore, we assume that investment adjusts gradually to this gap only by a certain portion in each year:

$$I_{p,t} = \lambda(K_t^* - K_t) \tag{3}$$

where, K* is desired level of capital from private point of view, K_t is the actual level of capital (private) and λ is the portion of the gap between the level of desired and stock of capital adjusted in each year.

The desired level of capital stock, in turn, depends on the expected profitability of investment. The expected profitability of any investment depends on a number of external and domestic factors. Specifically, it is modeled as follows in the present study:

$$K_t^* = \phi_0 + \phi_1 v + \phi_2 p + \phi_3 l + \phi_4 I_{g,t} + \phi_5 E_t \tag{4}$$

where v is a measure of perception about economic performance of the country, p is a measure of price of industrial raw materials and metal in international market, l is measure of liquidity situation of the economy and E is the growth of world economy.

Perception about the economic performance of the country results in a precautionary motive for savings (or dis-saving) over and above the life-cycle motive. Part of this savings is ultimately deposited in the commercial banks and therefore can potentially increase the investment. For example, Carroll (1994) finds that a one-standard deviation increase in income uncertainty (a negative perception about the economic performance) decreases consumption by 3-5 per cent. At the same time, increase in uncertainty

negatively affects investment. For example, Pyndyck (1993) finds that the level of stock market uncertainty, as measured by the quarterly variance of stock returns, has a significant negative effect on the growth of aggregate investment. Federer (1993) uses a risk premium embedded in the term structure of interest rates as a measure of uncertainty, and finds a similar negative relationship between uncertainty and both durable equipment expenditures and orders of new plant and equipment. So perception about the economic performance entails two opposing effects on investment; which one dominates is an empirical question.

Since Bangladesh depends significantly on imported items for investment, their price can potentially affect private investment in the country. A price index of industrial inputs in international market is included as a proxy for the price of all imported machineries and raw materials.

The missing variable in this specification is the user cost of capital or interest rate. Most empirically estimated models of investment have not found that interest rate or other proxies for the user cost of capital are significant in explaining variations in investment (e.g., Majumdar 2007).

The stock of capital at period't' is determined by a law of motion. At any given period't', stock of capital is determined as per the following law of motion:

$$K_t = (1 - d)K_{t-1} + I_{p,t-1} \tag{5}$$

where, d is the rate of depreciation. Equation (5) states that stock of capital in a period is equal to the total capital stock and investment made in the previous period minus total depreciation of capital during that period.

Substituting equation (4) and (5) into equation (3) we get,

$$I_{p,t} = \lambda\left[\phi_0 + \phi_1 v + \phi_2 p + \phi_3 l + \phi_4(\alpha_1 + \alpha_2 B + \alpha_3 G_t) + \phi_5 E_t - (1 - d)K_{t-1} - I_{p,t-1}\right] \tag{6}$$

With some mathematical manipulation, we can write

$$I_{p,t} = \left(\lambda\phi_0 + \lambda\phi_4.\alpha_1\right) + \lambda\phi_1 v + \lambda\phi_2 p + \lambda\phi_3 l + \lambda\phi_4.\alpha_2 B + \lambda\phi_4.\alpha_3 G_t + \lambda\phi_5 E_t - \lambda.(1-d)K_{t-1} - \lambda.I_{p,t-1} \tag{7}$$

It follows from equation 7:

$$I_{p,t} = \beta_0 + \beta_1 v + \beta_2 p + \beta_3 l + \beta_4 B + \beta_5 G_t + \beta_6 K_{t-1} + \beta_7 I_{p,t-1} + \beta_8 E_t \tag{8}$$

Where; $(\lambda.\phi_0 + \lambda.\phi_4.\alpha_1) = \beta_0$, $\lambda.\phi_1 = \beta_1$, $\lambda.\phi_2 = \beta_2$, $\lambda.\phi_3 = \beta_3$, $\lambda.\phi_4.\alpha_2 = \beta_4$, $\lambda.\phi_4.\alpha_3 = \beta_5$, -$\lambda.(1-d) = \beta_6$, -$\lambda = \beta_7$, and $\lambda.\phi_5 = \beta_8$

The feedback of the private investment made in the previous period on the private investment of the current period is transmitted through β_7. If β_7 is set to zero, the feedback effect is excluded and only the contemporaneous impact of the explanatory variables is considered. Equation (8) is estimated both in a static setting by restricting β_7 to zero, and in a dynamic setting by allowing β_7 to assume any value.

variables is considered. Equation (8) is estimated both in a static setting by restricting β_7 to zero, and in a dynamic setting by allowing β_7 to assume any value.

4.2 Estimation of Crowding In or Crowding Out Impact

To evaluate the existence of crowding in or crowding out impact of public borrowing, we estimate the long term coefficient of $\beta_{4,LR}$ following Agoison and Mayor (2000), which was also followed by Titarenko (2006) and Mileva (2008). The long run impact of public borrowing on private investment is calculated by setting $I_{p,t}$ equal to $I_{p,t-1}$ in equation 8 in steady state yielding

$$\beta_{4,LR} = \frac{\beta_4}{1 - \beta_7}$$

The estimated value of $\beta_{4,LR}$ will determine whether public borrowing crowds out the private investment in Bangladesh or not.

1. $\beta_{4,LR} = 1$, one unit of public borrowing brings in one unit of private investment.

2. $\beta_{4,LR} > 1$, one unit of public borrowing brings in more than one unit of private investment. This signifies crowding in impact of public borrowing.

3. $\beta_{4,LR} < 1$, one unit of public borrowing brings in less than one unit of private investment. This signifies crowding out impact of public borrowing.

CHAPTER 5

EMPIRICAL MODEL AND DATA

Our empirical specification will follow the analytical framework presented in section 4 (equation 8). The analytical framework represents a long-run relationship between private investment, perception about economic performance, price of machineries and raw materials, capital stock of the previous year, liquidity situation, public borrowing, GDP, private investment of the previous year, and growth of world economy. Adding the error term, the empirical specification to be estimated in our case thus be written as:

$$I_{p,t} = \beta_0 + \beta_1 v + \beta_2 p + \beta_3 l + \beta_4 B + \beta_5 G_t + \beta_6 K_{t-1} + \beta_7 I_{p,t-1} + \beta_8 E_t + \varepsilon_t \quad (9)$$

where ε_t represents the error term. β_4 and β_7 are the primary interest of this study and their sign cannot be predetermined.

5.1 Data

Data used in this study are collected from different secondary sources. They include Ministry of Finance, World Bank, International Monetary Fund (IMF) and Bangladesh Bank. We derive a number of indices for our analysis by using the secondary data. Based on the availability of data, the sample period for this study covers the 1987-2011 period.

Information on public borrowing, investment and money supply has been collected from *Bangladesh Economic Review* (2012). Data on capital stock and GDP have been collected from World Bank. Information about the price of machineries and raw materials as such is not available. As a proxy, we use the international price index for industrial input as provided by IMF. Two indices, one as a measure of uncertainty and another as measure of liquidity situation, have been constructed.

To construct a measure of perception about the economic performance, we fit an autoregressive moving average (ARMA) model on GDP of Bangladesh. The measure of perception is the mean absolute value of forecast error of the past three years. The ARMA approach combines two different specifications into one equation. The first specification is an autoregressive (AR) process, and the second specification is moving average (MA) process. The autoregressive process expresses the dependent variable as a function of its past values, whereas the moving average process expresses a dependent variable as a function of its past values of the error term.

In estimating the ARMA model, we chose the order of autoregressive and moving average terms by examining the autocorrelation and partial autocorrelation function (ACF and PACF). The last lag before which the PACF tends to zero is the number of order chosen for autoregressive part and the last lag before the ACF tends to zero is number of order chosen for moving average part. On these basis, we use the ARMA model in this study to forecast GDP has an order of (2, 2).

Following Mileva (2008), we construct a measure for liquidity situation by taking the deviation of M2 from its three year moving average.

5.2 Estimation Strategy and Results

The empirical exercise involves estimation using time series data. Since the postulation of Nelson and Plosser (1982), modern econometrics attaches a lot of importance to the characteristics of time series data. Central to this is the distinction between the stationary and non-stationary time series in contrast to the traditional practice of assuming all variables in the regression model to be stationary (Razzaque et al. 2012)[1]. A time series data is said to be stationary if its mean, variance and auto-covariance are independent of time, and remain constant over time. Many macroeconomic time series are non-stationary in nature and consequently the ordinary least square (OLS) regression using these data might produce inconsistent, inefficient and often spurious estimates. In order to avoid such problems the integrating properties of the variables are now routinely examined by testing for the existence of unit roots in variables under consideration.

Although there are several methods for testing unit roots, having applied them as part of this exercise, it is found that one single test would be sufficient for summarising the main statistical results and deciding about the outcomes. This test is known as the Augmented Dickey Fuller (ADF) test, which is the most popular one in time series econometrics. This test is based on equation (10), where Z is the variable under consideration, Δ is the first difference operator, subscripts t denotes time period, T is the time trend and e is the error term.

$$\Delta Z_t = \tau + (\varphi - 1)Z_{t-1} + \gamma T + \delta \Delta Z_{t-1} + e_t \tag{10}$$

The null hypothesis for this test is that $(\varphi - 1) = 0$, i.e., Z_t is non-stationary, against $(\varphi - 1) < 0$, i.e., Z_t is stationary. The 't' test on the estimated coefficient of Z_{t-1} provides ADF test for the presence of a unit root. However, the estimated t-ratios on $(\varphi - 1)$ are non-standard, requiring the computed test statistics to be compared with the corresponding critical values to infer about the stationarity of the variables.[2] It is common to find that macroeconomic time series data are non-stationary on their levels but stationary on their first or higher order differences. Following Engle and Granger (1987), a time series is said to be integrated of order d (usually denoted as $\sim I(d)$ with d is the number of times that the series needs to be differenced in order to become stationary.

However, it needs to be mentioned that for the small sample the testing procedure for unit roots might be quite challenging. Not only that the results emanating from different unit root testing procedures can be inconclusive but also that the test like ADF often

---

[1]This subsection is heavily drawn on Razzaque *et al.* (2012).

[2]These critical values were first computed by Dickey and Fuller (1981). If the estimated test statistics exceed the critical values, the null hypothesis is rejected. Estimated t-ratios and the corresponding critical values are compared on their absolute terms. These days many econometric software provide simulated critical values based on the model specifications, e.g., if the intercept and/or trend term are included or not, and the number of observations.

suffers from "low power" (Engle and Granger 1987), which is often reflected in the tendency to over-reject the null when it is true and under-reject the null when it is false. Hall (1986) suggests the inspection of autocorrelation function and correlogram as an important tool to determine whether a variable is stationary or not by using a small sample.

The autocorrelation coefficients at different lags are plotted against k , the population correlogram is obtained. For non-stationary variables, correlograms die down slowly giving rise to secular declining trend in the graph of autocorrelation coefficients. In the case of stationary variables, the correlograms damp down almost instantly and then show random movement. As our sample is small, we have also used the autocorrelation coefficients and correlograms to determine the integrating properties of the variables.

Once the non-stationary variables in our model are identified, we use a technique to make them stationary for using in our estimation. We use the Hodrick-Prescott filter to detrend the non-stationary variables and make them stationary before using them in our OLS analysis. The Hodrick-Prescott filter is a smoothing method that is widely used to obtain a smooth estimate of long-term trend component of a series. The method was first used in a working paper by Hodrick and Prescott to analyse postwar US business cycles. Technically, the Hodrick-Prescott filter is a two-sided linear filter that computes the smoothed series s of y by minimising the variance of y around s , subject to a penalty that constraints the second difference of s . That is Hodrick-Prescott filter chooses s to minimise:

$$\sum_{t=1}^{T}(y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1}((s_{t+1} - s_t) - (s_t - s_{t-1}))^2 \qquad (11)$$

The penalty parameter λ controls the smoothness of the series σ. The larger the λ , the smoother the σ. As $\lambda \to \infty$, σ approaches a linear trend. Detrended GDP, private investment, capital stock and price of industrial raw materials and metal are shown in Graph 5.2.

After we estimate the causal relationship between private investment and public borrowing and assess the existence of crowding out effect, we examine whether this relationship is time invariant or characterised by structural breaks. If the date and number of the breaks are known, testing for them can be easily performed using a Wald test. However, when the date of the break is unknown, the problem is complicated by the fact that the break date becomes a nuisance parameter that is present only under the alternative hypothesis but not under the null of no structural break. When this is the case, the standard asymptotic properties of the Wald test do not hold. Again, if the breaks are induced as a result of any policy change, structural break will take place gradually. This is the reason why it is not possible to know the date and number of breaks at prior. Therefore, we use the method of testing for break at an unknown date.

There are several tests available to identify breaks at unknown time period in a regression system. Most known ones are CUSUM and CUSUM square (Brown, Durbin and Evans (1975)), Sup-Wald (Andrew 1993), and Bai and Perron (1998, 2003 a,b). In our case, we use the CUSUM and CUSUM square as these tests are easy to implement and comprehend. These test statistics are defined on the basis of cumulative sum of residual or squared residual normalized by standard error of the regression.

In terms of notation, the CUSUM test statistic can be written as:

$$W_t = \sum_{r=k+1}^{t} w_r / s \quad , \tag{12}$$

where k number of coefficients, $t = k+1, ..., T$, w is the recursive residual, and s is the standard error of the regression fitted to all T sample points. If the vector of coefficients remains constant over time, $E(W_t) = 0$. But if the vector of coefficients changes, W_t will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, the distance between which increases with t. Movement of W_t outside of these lines is suggestive of structural break at that point of time when the test statistics move outside the 5 per cent critical bands.

The CUSUM squares test is based on the test statistic

$$S_t = \frac{\left(\sum_{r=k+1}^{t} [w_r^2]\right)}{\left(\sum_{r=k+1}^{T} [w_r^2]\right)} \tag{13}$$

The expected value of S under the hypothesis of time-invariant coefficients is

$$E(S_t) = \frac{t-k}{T-k} \tag{14}$$

Which ranges from zero, at $= k$, to unity at $t = T$. The significance of departure of S from its expected value is assessed by reference to a pair of parallel straight lines around the expected value. The standard practice is to plot the CUSUM squares test statistics against t and the pair of 5 percent critical lines. Movement of S_t outside of these lines is suggestive of structural break at the time when it crosses the 5 percent critical bands.

Finally, to determine the time required for public borrowing to have impact on the private investment, we use the vector autoregression (VAR) to derive the impulse response function (IRF). The impulse response function is the path that x follows if it is kicked by a single unit shock ε_t, i.e., $\varepsilon_{t-j} = 0, \varepsilon_t = 1, \varepsilon_{t+j} = 0$.

The mathematical representation of a VAR is

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + B x_t + \varepsilon_t \tag{15}$$

Where y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, A_1, ...A_p and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and other right-hand side variables. Since only lagged values of endogenous variables appear on the right hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates.

In our case, private investment, public borrowing and GDP are assumed to be endogenous variables. This choice of variables allows us to focus on the effects of public borrowing on private investment. Due to the stationarity of these variables, we use the detrended value of the variables. To determine the appropriate lag lengths, p, we use Akaike's information criterion (AIC).

CHAPTER 6
RESULTS

6.1 Time Series Properties of Variables

Graph 6.1 presents the variables that we use in our empirical exercise. It seems from a visual examination that all variables except growth of world GDP and measure for perception are probably non-stationary. This observation is corroborated by Graph 6.2 that represents the correlogram of the variables. The correlograms die down slowly for public borrowing, private investment, GDP of Bangladesh, capital stock, price of raw materials and metals, and liquidity situation. Only in the case of growth of world GDP and the perception index, the correlograms die down instantly and then show random movements, implying the stationary nature of these variables.

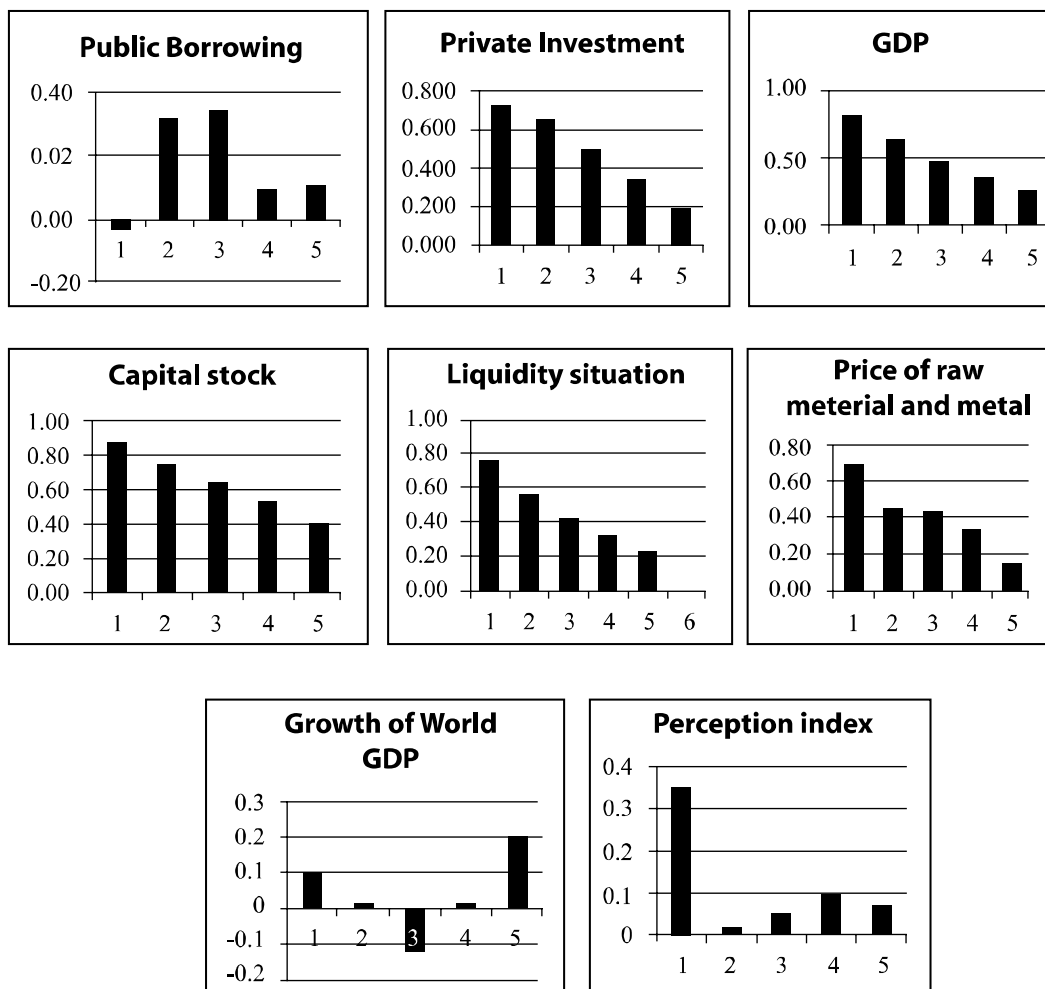**Graph 6.1: Properties of Different Time Series Data**
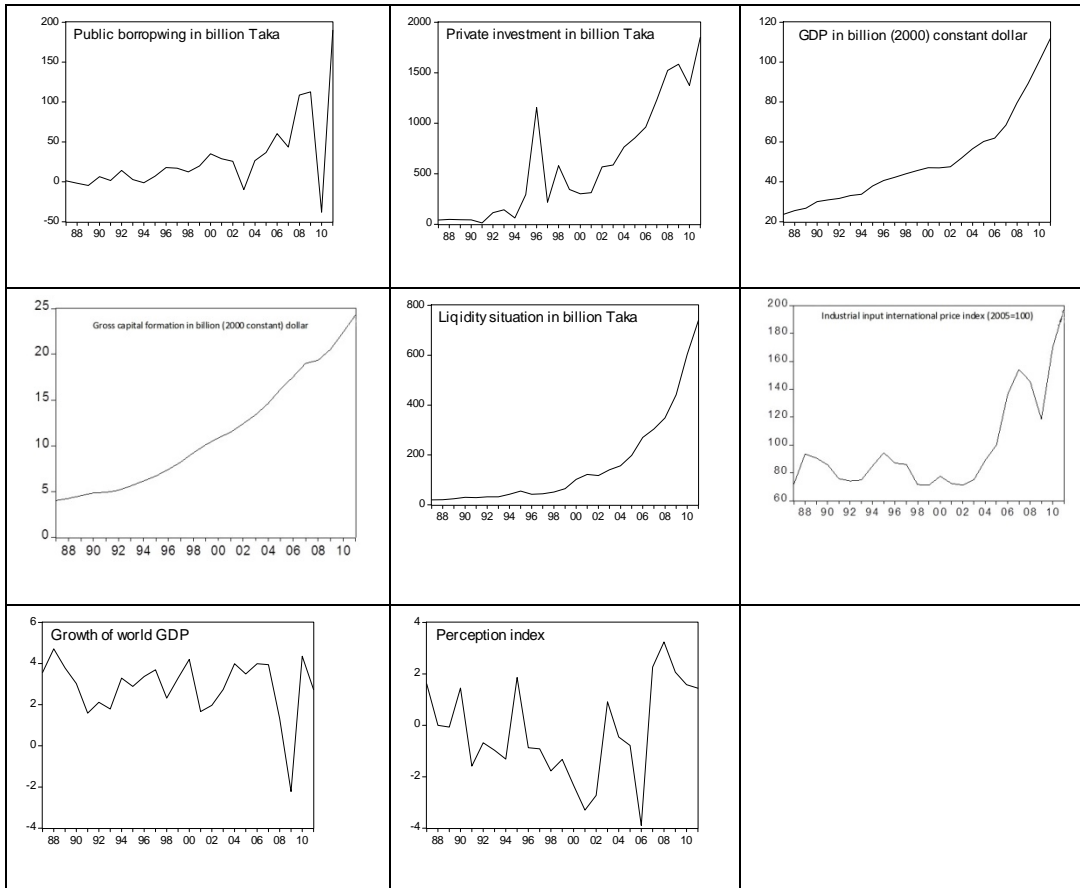
Graph 6.2: Correlograms of Different Time Series Data

Table 6.1 provides the ADF test statistics on level of the variables, both and without the trend term, in the regression. In all cases, we use the intercept. In the case of public borrowing, the ADF regression without the trend term returns a test statistic -1.45, which is smaller than 95 per cent absolute critical value of 3.72. Therefore, the null hypothesis of non-stationarity can be rejected. However, the ADF test statistic with trend is -3.38, which is smaller than 95 per cent absolute critical value of 3.6. In both cases, we fail to reject the null hypothesis of non-stationarity. Therefore, we conclude that public borrowing is non-stationary, which is also consistent with its correlogram.

The ADF test statistic for private investment also provides conclusive results; the test with and without trend rejects the null hypothesis of non-stationarity. For GDP, capital stock, liquidity situation and price index of industrial input in international market, the ADF as well as the correlograms provides conclusive evidence of non-stationarity.

Similarly, there is conclusive evidence of stationarity of growth of world GDP provided by both ADF test and correlograms. However, in the case of the measure of uncertainty, ADF test statistic implies stationarity, while the correlogram implies non-stationarity. As mentioned earlier, in the case of small sample, the ADF test may suffer from low power but not the correlograms. Therefore, we consider the finding of the correlogram and conclude that the measure of uncertainty is stationary.
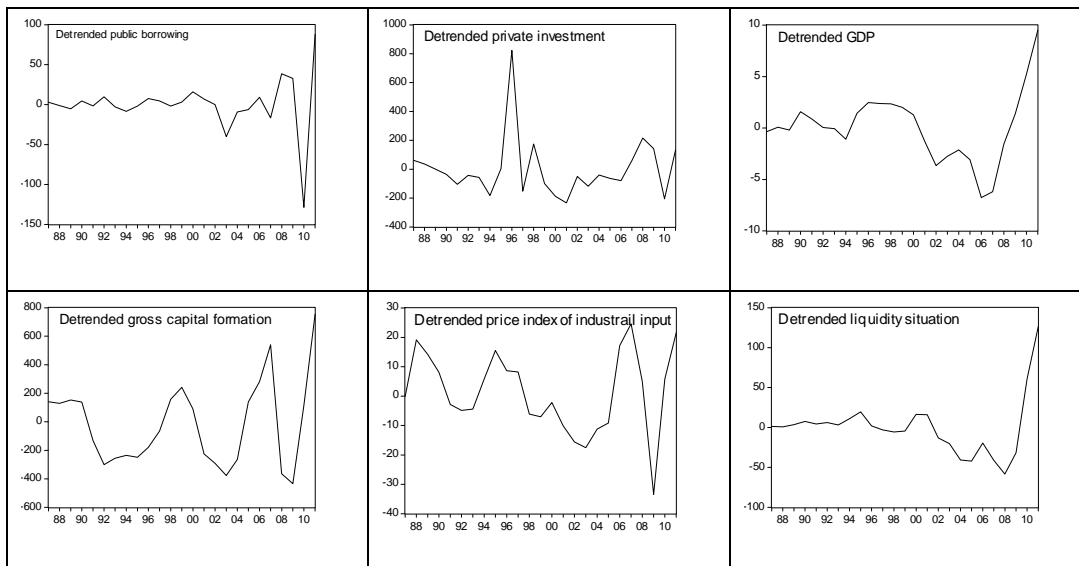
Table 6.1
ADF Test Statistics

Variables	ADF with intercept	ADF with intercept and trend
Public borrowing	-1.45	-3.38
Private investment	0.20	-1.82
GDP of Bangladesh	2.26	1.56
Capital stock	0.59	-0.62
Liquidity situation	3.84	2.93
Price of raw materials and metals	0.001	-1.08
Growth of World GDP	-3.75	-3.98
Perception index	-2.43	-2.48

Note: The 99 per cent asymptotic critical value using sample size of this paper and 1000 replications without trend is -3.72 and for models with trend is -4.38. The same values for 95 per cent critical value are -2.98 and -3.60 respectively.

Before using them in estimation of our model, we detrend them by using Hodrick-Prescot (HP) filter. Specifically, we subtract the trend value from the level of the corresponding variable to get the detrended component which is stationary. Graph 6.3 shows the detrended GDP, public borrowing, private investment, capital stock, price of raw materials and metals, and the measure for liquidity situation.

Graph 6.3: Detrended Macroeconomic Variables

6.2 Regression Results

The results estimated by equation 9 are reported in Table 6.2. It appears from different trials that some variable affects private investment with some lag effects, while some other variable affects contemporaneously.

Table 6.2

Empirical Results (Dependent Variable: Detrended Private Investment)

Variable	Coefficient	P-value	Coefficient	P-value
	Static Specification		Dynamic Specification	
Constant	-229.78	0.225	-303.02	0.106
1st lag of perception index	22.45	0.000	30.75	0.000
1st lag of detrendedgross capital formation	-0.47	0.059	-0.57	0.024
Detrended public borrowing	3.20	0.029	3.09	0.028
Detrended price index of industrial inputs	9.6	0.021	12.08	0.006
2nd lag of growth of world GDP	62.95	0.219	81.57	0.109
Detrended (1st) lag private investment	-	-	-0.41	0.065
Detrended GDP of Bangladesh	52.18	0.015	79.77	0.003
Liquidity situation	-0.02	0.207	-0.04	0.064
Adjusted R-squared	0.87	-	0.89	-

The static specification in the first column shows that the model can explain about 87 percent of variation in the movement of private investment. In the case of dynamic specification, the model can explain 89 per cent of the variation of private investment. The results of the dynamic specifications are a matter of primary interest of this paper. Based on the empirical findings of this specification, some observations are in order.

The result shows that uncertainty negatively affects private investment and this affect is significant at 96 per cent level of significance in the case of static specification, and 99 per cent level of significance in the case of dynamic specification. Capital stock of the past year negatively affects the private investment of the current year, implying built-up of capital in any year requires less investment in the following year. However, this result is not statistically significant.

1. Perception about economic performance: A forward-looking investor always invests on the basis of his/her expectation of the future course of the economy. People form expectation on the basis of the available information. This is why how an economy performed in the past year can potentially influence the private investment of the current year. Our results also corroborate this assertion. As can be seen, the first lag of perception index positively affects the private investment of the current year, and this affect is statistically significant (p value is almost zero). In other words, a better-than-trend performance of the economy in the immediate past year boost investors' confidence and increases private investment.

2. Public borrowing: A negative coefficient of this variable would imply that public borrowing drives away the private investment, while a positive coefficient would mean the opposite. As can be seen from Table 6.2, the estimated coefficient is positive and statistically significant (p value is less than 3 per cent).

3. Past gross capital formation: Total capital formation in the past year negatively affects the private investment in the current year. As mentioned before, private investors invest essentially in response to the difference between their desired and actual capital stock. The adjustment of the gap between desired and actual capital is not instantaneous, rather gradual. Therefore, if more investment is made in the past year, investors tend to invest less in the current year.

4. Price of industrial inputs: The estimated result suggests increase in international price of industrial inputs positively affects total private investment in Bangladesh. The private investors of the country by far are importers of industrial input. With increase in their price in international market, total volume of industrial input may go down. It would not necessarily mean decline in their value. If these inputs are price inelastic, i.e., percentage decline in volume is smaller than percentage increase of price, total value would increase. In that case, total investment, evaluated in value terms, would also increase. The estimated coefficients imply that industrial inputs in Bangladesh are price inelastic.

5. Performance of global economy: Bangladesh economy has been well integrated with the global economy since the early 1990s. Roughly, one-fourth of the country's total products are sold abroad. Thus, the performance of the global economy, which, in turn, determines the demand for Bangladeshi products, can potentially affect the private invest of the country. As evident from Table 6.2, growth of global economy positively affects the private investment of Bangladesh.

6. GDP of Bangladesh: As expected, GDP of the country positively affects the private investment, and this affect is statistically significant (p value is 0.003).

7. Liquidity situation: The estimated results of this paper suggest that a loosening of overall liquidity situation negatively affects the private investment. This contradicts the popular view in support of loose monetary policy to promote investment and growth. A loose monetary policy can potentially reduce the interest rate and increase private investment. On the other hand, it can potentially increase inflation and reduce aggregate demand, thereby negatively affecting private investment. Which one of these two opposing forces dominates is an empirical question. The finding of this study suggests that the second force dominates over the first one.

8. Past investment: Like the past gross capital formation, past private investment also negatively affects the current investment for similar reason.

6.3 Crowding In or Out

As discussed earlier, the long run impact of public borrowing on private investment can be calculated by the following formula:

$$\beta_{4,LR} = \frac{\beta_4}{1 - \beta_7}$$

In our case, β_4 is 3.09, and β_7 is -0.41. Together they yield $\beta_{4,LR}$ = 2.19, which is greater than 1. Thus public borrowing in Bangladesh crowds in private investment in the long run.

6.4 Time-variance of the Relationship between Private Investment and Public Borrowing

Although public borrowing crowds in private investment in the long run, depending on the amount borrowed it can crowds out private investment in a given year. Any abnormal increase in public borrowing squeezing the scope for private sector borrowing can make it harder for the private investors to invest. In that case, our estimated model will not hold and the estimated relationship will be structurally different for that year. Thus by evaluating the stability of the estimated model, we can examine whether the crowding in effect of public borrowing had been the opposite in any year. As mentioned above, we have employed CUSUM test to evaluate the structural break in our estimated model.

Graph 6.4 presents the sum of recursive residuals (CUSUM test statistic) and the square of recursive residuals (CUSUM square statistic) with the 5 per cent significance lines. As can be seen from the graph, none of the test statics moves beyond the 5 per cent significance bands. So, the estimated coefficients of equation (9) remain time-invariant. In other words, we fail to identify any year in our sample period (1987-2011) when public borrowing crowds out private investment instead of crowding in.

Graph 6.4: Stability of the Crowding in Effect of Public Borrowing
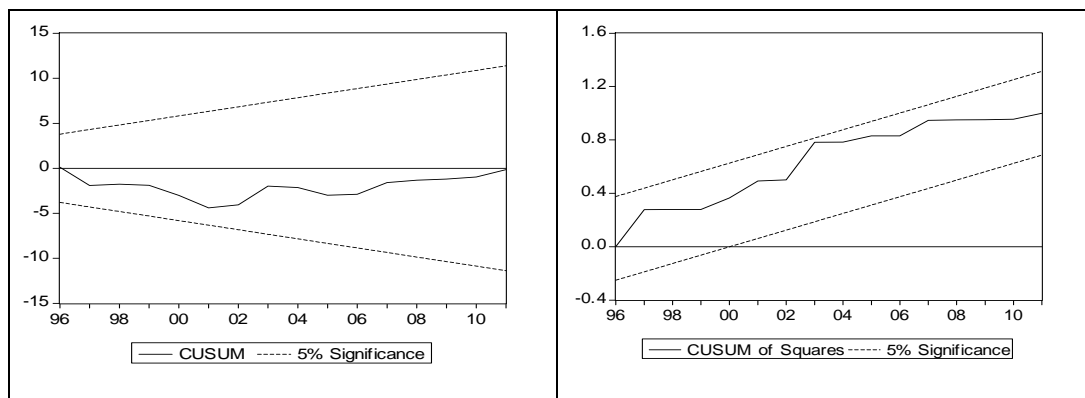
In addition to evaluating the stability of the whole model, we also evaluate the stability of the coefficients of public borrowing and lag of private investment as these two jointly determine the crowding in or out effect of public borrowing. Graph 6.5 presents the corresponding CUSUM and CUSUM square test statistics. As evident from this graph, these two coefficients also remain time-invariant, reiterating the fact that there has been no indication of crowding out effect of public borrowing in any of the year in our sample period.

Graph 6.5: Stability of Coefficient of Public Borrowing and Lag Private Investment
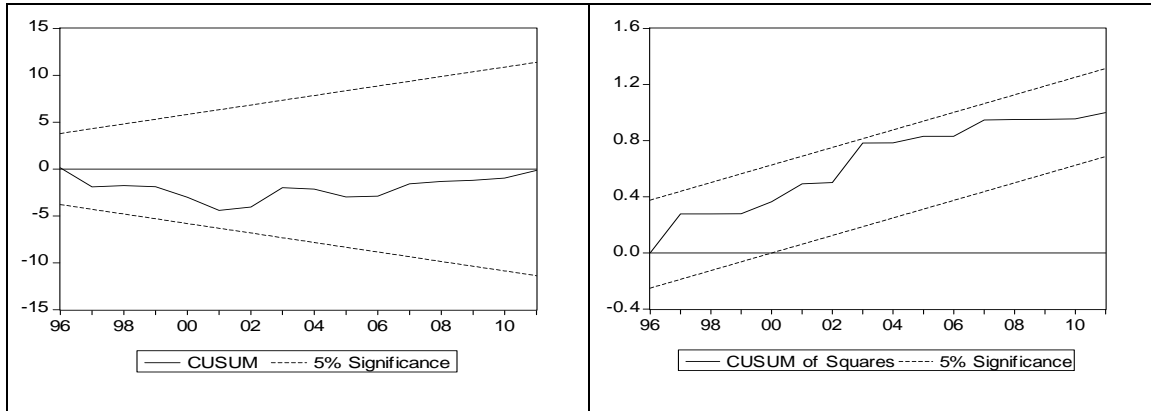

## 6.5 Time Required for Public Borrowing to Impact Private Investment

Although public borrowing crowds in private investment, the effect is not immediate. How fast public borrowing would affect private investment depends on the nature of the spending made by public borrowing. Vector autoregression (VAR) impulse response function (IRF) has been derived from estimated VAR by inducing a one standard deviation shock in public borrowing. This response function is shown in Graph 6.6. As can be seen from this graph, private investment does not respond to any increase in public borrowing instantly. It takes about three years for any stimulating effect of public borrowing to be transmitted into real sector in the form of increase in private investment. The stimulating effect of public borrowing continues for about four years, then it starts dying down.

Decomposition of total variance of private investment is shown in Graph 6.7. The ability of public borrowing to explain the variance in private investment increases from second year. About 30 per cent of the total variance of private investment can be explained in terms of public borrowing by the end of 4th year. This finding corroborates the corollary of the impulse response function that public borrowing significantly affects private investment for 4 years.

Graph 6.6: Response of Private Investment and GDP to a Shock in Public Borrowing by One Standard Deviation

Response of private investment to public borrowing
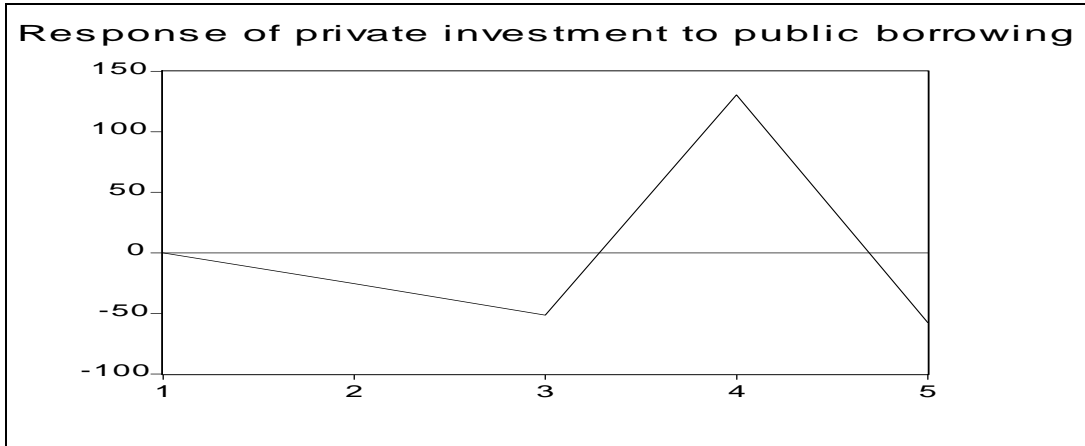
Graph 6.7: Variance Decomposition of Private Investment

Private investment variance explained by public borrowing
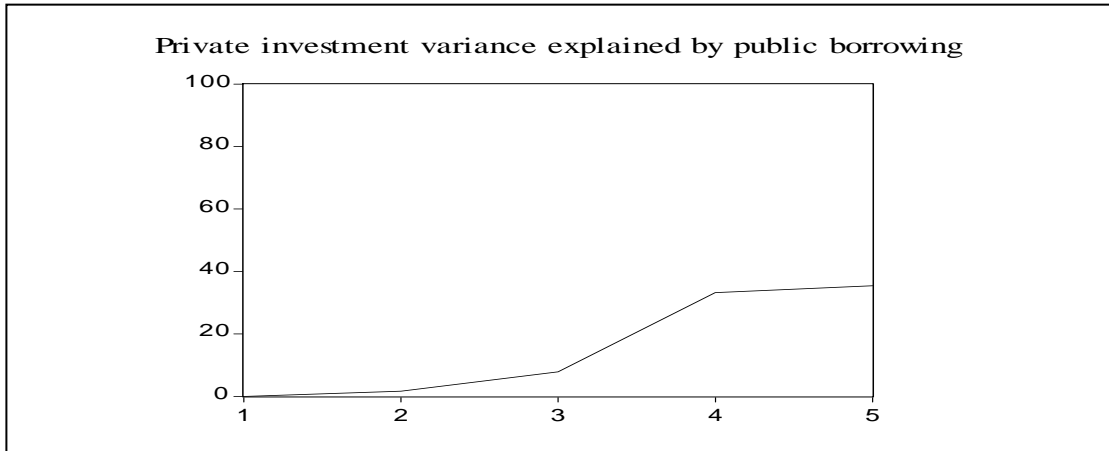
CHAPTER 7
MAIN POLICY IMPLICATION

Public borrowing has become a central topic of the current policy discourse in Bangladesh. The widely held popular view is that public sector credit limits the availability of credits to private sector. However, the findings of this paper contradict this popular view and suggest that public borrowing crowds in private investment with some lag effects. These findings have important policy implications. Some of them are discussed below.

i. It has been highlighted in many economic analyses that infrastructural deficits are one of the main roadblocks to private investment in Bangladesh (e.g., WB 2012). Infrastructure, possessing the characteristics of public goods, has to be provided by government as market fails to supply them. Due to lack of adequate revenue, government's ability to provide them is very limited. The finding that public borrowing does not crowd out private investment suggests that *government should not shy away from financing infrastructure through borrowing.* With current trend of public borrowing, no trade-off between provision of infrastructure and private investment is implied.

ii. Bangladesh is contemplating to borrow at commercial rates from international financial market by issuing sovereign bond. The real cost of borrowing of any dollar-denominated borrowing is equal to $R = R_\$ + \left(\frac{E^r_{tk}}{\$} - \frac{E^b_{tk}}{\$} \right) \Big/ \frac{E^b_{tk}}{\$}$, where R is the real cost of borrowing, $R_\$$ is the agreed interest rate in terms of dollar, $\frac{E^b_{tk}}{\$}$ is the exchange (taka per unit of dollar) at the time of borrowing and $\frac{E^r_{tk}}{\$}$ is the same exchange rate at the time of repayment. In addition to the high commercial interest rate, the exchange rate volatility will also result in high cost of borrowing from non-concessional external sources.[1] The main reason to resort to the costly commercial borrowing is the alleged crowding out effect of public borrowing from domestic sources. However, the finding of this paper implies that *there is no ground for such a policy shift as long as cost of borrowing from domestic sources is less than the cost of commercial borrowing from international financial market.*

---

[1]For example, from June 2011 to January 2012, the taka had been depreciated against the dollar by about 13 per cent, adding a cost to any dollar-denominated loan taken in June 2011 for six months by the same magnitude with the agreed interest rate.

iii. The result of this paper suggests that the estimated causal relationship between private investment and public borrowing, the later crowding in the former, remained stable for the period 1987-2011. In other words, public borrowing in none of the years of our sample period has been "too high" to induce a structural break in the estimated relationship and to crowd out the private investment. During this period, public borrowing accounted for about 2.5 per cent of GDP during some years. Therefore, it can be argued that *government can safely borrow up to 2.5 per cent of GDP from the domestic sources, if not more, without worrying about crowding out effect of public borrowing.*

iv. Due to the widely held view that public borrowing crowds out the private sector credit, a strong policy advocacy in favour of maintaining a loose liquidity situation is observed in Bangladesh. Despite its inflationary role, a loose monetary stance is argued ostensibly to ensure adequate credit to the private sector and increase private investment. The finding of this paper, however, implies that loose liquidity does not help private investment. On the contrary, it negatively affects private investment. With the structural inefficiency and different controls in place in the money market, interest rate remains more or less downward rigid in Bangladesh. As a result, a loose monetary stance seems to fail to benefit the private sector through the bank lending channel. Therefore, *a loose monetary policy should not be pursued just to offset the alleged negative effect of public borrowing* as long as it remains around 2.5 per cent of GDP.

v. Finally, the finding of this paper suggests that public borrowing requires about three years to affecting the private investment. This indicates some level of inefficiency of public spending. To ensure the highest possible benefit of public borrowing, *government needs to take action to increase the efficiency by promoting timely implementation of public projects.*

CHAPTER 8
CONCLUSION

The policy debate in many developing countries including Bangladesh whether to curtail the public borrowing or not is becoming a prominent one. Although emotions are high on both sides, in many cases this debate is not based on any empirical findings. This study finds that contrary to the widely held view in the country, public borrowing crowds in private investment in Bangladesh. This finding will help the policymakers to take an informed policy decision about public borrowing.

One reason for observed crowding in effect of public borrowing could be that infrastructural deficit in the country is so high that public spending, despite being of very poor quality, promotes private investment. Therefore, no conclusion should be made about the quality of public spending in Bangladesh on the basis of this finding. More research needs to be done to know what actually results in crowding in impact of public borrowing in Bangladesh.

REFERENCES

Agosin, M. R. and R. Mayer. 2000. "Foreign Direct Investment in Developing Countries: Does It Crowd in Domestic investment?"*UNCTAD Paper No. 146.*

Ahmed, Habib and Stephen M. Miller. 1999. *"Crowding-Out and Crowding-In Effects of the Components of Government."* University of Connecticut. Available at http://www.econ.uconn.edu/working/1999-02.pdf.

Andrews, D.W.K. 1993. "Tests for Parameter Instability and Structural Change with Unknown Change Point." *Econometrica,* 61: 821–856.

Bai, J. and P. Perron. 1998. "Estimating and Testing Linear Models with Multiple Structural Changes." *Econometrica*, 66:47-78

———2003a. "Computation and Analysis of Multiple Structural Change Models." *Journal of Applied Econometrics,* 18:1-22.

———2003b. "Critical Values for Multiple Structural Change Tests." *Econometrics Journal*, 6:72-78.

Barro, Robert J. 1990. "Government Spending in a Simple Model of Endogenous Growth." Harvard University and National Bureau of Economic Research. Available at http://ww1.worldbank.org/publicsector/pe/pfma06/BarroEndogGrowthJPE88.pdf

Bazaumana, Ouattara. 2004. "Modelling the Long Run Determinants of Private Investment in Senegal.*"* Centre for Research in Economic Development and International, Trade (CREDIT), University of Nottingham.

Brown, R. L., J. Durbin and J. M. Evans. 1975. "Techniques for Testing the Constancy of Regression Relationships over Time." *Journal of the Royal Statistical Society,* 37(2):149-192. Available at ftp://ftp.uic.edu/pub/depts/econ/hhstokes/e535/Brown_Durbin_evans_1975.pdf

Carroll, J. 1994. "Relating Complexity to Practical Performance in Parsing with Wide-coverage Unification Grammars." In *Proceedings of the 32nd Annual Meeting of the Association for Computational Linguistics,* NMSU, Las Cruces, NM. 287-294.

Cruz, Oliveira B. and Joanilio R. Teixeira. 1999. "The Impact of Public Investment on Private Investment in Brazil, 1947-1990." *Cepal Review*, 67(April). Available at http://www.eclac.cl/publicaciones/xml/9/20159/oliveira.pdf.

Devarajan, S., Swaroop V. and Zou H-fu. 1996. "The Composition of Public Expenditure and Economic Growth." Policy Research Department, The World Bank, Washington, D.C. Available at http://ww1.worldbank.org/publicsector/pe/pfma06/ShantaVinayHengfu.pdf

Emran, M. S. and S. Farazi. 2009. "Lazy Banks? Government Borrowing and Private Credit in DevelopingCountries."Availableat:http://ase.tufts.edu/econ/events/neudcDocs/SundaySession/Session38/MEmranLazyBanksGovernmentBorrowing.pdf

Engle, Robert F. and W. J. Granger. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing." *Econometrica*, 55(2): 251-276. Available at http://www.ntuzov.com/Nik_Site/Niks_files/Research/papers/stat_arb/EG_1987.pdf

Fayed, M.E. 2012. "Crowding Out Effect of Public Borrowing: The Case of Egypt." Available at http://fesp-eg.org/wp-content/uploads/2012/02/Mona-Essam-Crowding-Out-Effect-of-Public-Borrowing-The-Case-of-Egypt.pdf

Federer, J. Peter. 1993. "The Impact of Uncertainty on Aggregate Investment Spending: An Empirical Analysis." *Journal of Money Credit and Banking*, 25 (1): 30-48.

Hall. 1986. "An Application of the Granger and Engle Two-Step Estimation Procedure to United Kingdom Aggregate Wage Data." *Oxford Bulletin of Economics and Statistics*, 48 (3): 229-240.

Khan, R. E. A. and A. R. Gill. 2009. "Crowding out Effect of Public Borrowing: A Case of Pakistan." MPRA Paper No. 16292, posted 7 September 2009 09:41 UTC. Available at http://mpra.ub.uni-muenchen.de/16292/

Khondker, Bazlul H., Sayema H. Bidisha and Mohammad A. Razzaque. 2012. "The Exchange Rate and Economic Growth: An Empirical Assessment on Bangladesh." International Growth Centre (IGC).

Kneller, R., M. Bleaney and N. Gemmell. 1999. "Fiscal Policy and Growth: Evidence from OECD Countries." *Journal of Public Economics*, 74: 171-190.

Maana, I., R. Owino and N. Mutai. 2008. "Domestic Debt and its Impact on the Economy–The Case of Kenya." Paper presented during the 13th Annual African Econometric Society Conference in Pretoria, South Africa from 9th to 11th July 2008. Available at http://www.africametrics.org/documents/conference08/day1/session2/maana_owino_mut ai2.pdf

Majumder, A. 2007."Does Public Borrowing Crowd-out Private Investment? The Bangladesh Evidence." Bangladesh Bank Working Paper, WP 0708. Available at http://siteresources.worldbank.org/PSGLP/Resources/WP0708Final.pdf

Miguel, D. Ramirez. 1994. "Public and Private Investment in Mexico, 1950-90: An Empirical Analysis." *Southern Economic Journal,* 61(1):1.

Mileva, E. 2008. "The Impact of Capital Flows on Domestic Investment in Transition Economies." European Central Bank, Working Papers No. 871. Available at http://www.ecb.eu/pub/pdf/scpwps/ecbwp871.pdf

Nelson, C. R. and C. R. Plosser. 1982. "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications." Available at http://schwert.ssb.rochester.edu/a425/jme82_NP.pdf

Pritha, Mitra. 2006. "Has Government Investment Crowded Out Private Investment in India?"Available at http://www.aeaweb.org/annual_mtg_papers/2006/0108_1015_0102.pdf.

Rama, M. 1993. "Empirical Investment Equations for Developing Countries." In: L. Servén and A. Solimano (eds*), Striving for Growth after Adjustment.* Washington, DC: World Bank.

Robert, S. Pindyck. 1993. "Investments of Uncertain Cost*."* NBER Working Papers 4175. National Bureau of Economic Research, Inc.

Serven, L. 1996. "Irrevesibility, Uncertainty and Private Investment: Analytical Issues and Some Lessons for Africa." The World Bank.

Titarenko, D. 2006. "The Influence of Foreign Direct Investment on Domestic Investment Processes in Latvia." *Transport and Telecommunication,* 1.7: 76-83.

The Authors

Dr. Abul Basher completed his Bachelor's from Dhaka University and Masters from Strathclyde University (UK) with distinction in economics. After completion of his PhD from University of Washington, he taught economics at Willamette University, USA and worked as a country economist at World Bank Dhaka Office before joining BIDS as a Research Fellow in 2012. He has publications in internationally reputed journals like Journal of Development Economics,Journal of International Development, etc. His research areas include macro and monetary economics, international trade, economic modeling, micronance and development issues.

Tahreen Tahrima Chowdhury joined BIDS as a Research Associate in 2011. She completed her M.S.S. in Economics in 2010 from the University of Dhaka. Prior to joining BIDS, she served as a Lecturer in the Department of Economics at BRAC University. Tahreen's areas of research interests include microeconomic theory, mathematical economics, theoretical and applied econometrics, applied economic research, macroeconomic policy issues, financial economics and international trade.

Jahangir Alam worked as a Research Assistant in this study. He completed his M.S.S. in Economics in 2010 from the University of Dhaka. His research interest includes macro and industrial economics.