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Impact of public and private investment on the gross domestic product in Bangladesh: An empirical assessment using an autoregressive distributed lag approach

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Abstract

The key objective of this study is an empirical examination of the impact of public and private investment on the real gross domestic product (GDP) in Bangladesh from 1972 to 2017. This research uses time-series data from 1972 to 2017 and applies an autoregressive distributed lag model bounds testing approach to examine the relationship. Employment is included in this model as a common economic standard since increasing employment has a direct impact on GDP, and Bangladesh is a labor-rich country. In this research, it is explored that though public investment has a short-run impact on GDP but in the long run, private investment influences GDP positively which has statistical significance also. Further, there is an inverse relationship between GDP and public investment in the long run indicating the prevalence of the crowding-out effect. Another finding of this empirical investigation is a long term significant inverse relationship between employment and GDP. This conclusion indicates that Bangladesh's economy is hampered by low per capita capital and inefficient capital utilization. This research study investigates the existence and nature of the effect of public and private investment on real GDP in Bangladesh.

Keywords: Public Investment; Private Investment; Employment; Gross Domestic Product; Autoregressive Distributed Lag

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1. Introduction

Investment is commonly identified by economists and policy-makers as an important factor in the economic growth process. However, it is still a matter of logical argument between public and private investments which type of investment is more crucial for economic progress (Thanh, 2011; Hossain and Cheng, 2002; Coutinho and Gallo, 1991; Naveed H. Naqvi, 2003). Private investment is a vital pre-requisite for economic growth. It allows entrepreneurs to carry out the economic activity by utilizing resources to produce goods and services. Entrepreneurship and investment drive higher productivity and make it possible to invest greater sums in the future. Rapid and sustained economic development is gestated by this virtuous circle. Employments are created and new technologies are introduced in the path of this process. Efficient mobilization of private investment is thus important for creating job opportunities and enhancing growth rates.

Public investment has been considered as one of the pivotal factors to contributing economic growth in various macroeconomic theories. Public investment can establish the infrastructural support with which private investment may facilitate and stimulate. The productivity of capital can be raised and the overall resource availability can be enhanced by increasing output. However, additional public investment requires raising future tax and domestic interest rates which can cause the crowd out of the private investment. The same can happen if the investment goods that directly compete with private goods are produced by the public sector. When a government needs more financing, interest rates move upward. Moreover, this minimizes the private sector's capability to take access to money markets. Thus, economic growth sluggish because of a decline in private investment is recognized as the crowding-out effect of the public on private investments.

On the other hand, the generation of employment or the creation of job opportunities is one of the most popular concerns for a country. The employment rate has a tremendous influence on the development of the economies of each country. A positive relationship between employment and gross domestic product (GDP) is considered as a norm in macroeconomic theory. However, nowadays in various developing countries, this norm is violated empirically because of low per capita capital as well as inefficient use of that (Li and Liu, 2012; Page, 2012; Mwinga, 2012). Logically, in this study, the rate of employment is incorporated also. This study has concentrated on the contribution of public and private investment to the GDP of Bangladesh.

2. Literature review

Finding a way to vitalize private investment becomes one of the key challenges for countries struggling to attain higher and sustainable growth. It is important to analyze the interrelationship among private investment, public investment, and GDP from the perspective of policies designed to elevate private investment. Both public and private investments can play a key role to increase the GDP of an economy and it is a common norm of macroeconomics. Makuyana and Odhiambo, 2018, used annual data from 1970 to 2017 of South Africa and applied autoregressive distributed lag (ARDL) bounds testing approach to find out nexus among public investment, private investment, and economic growth. The study reveals that private investment has a positive impact on economic growth both in the long run and short-run and that public investment has an inverse effect on economic growth in the long run, indicating the crowding-out effect on private investment. By employing cointegration-ARDL bounds testing procedure, Makuyana and Odhiambo,

2019, obtained that private investment has no immediate effect on economic growth, and in the short run, public investment has a crowding-out effect on private investment in Malawi. Employing time series econometric techniques such as unit root tests, cointegration, and error correction techniques within an ARDL framework, research carried out by Frimpong and Marbuah, 2010, reveals that private investment is determined in the short run by public investment in Ghana. The utilization of additional physical and financial resources by the public sector, which would otherwise be available to the private sector, may also hinder private investment (Mario I. Blejer, 1984). A study based on 33 countries in the period 1970–1988 showed the evidence of crowding out of private investment from public investment (Coutinho and Gallo, 1991). In a research work conducted with 15 developing countries in Asia covering the periods 1984–2009 (26 years) (Phetsavong and Ichihashi, 2012), it has been found that public investment has prevailed as one of the most significant factors driving economic growth. Public investment can provide infrastructural support to facilitate and stimulate private investment which can elevate the productivity of capital and magnify the overall resource availability by increasing output. Utilizing a large sample of 95 developing countries over the period of 1970–1990, Khan, 1996 found that there is a significant difference in the impact of private and public investment on GDP growth. Moreover, it is empirically proved that private investment has a much larger impact than public investment. A study regarding the impact of public investment on private investment in 116 developing countries between 1980 and 2006 explores that there is a strong and robust crowding-out effect both across regions and over time (Cavallo and Daude, 2011).

By (Md. Nisar Ahmed Shams, 2016) analyzing the causal relationship between public investment and economic growth in Bangladesh from 1972 to 2014, it is obtained that there is a long-run relationship between these two variables. The analysis also indicates a unidirectional causality from public investment to grow. The main findings of the study are that public investment invariably causes GDP growth. Empirical evidence from Bangladesh (1972–2011) indicates that there is a short-run and long-run relationship between public and private investment and economic growth. This clarifies that public and private investment impact positively economic growth in the short- and long-run time periods. In addition, it statistically signifies that private investment is more effective in the long run than public investment (Haque, 2012). Rahman et al., 2016, examined the roles of per capita real public and private investment growths in influencing per capita real GDP growth in Bangladesh spanning over 1972 to 2012. They applied ARDL technique and vector error correction model. By doing so, it is obtained that private investment plays a greater role than public investment in improving per capita real GDP growth in Bangladesh. The very weak immediate impact of public and private investment on GDP growth is also found in this research.

On the other hand, change in GDP due to one unit change in employment depends on the amount of labor already employed. The greater current employment drives the less marginal productivity of labor because the continuous employment of labor with the fixed amount of capital results in diminishing per capita capital (Thurow, 1968). In the perspective of South Africa (Meyer and Sanusi, 2019), it has been found that the negative influence of employment on GDP could be accompanied by the inefficient use of fixed available factors of production and inadequate technological advancement. Besides that, automation can reduce the cost of producing using labor and increase GDP by enhancing labor productivity (Restrepo, 2018).

The “National Industrial Policy-2016” is announced by the government of Bangladesh to accelerate the pace of industrialization and one of the underlying objectives of this policy is to create new entrepreneurs. Alongside massive public investment is employed to boost the social overhead capital of the country.

This study reinvestigates the impact of public and private investment on GDP of Bangladesh as there is considerable debate on the relationship among these variables. In most of the existing literature concerning GDP and employment issues, the variable "Unemployment rate" is focused. To highlight the issue of productivity and per capita capital, in this study, "employment" (a person employed in thousand) is adapted as a control variable.

3. Objectives of the study

The main objective of this study is to empirically examine the relative contribution of public and private investment to GDP in Bangladesh from 1972 to 2017. The study attempts to answer the question of whether public investment spurs GDP more than private investment.

4. Model and data

4.1. Theoretical model

Public and private investment influences the growth of GDP in different ways for different countries. That is why it is being addressed from policy and theoretical perspectives. This has been an unsettling issue particularly in developing economies like Bangladesh. It is a labor-abundant economy with a huge active age population who are struggling with unemployment and underemployment. Thus, it can be concluded that Bangladesh is capital constrained with surplus labor (Rahman et al., 2016). The paper utilizes a production function approach with public investment along with private investment and employment as arguments in the analysis. From the literature (Ademola, 2016; Alhdiy et al., 2015; Erden and Holcombe, 2005; Evans and Karras, 1994; Khan and Kumar, 1997; Khan and Reinhart, 1990; Kreishan, 2011; Lee, 2000; Tatom, 1991), the theoretical model is given as:

$$GDP=f(PUI,PRI,EMP) \quad (1)$$

Where, *GDP* = Gross domestic product, *PUI* = Public investment, *PRI* = Private investment, and *EMP* = Employment

4.2. Empirical model

4.2.1. Autoregressive distributive lag model

Based on both the theoretical and empirical literature, the econometric model is constructed to show the influence of public and private investment on GDP. Thus, the following Kripfganz and Schneider, 2016, and Adeleye et al., 2018, the generalized autoregressive distributive lag (ARDL) model:

$$logGDP_t = \omega_i + \sum_{i=1}^{\tilde{n}} \sigma_1 logGDP_{t-i} + \sum_{i=1}^{p} \beta_1 logPUI_{t-i} + \sum_{i=1}^{p} \beta_2 logPRI_{t-i} + \sum_{i=1}^{p} \beta_3 logEMP_{t-i} + e_t \quad (2)$$

Where, $logGDP_t$ is the natural logarithm of real *GDP*, *logPUI* is the natural logarithm of public investment, *logPRI* is the natural logarithm of private investment, and *logEMP* is the natural logarithm of employment.

ω is constant term, β_1, β_2, and β_3 are the parameters. The dependent and explanatory variables are allowed to be purely I(1) or cointegrated and p is the optimal lag order. t refers time and e_t stands for vector of error term which is unobservable zero mean white noise vector process (serially uncorrelated or independent).

Equation (2) specifies the issue whether GDP of Bangladesh from 1972 to 2017 is influenced by public and private investment. Finally, employment is added as a control variable (Table 1 for a complete list of variables with summary statistics) to see if the major explanatory factors' effect on the dependent variable still holds in the presence of covariates.

4.3. Cointegration test

4.3.1. Bound cointegration test

In this research work, whether the variables are cointegrated or not are analyzed using the ARDL bounds test method as developed by Pesaran et al., 2001. The test is mainly focused on the joint F-statistic where asymptotic distribution is non-standard under the null hypothesis of no cointegration against the alternative hypothesis of a co integrating relationship. The bounds test assumes that the model includes of both I(0) and I(1) variables and two levels of critical values are obtained. The three options of the decision criteria are as follows:

1. It can be decided that there is a long-run relationship among the variables when the calculated F-statistics is greater than the critical value bounds for the upper bound I(1)
2. It can be decided that there is no relationship among the variables if the calculated F-statistic falls below the theoretical, critical value for the lower bound I (0) bound
3. The test is unsettled if the F-statistic falls between the lower bound I(0) and the upper bound I(1).

In this study, the event of long- and short-run dynamics are investigated using log-log error correction representations specified as:

Table 1. Definition of variables, frequency, and sources.

Variable	Definition	Year	Source
GDP	Gross domestic product, in billions of constant 2011 international dollars	1972–2017	Investment and Capital Sock dataset of international monetary fund
Public Investment	General government investment (gross fixed capital formation), in billions of constant 2011 international dollars	1972–2017	Investment and Capital Sock dataset of international monetary fund
Private investment	Private investment (gross fixed capital formation), in billions of constant 2011 international dollars	1972–2017	Investment and Capital Sock dataset of international monetary fund
Employment	Persons employed (thousands)	1972–2017	Conference Board Total Economy Database, Output labor and labor productivity, 1950–2019

$$\Delta logGDP_t = \alpha_{01} + \gamma\left(b_1 logGDP_{t-i} - b_2 logPUI_{t-i} - b_3 logPRI_{t-i} - b_4 logEMP_{t-i}\right) + \sum_{i=1}^{\tilde{n}} \alpha_1 logGDP_{t-i} + \sum_{i=1}^{q_1} \alpha_2 logPUI_{t-i} + \sum_{i=1}^{q_2} \alpha_3 logPRI_{t-i} + \sum_{i=1}^{q_3} \alpha_4 logEMP_{t-i} + e_{1t} \quad (3)$$

Where, Δ is the difference operator. $\gamma = 1 - \sum_{j=1}^{\tilde{n}} \delta_i$ is the speed of adjustment coefficient. The terms in parenthesis stand for the error correction term, ECT, which is the residual from the long-run equation. b_i is the long-run coefficients and a_i is the short-run dynamic coefficients of the models' adjustment long-run equilibrium.

Equation (3) states that $\Delta logGDP_t$ depends on its lag, the differenced explanatory variables, and also on the equilibrium error term. If the equilibrium error term is non-zero, then the model is out of equilibrium. γ is expected to be negative. Its absolute value decides how quickly equilibrium is restored.

4.3.2. Unit root tests with structural breaks

To avoid spurious estimation of the ARDL model, stationarity properties of the series are checked with Zivot and Andrews, 1992, unit root test technique. It is argued that augmented Dickey–Fuller (ADF), Phillips–Perron (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) are inadequate to accommodate information about structural breaks in the series and tend to provide spurious results (Iorember et al., 2019). In several studies, it is also empirically observed that order of integration of the variable by ADF, PP, DF-GLS, and Ng-Perron is not reliable (Iorember et al., 2019). Hence, attempts have been made to develop test of unit root which accounts for the presence of structural breaks in the null of unit root hypothesis (Nilsson, 2009). The Zivot-Andrews test identifies a single unknown structural break. For this test, the null hypothesis indeed states that,

H_0:θ=0. This indicates that there is a unit root in the presence of a single breakpoint.

Moreover, the alternative hypothesis is stated as,

H_1:θ<0, indicating that in the presence of a single breakpoint, no unit root is found.

Therefore, the Zivot-Andrews unit root test for this study includes Model X – a model with break in intercept, Model Y – a model with break in trend, and Model Z – a model with break in intercept and trend.

Model X: $\Delta X_t = \alpha_0 + \alpha_1 + \lambda X_{t-1} + \varnothing DU_t + \sum_{j=1}^{k} \theta_j \Delta X_{t-j} + V_t$

Model Y: $\Delta X_t = \delta_0 + \delta_1 + \lambda X_{t-1} + \succ DT_t + \sum_{J=1}^{k} \theta_j \Delta X_{t-j} + V_t$

Model Z: $\Delta X_t = \varphi_0 + \varphi_1 + \lambda X_{t-1} + \varnothing DU_t + \succ DT_t + \sum_{j=1}^{k} \theta_j \Delta X_{t-j} + V_t$

Following model X, Model Y, and Model Z, DU_t is dummy variable. It is indicating the mean shift that prevails at each possible breakpoint ($T_j{}^b$). The corresponding mean shift is the trend variable which is denoted by DT_t. DU_t=1 if $t>T_j{}^b$ and 0 if otherwise. Similarly, $DT_t=t-T_j{}^b$ if $t>T_j{}^b$ and 0 if otherwise. Note that $T_j{}^b$ exhibits the possible break point in the series.

4.3.3. Gregory-Hansen structural break cointegration test

If there is a long-run equilibrium relationship which is changed at some unknown time during the sample period, the Engle-Granger procedure to cointegration may accept the no cointegration null hypothesis. This

means that a low power may be demonstrated by a cointegration test that does not take into account of the break in the long-run relationship (John Bosco Dramani, 2012). For allowing a single break in the long-run relationship, Gregory and Hansen, 1996, provided an extension of the Engle-Granger model. This extension takes into account endogenous structural break in the cointegration vector and permits for four alternative models. Therefore, Gregory-Hansen structural break cointegration test includes Model (C) – a model with break in intercept, Model (C/T) – a model with level shift with trend (it assumes break in intercept and incorporates time trend), Model (C/S) –a model with regime shift (it incorporates break in both slope and intercept), and Model (R/S) – a model with regime plus trend shift (it assumes break in intercept, slope, and time trend).

Model (C): $X1t = \mu 1 + \mu 2\varphi t\tau + \alpha X2t + \in t$

Model (C/T): $X1t = \mu 1 + \mu 2\varphi t\tau + \beta 1t + \alpha X2t + \in t$

Model (C/S): $X1t = \mu 1 + \mu 2\varphi t\tau + \alpha 1X2t + \alpha 2X2t\varphi t\tau + \in t$

Model (R/S): $X1t = \mu 1 + \mu 2\varphi t\tau + \beta 1t + \beta 2t + \alpha 1X2t + \alpha 2X2t\varphi t\tau + \in t$

Gregory-Hansen propounded versions of Engle-Granger (Engle et al., 1987) ADF cointegration tests and for the Z_α and Z_t statistics of Philips and Quliaris (Phillips and Ouliaris, 1990). On the basis of this discussion, it can be said that the appropriate cointegration test is the Gregory-Hansen structural break cointegration test (Gregory and Hansen, 1996), which is used here. Table 2 reports the results of the Gregory-Hansen test for the ADF, Z_α and Z_t statistics. The model is formulated to accommodate the possibility of structural breaks in the cointegrating relationship. The rejection of null hypothesis clarifies that, with a break, the linear combination of the variables exhibits stable properties in the long run. This concept is applied in the study to define the existence of a long-run equilibrium to which the variables converge over time (Blecker, 2009; Borozan, 2017; John Bosco Dramani, 2012; Sbia et al., 2017).

4.4. Data

In this study, the variables' scope is from 1972 to 2017. Variables are defined as follows:

Table 3 is showing summary statistics after log transformation. We did log transformation to do a better assessment of the dependent variable. From the table, it is easy to observe that all the variables are following normality assumption ($P < 0.001$).

Table 2. Gregory-Hansen test for cointegration.

Gregory-Hansen models	ADF		Zt		Za	
	Statistic	Break point	Statistic	Break point	Statistic	Break point
Change in level	–3.57	1977	–4.93	1976	–23	1976
Change in level and trend	–4.91	1986	–4.96	1986	–33.78	1986
Change in regime	–4.41	1989	–4.59	1989	–28.95	1989
Change in regime and trend	–6.59**	1992	–6.98***	1990	–48.88	1990

, **, * denotes statistical significance at 10%, 5%, and 1% levels, respectively. Stata routine ghansen is used with optimal lag structure chosen by the BIC*

Table 3. Summary statistics after log transformation.

Variables	Mean	Median	SD	Min	Max	Range	Skewness	Kurtosis
logGDP	5.240	5.153	0.629	4.305	6.436	2.130	0.295	1.884
logEMP	3.717	3.748	0.320	3.139	4.197	1.058	–0.266	1.829
logPRI	2.949	2.771	1.098	0.007	4.738	4.731	–0.278	2.737
logPUI	1.936	1.935	0.937	–0.877	3.637	4.514	–0.607	3.693

5. Results and discussion

5.1. Stationary test

To establish that none of the variables are integrated of order two, that is, I(2) series, the stationarity test is applied using the Zivot-Andrews test procedures before estimating the model. The appropriate cointegration test to adopt is the bounds test because the result exhibited in Table 4 reveals that the variables used in this study are I(1) series. The existence of structural break in the data substantially reduces the power of Johansen test. Zivot-Andrews can be used here to be sure if there is a structural break exist or not (Ayad, 2019). From Table 4, the evidence show that GDP, private investment, and public investment series have a structural break in 1975, whereas the employment series has a structural break in 1992. In this case, Gregory and Hansen (1996) test must be applied for cointegration with regime shift (with structural breaks).

5.2. Cointegration test result

5.2.1. Bound cointegration test result

Since all the series are integrated of order one (I(1)) and none is integrated of order two, we proceed to investigate the cointegrating relationship using the bounds tests. In the lower panel of Table 5, the results for the bounds cointegration test are given. The null hypothesis of no cointegration is rejected at a 1% level of significance as the calculated value of F-statistics is 4.373 for the lower bound and 5.868 for the upper bound. This indicates that there are unique cointegrating relationships among the variables in the models. These results prove that in both relationships, the explanatory variables move first when a common stochastic shock hits the system. The above findings clarifies that GDP of Bangladesh follows changes in public and private investment.

5.2.2. Gregory-Hansen structural break cointegration test

In Table 2, the outcome of Gregory and Hansen (1996) cointegration test is exhibited. The result confirms that for change in regime and trend model, the null hypothesis of no cointegration is rejected at the 5% and 1% significance levels. This study adopts the Zt results. In the early 1990s, Bangladesh's economy went through trade and financial sector reform or economic liberalization; therefore, there is a compelling reason to suspect the existence of a structural break in its macroeconomic time series (Saidjada and Jahan, 2018). Hence, this study accepts the Zt results and utilizes 1990 as the breakpoint year.

Table 4. Zivot-Andrews unit root test.

Variable	Intercept				Trend				Both			
	Level	Break	First Difference	Break	Level	Break	First difference	Break	Level	Break	First difference	Break
logGDP	–1.437	1980	–13.03***	1975	–2.465	1995	–13.030***	1976	–2.303	1994	–13.030***	1975
logEMP	–3.445	2004	–5.124**	1992	–3.636	2001	–4.728**	1975	–3.649	1996	–5.002*	1992
logPRI	–8.787***	1988	–12.673***	1975	–6.124***	1993	–12.673***	1976	–8.106***	1987	–12.673***	1975
logPUI	–6.699***	2012	–9.680***	1975	–6.759***	2010	–9.680***	1976	–6.663***	2012	–9.680***	1975

*Estimations augmented with lag structures obtained from BIC using the varsoc routine in Stata. *, **, *** denotes statistical significance at 10%, 5%, and 1% levels, respectively*

Table 5. Error correction model results.

Variable	ΔGDP (log)*	Standard error	t	P>|t|	95% confidence interval	
Constant	–72.001	12.515	–5.750	0.000	–97.434	–46.567
Adjustment	–0.667	0.107	–6.240	0.000	–0.885	–0.450
Long-run estimate						
logEMP	–0.895	0.115	–7.780	0.000	–1.129	–0.661
logPRI	0.113	0.022	5.070	0.000	0.067	0.158
logPUI	–0.046	0.015	–2.980	0.005	–0.077	–0.015
dum	–0.210	0.037	–5.680	0.000	–0.286	–0.135
dumlogPUI	0.123	0.020	6.210	0.000	0.083	0.164
Year	0.058	0.003	17.550	0.000	0.051	0.065
Short-run estimate						
logEMP D1	0.477	0.165	2.890	0.007	0.142	0.812
logPUI D1	0.042	0.010	4.020	0.000	0.021	0.063
Diagnostics						
Bound test			4.373@			
Observation			44			
R-square			0.79			
Durbin-Watson (autocorrelation)			2.25			
Breusch-Godfrey LM (serial correlation)			2.373			
White (homoscedasticity)			44			
Breusch-Pagan/Cook-Weisberg test			1.88			
Jarque-Bera (normality)			0.3957			
CUSUMSQ (stability)			0.6222			

Indicates model with breakpoint. *,,@ denote statistical significance at 10%, 5%, and 1% levels, respectively. Breakpoint model is Stata generated Schwartz-Bayesian information creation using the varsoc routine. CUSUMSQ: Cumulative sum of squared residuals*

5.3. Error correction model result

This section presents the results of this non-experimental study. Table 5 reveals the results for the model where convergence to long-run equilibrium is at a speed of 66% with the adjustment term negative and statistically significant (P = 0.000). In the short run, the first lag of the employment rate (0.477) and public investment (0.042) have asymmetric effects on GDP with statistical significance (P = 0.007 and P = 0.000). On the other hand, on average, ceteris paribus, private investment (0.112) is a positive predictor of GDP while public investment negatively impacts GDP (0.046) with statistical significance (P = 0.000 and P = 0.005) in long run. Furthermore, in the long run, a percentage point increase in the employment rate is causing an abatement in the GDP by –0.89. This suggests that 89% decrease in GDP on average can be contributed by 1% enhancement in employment rate with statistical significance (P = 0.000), ceteris paribus.

The model shows a good fit as the regressors explain about 79% variation in GDP. F statistics of Durbin-Watson test and Breusch-Godfrey LM test consequently indicate that there are no autocorrelation and serial correlation. x^2 statistics of Breusch-Pagan/Cook-Weisberg test and Jarque-Bera exhibits homoscedastic and normally distributed dataset. Statistics for CUSUMSQ specifies that the model is stable.

6. Limitation of the study and future research implication

This research has certain limitations as do many empirical studies. It only covers the period from 1972 to 2017. The GDP and private investment models may have been under specified as a result of the non-availability of data on some factors. As well as, the direction of long-run and short-run causality between the dependent variable and the independent variables is not examined in this study.

When empirical data for infrastructural and non-infrastructural public investment and investment from public-private partnership become incorporated in this model, it would be interesting to discover crowding-out and crowding-in effects on private investment from future studies. It would be attention grabbing to find out if the empirical results would change fundamentally in future studies after the inclusion of other factors such as the rate of modern industrialization, exports competitiveness and structure, institutional quality, and sociopolitical stability.

7. Conclusion and policy recommendation

This study has empirically examined the impact of public and private investment on GDP in Bangladesh for the period from 1972 to 2017. To do so, ARDL bounds testing approach is applied. The empirical results of this study reveal that, in the long run, public investment negatively affects GDP, while private investment has a significant affirmative effect on it. Moreover, in the short run, public investment positively affects GDP and private investment has no statistically significant effect on it. Based on this result, it can be concluded that private investment has a greater contribution to GDP in Bangladesh than public investment (Makuyana and Odhiambo, 2018). Consequently, these findings may suggest that public investment needs to be considered carefully to avoid the negative impact which would reduce the GDP. It is found in the study of Le and Suruga that public investment may harm economic activity when exceeding the proper levels (8–9%)

(Le and Suruga, 2005). This result is consistent with the commonly accepted theory that the private sector plays a more crucial role than a public investment to sustained growth and economic development. In recent years, more emphasis has been placed on public investment to attain higher GDP growth in Bangladesh (Saidjada and Jahan, 2018). Thus for the formulation of monetary and fiscal policy, the findings of this study have important implications. To avoid the presence of the crowding-out effect, the government can adopt more favorable policies to induce public-private partnerships. Government can identify the areas of investment where social returns are the highest, externalities and spillover effects are significant and have a complementary impact on the private sector. By investing in these areas, it can play a pivotal role to increase productivity and competitiveness in the economy. A public investment that does not support these criteria would appear to affect the GDP inversely and thus should be avoided or not undertaken (Khan, 1996). The result from this study shows a positive relationship between employment and GDP in the short run but an inverse relationship in long run. The long-run relationship opposes the theoretical priory expectation which holds that high employment is positively related to GDP. That means in the case of Bangladesh, GDP does not thwart by unemployment. These types of growth in economics are identified as "Exclusive Growth." That is, growth does not reflect in the standard of living of the average citizen of the country (Badiru, 2016). The result is showing that economic growth is not linked to the total labor force but the labor productivity (Akinyemi et al., 2018). This study, therefore, recommends that Bangladesh should aim to attain a sustained high level of development by empowering its active labor force through skill acquisition. Another policy implication of this study is that the private sector should carry on the investment projects that require labor-intensive techniques since Bangladesh has an abundant labor force. In light of the above findings, it can be suggested that the stimulation of private investment should be focused more on the development policy of Bangladesh to enhance GDP. It would require the availability of credit flow and much easier access, timely disbursements of public funds, and proper implementation of public investment projects. As well as, easing of regulatory burden on the private investors is indispensable. Moreover, reducing public sector corruption, reforming bureaucracy, and improving overall governance would further accelerate private investment.

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