An Empirical Analysis of the Ricardian Equivalence, Feldstein-Horioka Puzzle and Twin Deficits Hypothesis in Bangladesh

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This paper analyses the possibility of the twin deficits hypothesis existing in the context of Bangladesh. The novelty of this paper lies in its approach to link and check the validity of the twin deficits hypothesis in light of the Ricardian equivalence hypothesis and the Feldstein-Horioka puzzle based on annual time-series data stemming from 1990 to 2017. Fully-Modified Ordinary Least Squares (FMOLS) estimator, Vector Error-Correction Modeling and Granger causality estimating techniques are applied to provide statistical evidence regarding the nature of the simultaneity of the twin deficits. The corresponding results, although refuting the Ricardian equivalence hypothesis in the country, suggest in favour of rejection of the twin deficits hypothesis as perceived from a negative unidirectional reverse causality running from current account deficit to Bangladesh's fiscal shortfalls. Thus, our results impose key challenges and policy implications for the government to take into consideration with respect to simultaneous reduction in these two macroeconomic deficits.

Keywords: Twin Deficits, Ricardian Equivalence, Feldstein-Horioka Puzzle, Budget Deficit, Current Account Deficit

JEL Classification: E62, F32, F41, H62

I. INTRODUCTION

The indispensable role of government expenditure in stabilising the economy with regard to restoring the natural rate of employment has been extensively acknowledged by the Keynesian school of thought and it is also partially put forward in the subsequent views of the New Keynesian and Post-Keynesian economists as well. Moreover, economists often refer to the size of the government being positively correlated to the rate of development of the associated economy (Landau 1983, 1986, Barro 1990, Amin and Murshed 2016). It is often

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hypothesised that the development projects in the emerging economies, in particular, are often pinned down following the aggravation of their respective budget deficit, thus obliging these countries to be predominantly reliant on the inflow of foreign development assistance and other sources of foreign currencies to finance the proposed public projects (Fischer and Easterly 1990, Clements, Gupta and Inchauste 2004, Siraj 2012).

Although such external financing is effective in bridging the fiscal gaps, it can also exert adverse impacts on the economy especially through worsening of the current account balance and possibly attributing to current account deficit (CAD) in adverse circumstances (Bagheri, Piraee and Keshtkaran 2012, Bakarr 2014). Thus, the notion of the twin deficits hypothesis (TDH) emerged postulating a simultaneous deterioration of the BD and CAD. The simultaneity of the BD and CAD first came into consideration in the 1980s following the persistent deterioration of these two deficits in the United States (Roy and Gupta 2013) and ever since this trend of worsening of the BD exerting upward pressure on the CAD has been found to be common in both the developed and developing economies worldwide (Normandin 1999, Zengin 2000, Baharumshah *et al.* 2006). Hence, keeping the consequences of the TDH into cognizance, the nature of the association between these two macroeconomic deficits has gone on to becoming an interesting genre of research for academicians and policy makers.

The TDH can be primarily understood from the nature of the correlative and causal associations between the BD and CAD. Firstly, a positive causal relationship running from BD to CAD can be referred to as the TDH in which a rise (or fall) in the BD stimulates a corresponding rise (or fall) in the CAD. Under such circumstances, fiscal consolidation via tax reduction is often said to be effective in mitigating both the deficits. Plausible explanations regarding such a causal association, based on theoretical frameworks, are discussed in the subsequent section of this paper. Secondly, a causal association in the opposite direction, from CAD to BD, can also be anticipated in some countries, which can be referred to as the '*reverse causation'* (Summers 1988). This phenomenon can be explained by the national income accounting equation in which a CAD deterioration, viewed in the form of an escalation in the net exports, is associated to a fall in the aggregated demand, diminishing economic growth and consequently aggravating the BD. Finally, a feedback causal nexus between BD and CAD can also be witnessed whereby it may not possible to target a reduction in one of the deficits via controlling the other. Therefore, the presence of the reverse causation

and the feedback causality between the BD and the CAD can be considered statistical evidence refuting the TDH taking place in an economy.

A steady BD is considered to be one of the leading causes of economic affliction providing significance to the importance of globalisation in order to facilitate the inflow of foreign capital to bridge the fiscal deficit. In addition, escalation of the CAD, arising due the growth of the total monetary value of imports outpacing that of exports, is also a concern since current account imbalances are expected to hinder the economic development strategies (Marinheiro 2008). Such negative trends in the fiscal budget and the current account are common features of most developing countries to which Bangladesh is no exception.

Against this backdrop, this paper aims to apply rigorous econometric techniques to examine the possibility of the TDH to be existing in Bangladesh. Ever since its independence in 1971, the nation has embarked on widespread structural reforms with the underlying objective of curbing public sector shortfalls and mitigating external deficits underscoring the necessity of stabilising its macroeconomic environment. However, despite such reformative measures enabling the nation to maintain a sustained annual economic growth rate close to 6.5 per cent on average in the last decade or so (Amin and Murshed 2017, Murshed 2018a), mitigation of Bangladesh's fiscal deficits seems to be a goal that is far-fetched. As a consequence, the nation's overall BD has not only deteriorated over the years but it has also worsened to a large extent. On the other hand, the current account balance of the nation did exhibit positive trends until 2015 despite the net exports of depicting negative figures all throughout. The positive current account balance of the nation can be attributed to the enormous growth of its international remittance inflows. The recent negative trend in Bangladesh's current account balance, coupled with its historic BD trends, thus raises deep concerns for the policymakers with regard to suggesting plausible solutions to the nation's CAD woes at present, thus, making the investigation of the TDH in the context of Bangladesh quite pertinent from policy perspectives.

The paper contributes to the literature in the following ways. Firstly, the paper provides an empirical analysis of the Ricardian Equivalence (RE) in Bangladesh, which is important in the sense that only in the absence of the RE, a worsening of the BD can be associated with a corresponding corrosion in the CAD. Secondly, the paper also probes into examining the validity of the Feldstein-Horioka Puzzle (FHP) which advocates in favour of perfect capital mobility across nations to

determine the TDH. To the best of the authors' knowledge, there had not been a similar study regarding the empirical examination of the TDH, in light of the RE and FHP, exclusively in the context of Bangladesh.

The remainder of this paper is organized as follows. Section II provides a review of the theoretical framework addressing the TDH. The methodology of research and the attributes of the dataset are explained in section III. Section IV. reports the trends in the fiscal and current account balances in Bangladesh. The results from the econometric exercises are reported and discussed in section V. Finally, section VI. concludes and suggests policy recommendations.

II. THEORETICAL FRAMEWORK

The preliminary discussion regarding the association between the BD and the CAD, ultimately shedding light onto the fundamentals of the TDH, can be put forward using the national income accounting framework in the context of an open economy:

$$Y = C + I + G + (X - M) \tag{1}$$

where Y denotes national income; C is the private consumption; I refers to the private investment; G includes government expenditure and X-M refers to the net exports. Similarly, referring to domestic absorption, national income can also be written as:

$$Y = C + S + T \tag{2}$$

where S refers to the national savings, summing up both private and public savings, while T denotes government revenue. Thus, equating equations (1) and (2) gives us:

$$(X - M) = (T - G) + (S - I) \tag{3}$$

where X-M can be described as the CAD while the BD is given by (T-G), assuming both import and government expenditure outweighing export and government revenue respectively. Hence, holding the domestic savings and investment gap (S-I) to be unchanged, a rise (fall) in the BD is likely to be reflected through a simultaneous rise (fall) in the CAD, thus, explaining the TDH.

Apart from this possible inter-relationship between the BD and CAD, various schools of thoughts have also attempted to explain the TDH.

2.1. Mundell-Fleming Model

The positive causal association between the BD and CAD, explaining the TDH, can be understood from the theoretical framework proposed by Mundell (1963) and Fleming (1962), which talks about a rise in the BD exerting an upward pressure on the domestic interest rate, which in turn would attract foreign capital inflows, leading to a real exchange rate appreciation. This decline in the exchange rate would dampen exports at the expense of imports, ultimately deteriorating the CAD (Kouassi*et al.* 2004). This phenomenon can also be linked to the Dutch Disease hypothesis whereby inflow of foreign currency appreciates the real exchange rate of the recipient economy affecting its export sector and distorting its current account balance (Younger 1992, Murshed 2018b, Amin and Murshed 2018, Polat and Rodríguez Andrés 2019).

2.2. Keynesian Absorption Theory

The TDH is also in line with the traditional Keynesian absorption theory which asserts that as the BD increases, assuming that the government decreases the taxation efforts, the disposable incomes of the consumers increase whereby the demand for imports are expected to go up. Thus, the consumers' total absorption, denoting the domestic residents' consumption expenditure on goods and services, surpasses the number of goods and services produced locally and thereby deteriorate the current account balance (Ratha 2012, Vines, 2017, Ncanywa, &Letsoalo 2019).

2.3. Ricardian Equivalence

Although the Keynesian School of thought acknowledges the possibility of the TDH existing, the RE theory, put forward in the seminal paper by Barro (1974), refutes it. According to the concept of RE, changes in the government's financing strategies are ineffective in stimulating private consumption patterns and, as a result, the domestic interest rate is left unaffected. Hence, the exchange rate is also expected to stay put whereby the possibility of current account balance distortions is nullified. This is because the government's financing decisions do not affect the intertemporal budget constraints of the consumers and any change in the disposable income is adjusted by a change in the savings, keeping the consumption levels unaltered. For instance, as the BD increases, a tax cut now is viewed as a potential tax hike in future and, as a result, the consumers save the entire increment in their disposable income, following the tax cut at present, to compensate for the tax hike in future. As a result, the inter-temporal consumption path is unchanged

whereby the deterioration of the BD is not translated into a corresponding deterioration of the CAD. In contrast, the absence of the RE could possibly set the stage for the TDH to hold true. The RE can also explain the lack of correlation between BD and movements in the real exchange rates, particularly due to the consumption path and the domestic interest rates being unaffected (Evans 1986, Bernheim 1987, Seater 1993).

2.4. The Feldstein-Horioka Puzzle

Feldstein and Horioka (1980) in their study found a near-perfect correlation between domestic savings and domestic investment rate in the presence of provision for capital mobility across nations. The correlation is puzzling in the sense that under a perfect capital mobility circumstance, people are likely to invest in foreign countries provided the marginal return to capital is lower in the domestic country as compared to that in the foreign country. Thus, the domestic savings and investment should be expected to be uncorrelated in light of theoretical explanations adhering to the notion of capital mobility across the national boundaries. The link between the FHP and the TDH could be put forward in the manner that in the absence of the RE, a rise in the BD is likely to reduce the domestic savings which in turn would reduce the marginal returns to capital within the domestic country. As a consequence, the local residents would have a tendency to invest abroad. Thus, the inflow of foreign currency would be required to bridge the fiscal deficit, leading to a possible appreciation of the exchange rate and possibly deteriorating the CAD further. Thus, under perfect capital mobility (in the presence of the FHP), the TDH is likely to be held true and vice versa.

A summary of relevant empirical studies shedding light on the TDH is provided in appendix Table A.

III. METHODOLOGY AND DATA

The empirical examinations tapped in this paper starts off with the test of the Ricardian equivalence hypothesis to understand the dynamics of private consumption decisions in Bangladesh that are associated with the government's budget deficit financing policies in the form of alterations in the taxation efforts. Following Perelman and Pestieau (1993), the empirical model of Ricardian equivalence is given by:

$$C_t = \beta_0 + \beta_1 (Y\text{-}T)_t + \beta_2\, BD_t + \beta_3\, GDEBT_t + \beta_4\, NSAVE_t + \beta_5\, INF_t + \varepsilon_t \quad (4)$$

where C is real private consumption, Y-T is the aggregate disposable income, BD is the budget deficit, NSAVE is national savings and INF is domestic inflation in Bangladesh. In line with the Ricardian equivalence hypothesis, the government's taxation decisions do not affect domestic private consumption. Thus, the predicted values of $(\beta_1 + \beta_2) = 0$ and $\beta_3 = 0$, meaning that a tax-for-debt swap does not stimulate changes in the domestic private consumption levels. In contrast, $\beta_2 = 0$ implies Keynesian views asserting that a tax-for-debt swap has a strong impact on consumption.

In addition to the Ricardian equivalence hypothesis explaining the possibility of the twin deficits taking place, capital mobility, incorporating the hypothesis of the Feldstein-Horioka puzzle, is also believed to a decisive factor. Extending the bivariate model proposed in the seminal paper by Feldstein and Horioka (1980), additional control variables are included in equation (5):

$$DINV_t = \alpha_0 + \alpha_1 NSAVE_t + \alpha_2\, GDPG_t + \alpha_3 PCON_t + \alpha_4 GI_t + \varepsilon_t \tag{5}$$

where DINV is domestic investment, GDPG is growth rate of gross domestic product, PCON is public consumption expenditure and GI is globalisation index. The predicted value of α_1 provides the savings-retention rate denoting the degree of capital mobility in the country. In the context of the Feldstein-Horioka puzzle existing in the economy, the estimated value of α_1 is expected to be close to 1 implying perfect international capital immobility while the estimated value being close to 0 would suggest domestic investment being uncorrelated to domestic savings, condemning the existence of the puzzle.

Finally, the twin deficits hypothesis is examined expressing CAD as a function of BD and other control variables:

$$CAD_t = \gamma_0 + \gamma_1\, BD_t + \gamma_2\, RER_t + \gamma_3\, GDPG_t + \gamma_4 INF_t + \gamma_5 GI_t + \varepsilon_t \tag{6}$$

where CAD is current account deficit, BDEF is budget deficit, RER is real exchange rate, INF is domestic inflation and GI is globalisation index. For the possible existence of the twin deficits hypothesis, the estimated coefficient γ_1 is expected to be positive and, moreover, a causal association stemming from BD to CAD should also be found, suggesting that a rise in the government's borrowing activities (a rise in the BD) causes a rise in the CAD.

As part of the methodology, this paper performs the stationarity test using the Augmented Dickey-Fuller approach and also uses the Johansen test for cointegration between the concerned variables. The Fully-Modified Ordinary Least Squares (FMOLS) estimator is used for regression analyses following the

problem of serial correlation in the data whereby the use of the Ordinary Least (6) Squares (obs) estimator is no longer appropriate. In addition, only in context of model, the short run causal analysis is done using the Vector Error-Correction Model (VECM) approach while the long run causal estimates are sourced using the Granger causality test in order to comment on the existence of the TDH in Bangladesh.

Data concerning all the aforementioned variables have been accumulated from multiple sources from 1990 to 2017. All the variables are expressed in terms of their natural logarithm. The sources of data are provided in appendix Table A.

IV. HISTORICAL TRENDS IN BD AND CAD IN BANGLADESH

Fiscal deficits are common to all the developing countries across the globe, Bangladesh is no exception. Figure 1 shows the trends in the country's fiscal balances between 1992 and 2017. As can be seen from the figure, the country not only had sustained its negative budget balance but had also witnessed a persistent deterioration in its BD figures with time. This particular scenario can at large be explained by the fact that the fiscal budgets proposed by the government, over the last two decades in particular, have always exceeded the previous year's budget, which was not matched by a complementary rise in the public revenue figures, particularly due to following the failure to mobilise domestic revenues in Bangladesh (Murshed and Saadat 2018). As a consequence of such aggravation in the fiscal shortfalls, the country had also been predominantly reliant on external financing of its BD.

On the other hand, the current account balance trends in Bangladesh have depicted relatively greater fluctuations. Figure 1 shows that the country did manage to ensure a positive current account balance from 1999 onwards. However, it did become negative in recent times, thus, raising concerns amongst the policy makers with respect to mitigating the deficit in future. Moreover, it is to be noted that although the current account balances were positive over the aforementioned time period, the country did experience a trade deficit all throughout. A core reason behind such dismal trade performance could be interpreted as the country's failure to broaden its export basket. However, in comparison to the South Asian neighbouring economies, Bangladesh had portrayed relatively better performances in terms of maintaining a favourable current account balance. Figure 2 shows that, in the recent past, Bangladesh is the only nation amongst the four major lower-middle-income countries within the South Asian belt to have accounted for a positive current account balance which can be understood from the sustained CAD scenarios in India, Pakistan and Sri Lanka.

FIGURE 1: **Trends in Fiscal and Current Account Balances in Bangladesh**
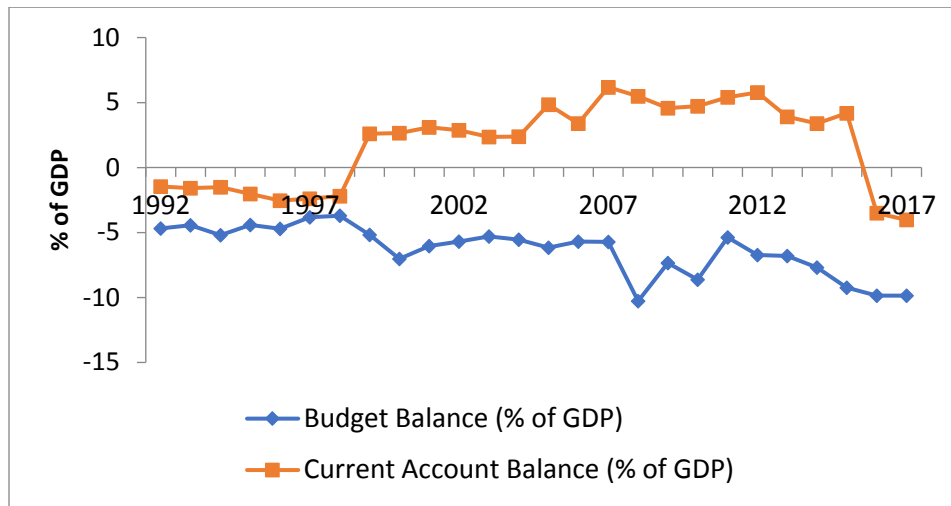
Source: *Bangladesh Economic Review* (2005, 2010, 2017).

FIGURE 2: **Trends in Fiscal and Current Account Balances in Bangladesh**
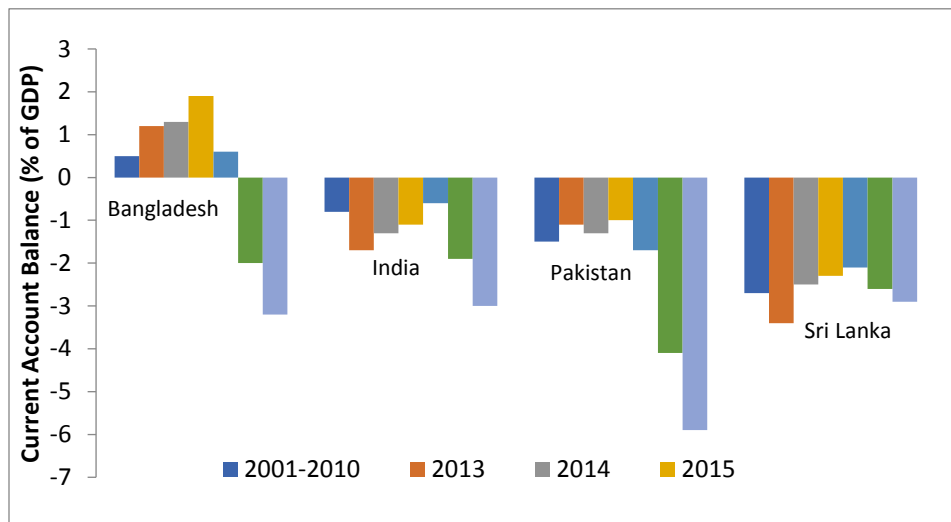
Source: *World Economic Outlook*, IMF.

V. EMPIRICAL RESULTS

The results from the ADF unit root tests on the dataset are reported in Table I. As be seen from the table, all the variables considered in this paper are stationary at their respective first differences, I(1), implying the absence of possible unit roots in our dataset. Thus, the probabilities of the regression analyses to be performed being spurious are nullified.

TABLE I
ADF UNIT ROOT TEST RESULTS (LAGS=5)

Var.	ADF Stat.[a]	P-value	Decision on Stationarity
			First Difference I (1)
C	-4.847	0.004	Stationary considering constant and trend
(Y-T)	-5.604	0.001	Stationary considering constant and trend
BD	-5.979	0.000	Stationary considering constant and trend
CAD	-6.022	0.000	Stationary considering constant and trend
GDEBT	-4.518	0.010	Stationary considering constant and trend
NSAVE	-5.541	0.001	Stationary considering constant and trend
INF	-5.623	0.001	Stationary considering constant and trend
GDPG	-5.411	0.013	Stationary considering constant and trend
PCON	-4.970	0.000	Stationary considering constant and trend
GINDEX	-3.964	0.001	Stationary considering constant and trend
RER	-4.279	0.013	Stationary considering constant and trend
DINV	-4.398	0.014	Stationary considering constant and trend

Table: Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root

Level of Significance	Level I (0)		First Difference I (1)	
	Only Constant	Constant and Trend	Only Constant	Constant and Trend
5%	-2.951	-3.548	-2.954	-3.553

Note: a: considering trend and intercept; the optimal lag selection is based on the Schwarz Information Criterion (SIC).

The results from the Johansen cointegration tests are reported in appendix Tables A.3, A.4 and A.5. According to the statistical estimates, it can be inferred

that there are cointegrating equations in our regression models providing statistical evidence regarding the long run association between the concerned variables. Thus, the prerequisite to performing the causality analyses is met.

These are followed by the Breusch-Godfrey LM test for autocorrelation and the Ramsey Reset test for omitted variable bias to detect the possible serial correlation and endogeneity problems in our dataset. The corresponding results, as reported in appendix Tables A.6 and A.7, suggest the existence of autocorrelation and omitted variable bias in our dataset whereby application of the OLS is no longer appropriate. Thus, the FMOLS estimation technique is applied.

The FMOLS regression results in the context of model (4) are provided in Table II. According to the estimates, it is found that the estimated coefficient attached to aggregate disposable income is positive and statistically significant at 5% level of significance. Thus, it can be interpreted as a 1 percent change in aggregate disposable income leads to a 0.887 percent rise in the total real private consumption on average, *ceteris paribus.* This is in line with the Keynesian views which assert that the consumption patterns of consumers adhere to the changes in their respective levels of disposable income. Our results also advocate in favour of a negative association, although statistically insignificant, between BD and private consumption. The important point to note here is that the sum of these two aforementioned estimated slope coefficients does not sum up to be equal to zero whereby, in light of the statistical evidence found, it can be inferred that the notion of RE does not hold. Thus, in line with the Keynesian school of thought, fiscal policy is effective in stabilising the economy following inflationary and recessionary gaps. This is further supported by the finding that the estimated coefficient attached to government debt is not equal to zero either, which, overall, implies that a tax-for-debt swap by the government does impact the consumption trends of the people, indicating against the validity of the RE concept. Thus, in absence of the RE, there could be a possibility of the TDH holding within the economy of Bangladesh.

TABLE II

FMOLS REGRESSION OUTPUT IN CONTEXT OF MODEL (4)

Dependent Variable: LnC	
Regressors	Coefficient
	(Standard Errors)
Ln(Y-T)	0.887** (0.406)
LnBD	-0.055 (0.272)
LnGDEBT	0.512 (0.477)
INF	-1.922* (0.139)
LnNSAVE	0.184*** (0.100)
Intercept	9.211* (3.108)
Adj. R^2	0.797
S.E. of Regression	0.413

Note*: Trend assumption: Linear; the standard errors are reported within the parentheses; *, **, and *** denote statistical significance at 1%, 5% and 10% levels respectively.

Table III reports the regression results in the context of model (5). From the table, it can be seen that there is statistical evidence regarding a positive nexus between domestic investment and savings in Bangladesh, as perceived from the corresponding statistically significant slope coefficient. According to the estimated value, the savings-retention rate is more than 56 per cent, which implies moderate capital mobility across the national boundary and, as a result, it can be inferred that the FHP, although weakly, does exist in the context of Bangladesh. This finding corroborates with the conclusions made by Marinheiro (2008) in the context of Egypt, a country that too like Bangladesh has witnessed prolonged periods of deteriorating trends in its BD and CAD. The lack of capital mobility in Bangladesh can also be attributed to the implementation of government's affirmative measures and acts, following its concerns regarding capital flight and money laundering issues with the economy, which impede financial outflows from the country.

TABLE III

FMOLS REGRESSION OUTPUT IN CONTEXT OF MODEL (5)

Dependent Variable: LnTIV	
Regressors	Coefficient
LnNSAVE	0.560** (0.479)
LnGINDEX	3.207* (0.830)
GDPG	0.014 (1.018)
LnPCON	0.165*** (0.525)
Intercept	0.301 (0.891)
Adj. R^2	0.817
S.E. of Regression	0.309

Note: Trend assumption: Linear; the standard errors are reported within parentheses; *, **, and *** denote statistical significance at 1%, 5% and 10% levels respectively.

The regression results from model (6) are reported in Table IV. From the table, it can be seen that the estimated slope coefficient attached to BD is negative, and statistically significant at 1% level of significance, implying a negative correlation between BD and CAD. Thus, based on this correlative result, it can be said that the government's budgetary account and the current account do not move in the same direction whereby there is no statistical regarding the existence of the TDH. This can be justified with regard to the existence of the FHP found from the regression output reported in Table IV. Furthermore, for robustness check, we also resort to the causality analysis in order to unearth the possible causal association between BD and CAD in the country.

TABLE IV

FMOLS REGRESSION OUTPUT IN CONTEXT OF MODEL (6)

Dependent Variable: LnCAD	
Regressors	Coefficient
LnBD	-0.152* (0.011)
LnTINV	-0.293* (0.015)
LnRER	1.209** (0.062)
INF	0.212*(0.005)
LnGINDEX	2.291 (1.221)
GDPG	-0.117* (0.019)
Intercept	1.642* (0.000)
Adj. R^2	0.879
S.E. of Regression	0.240

Note: Trend assumption: Linear; the standard errors are reported in the parentheses; *, **, and *** denote statistical significance at 1%, 5% and 10% levels respectively.

The TDH advocates in favour of a causal association running from BD to CAD. Thus, the short and long-run causal association between these two variables in particular are analysed using the VECM approach and the Granger causality

test, respectively. The causality examinations are conducted explicitly in the context of model (6). Table V reports only the estimated chi-squares statistics from the VECM analysis. The corresponding results reveal that there is no causation between BD and CAD, implying the invalidity of the TDH in the short-run. This can be inferred as the causal linkage between these two macroeconomic deficits being subject to time lags whereby statistical evidence is found to refute the existence of the TDH in the short-run. Moreover, the other relevant findings from the VECM analysis denote non-causalities between CAD and the other controlled variables considered in the model with the only exception in the form of GINDEX, whereby the statistical estimations project short run bidirectional causality between CAD and the degree of globalisation efforts in Bangladesh. The error-correction term (ECT_{t-1}) is negative and statistically significant, which implies that any distortion from the equilibrium is corrected in the next period at a rate of almost 62 percent.

TABLE V

VECM GRANGER CAUSALITY TEST RESULTS OF MODEL (6)

Null Hypothesis	Chi-sq.-Stat.	Prob.	Type of causation
BD does not cause CAD	1.839	0.399	No causality
CAD does not cause BD	0.746	0.688	
RER does not cause CAD	3.227	0.199	No causality
CAD does not cause RER	3.494	0.173	
INF does not cause CAD	1.945	0.378	No causality
CAD does not cause INF	0.820	0.403	
GINDEX does not cause CAD	9.030	0.011	Bi-directional causality
CAD does not cause GINDEX	5.223	0.074	Between CAD and GINDEX
GDPG does not cause CAD	4.068	0.131	No causality
CAD does not cause GDPG	3.979	0.136	
ECT_{t-1}	-0.619	0.041	

Note: The estimated chi-square statistics are tested to be statistically significant at 5% and 10% levels of significance; The optimal lags selection is based on the Schwarz Information Criterion (SIC).

The estimated F-statistics from the Granger causality test, as reported in Table VI, puts forward statistical evidence suggesting a *reverse causation* running from CAD to BD. Thus, this finding along with the negative correlation found between these two variables in the regression analysis tends to suggest that, despite the absence of the RE, the TDH does not hold to be true in the context of Bangladesh over the long-run. Thus, this unidirectional reverse causality implies that rising imbalances in the current account can hinder the simultaneous budget consolidation efforts of the government. Moreover, our results provide statistical evidence regarding greater globalisation, as in the case of the short-run, and the rate of economic growth causing changes in the CAD in the long run.

TABLE VI

GRANGER CAUSALITY TEST RESULTS IN THE CONTEXT OF MODEL (iii)

Null Hypothesis	F-Stat.	Prob.	Type of causation
BD does not Granger cause CAD	1.345	0.259	Unidirectional causality
CAD does not Granger cause BD	5.770	0.026	from CAD to BD
RER does not Granger cause CAD	0.060	0.810	No causality
CAD does not Granger cause RER	1.400	0.250	
INF does not Granger cause CAD	0.613	0.443	No causality
CAD does not Granger cause INF	0.798	0.381	
GINDEX does not Granger cause CAD	5.877	0.025	Bidirectional causality
CAD does not Granger cause GINDEX	5.014	0.046	between GINDEX to CAD
GDPG does not Granger cause CAD	5.057	0.035	Bi-directional causality
CAD does not Granger cause GDPG	5.446	0.030	Between CAD and GDPG

Note: The estimated F-statistics are tested to be statistically significant at 5% and 10% levels of significance; The optimal lags selection is based on the Schwarz Information Criterion (SIC).

VI. CONCLUSIONS

The paper analyses both theoretically and empirically, the validity of the twin deficits hypothesis taking place in Bangladesh, a country that has experienced prolonged periods of negative budget and trade balances. The novelty of this paper lies in its approach to link the Ricardian Equivalence hypothesis and the Feldstein-Horioka Puzzle to check the validity of the twin deficits hypothesis, particularly in the context of Bangladesh. Although the empirical results refute the existence of the Ricardian equivalence, the twin deficits hypothesis is found to be invalid, which can particularly be attributed to the lack of capital mobility in the country. Our results explicitly confirm a *reverse causation* between budget and current account deficits in Bangladesh, which imposes key policy implications on the economy, especially with regard to simultaneously mitigating the budget and trade imbalances. Hence, the government's policy efforts are ought to be directly controlling the aggravation of the negative current account balance through favourable export-boosting public policies in particular.

However, a matter of concern in this regard is the negative correlation between budget and current account deficits found in this paper, which implies a trade-off between these two macroeconomic indicators. Thus, a reduction in the deficit in the current account can be expected to widen the fiscal deficit of the government. Therefore, the public policies are better off addressing both these issues separately and keeping the opportunity cost of restoring trade imbalances to the minimum. A credible solution to this could be in the form of enhancement in the capital mobility across the national boundary of Bangladesh whereby the Feldstein-Horioka Puzzle

would not hold and following the rejection of the Ricardian equivalence, the twin deficits hypothesis could well prove to be valid in the near future; whereby fiscal consolidation can be effective in curbing both the deficits.

Data constraint is the key limitation of our paper whereby the period of study had to be confined to between 1990 and 2017. Moreover, the lack of availability of disaggregated data had to be taken into account, limiting the incorporation of relevant macroeconomic explanatory variables in our model. As the scope for future research is concerned, this paper can be a standpoint for cross-country analyses of the twin deficits hypothesis across various geographic regions in order to account for the effects of the country-specific demographic disparities on the validity of the twin deficits hypothesis in the respective countries.

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Appendix

Table A.1: Summary of Empirical Literature on the TDH

Study	Country	Time Period	Relevant Methodology	Results
Zamanzadeh and Mehrara (2011)	Iran	1959 – 2007	Vector Error-Correction Model	Bidirectional Causality between BD and CAD
Sobrino (2013)	Peru	1980Q1 – 2012Q1	Granger Causality Test	Reverse Causality from CAD to BD
AZGÜN (2012)	Turkey	1980 – 2009	Granger Causality Test	Unidirectional causality from BD to CAD
Ratha (2013)	India	1998 – 2009 (both monthly and quarterly data)	Bounds Testing and Error-Correction Modeling	TDH holds true in the short run only
Tang (2014)	United States	1960Q1 – 2013Q1	Toda & Yamamoto Causality Test	CAD Granger causes BD
Saeed and Khan (2012)	Pakistan	1972 – 2008	Error-Correction Modeling	Causality runs from CAD to BD
Sen *et al.* (2014)	Turkey	1980 – 2010	Dolado-Lütkepohl Granger Causality Analysis	No causal association between BD and CAD
Ganchev (2010)	Bulgaria	2000M1 – 2010M12	Granger Causality Test	Bidirectional causality between BD and CAD
Merza, Alawin and Bashayreh (2012)	Kuwait	1993Q4 – 2010Q4	Granger Causality Test	Causality runs from CAD to BD
Bakarr (2014)	Sierra Leone	1980 – 2012	Bounds Testing and Toda & Yamamoto Causality Analysis	Unidirectional causality runs from BD to CAD
Elhendawy (2014)	Egypt	1980 – 2011	Error-Correction Modeling	Bidirectional causality between BD and CAD
Wanjiru (2017)	Kenya	1980 – 2015	Autoregressive Distributed Lag (ARDL) approach	BD positively influences CAD
Egwaikhide (1997)	Nigeria	1973 – 1993	Ordinary Least Squares	BD negatively affects Current Account Balance
Perera and Liyanage (2012)	Sri Lanka	1960 – 2009 (both annual and quarterly data)	Granger Causality Test	Causality runs from BD to CAD
Bagheri, Piraee and Keshtkaran (2012)	Iran	1971 – 2007	Granger Causality Test	Unidirectional causality from BD to CAD

TableA.2: Data Sources

Variable	Unit of measurement	Data Source
C	Million US$	Bangladesh Economic Review (2005, 2010, 2016)
(Y-T)	Million US$	
BD	Million US$	
CAD	Million US$	
GDEBT	Million US$	
NSAVE	Million US$	
INF	Per cent	
GDPG	Per cent	
PCON	Million US$	
DINV	Million US$	
GINDEX	Index	KOF Globalization Index (2017)
RER	BDT/US$	Statistical Yearbook of Bangladesh (2016)

Table A.3: Johansen Cointegration Test Results for Model (4)

		Trace Test		
Null	Alternative	Trace Statistic	95% Critical Value	Conclusion
r = 0	r = 1	102.162**	95.754	
r<=1	r = 2	57.995	69.819	1 cointegrating equation
		Maximum Eigen Value Test		
Null	Alternative	Max-Eigen Statistic	95% Critical Value	Conclusion
r = 0	r = 1	44.167**	40.078	
r<=1	r = 2	22.971	33.877	1 cointegrating equation

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC). EViews 7.1 software automatically selects the most significant lag length based on this criterion; ** denotes statistical significance at 5% level of significance.

Table A.4: Johansen Cointegration Test Results for Model (5)

		Trace Test		
Null	Alternative	Trace Statistic	95% Critical Value	Conclusion
r = 0	r = 1	141.250*	69.819	
r<=1	r = 2	55.471***	47.856	2 cointegrating equations
r<=2	r = 3	28.174	29.797	
		Maximum Eigen Value Test		
Null	Alternative	Max-Eigen Statistic	95% Critical Value	Conclusion
r = 0	r = 1	85.779**	33.877	1 cointegrating equation
r<=1	r = 2	27.297	27.584	

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC). EViews 7.1 software automatically selects the most significant lag length based on this criterion; *, **, *** denote statistical significance at 1%, 5% and 10% levels of significance respectively.

Table A.5: Johansen Cointegration Test Results for Model (6)

		Trace Test		
Null	Alternative	Trace Statistic	95% Critical Value	Conclusion
r = 0	r = 1	134.474*	95.754	
r<=1	r = 2	76.182**	69.819	2 cointegrating equations
r<=2	r = 3	40.313	47.857	
		Maximum Eigen Value Test		
Null	Alternative	Max-Eigen Statistic	95% Critical Value	Conclusion
r = 0	r = 1	58.291*	40.078	
r<=1	r = 2	35.869***	33.877	2 cointegrating equations
r<=2	r = 3	20.274	27.584	

Notes: Selection of the lag is based on Schwartz Information Criterion (SIC). EViews 7.1 software automatically selects the most significant lag length based on this criterion; *, **, *** denote statistical significance at 1%, 5% and 10% levels of significance respectively.

Table A. 6: Breusch-Godfrey LM Test Results

	Ho: No Serial Correlation		
Model	Chi. Sq. Stat.	Prob.	Decision on Serial Correlation
(4)	18.995	0.000	Autocorrelation present
(5)	13.925	0.000	Autocorrelation present
(6)	6.045	0.006	Autocorrelation present

Note: Selection of the optimal lag length is based on Schwartz Information Criterion (SIC).

Table A.7: Ramsey Reset Test Results

	Ho: No Omitted Variable Bias		
Model	F-Stat. (12, 8)	Prob.	Decision on Endogeneity
(4)	19.601	0.000	Regressors are endogenous
(5)	14.111	0.000	Regressors are endogenous
(6)	12.745	0.006	Regressors are endogenous

Note: Selection of the optimal lag length is based on Schwartz Information Criterion (SIC).