The Twin Deficits Hypothesis: An Empirical Analysis for Tanzania

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Abstract

This paper examines the relationship between current account and government budget deficits in Tanzania. The paper tests the validity of the twin deficits hypothesis, using annual time series data for the 1966-2015 period. The paper is thought to be significant because the concept of the twin deficit hypothesis is fraught with controversy. Some researches support the hypothesis that there is a positive relationship between current account deficits and fiscal deficits in the economy while others do not. In this paper, the empirical tests fail to reject the twin deficits hypothesis, indicating that rising budget deficits put more strain on the current account deficits in Tanzania. Specifically, the Vector Error Correction Model results support the conventional theory of a positive relationship between fiscal and external balances, with a relatively high speed of adjustment toward the equilibrium position. This evidence is consistent with a small open economy. To address the problem that may result from this kind of relationship, appropriate policy variables for reducing budget deficits such as reduction in non-development expenditure, enhancement of domestic revenue collection and actively fight corruption and tax evasion should be adopted. The government should also target export oriented firms and encourage an import substitution industry by creating favorable business environments.

Keywords: Budget deficit, current account deficit, twin deficits

JEL Classification: C32, E60, E62, F32, H62

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1. Introduction

Maintaining sustainable budget deficits is one of the major pre-conditions for an economy to thrive. According to Salvatore (2006) government budget deficits lead to current account deficits. An increase in budget deficits induce upward pressure on interest rates that trigger capital inflows and appreciation of the exchange rate which in turn makes imports cheaper and exports more expensive relative to the prices of foreign goods. Large current account deficits tend to jeopardises the external stability in particular and the macroeconomic stability in general. Thus, in general, the budget deficits and the current account deficits are considered as major macroeconomic concerns in any economy. Because of its importance, the relationship between budget deficits and current account deficits has attracted a great deal of attention from academics and policy-makers. The main argument behind the twin deficits hypothesis is that reduction in government tax revenue, which increases the budget deficit, results in increased spending on the part of taxpayers, whose disposable income has increased. The increased spending reduces the national savings rate, causing the economy to increase borrowing from abroad (Imimole, 2017).

Theoretical work on the relationship that exists between variations in the stance of fiscal policy and the trade balance has been based upon the Keynesian proposition and the Ricardian equivalence hypothesis. Based on the Mundell-Fleming framework, the Keynesian view asserts that budget deficits have a statistically significant impact on current account deficits main through the interest and exchange rate channels (see for example Fleming, 1962; Mundell, 1963; Volcker, 1987; Kearney and Monadjemi, 1990 and Haug, 1996; Branson, 1976; Dornbusch, 1976; Kawai, 1985 and Marston, 1985). By contrast, the Ricardian Equivalence hypothesis posits that a cause and effect relationship does not exist between the two deficits (see for example Barro, 1974 and 1989; Buchanan, 1976; Chowdhury and Sareh, 2007 and Olanipekun, 2012). This hypothesis shows that shifts between taxes and budget deficits do not affect the real interest rate, the quantity of investment, or the current account balance. The effect of the present tax cut or increase in government expenditure does not alter the mix of current consumption and investment since rational agents foresee the present tax cut as a tax burden in future. Therefore, they will increase savings in order to pay for future tax increases. The decrease in the public saving will be compensated by an equal increase in private saving. The national saving will not be affected. Therefore, the budget deficit has no effect on the current account deficit. Notably, in the Ricardian model, the driving force behind the current account is the response of consumption to various shocks to the economy.

The mixed findings in the study of the relationship between budget deficits and current account deficits may be attributed to the use of different econometric techniques in the analysis, different variables and different samples of data. Nonetheless, these contrasting views pose a challenge for policy formulation and direction. In fact, empirical investigation of the relationship between the two deficits appears to be much important for a specific country. For example, if the causal relationship between the twin deficits does not exist in the country such as Tanzania, then simple reductions in the budget deficits may not resolve the current account imbalances. Thus, considering the severity of budget deficits and current account deficits in Tanzania, it is important to understand the causal relationship between the two deficits, which would help to formulate appropriate macroeconomic policies for a country.

Undoubtedly, fiscal deficit causes government debt to increase, which may lead to capital flight. In Tanzania, budget deficit, on average, rose from -2.0 percent of GDP during the 1990-89 period to -3.8 percent of GDP over the 2010-2015 period (Table 1). Similarly, current account deficits rose from -4.9 percent of GDP over the 1990-89 period to -10.0 percent of GDP during the 2010-15 period. During the 2010-2015 period, external debt grew, on average, by 11.8 percent. Overall, public debt in Tanzania increased from 21.6 percent of GDP to 39.0 percent in 2016 (Baunsgaard *et al.*, 2016). The country is underdeveloped and it has been spending heavily on modern transport and communication infrastructure. Over the 2006-2014 period, investment commitment in infrastructure projects was USD 3,172 million (World Bank, 2016). Moreover, the country has been spending heavily on social programmes such as provision of free education to reduce the high illiteracy levels and free medical services (World Bank, 2016). However, government revenue has been lower than planned expenditures, mainly because the tax revenue base is narrow coupled with loopholes and corruption in revenue collection and improper taxation policies (World Bank, 2016).

Table 1

Selected Economic Indicators in Tanzania, 1966-2015

Indicator	1966-79	1980-89	1990-99	2000-09	2010-15
Budget Deficit, Percent of GDP	-4.8	-5.5	-1.3	-2.0	-3.8
Current Account, Percent of GDP	-3.7	-5.3	-13.5	-4.9	-10.0
External Public Debt, growth rate	17.7	5.7	3.1	2.8	11.8

Indicator	1966-79	1980-89	1990-99	2000-09	2010-15
Real GDP growth rate	3.9	2.3	3.3	6.5	6.8
Lending Interest Rate	8.0	13.9	28.2	16.5	16.0
Real Exchange Rate	711.1	713.5	1429.1	1412.3	1266.4
Inflation rate	11.9	30.1	23.1	6.8	9.1

Source: Author's calculations using data from BOT (various) and WDI (2016)

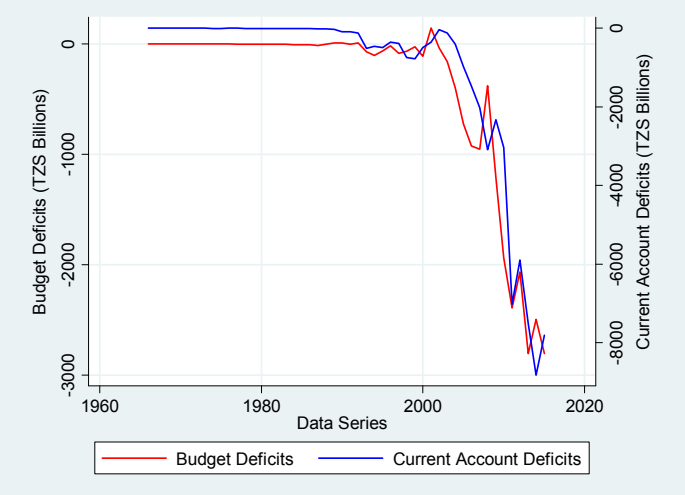
A heavy debt service burden, inadequate collection of taxes coupled with heavy government expenditures on infrastructure lead subsequently to the emergence of recurrent budget deficits. Increases in the budget deficit induce upward pressure on domestic interest rates, thus, causing capital inflows seeking investment in Treasury Bills (TBs). This may lead into an appreciation of the real exchange rate, resulting in an increase in the trade deficit. Figures 1a and 1b report the patterns between the budget balance and current account balance in Tanzania, in TZS billions and as percent of GDP respectively, over the 1966-2015 periods. Few interesting features can be abstracted from the patterns presented in these Figures. The budget and current account deficits appear relatively large and have been widening particularly over the 2000-2015 period in the face of positive output growth and decline in inflation (Table 1 and Figure 2). For example, real GDP growth has been positive and on average, rose from 3.1 percent over the 1990-1999 period to 6.8 percent during the 2010-15 period. Also, inflation declined from 23.1 percent during the 1990-1999 period to 9.1 percent over the 2010-2015 period. In addition, lending interest rate and real exchange rate were generally stable in the last 15 years (Figure 3).

In general, current account deficits in Tanzania might be attributed to overreliance on foreign finances and that the country is net importer of consumer goods and services. Nevertheless, the persistent budget and current account deficits over many years which contrast the positive outlook of other macroeconomic indicators such as real output growth and inflation rates over the same period require further scrutiny to ascertain whether or not there is a link between internal and external balances in Tanzania. In fact, the relationship between deficits in the fiscal account and current account has important policy implications for a number of reasons. As has been mentioned, persistent large deficits cause indebtedness due to borrowing internally and externally and hence, impose a burden on future generations (Harko, 2009). Also, current account deficits coupled with an increase in budget deficits and resultant inflation could lower the country's sovereign ratings and trigger a capital flight while creating difficulties on external financing (Perera and Liyanage, 2011). Moreover, growing fiscal and current account imbalances cause macroeconomic imbalances and hence, affect long-term economic progress of a country (Baharumshah *et al*, 2006).

Thus, the main argument to be discussed in this paper is whether the fiscal deficit is responsible for the current account deficit in Tanzania in consonance with the twin deficits hypothesis. The twin deficits hypothesis, which is virtually inconclusive, asserts that a reduction in the budget deficits causes a reduction in the current account deficits. Both budget deficits and current account deficits may require the government to borrow locally or abroad which, in the Keynesian argument, increase interest rates in the domestic market. This may in turn, lead to crowding out the private sector and reduction in the productive capacity of the country. Presumably, the amount of exports will decline following reduction in productive capacity thus exacerbating the current account deficit (see also Mandishekwa *et al.*, 2014).

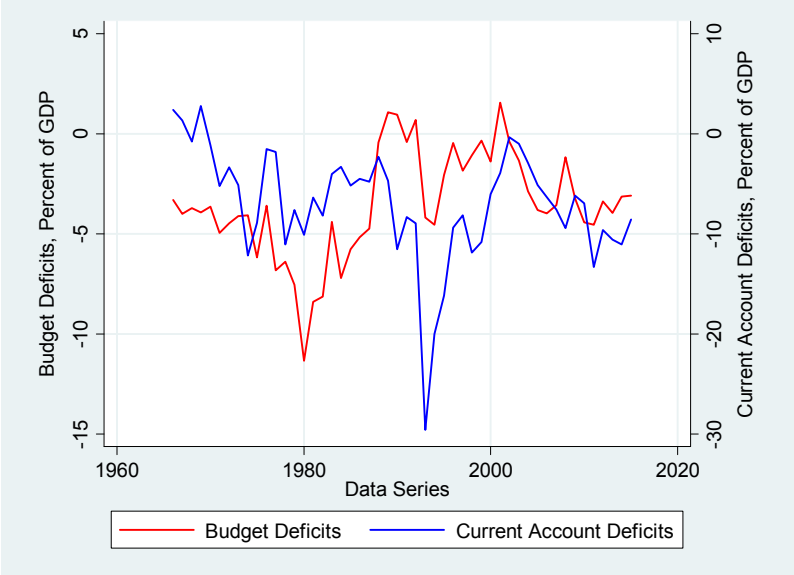
The relationship between current account deficits and government budget deficits should be taken into consideration for policy purposes. Hence, this paper examines the applicability of the twin deficit hypothesis in Tanzania given the controversy surrounding the hypothesis in other countries. The paper determines any cointegrating or long-run relationship between the two deficits and control variables namely, real GDP, interest rate, and real exchange rate, and it identifies the causal relationship or short-run relationship between the variables for policy measurements and implications.

Figure 1a. Budget and Current Account Deficits, TZS Billions



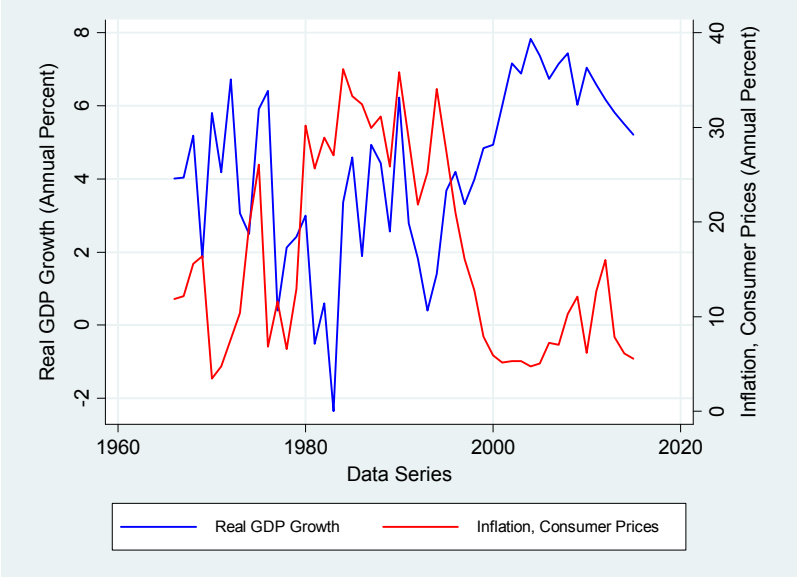
Source: Author's Estimates using Data from Bank of Tanzania (2011, 2016)

Figure 1b. Budget and Current Account Deficits, Percent of GDP



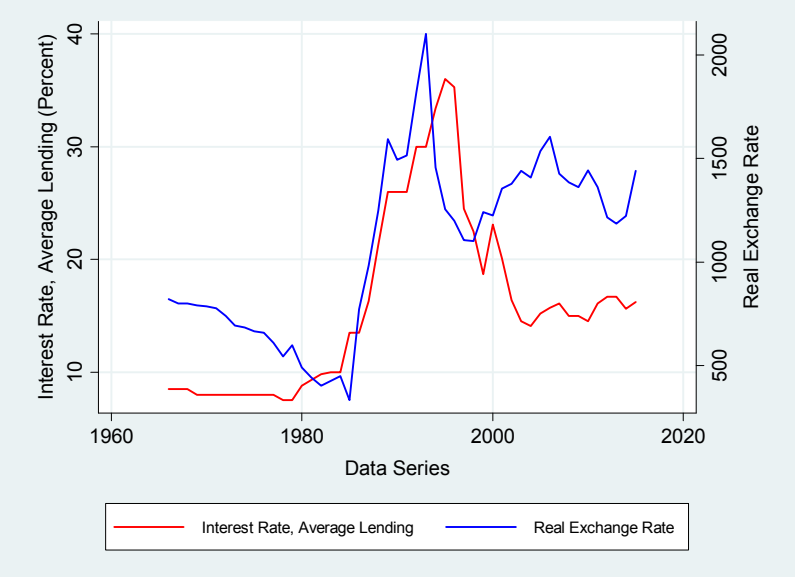
Source: Author's Estimates using Data from Bank of Tanzania (2011, 2016)

Figure 2. Real Growth Rate and Inflation Rate



Source: Author's Estimates using Data from Bank of Tanzania (2011, 2016)

Figure 3. Lending Interest Rate and Real Exchange Rate



Source: Author's Estimates using Data from Bank of Tanzania (2011, 2016)

2. Theoretical Framework

The theoretical foundations of the relationship between the budget and current account deficits can be derived from both the national income identity as well as the Mundel Flemming framework. Essentially, all analyses of the twin deficits hypothesis begin with a review of a basic national accounting identity in the context of an open economy that can be represented as

$$Y = C + G + I + (X - M) \quad (1)$$

where Y = Gross Domestic Product (GDP)
C = Households consumption expenditure
G = Gross private investment
I = Total government purchases of goods and services
X = Total exports of goods and services
M = Total imports of goods and services; $X - M$ is trade account balance *(CA)*

Identity (1) measures GDP by expenditures on final products. Similarly, GDP can be measured by the way income earned in production is disposed of; that is

$$Y = C + S + T + R_f \qquad (2)$$

where S = Total savings
T = Tax revenue
R_f = Transfer payments

Equating the two sides of the GDP identity, assuming negligible transfers and rearranging the terms yields:

$$(X - M) = (S - I) + (T - G) \qquad (3)$$

In this case, trade account balance *(CA),* $(X - M)$*,* simply equals the private saving investment gap $(S - I)$ plus the budget balance $(T - G)$. This relation implies that the current account balance is directly related to saving investment gap and the tax-expenditure gap. Under a stable saving investment gap assumption, an increase in budget deficits will cause an increase in trade deficits suggesting the traditional twin deficits relationship (see for example Abell, 1990; Bachman, 1992; Vamvoukas, 1999; Salvatore, 2006; Suresh and Tiwari, 2014). It is worth noting that national savings can be decomposed further into private saving, S_p and government saving S_g, expressed as

$$S = S_p + S_g \qquad (4)$$

where S_p is that part of individuals' income left after adjusting for taxes and consumption expenditure and it can be expressed as $S_p = Y - T - C$, and S_g is the difference between pubic or government receipts from taxes and expenditure on goods and services expressed mathematically as $S_g = T - G$. With the understanding of S_p and S_g, equation (3) can be rewritten as

$$CA = (S_p - I) + BD \qquad (5)$$

Equation (5) suggests that current account balance (*CA*) depends on the saving deficit that is given by the difference between private saving and investment; and the budget deficit (*BD*) that is represented by the difference between government revenue through taxes, and government expenditure on goods and services. However, if the relationship between private saving and investment is not stable then changes in the budget deficits could be offset by

changes in the difference between private saving and investment. As a result, fluctuations in the fiscal and the current account deficits will be unrelated (see for example Barro, 1974, 1989; Suresh and Tiwari, 2014).

The main argument behind the Keynesian twin deficits, that is also based on the Mundell-Fleming framework, is that an increase in budget deficit would induce upward pressure on interest rates, causing capital inflows and exchange rates to appreciate which in turn makes exports less attractive and increases the attractiveness of imports, subsequently worsening the current account under a flexible exchange rate system (Baharumshah *et al*, 2006; Sakyi and Opoku, 2016; Fleming, 1962; Mundell, 1963; Ball and Mankiw, 1995). Under a fixed exchange rate regime, the budget deficit stimulus would generate higher real income or prices and this would worsen the current account balance. By contrast, as reported earlier, the Ricardian equivalence hypothesis suggests that the tax-financed expenditures do not affect private spending or national saving and hence, the current account deficits are independent of the fiscal deficits (Barro, 1974 and 1989). Budget deficits have a consequential effect of tax cut which in the sense of national saving, would affect only government but not private saving (Sakyi and Opoku, 2016). Since desired national savings do not change, this would have no implications for the current account balance as private savings rise by enough to prevent international borrowing (Barro, 1989).

Another different view is that the relationship between the fiscal and current account deficits could be negative (see for example Cavallo, 2005, Corsetti and Muller, 2005; Kim and Roubini 2008, Tosun *et al*., 2014). The main argument in this view is that an investment crowding out effect would lead to a situation whereby fiscal expansion and hence fiscal deficit causes domestic interest rate to increase which in turn crowd out private investment and boost private savings (see also Cavallo, 2005; Kim and Roubini, 2008 and Sakyi and Opoku, 2016). As a result, aggregate demand falls leading to an improvement in the current account deficit. Nonetheless, an increase in current account deficit may put a pressure on government to expand more and these government expenditures in turn lead to an increase in budget deficit. Also, there is a possibility of a two-way causality between the two deficits. That is, there is causality running from budget deficit to current account deficit and vice versa.

3. Empirical Literature Review

Generally speaking, the concept of the twin deficits hypothesis is rife with controversy. Even the empirical studies testing the relationship between budget and current account deficits have produced mixed findings. Several reasons including country specificity, sample size and methodology used have been cited

for the difference in the results (see for example Sakyi and Opoku, 2016; Mukhtar *et al*., 2007; Bose and Jha, 2011; Ratha, 2012; Sobrino, 2013). Consequently, a number of testable hypotheses arise from the twin deficits phenomena. The first testable hypothesis is based on the Keynesian conventional proposition. The basic argument here is that first, there is positive relationship between current account and budget deficit and second, there exists a unidirectional Granger causality that runs from budget deficit to current account deficit. Empirical studies such as Zamanzadeh and Mehrara (2011) for Iran; Miteza (2012) for 20 OECD countries; Anas (2013) for Morocco; Forte and Magazzino (2013) for 33 European countries; Mudassa *et al*., (2013) for Pakistan; Suresh and Tiwari (2014) for India; Panagiotis *et al*., (2009) for Greece, Abell (1990) for United Sates; Saleh *et al.,* (2005) for Sri Lanka, Lau and Baharumshah (2006) for nine South East Asian Central Banks (SEACEN) countries; Salvatore (2006) for the G-7 countries, and Vamvoukas (1999) for Greece, Piersanti (2000) for OECD countries show strong evidence to support the Keynesian view suggesting that an increase in fiscal deficits cause an increase in current account deficits. These evidences are consistent with the twin deficits hypothesis.

The second testable hypothesis is the Ricardian equivalence which stipulates that budget deficits and current account balances are independent. This hypothesis is proposed by Barro (1989). The main argument in the Ricardian equivalence hypothesis is that an intertemporal shift between taxes and budget deficits does not matter for the real interest rate, the quantity of investment or the current account balance and hence, there is no any Granger causality between the two deficits. A number of empirical evidence including Miller and Russek (1989) for United States, Enders and Lee (1990) for United States, Evans and Hasan (1994) for Canada; Wheeler (1999) for the United Sates, Kaufmann *et al.,* (2002) for the Austrian; Kiran (2011) for Turkey; Mohammadi and Moshrefi (2012) for South Korea, Malaysia, Singapore and Thailand., Merza *et al*., (2012) for Kuwait; Ratha (2012) for India; Tosun *et al*., (2014) for Latvia, Lithuania, Poland, Romania, Serbia and Slovenia; Ogbonna (2014) for South Africa; Rahman and Mishra (1992) for the United States conclude that there is no causal relationship between the two deficits and hence are supportive of the Ricardian equivalence.

Third, a number of empirical studies have tested the twin divergence hypothesis. For example, Kim and Roubini (2008) find that fiscal deficits improve the current account deficits in the United State. Many other studies including Bon (2014) for 10 developing Asian countries; Corsetti and Muller (2005) for Australia, Canada, the United Kingdom and the United States., Javid *et al.* (2010) for Pakistan; Nazier and Essam (2012) for Egypt; Abbas *et al.* (2011) for 88 non-oil exporting countries; Sakyi and Opoku (2016) for Ghana; Cardoso and Domenech

(2011) for Spain; Misztal (2012) for Latvia, Lithuania and Estonia; Cheung *et al.* (2013) for a sample of 94 countries have found support for the argument that fiscal deficits improve the current account deficits of the economies. Consequently, the twin divergence hypothesis has in recent years become debatable both in the developed and, mainly in the developing economies. In fact, the twin divergence hypothesis and the Recardian equivalence provide evidence that there is no clear consensus regarding the effect of fiscal policy on the current account. Therefore, a standard implication of many theoretical models that a fiscal contraction leads to a depreciation of the real exchange rate and a subsequent fall in the current account deficit is not conclusive.

Fourth, a unidirectional causality that runs from current account deficits to budget deficits may exist. This outcome occurs when the deterioration in current account leads to a slower pace of economic growth and hence increases the budget deficit. Summers (1988) refers this reverse causality running from current account to budget deficits to current account targeting in which external adjustment may be sought via budget policy. Empirical studies by Anoruo and Ramchander (1998) for India, Indonesia, Korea, Malaysia and the Philippines; Kim and Kim (2006) for Korea; Marinheiro (2008) for Egypt; Sobrino (2013) for Peru; Kearney and Monadjemi (1990) for OECD countries, and Khalid and Teo (1999) for Indonesia and Pakistan support this hypothesis. A unidirectional causality running from current account to budgetary variable is prevalent for small open developing economies that highly depend on foreign capital inflows (e.g. foreign direct investment) to finance their economic developments (Baharumshah *et al.*, 2006).

Moreover, a bi-directional causality between the budget and current account deficits may also exist. Some empirical studies show that there is causality running from budget deficits to current account deficits and vice versa. Studies such as Darrat (1988) for United States, Lau and Baharumshah (2004) for Malaysia; Mukhtar *et al.*, (2007) for Pakistan; Lau *et al.*, (2010) for Indonesia, Kearney and Monadjemi (1990) for Austria Korea and the Philippines; Lau and Tang (2009) for Cambodia; Normandin (1999) for Canada and United States provide evidence of a bi-directional causality between fiscal deficits and current accounts deficits for the economies under investigation. Also, a recent empirical evidence provided by Ganchev (2010) for Bulgaria; Omoniyi *et al.* (2012) for Nigeria and Alam *et al.*(2014) for Bangladesh are consistent with this hypothesis.

Furthermore, a critical examination of the empirical studies shows that no specific methodology is peculiar to any particular study. The methodological approaches adopted have been centred on the use of the Johansen Maximum Likelihood procedure for long-run cointegration and Granger causality

methodologies (see for example Saeed and Khan, 2012; Kaufmann *et al*., 2002; Panagiotis *et al*., 2009; Tambudzai and Marufu, 2014; Khalid and Guan; 1999; Merza *et al*., 2012; Mohammadi and Moshrefi, 2012; Islam, 1995, Alam *et al*.,2014; Omoniyi *et al*.,2012; Lau *et al*.,2010; Darrat, 1988; Kim and Kim, 2006; Lau and Tang, 2009; Sobrino, 2013). Empirical studies for example, Saleh *et al*. (2005); Ratha, (2012) and Tosun *et al*.(2014) apply autoregressive distributed lag (ARDL) bounds test for cointegration while other studies for example Vamvoukas (1999); Lau and Haw (2003) and Hashemzadeh and Wilson (2006) use vector autoregressive (VAR) models. Also, some studies for example Grier and Ye (2009) apply a vector auto regression-generalised auto regressive conditional heteroscedasticity (VAR-GARCH) (1, 1) model, generalised impulse response functions and variance decompositions. Also, some empirical studies for example Alkswani (2000) and Iyidogan (2013) apply the error correction models (ECM) and Johansen co-integration Granger causality tests. Regarding panel studies, a number of empirical studies for example Beetsma *et al*. (2008) and Anorus and Ramchander (1998) use annual panel VAR models. In addition, models such as the panel fixed and random effects, the generalised method of moments (GMM), and panel cointegration estimation methods have been applied (see for example, Bartoloni and Lahiri, 2006; Lau and Baharumshah, 2006; Miteza, 2012).

In general, the theoretical and empirical literature is not in unison on the conventional view that budget deficit exerts significant influence on the current account deficits; hence accounting for the plethora of mixed empirical results on the subject matter. Besides, studies on the relationship between the fiscal and the current account deficits for countries in Africa have been scanty with virtually no specific study on Tanzania. This paper hopes to fill this empirical gap.

4. Model Specification, Data and Descriptive Statistics

Economic theory hypothesizes that private saving, S_p is positively affected by households' disposable income, y and the interest rate, r. Contrary, interest rate r tends to affect domestic investment, I negatively (see also Sakyi and Opoku, 2016). Based on this proposition, equation (5) can be expressed as follows:

$$CA = \left(S_p(y,r) - I(r)\right) + BD \tag{6}$$

Equation (6) can be specified as

$$CA = f(y,\ r,\ BD) \tag{7}$$

In addition, literature shows that exchange rate is an important macroeconomic variable that also can influence the current account movement.

Changes in the exchange rate can have a significant impact on current account by altering the relative returns in the tradable and non-tradable sectors. In fact, a depreciation of real exchange rate, rer means domestic goods are more competitive on international markets. Hence, equation (7) can be expressed as

$$CA = f(y, r, BD, rer) \tag{8}$$

Accordingly, equation (8) can be specified in an econometric model as follows

$$\Delta CA(t) = \varphi_c + \varphi_{BD}\Delta BD(t) + \varphi_y \Delta \ln y(t) + \varphi_r \Delta r(t) + \varphi_{rer}\Delta \ln rer(t) + u(t) \tag{9}$$

where CA, BD, y, r, and rer are as previously defined, u is the error term, φ_c, φ_{FD}, φ_y, φ_r, and φ_{rer} are parameters to be estimated and t stands for the time period. The definitions of variables included in model (9) and sources of data are summarized in Table 1.

Table 1

Definitions of variables and sources of data

Variable	Prior	Definition	Source
CA		Current account deficit, percent of GDP	Bank of Tanzania: (1) A Review of the Role and Functions of the Bank of Tanzania (1961-2011) and (2) Annual Report (various issues).
BD	$\varphi_{FD} > 0$	Fiscal deficit excluding grants(tax revenue minus Government expenditure), percent of GDP	Bank of Tanzania: (1) A Review of the Role and Functions of the Bank of Tanzania (1961-2011) and (2) Annual Report (various issues).
y	$\varphi_y < 0$	Real GDP	Bank of Tanzania: (1) A Review of the Role and Functions of the Bank of Tanzania (1961-2011) and (2) Annual Report (various issues).
r	$\varphi_r > 0$	Average lending interest rate	Bank of Tanzania: (1) A Review of the Role and Functions of the Bank of Tanzania (1961-2011) and (2) Annual Report (various issues).
rer	$\varphi_{rer} < 0$	Derived by multiplying the nominal exchange rate by the ratio of the U.S. to local currency Consumer Price Index.	The International Financial Statistics of the International Monetary Fund

Source: Author's constructions

The descriptive statistics of the variables are summarized in Table 2. Large sample of 50 years provides more precise estimates of the process parameters, such as the mean and standard deviation. The median and the mean, both measure central tendency. Presumably, data are symmetric because the mean and median are very close to each other. Notably, the mean of both *CA* and *BD* are negative indicating the persistence of these deficits over the 1966-2015 period.

Table 2

Descriptive statistics, 1966-2015

	CA	*BD*	ln *y*	*r*	ln *rer*
Mean	-6.984	-3.541	15.756	15.888	6.882
Median	-6.344	-3.752	15.672	15.000	7.083
Maximum	2.803	1.558	16.923	36.000	7.651
Minimum	-29.597	-11.357	14.883	7.500	5.804
Std. Dev.	5.642	2.635	0.5693	7.960	0.453
Skewness	-1.323	-0.329	0.513	0.939	-0.593
Kurtosis	6.836	3.419	2.229	3.027	2.325
Jarque-Bera	45.265	1.267	3.429	7.352	3.882
Probability	0.000	0.531	0.180	0.025	0.144
Observations	50	50	50	50	50

Source: Author's estimates

Furthermore, Table 3 and Table 4 present the correlation and covariance matrices for the system variables in levels and first differences. These correlation and covariance matrices clarify the direction and the degree of the relationships between variables in the system. Covariance is an unstandardized version of correlation. Also, it is worth noting that the variance measures how much the data are scattered about the mean. The variance is equal to the square of the standard deviation. As reported in Table 3, the correlation coefficients for the level of the variables are relatively high, but not quite high for the first differences. Similarly, covariance matrix (Table 4) provides the information about the direction of the relationship between variables. Covariance calculations are used to find relationships between dimensions in high dimensional data sets where visualization is difficult.

Table 3a

Correlation Matrix (Levels)

	CA	*BD*	ln *y*	*r*	ln *rer*
CA	1				
BD	0.023	1			
ln *y*	-0.314	0.282	1		
r	-0.563	0.608	0.338	1	
ln *rer*	-0.320	0.716	0.616	0.671	1

Source: Author's estimates

Table 3b

Correlation Matrix (First Differences)

	Δ*CA*	Δ*BD*	Δ ln *y*	Δ*r*	Δ ln *rer*
Δ*CA*	1				
Δ*BD*	0.354	1			
Δ ln *y*	0.043	-0.033	1		
Δ*r*	0.031	0.200	-0.127	1	
Δ ln *rer*	-0.085	0.098	-0.056	0.031	1

Source: Author's computations

Table 4a

Covariance Matrix (Levels)

	CA	*BD*	ln *y*	*r*	ln *rer*
CA	31.197	0.339	-0.988	-24.764	-0.802
BD	0.339	6.806	0.415	12.507	0.837
ln *y*	-0.988	0.415	0.318	1.501	0.156
r	-24.764	12.507	1.501	62.099	2.369
ln *rer*	-0.802	0.837	0.156	2.369	0.201

Source: Author's computations

Table 4b

Covariance Matrix (First Differences)

	Δ*CA*	Δ*BD*	Δ ln *y*	Δ*r*	Δ ln *rer*
Δ*CA*	22.542	3.088	0.005	0.363	-0.068
Δ*BD*	3.088	3.371	-0.001	0.897	0.030
Δ ln *y*	0.005	-0.001	0.001	-0.007	-0.001
Δ*r*	0.363	0.897	-0.007	5.959	0.013
Δ ln *rer*	-0.068	0.030	-0.001	0.013	0.028

Source: Author's computations

5. Analysis of Results

5.1. Unit Root Test

Testing for unit root or stationarity prior to estimation has become conventional because almost all macroeconomic time series are nonstationary and model estimation with these series without appropriate estimation methods could lead to the generation of spurious results. Unit root tests involve testing the stationarity properties of the variables so as to determine their order of integration. This is very relevant since it serves as a guide in the choice of appropriate estimator (see also Sakyi and Opoku, 2016).

In testing for the stationarity property of the variables, this paper employs the Augmented Dickey-Fuller (ADF) unit root test. The ADF test can be used with serial correlation and it can handle large complex set of time series models. It tests the null hypotheses of unit root or nonstationary against the alternative hypothesis of non-existence of unit root or stationarity. Table 4 presents the results of the ADF test in levels and in first differences of the data. The results of the ADF tests show that all the variables are integrated of order one, i.e. $I(1)$, indicating that they contain unit root. With these results, it can be concluded that all the variables are indeed nonstationary in levels, ie. *I(0).* However, after transforming them into first difference they become stationary.

Table 5

ADF Unit Root Test

	Levels		First Difference, Δ	
Optimal Lag = 1	Constant $\psi_1 = 0$	Constant & Trend $\psi_1 = \psi_2 = 0$	Constant $\psi_1 = 0$	Constant & Trend $\psi_1 = \psi_2 = 0$
CA	-2.158	-0.735	-7.835	-8.772
BD	-0.344	-2.912	-7.548	-7.441
ln *y*	-1.937	-0.116	-3.574	-4.135
r	-1.273	-1.039	-5.319	-5.312
ln *rer*	-1.187	-1.789	-6.200	-6.134
5% Critical Value	-2.924	-3.506	-2.924	-3.506

Null Hypothesis: there is a unit root
Source: Author's estimations

5.2. Cointegration Tests

Once the stationarity properties of the variables are known, the next procedure is to choose an appropriate cointegration test to determine whether there is a long-run relationship among the variables included in the estimation model. The maximum likelihood test method recommended by Johansen and Juselius (1990) is used to identify long-run economic relationships between the variables. The main advantage of the Johansen's cointegration procedure is in the testing and estimation of the multiple long-run equilibrium relationships. Also, the testing of various economic hypotheses via linear restrictions in cointegration space is possible when using Johansen's estimation method (see Johansen and Juselius 1990).

Trace and maximum eigen values are used to determine the presence of co-integration between variables. The results of the cointegration test are presented in Table 6. On the basis of the maximum eigen value test, the null hypothesis of no cointegration ($r = 0$) is rejected at the 5 percent level of significance in favour of the specific alternative, namely there is at most 2 cointegrating vector ($r = 2$). The implication of these results is that a linear combination of all the series in the model is found to be stationary and that there is a stable long-run relationship between the series. The establishment of cointegration among the variables is an indication of a possible relationship between fiscal deficits and current account deficits and hence an outright rejection of the Ricardian equivalence proposition for Tanzania. Nonetheless, justification of the existence of the twin deficits hypothesis will depend on the direction of the relationship and more importantly on the statistical significance of the relationship.

Table 6

Johansen Tests for Cointegration

Sample (adjusted): 1968 2015
Included observations: 48 after adjustments
Series: *CA BD* ln *y r* and ln *rer*

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.506646	86.03632	69.81889	0.0015
At most 1 *	0.463090	52.12294	47.85613	0.0188
At most 2	0.303396	22.27056	29.79707	0.2837
At most 3	0.058099	4.916759	15.49471	0.8176
At most 4	0.041683	2.043701	3.841466	0.1528

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.506646	33.91338	33.87687	0.0495
At most 1 *	0.463090	29.85238	27.58434	0.0251
At most 2	0.303396	17.35380	21.13162	0.1560
At most 3	0.058099	2.873057	14.26460	0.9548
At most 4	0.041683	2.043701	3.841466	0.1528

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

5.3. Error Correction Estimation Results

Results of the regression analysis are reported in Table 7. The F-statistic is significant at the 1 percent level, suggesting that the overall model is significant. This also confirms the evidence of long run cointegration between current account deficit and regressors namely, budget deficit, real GDP, interest rate and real exchange rate. The Durbin Watson (DW) statistic is included in the results to test for auto-correlation in the error term. It is worth noting that, as a rule of thumb, if DW is found to be 2 in an application one may conclude that there is no first order autocorrelation. Therefore, the closer DW is to 2, the greater the evidence of no serial correlation in the residuals. Similarly, the estimated probability values of the chi-square tests for Breusch-Godfrey serial correlation LM test and Breusch-Pagan-Godfrey heteroskedasticity test are not significant which reveal that there are no serial correlation and heteroscedasticity problems in the model. Moreover, the histogram and Jarque-Bera normality test as reported in Figure 4 suggest that the error term of the model is normally distributed as we fail to reject the null hypothesis of normality using Jacque-Bera at 5 percent. By and large, Figure 5 summarizes that residuals are normally distributed, they are not correlated and that their mean is zero. Indeed, probability values of Portmanteau test for white noise and Barlett's periodogram-based white noise test fail to reject the hypotheses that residuals are random or independent, there is no serial correlation among residuals and that residuals are stationary. Notable, the R^2 is relatively low. However, low value of *R*, does not mean that factors in the disturbance term are correlated with the independent variables (Wooldridge, 2006).

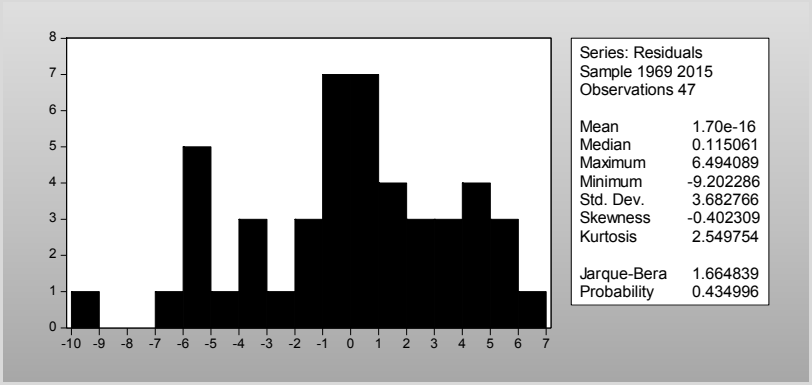
Table 7

Error Correction Model Estimation Results: Dependent Variable, ΔCA

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.2576	0.5923	-0.4349	0.666
ΔCA_{-1}	-0.3797***	0.1402	-2.7085	0.010
ΔBD	1.2399***	0.3539	3.5031	0.001
$\Delta \ln rer$	-2.9912	3.7600	-0.7955	0.431
Δr	-0.3324	0.2709	-1.2271	0.227
ΔBD_{-1}	0.7123*	0.3914	1.8197	0.076
$\Delta \ln y_{-1}$	0.6169**	0.2730	2.2599	0.029
Δr_{-1}	-0.4963*	0.2618	-1.8957	0.066
ECT_{-1}	-0.9403**	0.3358	-2.8001	0.008
R-squared	0.439894	Durbin-Watson stat		2.243204
F-statistic	3.730539	Prob(F-statistic)		0.002627
Breusch-Godfrey Serial Correlation LM Test				
F-statistic	0.705665	Prob. F.		0.5551
Obs*R-squared	2.680678	Prob. Chi-Square		0.4435
Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	1.707090	Prob. F.		0.1285
Obs*R-squared	12.42560	Prob. Chi-Square		0.1332

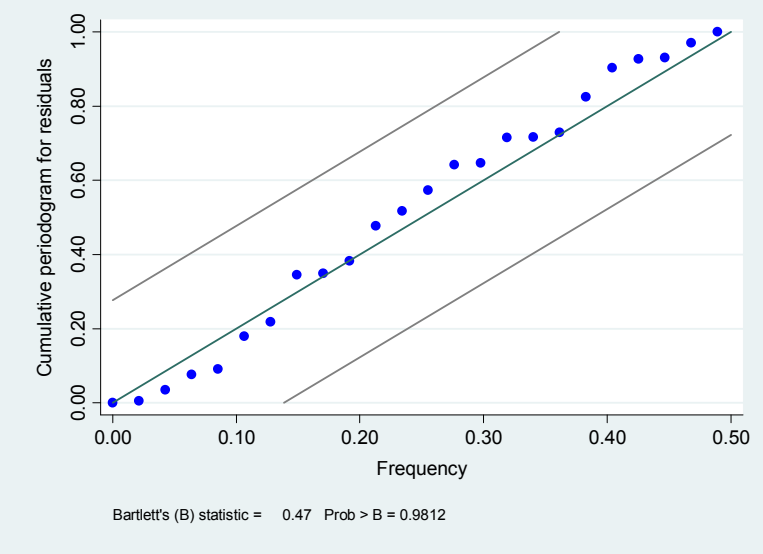
Notes: (1) included observations: 47 after adjustments (2) * significant at 10 percent; **Significant at 5 percent; ***Significant at 1percent.
Sources: Author's estimations

Figure 4. Normality Test of the Residuals



Source: Author's estimations

Figure 5. White noise Test of the Residuals



Source: Author's estimates

The adjustment parameter is negative, indicating the long run convergence. Specifically, the ECM estimation reveals that 94 percent of the disequilibrium in CA would be adjusted in every year. Thus, there is a stable long run relationship between the variables. The coefficient of budget deficit is positive and significant at 1 percent level. These results suggest that fiscal deficits have a significant and positive impact on trade deficits and hence it validates the existence of Keynesian proposition and rejects the Recardian equivalence hypothesis, consistent with Fleming (1962) and Mundell (1963), among others. Generally, the results are also consistent with theoretical expectations that the increase in budget deficits will lead to a rise in foreign borrowing.

Contrary to expectation, the coefficient of GDP is positive and significant at 5 percent level. The expectation is that economic development tends to improve infrastructure, the quality of human capital, and the efficiency of the factors of production. As a result, cost of production declines leading to production expansion. The expansion or increase in production ultimately improves the size of exports and hence it shrinks current account deficit in the country (see for example Calderon *et al.* 2001). The case of Tanzania is different. Empirical results show that the increase in real GDP tends to worsen the current account deficits. Nevertheless, this finding is not surprising because with the increase in economic activities demand for imports also increases leading to

current account deficits in the economy. In fact, an increase in real income may worsen current account deficit because developing countries such as Tanzania tend to import more capital goods as their income level increases (see for example Roldos, 1996). In addition, increase in real income implies that consumers have increased income and therefore increase their demand for consumable goods. Thus, since imports of capital needed for development and consumable goods in Tanzania increase with the level of development, the increase in demand for these goods tends to worsen the current account deficit, *ceteris paribus*. Moreover, increase in real income is believed to necessitate an increase in capital inflows which in turn worsens the current account deficit (also see Sakyi and Opoku, 2016). Based on these reasoning, it is therefore unsurprising that for the case of a developing country such as Tanzania, the increase in real GDP may raise the current account deficit.

The real exchange rate has been used as a proxy for the private saving-investment imbalance and the *a priori* reasoning is that an appreciating real exchange rate should raise foreign borrowing because this worsens international competitiveness and hence the current account deficit. In this paper however, the variable turns out to be statistically insignificant. Surprisingly, the coefficient of lagged interest rate is negative and significant at 10 percent level. These results suggest that an increase in interest rate improves the current account deficit. Notwithstanding, it is important to note that the effect of an increase in interest rates on the current account balance is uncertain. For example an increase in interest rates will reduce consumer spending which in turn reduces import spending and therefore improves the current account. Similarly, high interest rate may reduce inflation making exports more competitive and hence, leading to improving current account. By contrast, high interest rates may lead to an appreciation in the exchange rate making exports more expensive and import cheaper, which in turn tends to worsen the current account. Nonetheless, real exchange rate seems to be insignificant in this case. Based on this reasoning, an increase in domestic interest rate would worsen the current account deficits.

The inverse relationship between interest rate and current account deficits, which is indeed, consistent with Sakyi and Opoku (2016) for Ghana, Anoruo and Elike (2008) for Thailand Calderon *et al.* (1999) for 44 developing countries, and Bon (2014) for 10 Asian developing countries, may be due to a number of reasons. One possible reason is that an increase in domestic interest rate has an impact on private consumption and investment, instead of foreign capital inflows (see Sakyi and Opoku, 2016). As has been reported in Figure (3), interest rate in Tanzania is high; increasing the cost of borrowing and discouraging private investment (see also Hall, 1977; Bader and Malawi, 2010). In addition, high

interest rate tends to discourage people from borrowing to finance current consumption. Similarly, high domestic interest rates lead to an increase in prices of goods and services (see Kraev, 2004; Kwakye, 2010) which also discourage consumption and lead to reduction in aggregate demand. The fact that import of consumable goods in Tanzania is substantial; a decline in consumption for these goods would lead to an improvement in the current account deficits.

Furthermore, for policy purposes, it is important to determine the direction of causality between budget deficits and current account deficits. The significance of this test is also based on the fact that literature review has a contradicting result on the relationship between budget deficits and current account deficits. Understandably, if the two series are cointegrated, then there will be at least unidirectional causality between the variables. To determine the causal relationship between the two variables, the paper applies Granger causality test using lag length up to 3 periods and the results are presented in Table 8. Granger causality results show that the hypothesis that budget deficit does not Granger cause current account deficit is rejected supporting the conventional hypothesis of twin deficits. In other words, this result suggests that budget deficit causes current account deficit. At the same time, the null hypothesis that current account deficit does not Granger cause budget deficit is not rejected and hence it invalidates the reverse hypothesis making causality between the two variables rather unidirectional.

Table 8

Results of Granger Causality Wald Test

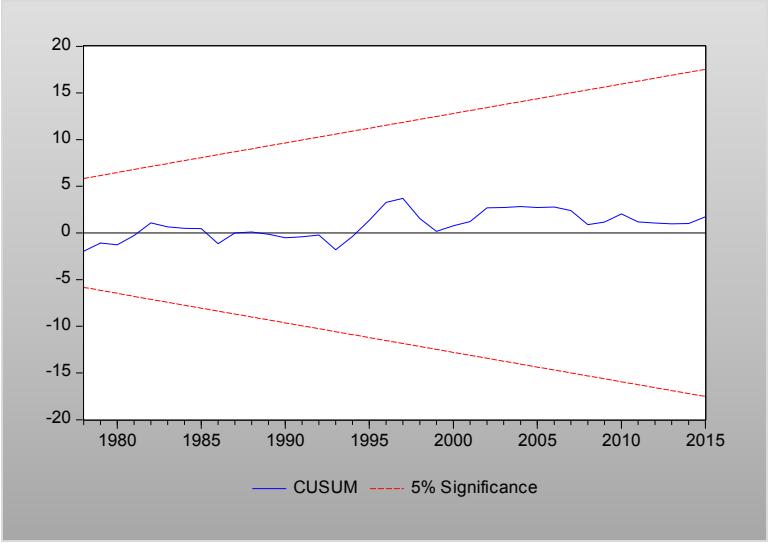
Null hypothesis, H_0	Obs	F-Statistic	Prob. Value	Decision
Lags: 1				
CA does not Granger cause *BD*	49	0.433	0.514	Do not reject H_0
BD does not Granger cause *CA*		12.78	0.001	Reject H_0
Lags: 2				
CA does not Granger cause BD	48	0.967	0.388	Do not reject H_0
BD does not Granger cause *CA*		5.550	0.007	Reject H_0
Lags: 3				
CA does not Granger cause *BD*	47	2.106	0.115	Do not reject H_0
BD does not Granger cause *CA*		4.640	0.007	Reject H_0

Note: For F-statistics, probabilities that are less than 5 percent level null hypotheses are rejected at that level.
Source: Author's estimations

To statistically test the stability of the model over time, a number of recursive tests are carried out. First, a structural stability of the model is estimated using the cumulative sum of the recursive residuals (CUSUM) and the CUSUM of squares tests. These tests are based on recursive residual and have the advantage that does not require the break point to be known. If the CUSUM or CUSUMSQ goes outside a critical bound, one concludes that there is a structural break at the point at which the cumulative sum begins its movement toward the bound. Parameter stability is indicated when the plots of the CUSUM and the CUSUMSQ stay within the 5 percent significance level. The results of recursive estimated parameters are reported in Figure 6 and Figure 7. Clearly, both Figures do not detect instability in the parameters of the model. In addition, Figure 8 presents a plot of recursive residuals. Like, CUSUM and CUSUMSQ, results of recursive residuals fail to reject the null hypothesis of stability in the regression model. Residuals are within the standard errors bands. Hence, it can be concluded that the estimated regressors are stable throughout the observed period.

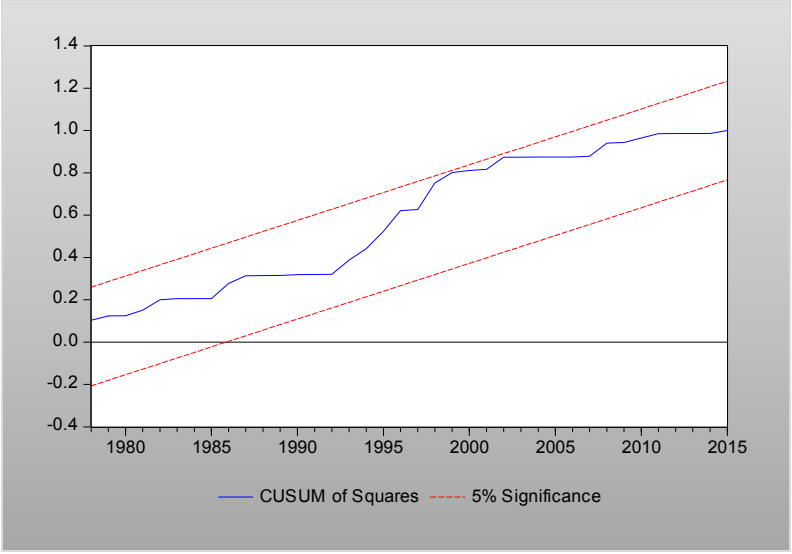
Second, the coefficients of the model are estimated. The results of the estimated coefficients are reported in Figure 9. Despite a slight instability in some parameters, most of which are insignificant, overall results suggest no statistically significant changes in parameters.

Figure 6. Plot of Cumulative Sum of Recursive Residuals



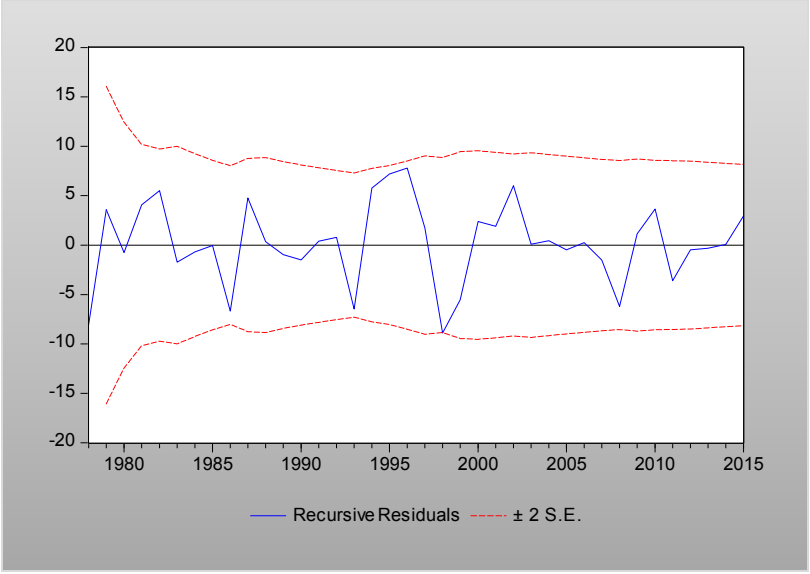
Source: Author's estimates

Figure 7. Plot of Cumulative Sum of Squares of Recursive Residuals



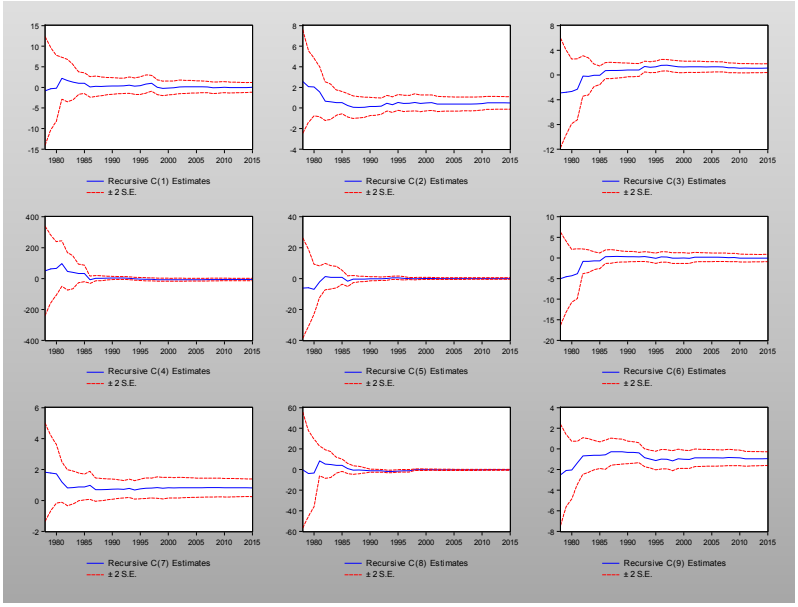
Source: Author's estimates

Figure 8. Recursive Residuals



Source: Author's estimates

Figure 9. Recursive Estimates of the Estimated Coefficients



C(1) = Intercept
C(2) = Coefficient on ΔCA_{-1}
C(3) = Coefficient on ΔBD
C(4) = Coefficient on $\Delta \ln rer$
C(5) = Coefficient on Δr
C(6) = Coefficient on ΔBD_{-1}
C(7) = Coefficient on $\Delta \ln y_{-1}$
C(8) = Coefficient on Δr_{-1}
C(9) = Coefficient on ECT_{-1}

Source: Author's estimates

6. Conclusions and Policy Implications

The main objective of this paper is to examine the existence of twin deficits issue in the context of Tanzanian economy. The estimated empirical results based on the time-series data spanning from 1966 to 2015 lead to the following conclusions. First, current account deficits, budget deficits, real GDP, interest rate and real exchange rate are found to be cointegrated suggesting that there exists an underlying equilibrium relationship binding all these macroeconomic variables. Second, results confirm the strong evidence in favour of relationship between the budget deficits and current account deficits. This significant and positive impact of budget deficits on current account deficits confirms the evidence of Keynesian proposition for Tanzania. Likewise, Granger causality test results support the existence of a unidirectional causal relationship

between budget deficits and current account deficits. Third, the stability tests of both CUSUM and CUSUM square plots confirm the absence of structural break.

The policy implication of these results is that the government should use a policy mix tool to deal with the twin deficits problem. The policy-mix tool can include an attempt to increase the national saving by reducing domestic interest rates; provision of infrastructure and services such as transportation, telecommunication, health, education relevant for growth and development, and provision of a conducive business environment for private sector development. All this seems to be a plausible solution because it will lead to a decline in the cost of production, expansion of employment and gross investment and which in turn enhance domestic production. Other factors being equal, an increase in domestic production will improve the country's external competiveness as producers correspondingly reduce the final price of their products. At the same time, the government will collect more revenue leading to lower current account deficits and budget deficits. Moreover, the government should introduce fiscal adjustment measures such as reducing non-development expenditure and increasing subsidized inputs in the markets aiming at enhancing domestic production. It should also enhance the tax and non-tax revenue collection system and actively fight corruption and tax evasion.

The government may also target export oriented firms that aim at expanding their businesses and encourage an import substitution industry by creating favorable business environments. The increase in export oriented firms and import substitutes in the home country will increase home production, employment and earnings which in turn boost export performance and reduce imports volume. These policies if effectively implemented will ultimately reduce budget deficits and improve the country's current account balance over time.

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