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Twin Deficits in Sri Lanka: An Econometric Analysis

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Abstract

This paper examines empirically the relationship between current account and budget deficits in the developing small open economy of Sri Lanka using time series econometric tests. Economic theory suggests that there is a link between the twin deficits in open economies. Increased budget deficits lead to an increase in the interest rate. An increase in the interest rate appreciates the exchange rate. In turn, exports become relatively expensive and imports cheaper, thus generating a trade deficit. Hence, empirical evidence of a relationship between the two would be very important to enable economists and policymakers to better understand whether there is a causal relationship or merely a correlation between these two variables. The empirical results of this study support the existence of a long-run relationship between the budget and current account deficits in Sri Lanka. To avoid a future depreciation of the exchange rate and perhaps a fiscal and currency crisis, the Sri Lankan government will have to timely introduce fiscal adjustment measures to control the negative implications of its rising budget deficits and public debt.

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Introduction

The relationship between budget deficits (BD) and current account deficits (CAD), which is known as trade deficit, has given a great deal of attention from academics and policy-makers in recent years. The theoretical and empirical literature on the relationship between these two deficits may be divided into two strands: the Keynesian School and the Ricardian School. The Keynesian school suggests that budget deficits have a statistically significant impact on current account deficits, while the Ricardian School argues that there is no relationship between the two deficits.

In recent years, Sri Lanka has emerged to be a major debtor country. According to Annual Report of the Central Bank of Sri Lanka (Central Bank of Sri Lanka 2010), the total external debt is 37.1 percent as a percentage of GDP in 2008. It has increased up to 44.5 in 2009. In US dollar, it accounts US\$ 18,662 million in 2009. The government debt continued to account for a major share of the external debt (88.5 percent in 2009). A heavy debt service burden, inadequate tax revenue, a heavy government expenditures led subsequently to the emergence of recurrent budget deficits. Increases in the budget deficit have induced upward pressure on domestic interest rates, thus, causing capital inflows seeking investment in Treasury Bills (TBs), and printing money. This had led to the appreciation of the nominal exchange rate and the real exchange rate resulting in an increase in the trade deficit. Sri Lanka, at the same time, has always been a significant importer of goods and services, while its export sector has been rather weak.

This paper aims to achieve two broad objectives. The first is to determine any cointegrating (or long-run) relationship between the two deficits for the case of the small open economy of Sri Lanka, and to identify the causal relationship (short-run) between the two deficits and the direction of causality. The second is to study whether the recurrent budgetary deficits have started to put even more strains on the chronic current account deficits. And if that is the case, what are the implications on the exchange rate, interest rates and the balance of payment? The findings of the study are expected to guide policymakers to formulate fiscal and monetary policies to avert further budget and current account deficits, enabling the Central Bank to mitigate the potentials of a future fiscal or currency crisis.

The next section of the paper highlights recent macroeconomic developments in Sri Lanka over the last three decades. Section three presents a review of related literature.

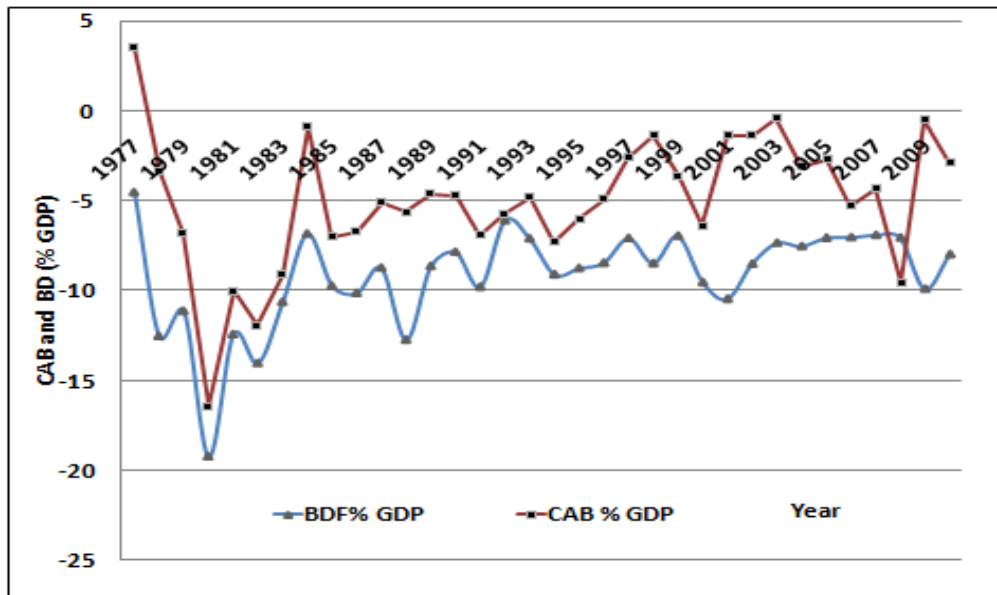
Methodology of the study is presented in Section 4. The relationship between the current account and budget deficits is examined empirically in Section 5. Finally, the last section offers some conclusions and policy implications.

Macroeconomic Performance of Sri Lanka

Sri Lanka is a country with scarce resources, a growing population, and a relatively underdeveloped economy. The macroeconomic performance changed gradually after Sri Lanka achieved independence in 1948. Having an open economy, Sri Lanka always has a chance to get a big impact of the changes in global economy. An important feature of the Sri Lankan economy at the time of its independence was its relatively favorable economic status. The economy, inherited from the colonial past, was much more prosperous compared to the most of Sri Lanka's Asian neighbors. Although Sri Lanka shared much of its initial conditions in common with most of the primary-exporting and low-income countries, it also had some distinguishing and even unique features. Since independence, the economy was dependent on income derived from the export of plantation crops such as tea, rubber and coconut. The plantation economy had transformed Sri Lanka into one integrated with the world trade network. After economic liberalization in 1977, garment and textile sector becomes the leading export earner, while the plantation sector owns the second place.

Since the late 1960s like many other developing countries, Sri Lanka has been experiencing both the current account deficit (CAD) and budget deficit. High CAD and BD increase aggregate demand resulting in inflationary pressures and higher external current account deficits. International evidence suggests that large fiscal deficits are probably the primary cause of macroeconomic instability in most countries. Previous studies for other countries (For example, Abbas et al. 2010, Bussière , Fratzscher and Müller 2010, Chinn and Prasad 2003, Gruber and Kamin (2007), Lee et al. 2008, and Gagnon 2011) find that a 1 percent of GDP fiscal consolidation reduces the current account deficit-to-GDP ratio by 0.1-0.3 percentage points.

Figure: 01, Current account balance and Budget deficit in Sri Lanka, 1977-2010



Source: Central Bank of Sri Lanka, various issues

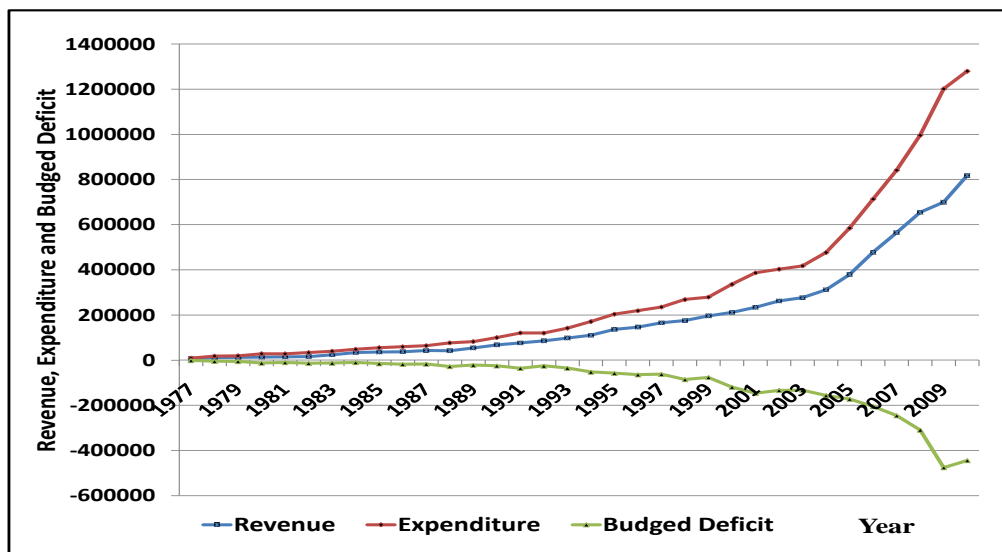
Excessive monetary financing leads to inflation while excessive domestic borrowing drives up interest rates and crowds out private borrowing, and immoderate foreign borrowing leads to debt crises and loss of creditworthiness. Sri Lanka's record in this area is weak. The average budget deficit during 1977-1997 was high (11.9 percent of GDP), and contributed significantly to the rapid growth in external debt (45.3 percent of GDP), as well as to inflation (12 percent). Sri Lanka achieved some progress during 1998-2007 in reducing the fiscal deficit (8.6 percent), external debt (43.3 percent) and inflation (10 percent). In 1995, the fiscal deficit is estimated to worsen somewhat at a ratio to GDP at 10.1 percent because of rising defense expenditures and slow progress in correcting the 1994 slippages.

Budget Deficit in Sri Lanka

The budget deficit has been driven by relatively high expenditures and low revenues. The overall fiscal balance has been to remain as a deficit amounting to over 5 percent of GDP until the mid 1970s. The data indicates that this deficit as a percentage of GDP has increased significantly after 1977. The significant increase in budget deficit can be attributed to many factors such as decreased government revenue (due to narrow tax base and inefficiency of tax collection) and increased public expenditure especially on food subsidy and defense. Its sharp rise after the mid 1980s was due to the large budget deficits as a consequence of the massive increase in public expenditure on infrastructure during the initial stage of trade liberalization. Despite an initial upsurge in revenue and expenditure following trade liberalization, the period after the late 1980s was marked by

a substantial change in fiscal operations and a worsening of its fundamental weaknesses. Both revenue and expenditure declined and the budget deficit fell to around 10 percent of GDP, which is still considered to be high as far as the macroeconomic stability of the country is concerned. A large fiscal adjustment took place since the peak of the government deficit in 1988 through 2001. The budget deficit declined from 15.7 percent of GDP in 1988 to 8.0 percent in 1992, and then increased to 10.8 percent in 2001.

Figure: 02, Trend of Government Revenue, Expenditure and Budgeted Deficit, 1977-2010



Source: Central Bank of Sri Lanka, Annual Reports (various issues)

The high deficits in budget, which is a common feature for many decades, is mainly financed by domestic market and borrowings, whilst foreign finance by way of long term loans, grants and aid make the rest. Prior to trade liberalization, the governments resorted mainly to domestic sources of financing the budget deficit. As a result, domestic debt continued to grow from around 20 percent of GDP in the latter half of the 1950s to about 50 percent in the latter half of the 1960s. This scenario changed particularly during the initial phase of the liberalized trade regime. Foreign debt showed a sharp increase after the mid 1970s and reached its peak point of over 60 percent of GDP by 1989. This was a result of an increased reliance on foreign borrowings to finance the growing budget deficit. The total debt though with minor fluctuations in the short-run shows a sharp increase over the past five decades of the twentieth century. Since the late 1980s, it remained above 90 percent of GDP, except in 1997- the year the economy recorded a 6.3 percent GDP growth. In fact, the total government debt was greater than the GDP in the late 1980s, when the foreign debt increased to its historical peak levels.

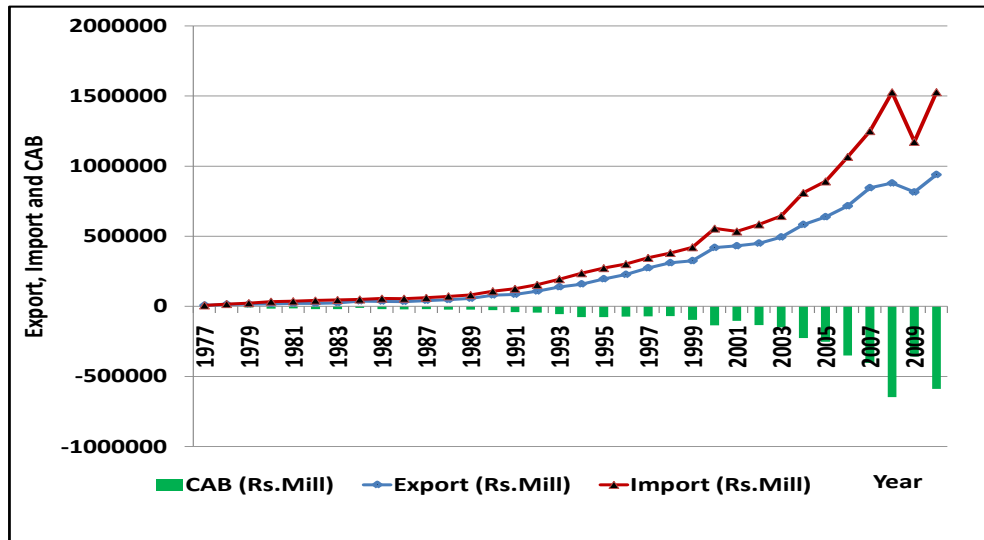
As a result Government debt (both external and domestic) has increased from approximately 60 percent of GDP in the early 1970s and 96 percent in early 1990s to over 106 in 2003. Public sector debt has declined 81 percent by 2006, thanks to higher growth, lower interest rates and steady progress in fiscal consolidation. However, total external debt as percentage to GDP declined until 1997 then it has increased gradually (until 2004) and decreased thereafter. Further, high fiscal deficit has increased aggregate demand resulting in inflationary pressures and higher external current account deficits. In addition, international evidence suggests that large fiscal deficits are probably the primary cause of macroeconomic instability in most countries.

Current Account Balance

The current account balance has recorded an increasing share of deficit while the capital account an increasing share of surplus of the balance of payments throughout the period of the past 60 years. These changes could be attributed to the major elements of the respective trade regimes. The prosperous plantation export crops and their favorable world market conditions resulted in a healthy surplus in current account balance in the early and mid 1950s. But it has declined subsequently and turned to show even frequent deficits since the late 1960s.

At the initial stages of trade liberalization, the current account deficit grew sharply in reporting the ever-highest deficit of over 16.4 percent of GDP in 1980. This is not unusual, as imports facilitated by the an upward swing in terms of trade in 1976, responded instantly to trade liberalization in 1977, whereas export growth showed a considerable time lag. Therefore, over time the trade deficit has declined with export expansion and remained at around 5 percent of GDP after the mid 1980s. Sri Lanka has run a low but persistent current account deficit in recent years. The deficit rose from 1.4 percent of GDP in 2001 to 5.3 percent in 2006, and then fell back to 4.2 percent in 2007. The improvement in 2006 occurred despite a widening of the trade deficit. A jump in official transfers for post-tsunami assistance, and an increase in remittances, the other two main components of the current account balance, offset the deterioration in the trade account.

Figure: 03, Export, Import and Current Account Balance in Sri Lanka, 1977-2010



Source: Central Bank of Sri Lanka, Annual Reports (various issues)

To a large extent, these deficits in the current account and the fiscal account reflect the surge in concessional foreign aid since the late 1970s. Nevertheless, large macroeconomic imbalances, particularly fiscal deficits, have contributed to a rapid growth in domestic and international indebtedness, fueled a relatively high rate of inflation, and complicated monetary policy management in Sri Lanka's open economy. The cost of deficit financing is already a huge burden. Interest payments accounted for an extraordinary 25.1 percent of total expenditures in 2005 and are at the brink of spiraling upward as a result of new borrowing, compounded by the impact of inflation on domestic interest rates and the value of the rupee. Interest costs are a fiscal wild card that could worsen the deficit and feed inflation (if interest costs are financed by printing money), or crowd out spending on infrastructure, poverty programs, health care, and education (if financed by domestic borrowing).

Economic Growth

Sri Lanka has achieved very good aggregate growth performance, despite more than two decades of conflict. As the economy was heavily dependent on the fortune of traditional export crops, the annual fluctuations in growth performance could be attributed largely to the changes in weather conditions and world market conditions affecting the traditional export crops.

The Sri Lankan economy has grown at around 4.55 percent per annum during 1950-2007. However, the country had entered into a deep and prolonged economic stagnancy in its

increasingly restrictive trade regime prevalent until 1977. Compared with the slow growth of the economy at 3.6 percent per annum during this period the policy reforms towards trade liberalization after 1977 resulted in a relatively higher growth of the economy. Since then, the country has managed to maintain relatively a solid economic growth. Real GDP growth has averaged approximately 5 percent compounded annually over the period of 1977 to 2007 with a higher point at 7.7 percent in 2006 and a lower point at -1.5 percent in 2001. The annual average growth rate records as 6.9 percent for 2006 to 2010. The said growth performance has been able to maintain despite of its relatively high budget deficit, averaged about 10.8 percent of GDP and trade balance averaged about 5 percent of GDP.

Table 01: Annual average rate of economic growth 1950 - 2010 (%)

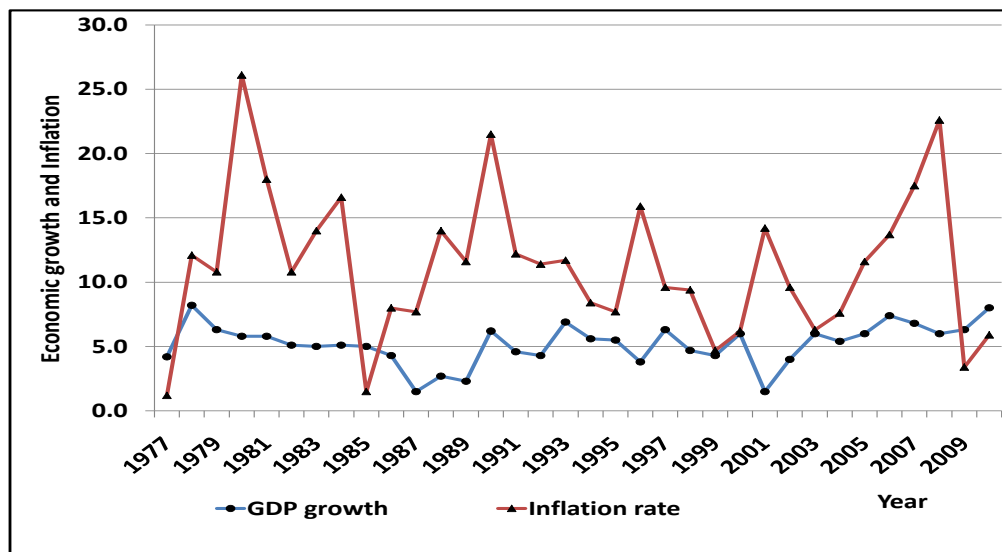
Period	Average Economic Growth
1951-55	4.3
1956-60	2.6
1961-65	3.6
1966-70	5.3
1971-75	2.6
1976-80	5.5
1981-85	5.2
1986-90	3.4
1991-95	5.4
1996-00	5.0
2001-05	4.0
2006-10	6.9

Source: CBSL. Annual Reports

Inflation

Sri Lanka has experienced a fairly high rate of inflation in the last 3 decades, with annual averages varying from 1.5 percent (1985) to 26.1 percent (1980) to GDP. The measures taken to control inflation have been exacerbated persistently by the high budget deficit. However, trend of inflation has been declining responding to stringent monetary policy adopted after minus growth (-1.5 percent), high inflation (14 percent) and high budget deficit (10.8 percent) highlighted in the year 2001. In 2002 and 2003 inflation has declined to 9.6 percent and 6.5 percent respectively. Since then, it has increase gradually from 11.6 percent in 2005, 13.7 percent in 2006 and 17.5 percent in 2007. Despite of Sri Lanka's budget deficit narrowed in 2002 and 2003 indicating 8.9 percent and 8.0 percent respectively, Sri Lanka has continually run relatively high budget deficits in relation to GDP.

Figure:04, Economic growth rate and inflation rate in Sri Lanka, 1977-2010



Source: Central Bank of Sri Lanka, Annual Reports (various issues)

Review of Related Literature

As noted above, the theoretical and empirical applications on the twin deficits may be divided into two groups as two schools of thoughts. The Keynesian School argues that budget deficits have a statistically significant impact on current account deficits. For example studies by Fleming (1962), Mundell (1963), Volcker (1987), Kearney and Monadjemi (1990), and Haug (1996) have argued that government deficits cause trade deficits through the interest and exchange rate channels. In a small open economy IS-LM framework, an increase in the budget deficit would induce upward pressure on domestic interest rates, thus, causing capital inflows. This will lead to an appreciation of the exchange rate through the high demand on domestic financial assets, leading to an increase in the trade deficit.

According to this view, a tax cut or other fiscal expansion financed by the issuance of public debt lowers national saving by increasing private disposable income and hence private consumption. The implications of this saving shortfall for investment and the current account depend on a country's degree of openness to capital transactions with the rest of the world. In countries that are relatively closed to capital flows, reduced domestic saving must be matched by decreased domestic investment, because residents cannot borrow from abroad to keep investment high. Thus, fiscal expansions "crowd out" domestic investment, usually by lifting domestic interest rates. More open economies, by comparison, may keep domestic investment stable by turning to foreign credit and thus

may not see interest rates rise. In these scenarios, a decline in national saving is matched by a rise in the current account deficit, leading to twin fiscal and current account deficits. The second view on the effect of fiscal deficits on private saving and investment is the so-called Ricardian view. According to this view, tax cuts financed by the issuance of new public debt lead residents to expect the government to raise taxes eventually to repay the new debt⁴. To prepare for future tax increases, residents save all the cash freed by the tax cut; consumption, national saving, and the current account are therefore unchanged⁵. They argue that there is no relationship between the two deficits. In other words, changes in the budget deficit have no real effects on the real interest rate, capital flows, or the current account balance.

However, the empirical evidence on the linkage between trade deficit and budget deficit are mixed. Based on time-series data in Ghana, Islam and Wetzell (1991) reveal that the rising budget deficit is associated with the deterioration in the trade deficit. In the case of Iran, Aghevli and Sassanpur (1982) argue that heavy government spending would lead to a deterioration of the trade deficit. Zaidi (1985) analyzing data from different countries such as South Korea, the Philippines, Thailand, Greece, and Brazil, found diverse results. While two-way causality was found between BD and the CAD in South Korea and the Philippines, a unidirectional causality from the CAD to BD was the situation in Thailand and Greece. In the case of Brazil, there is no a significant relationship between the two deficits.

With reference to the Philippines, Mansur (1989) has done a comprehensive study. His results indicate that enlarged budget deficits arising from growth in government expenditures, financed by both bank credit and external borrowing led to a deterioration of the current account deficit in the Philippines. One of the major arguments is that the weak management of fiscal policy and monetary policy worsen the CAD, because most of the policy instruments may define the relationship between the budget deficit and the trade deficit.

⁴ Whether the Ricardian view can actually be traced to the writing of economic theorist David Ricardo (1772-1823) is a controversial issue. In any case, the modern incarnation of the Ricardian view is typically attributed to Robert Barro (see, in particular, Barro [1989]).

⁵ Needless to say, this mechanism can operate smoothly only when domestic residents live long enough to care about their own future tax burdens or the tax burdens of future generations, when domestic residents have unfettered access to capital markets to transfer wealth over time, and when taxes have no effect on resource allocation other than through their impact on private saving. Hardly any scholar nowadays holds a pure Ricardian view. However, a key question is how closely the world adheres empirically to this benchmark.

Analyzing the linkage between the budget deficit and current account deficit, Rosensweig and Tallman (1993) state that the government budget surplus is equal to the current account surplus plus the excess of investment over private savings. They found a strong linkage between trade deficit and budget deficit. Hutchison and Pigott (1984) present a theoretical macro model relating budget deficits, interest rates, exchange rates and current account for an open economy under flexible exchange rates. They suggest that budget deficits are likely initially to raise domestic interest rates, which in turn push up the real exchange rate, leading to a current account deficit.

However, Feldstein (1992) argues that the savings gap that drives the enlarged trade deficit is not due to the increased budget deficit but rather to a sharp decline in private saving. The budget deficit tends to raise real interest rates and to crowd out private investment and net exports, which has been the major explanation of the high current account deficit in the early 1980s.

Meanwhile, Islam (1995) examined empirically the causal relationship between BD and CAD for Brazil from 1973:1 through 1991:4. Using Granger Causality tests, the study showed a presence of bilateral causality between trade deficits and budget deficits. Khalid and Guan (1999) used the cointegration technique proposed in Johansen and Juselius (1990) to examine the causal relationship between these two deficits. The results suggest a higher statistically significant association between the two deficits in the long-run for developing countries than is the case for developed countries. Furthermore, the direction of causality for developing countries is mixed. For example, for India the direction of causality is bi-directional. The results for Indonesia and Pakistan indicate that the direction of causality runs from the current account deficits to budget deficits. This is because much of the CAD was financed by internal and external borrowings, contributing further to the huge national debt. Interest payments on these debts have increased over the years, leading these countries to running bigger BDs.

Vamvoukas (1999) using the econometric methodology including cointegration analysis, error-correction modeling and a three variable Granger causality model explores the relationship between these two deficits in a small open economy using annual data. Vamvoukas's findings suggest that BD has short- and long-run positive and significant causal effects on the CAD.

The current paper adds to the limited existing literature on developing countries by studying the relationship between the twin deficits within the Sri Lankan context and under a small open economy framework.

The Theoretical Framework

Theoretical framework between budget deficit and trade deficit is well established under IS-LM framework. This has been developed over the years. According to this approach budget deficit is the gap between government expenditure and government income (G-T). Government expenditure is one of a key element of aggregate demand. Trade deficit is defined as the monetary value of domestic output and aggregate demand. This is easily understood from the national account identity (equation 1).

$$M_t - X_t = (I_t - S_t) + (G_t - T_t) \text{ ----- (1)}$$

Where M represents imports, X is exports, I is investment, S stands for savings, G is government expenditure and T represents government revenue (taxes). t is time since these are time series data. The term (X – M) is trade balance or current account balance (CAD), while the term (G – T) refers as budget deficit or budget balance. Accordingly, equation 1 can be rewritten as follows;

$$CAD_t = (I_t - S_t) + (G_t - T_t) \text{ ----- (2)}$$

Where $CAD_t = (M-X)_t$. Therefore, it indicates that the trade deficit is the sum of excess investment over savings and the budget deficit. Hence, the government can control external balance through a reduction in its expenditures or raises taxes (government revenue), which is practically very difficult in developing countries because of political pleasures and the level of poverty. Most available option for developing countries is that governments are to rely on bank credit to finance budget deficits. Governments use even foreign sources to finance their budget deficits. Since governments depend on bank credit, higher inflation will be the results. These tend to increase demand for imports. An increase level of imports which is more than exports will lead to current account deficits. Hence, theoretically a wider fiscal deficit typically should be accompanied by a wider current account deficit.

Equation (2) also suggests that net exports equal private and public savings. In the Mundell-Fleming framework, an increase in the government's budget deficit can generate an accompanying increase in the trade deficit through increased consumer spending. By

increasing the disposable incomes, the budget deficit encourages an increase in imports. To the extent that increased demand for foreign goods leads to a depreciation in the exchange rate, the effect on net exports is mitigated. However, the larger budget deficit also pushes up the interest rate because this appreciates the exchange rate, which encourages a net capital inflow and a larger decline in net exports.

Fieleke (1987) provided the theoretical basis for the relationship between the budget deficit and the trade deficit. According to Fieleke, an increase in government borrowing in a country will, other things being equal, put upward pressure on interest rates (adjusted for expected inflation) in that country, thereby attracting foreign investment. As foreign investors acquire the country's currency in order to invest there, they bid up the price of that currency in the foreign exchange market. The higher price of the country's currency will discourage foreigners from purchasing its goods but will conversely encourage residents of the country to use their now more valuable currency to purchase foreign goods, so that the country's current account will move toward a deficit. The second direction indicates that any increase in the country's total spending resulting from the enlarged government deficit will go partly for imports and for domestic goods that would, otherwise, be exported, also worsening the current account balance. The Keynesian view suggests that an increase in the budget deficit would induce domestic absorption and hence import expansion, causing a current account deficit. Increased budget deficits lead to an increase in the interest rate. An increase in the interest rate appreciates the exchange rate. In turn, exports become relatively expensive and imports cheaper, thus generating a trade deficit.

Another contrary view, as already noted, provided by the Ricardian Equivalence Hypothesis states that shifts between taxes and budget deficits do not matter for the real interest rate, the quantity of investment, or the CAD.

Data and Methodology

This study examines empirically the validity of the twin deficit hypothesis using time series yearly data for the small open economy of Sri Lanka, with relatively high budget and current account deficits over the period 1977-2010. The data used in this analysis are obtained from the various issues of the Annual Report of the Central Bank of Sri Lanka. GDP deflator is used to deflate the series. The real values are measured in 1996 prices. The data employed are graphically presented in Appendix A. The econometric analysis employed in this study will help policy makers to formulate appropriate policies to

resolve the problems of budget and current account deficits. Furthermore, this study examines the direction of causality if such a relationship exists. Table, 2 shows the descriptive statistics of the selected variables over the period of 1977 to 2010.

Table 02: Descriptive statistics of the key variables

	BDF	CAD
Mean	95372.62	123452.4
Median	44395.00	62942.30
Maximum	476361.0	647878.4
Minimum	1626.000	362.7800
Std. Dev.	119922.9	164863.0
Skewness	1.872689	1.892308
Kurtosis	5.970014	5.779976
Jarque-Bera	32.36919	31.23974
Probability	0.000000	0.000000
Observations	34	34

Empirical Results

Unit root test

The first step for co-integration test is to test whether each of the series is stationary or not. If they are stationary at first difference, then we may go to the second step to verify the long run relationship between them. Generally, Time series data are often found to be nonstationary, containing a unit root (Gujarati 1995, p.714). Thus, Augmented Dickey–Fuller (ADF) tests and Phillips Perron (PP) tests were carried out to find out the order of integration for each series. The results are reported below. These results reveal that none of the variables are stationary in their levels however after first differencing all the variables became stationary at 1 percent level of significance. Therefore, the order of integration is one I (1) and therefore, the first difference variables are used in OLS regressions.

Table 03: Augmented Dickey Fuller (ADF) and Phillips-Perron Test

Series	With intercept		With intercept and trend	
	ADF	PP	ADF	PP
	Level			
BDF	-2.6326	-2.6158	-3.2380	-3.2096
CAD	1.3981	1.3083	0.0582	-1.3862
	First difference			
BDF	-4.7337*	-4.7482*	-5.8033*	-5.8026*
CAD	-3.7378**	-10.0293*	-4.3943*	-12.0840*

Note: *, **denotes significant at 1 % and at 5 % level respectively

Engle Granger Co-integration Test

Since all of the series are integrated of the same order, the series may be tested for the existence of a long-run relationship between them that is a co-integrating relationship. In order to test the co-integration, this study applies the two step residual based test of Engle Granger (1987). In the first step applies the OLS to the regression equation 1 in which all the variables are found to be integrated of the same order of integration. Further, equation 1 also represents the long run equilibrium relationship between CAD and BDF.

$$CAD_t = \beta_0 + \beta_1 BDF_t + u_t \dots\dots\dots (1)$$

Given that both CAD and BDF are I (1) one can use the Engle Granger co-integration test procedure to examine the existence of co-integration between BDF and CAD. Where CAD is the current account deficit, BDF is the budget deficit, β_0 and β_1 are the parameters known as the intercept and slope coefficient and u is the random disturbance term.

Generally most of the time series variables are nonstationary in their levels and stationary in its first difference. Hence, using standard regression technique with nonstationary data can lead to the problem of spurious regressions involving invalid inference about causal effects. Thus, the above equation 1 can be written as follows,

$$\Delta CAD_t = \beta_0 + \beta_1 \Delta BDF_t + u_t \dots\dots\dots (2)$$

Where a variable with Δ is indicates the first difference of it.

$$\Delta CAD_t = CAD_t - CAD_{t-1} \text{ and}$$

$$\Delta BDF_t = BDF_t - BDF_{t-1}$$

The second step involves testing whether residual term from the above co-integration regression equation is stationery using ADF test. To examine the short run and long run

relationship between the two variables, equation (2) can be used. The two time series are cointegrated, if residuals from regression are stationary. (Gujarati, 1995, pp. 726-727). To perform a cointegration test, it is necessary that the order of integration of all the variables in the long-run relationship be the same (Enders 1995). The order of integration can be defined as the number of time a time series variable must be differenced for it to become stationary. From the above ADF tests and PP test (Table 3), all the variables are integrated of their first difference.

Table 4 summarizes the results of regression that measures the impact of change in budget deficit (BDF) on the Current account deficit (CAD). The result implies changes in budget deficit statistically significant in explaining the CAD.

Table: 04, Results of the Co-integration Test, 1977-2010

Variable	Coefficient	Std. Error	t - Statistic	Prob
BDF	1.250415*	0.100992	12.38138	0.0000
C	4197.086	15334.25	0.273707	0.7861
R-squared	0.827306			
Adj. R-squared	0.821909			
Durbin-Watson stat	2.338231			
F-statistic	153.2986 (0.000)			

Note: *, **, *** Represents significance at 1%, 5% and 10% critical value respectively.
Dependent Variable: CAD

Error Correction Model - ECM

The Error correction model incorporates variables both in their levels and first difference. By doing this, ECM captures the short run disequilibrium situations as well as the long run equilibrium adjustments between the variables. The results of this study illustrates that BD and CAD are cointegrated (see Table 04); that is, there is a long-term relationship between the two deficits. However, in short term there may be disequilibrium. The error correction mechanism (ECM) can be used to tie the short run behavior of CAD to its long run values. In other words, since the two deficits are co-integrated, the relationship between the two can be expressed as following equation.

$$\Delta CAD_t = \alpha_0 + \alpha_1 \Delta BD_t + \alpha_2 u_{t-1} + u_t \dots \dots \dots (3)$$

Where Δ denotes the first difference operator, u_t is a random error term, and u_{t-1} is the one-period lagged value of the error from the co-integrating regression. The ECM model states that ΔCAD depends on ΔBD and also on the equilibrium error term (Patterson 2000). Here α_2 indicates a direct convergence to long run equilibrium. In other words, it indicates how long it takes to reach long run equilibrium. The error correction methodology is appealing because of its ability to induce flexibility by combining the short run dynamic and long run equilibrium models in a unified system. At the same time, it ensures theoretical rigor and data coherence and consistency.

Stationarity of the residuals of these regressions were tested using ADF tests to ascertain whether there is a long run relationship between two variables in the regression. The results of the unit root tests for residuals and error correction model are presented in table 3 and 4 respectively. The error correction term is statistically significant at 1 percent level; conclude that the speed of adjustment term significantly different from zero with the expected negative sign, meaning that error correcting long run equilibrium behavior occurs. It suggests that any movement away from the long run equilibrium will be corrected with speed of adjustment 92 percent per year to return the long run equilibrium level.

Table 05: Unit Root Test for the residual

Error term	ADF	PP	Decision
Ut	-3.711457	-6.611245	I(0)

Table: 06, Error Correction Model, 1978-2010

Variable	Coefficient	Std. Error	t - Statistic	Prob
DBDF	0.577029	0.210894	2.736106	0.0103
RESID	-0.927245	0.099925	-9.279437	0.0000
C	25409.81	7154.126	3.551770	0.0013
R-squared	0.796307			
Adj. R-squared	0.782727			
F-statistic	58.64013			
Prob(F-statistic)	0.000000			

Note: *, **, *** Represents significance at 1%, 5% and 10% critical value respectively.

Dependent Variable: DCAD

Granger Causality Test

The systematic testing and determination of causal direction framework was developed by Granger (1969) and Sims (1972). Their approach simply based on the axiom that past and present may cause the future but the future cannot cause the past (Granger, 1981). The equation (6) and (7) postulates the bivariate regressions that are run by the E-views 5.0 program for this particular study.

$$Y_t = \alpha + \sum_{i=1}^m \beta_i Y_{t-i} + \sum_{j=1}^n \beta_j \phi_j X_{t-j} + \varepsilon_t \dots\dots\dots(4)$$

$$X_t = \chi + \sum_{i=1}^m \phi_i X_{t-i} + \sum_{j=1}^n \mu_j Y_{t-j} + v_t \dots\dots\dots(5)$$

Where: Y_t and X_t are two stationary series and i and j stand for lag lengths. The unilateral causality is exists when Y_t is said to be Granger-Caused by X_t which means the coefficients on the lagged of X_t are statistically significant. The same is true for the other way around. On the other hand, a bilateral causality is said to exist when both coefficients are statistically significant, and there is independence when both are statistically insignificant.

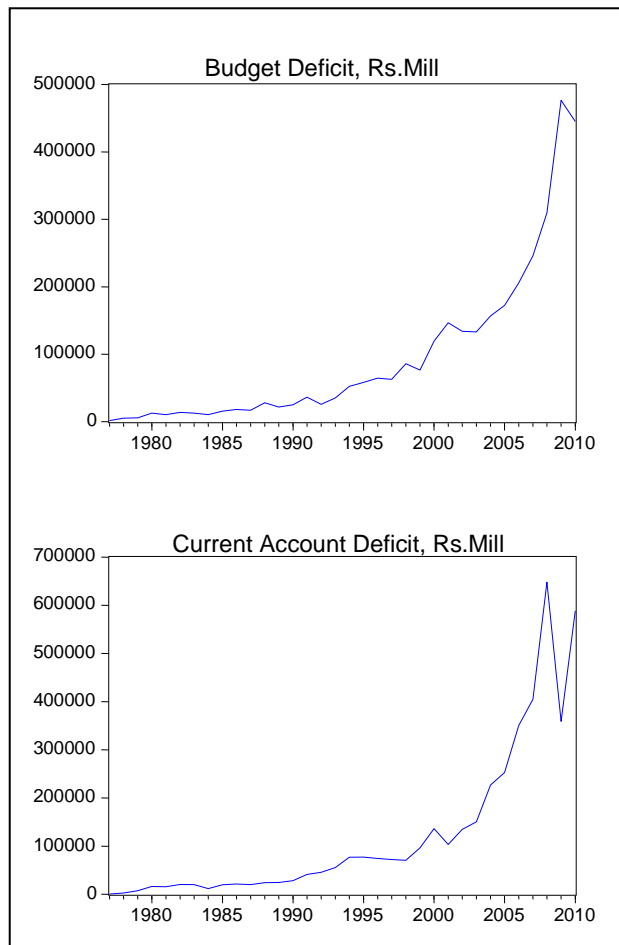
Table: 07, Results of Pair wise Granger Causality Tests

Null hypothesis	Lag	F- statistics	P- Value	Granger Causality
DCAD does not Granger Cause DBDF	2	76.2230	1.34311	No
DBDF does not Granger Cause DCAD	2	4.68015	0.01836	Yes

The lag length is taken to be equal 2 in our case. Many researchers (see chapter 3) take yearly data and use one or more lags. The rationale for such a procedure may be the following: if cross- border capital mobility is low, a longer period is needed to trace the impact on the current account. In case of short time series, however, a lag length that is longer than 2 will consume a lot of degrees of freedom and estimation becomes impossible (Gujarati, 1995, p.632).

The results of granger causality tests are presented in Table 7. The lag order of the vector auto regression is selected using both the Akaike Information Criterion (AIC). F test is used to test the hypothesis that collectively the various lagged coefficients are zero. The F statistics of 76.2230 implies that the null hypothesis that DCAD does not Granger Cause DBDF cannot be rejected at the 0.05 significance level. This indicates that a high rate of

trade deficit does not lead to expansion in budget deficit. On the other hand, the null hypothesis that DBDF does not Granger Cause DCAD can be rejected at the 0.05 significance level. This implies, an increasing budget deficit leads to high rate of trade deficit. Hence, the Granger Causality test shows that unidirectional causality goes from BD to CAD. On the other hand there is no causality between BD and CAD. It is possible to conclude that there is statistical dependence between movement in BD and CAD. In particular, past movements of BD contribute to an explanation of movements in CAD.

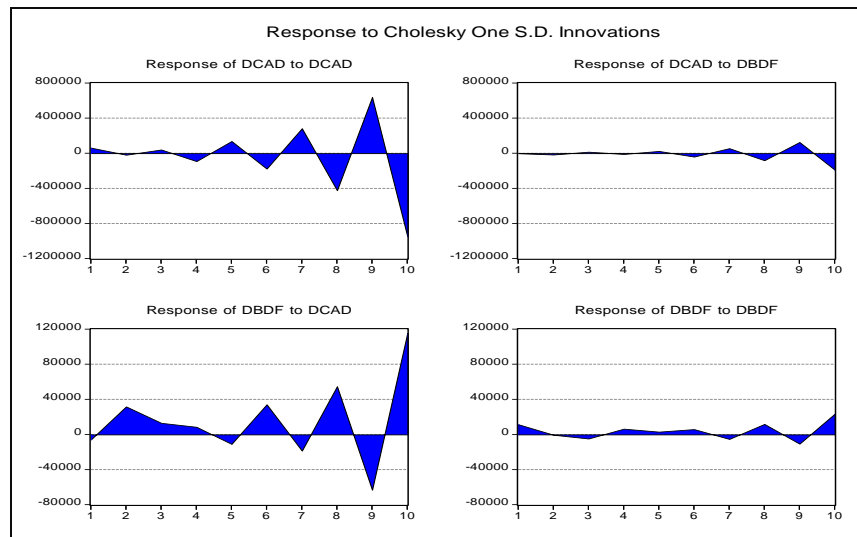


Impulse Response Function and Variance Decomposition Analysis

This section analyses the dynamic property of the model using impulse response functions and variance decomposition analysis. The impulse response functions trace the effect of a one-standard-deviation shock in a variable on current and future values of the variable. The below graphs are shows the response of each variable in the system to a one-standard deviation shock in one of the variable in the system. The x axis gives the

time horizon or the duration of the shock whilst the y-axis gives the direction and intensity of the impulse in the dependent variable away from its base line level.

According to the figure 1, Increases in the current account deficit tend to have a positive effect on CAD itself. The more significant impact however manifests itself after five years. The impact of the budget deficit changes on current account deficit is showed in the figure 2, although CAD is relatively unaffected by the BDF shock from period one to period six, the CAD is effected from sixth year onwards with small changes. Figure 3 shows the response of the budget deficit to a one standard deviation shock to the current account deficit. The graph shows that a positive shock to the CAD variable has a significant effect on BDF. Further, one standard deviation shock in CAD creates a significant impact on BDF. The impact of a BDF shock in CAD is increases from periods 1 to 4 before returning to the baseline in period 5. The highest increase in the BDF takes place in the 10 period in response to a 1 period CAD shock. According to chart 4, one standard deviation shock of BDF creates the smallest impact on BDF itself in period 1 and takes up to period 8.



In order to determine how much of the forecast error variance of each of the variable can be explained by exogenous shocks to the other variables, this section examines the variance decomposition analysis. Variance decomposition indicates the amount of information each variable contributes to the other variables. The results are presented in

table 08 and 09. The column gives the percentage of variance in BDF and CAD that are associated with specified variables, with each row adding up to 100.

Table: 08, Variance Decomposition of BDF

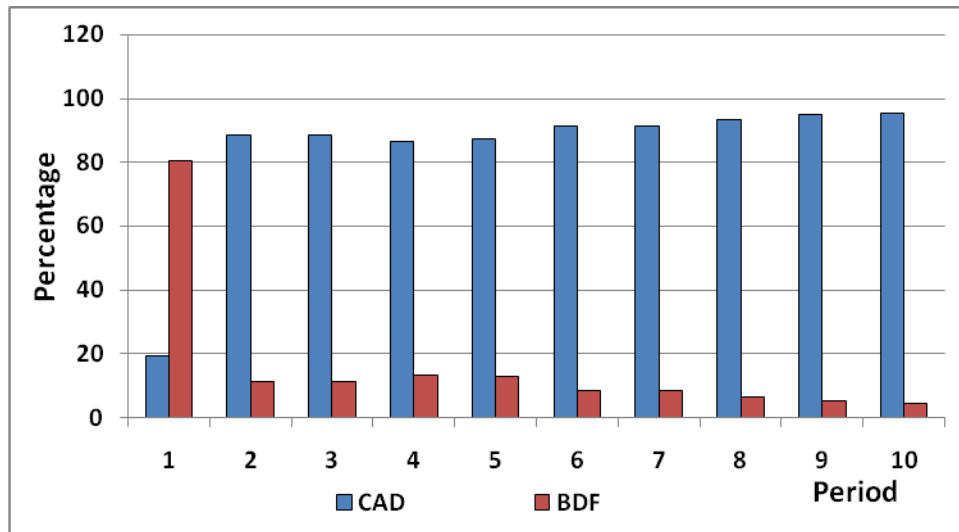
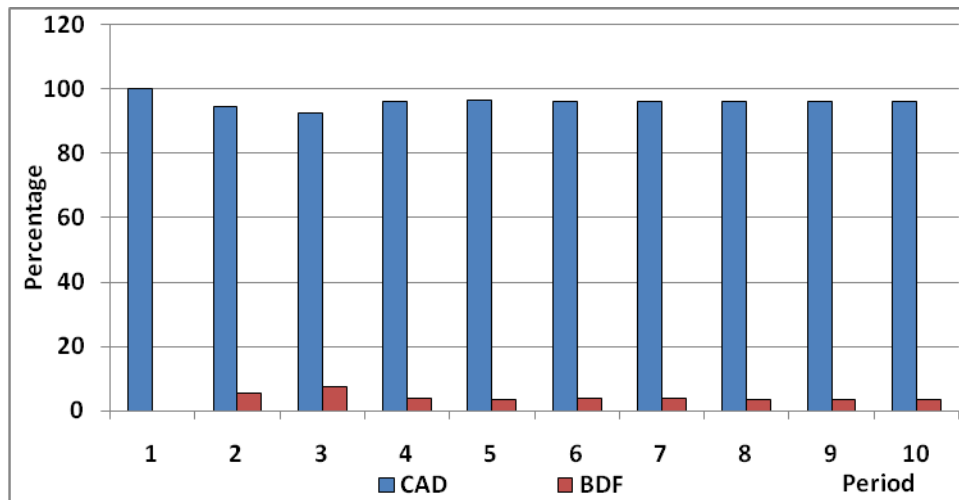


Table: 09, Variance Decomposition of CAD



According to the above empirical results, within four years about 86 percentage of the variation in BDF is due to variations in current account deficit (CAD), while 96 percentage of the variation in CAD are largely due to its own innovations. It is also noted from the above findings, over 90 percent variation in BDF from second year upward were due to variation in CAD; while variation in CAD are largely due to its own innovations.

Conclusion

This study examined the well-documented hypothesis in the open macroeconomics literature – twin deficits phenomenon for a small open economy, Sri Lanka using annual data from 1977 to 2010. The time series econometrics tests (i.e. co-integration tests, causality tests, and ECM, Impulse response function and Variance decomposition analysis) for the two candidate variables, namely Government budget deficit (BD), and current account deficit (CAD). According to the analysis, results of co-integration tests confirm that these two macroeconomics variables are moving together in the long run (co-integrated) as suggested by theory. Further, causality testing suggests unidirectional causality between BD and CAD in Sri Lanka. This causality is running from BD to CAD. Error correction model suggest that any movement away from the long-run equilibrium will be corrected with speed of adjustment of 92% per year to return the long-run equilibrium level.

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