Journal of Asian Economics 77 (2021) 101393

Contents lists available at ScienceDirect

Journal of Asian Economics

journal homepage: www.elsevier.com/locate/asieco

The dynamic linkages between current account deficit and budget balance deficit in the South Asian region

Iwanthika Rajakaruna *, Sandy Suardi

School of Accounting, Economics and Finance, University of Wollongong, Australia

ARTICLE INFO

JEL classification:
C23
E62
F32
H62
H63

Keywords:
Twin deficits
P-VAR model
Panel Granger causality test
Impulse response function
South Asia

ABSTRACT

The issue of twin imbalances is at the forefront of fiscal policy concerns in the South Asian region, fuelled by an ever-going budget deficit and current account deficit over the last five decades. A standard approach is to assume a model in which budget balance influences the current account. We relax this assumption by using a panel data vector autoregression model comprising five South Asian countries. The results show that both budget deficit and current account deficit are mutually causative, which contrasts the unidirectional causality running from fiscal deficit to current account deficit found in prior studies. Further, this bi-causality relationship is also demonstrated in the impulse response analyses. Budget balance in South Asian economies responds positively to a one standard deviation positive shock in the current account balance. Likewise, external balance increases to a one standard deviation positive shock in internal balance. Higher fiscal debt impedes economic growth, which in turn impacts negatively on the budget balance. Our findings lead us to reject 'fiscal policy only' recommendations to address the twin deficits.

1. Introduction

Following the 1980s economic liberalisation, the 1997 Asian financial crisis and the 2008 global financial crisis, South Asia continued to face massive challenges in international macroeconomic policy. Yet, it has experienced a decline in its macroeconomic fundamentals to the extent that many South Asian countries have for several years now experienced the twin deficits problem. The fiscal deficits in these countries were amongst the highest in the world in 2018. Furthermore, the current account deficit increased to 2.9% of Gross Domestic Product (GDP) in 2018 (International Monetary Fund, 2019).

According to the "twin deficits hypothesis", an increase (a decrease) in the fiscal deficit causes an increase (a decrease) in the current account deficit through the exchange rate and interest rate channels. Such a relationship could be explained through the following mechanism, endemic for many South Asian economies. The escalating debt-to-GDP ratio in many South Asian economies is a cause for concern. To finance debt repayment, the rise in demand for loanable funds may drive up interest rates which cause higher debt interest payments. Higher interest payments can further lead to a greater fiscal deficit since the government needs to increase expenditure. On the other hand, increasing budget deficit leads to more borrowings from domestic and external sources, thereby raising interest payments on debt.[1] The rise in interest rate brings about capital inflows and an appreciation of the domestic currency,

* Corresponding author.
E-mail addresses: iwanthika@cbsl.lk (I. Rajakaruna), ssuardi@uow.edu.au (S. Suardi).

[1] There are three ways to finance government fiscal deficits: printing money, using foreign resources, and borrowing from domestic or foreign sources. Public debt is the result of permanent deficits that are financed by borrowing from domestic and foreign sources (IMF, 2017).

https://doi.org/10.1016/j.asieco.2021.101393
Received 7 September 2020; Received in revised form 12 May 2021; Accepted 20 September 2021
Available online 29 September 2021

leading to increased expenditure on imports, decreased net exports and a deteriorating current account (Badinger, Fichet de Clairfontaine, & Reuter, 2017).

The issues mentioned above have been a subject of controversy among economists over the last few decades. The Keynesian absorption theory and the Mundell-Fleming open economy theory suggest that a budget deficit leads to a current account deficit. According to the absorption theory, an increase in the budget deficit would increase domestic absorption and hence imports, and the expansion of imports leads to the current account deficit worsening. The Mundell-Fleming open economy theory contends that an increase in budget deficit induces upward pressure on interest rates and capital inflows and appreciation of the exchange rate, leading to a reduction in net exports and worsening the current account balance. However, the Ricardian Equivalence Hypothesis (REH) argues there is no causal relationship between current account deficit and fiscal deficit. This is because the public saves its excess money to pay for expected future tax increases that will be used to pay off the debt (Mundell, 1963).

Based on contrasting theoretical backgrounds of the twin deficits hypothesis, several empirical studies have examined the relationship between the current account and budget balance; however, most studies of twin deficits in South Asia have only investigated a single country. While certain analyses provide strong evidence for twin deficits in India (Garg & Prabheesh, 2017; Ratha, 2012), some show that a budget deficit creates a trade deficit in the short-term but not in the long term (Suresh & Gautam, 2015). On the other hand, several studies find no evidence for such a phenomenon in India (see Basu & Datta, 2005; Ravinthirakumaran, Selvanathan, & Selvanathan, 2016). In Pakistan, while twin deficits exist, there seems to be a bi-directional causality between the two variables. On the other hand, some studies document a stronger causality in the opposite direction (Ravinthirakumaran et al., 2016). In Sri Lanka, empirical analyses support the conventional view of a long-term relationship between current account deficit and budget deficit (see Saleh, Nair, & Agalewatte, 2005; Ravinthirakumaran et al., 2016).

The twin deficits issue is an ongoing and persistent problem in many South Asian economies, and they have struggled to address it. To the best of our knowledge, the present paper is the first attempt to examine the issue from a panel perspective using five selected South Asian countries[2] spanning from 1980 to 2017. Hence, this paper contributes to the literature by demonstrating the links between internal and external deficits using the panel vector autoregression (P-VAR) approach. An important departure from past studies is that we relax the assumption that budget balance impacts current account balance without considering the possibility of reverse causality. The use of the P-VAR model makes no a priori assumption about the direction of causality for both internal and external balances. Further, we incorporate the debt-to-GDP ratio, which has been neglected in prior literature but has important implications for investigating the twin deficits issue. The 'vicious circle' relationship between fiscal deficit and fiscal debt implies that the debt-to-GDP ratio may impact the relationship between internal and external balances.[3] Further, to the extent that budget balance is influenced by economic growth, fiscal debt may provide a conduit that influences both internal and external balances. Our findings will help formulate a sound policy for the region to address the issues of twin deficits.

Our empirical results are in line with the theoretical predictions, but they contrast with some of the findings from previous studies. First, our results point to evidence supporting the bi-causality direction between the current account and budget deficit. These results lead us to reject the 'fiscal only' policy recommendations for twin deficits. This aspect of our findings differs from what has been documented in most past studies concerning the twin deficits. Previous studies have largely concluded that the direction of causality runs from budget deficits to current account deficits (see Aqeel, Nishat, & Qayyum, 2000; Saleh et al., 2005; Chowdhury & Saleh, 2007; Premaratne, Ravinthirakumaran, & Kesavarajah, 2011; Ratha, 2012). Second, the panels representing the impulse response of fiscal debt to a one standard deviation positive shock in budget balance clearly show a negative impact. We also observe that the impulse response of external balance increases to a one positive standard deviation shock in internal balance, confirming the validity of the twin deficits hypothesis.

Further, confirming the bi-causality relationship between current account balance and budget balance, an increase in a one standard deviation positive shock in current account balance has a positive response on budget balance in the South Asian economies. According to the World Bank South Asia economic forum in 2019, the primary commodity import constituted about one-third of total imports in South Asia. Petroleum and fertiliser products are subsidised in many countries in South Asia, and the government used to bear the burden of that subsidy. Many subsidised items may increase the people's real income, and they may consume more of these goods as their prices are subsidised. Higher consumption may lead to more imports leading to a greater trade deficit and possibly a rise of the current account deficit. Hence, this may give rise to the causality from a higher trade deficit to a greater budget deficit (World Bank, 2019). Similar conclusions are presented in several single country empirical studies in South Asia (see Asrafuzzaman, Amit, & Gupta, 2013; Mukhtar, Zakaria, & Mehboob, 2007). These findings are consistent with twin deficits theories: Keynesian Absorption and Mundell Fleming theories suggest that a budget deficit leads to a current account deficit. The positive link between them operates through interest rate and exchange rate channels. Our empirical findings help formulate policies for policymakers to reduce internal and external account deficits.

The remainder of the paper is organised as follows. Section 2 discusses the empirical literature and points out the research gaps. Section 3 discusses the dataset, variables, and sources used. Section 4 outlines the theoretical framework and empirical methodology. Section 5 presents the empirical results by analysing the dynamic linkages of the current account and budget balance. Section 6

[2] All of which have more than 70% of debt-to-GDP ratio as of the first quarter of 2018 (IMF Regional Report, 2017) (Sri Lanka, India, Pakistan, Maldives, and Bhutan).

[3] Increasing the budget deficit leads to more borrowings from domestic and external sources, thereby raising interest payments on debt. In turn, higher interest payments lead to greater fiscal deficit as a government needs to increase expenditure. This vicious circle is endemic for many developing countries and is closely linked to their fiscal debt and fiscal deficit.

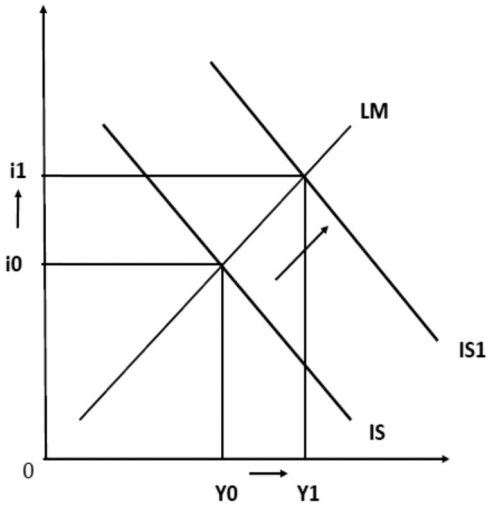


Fig. 1. Flexible exchange rate.

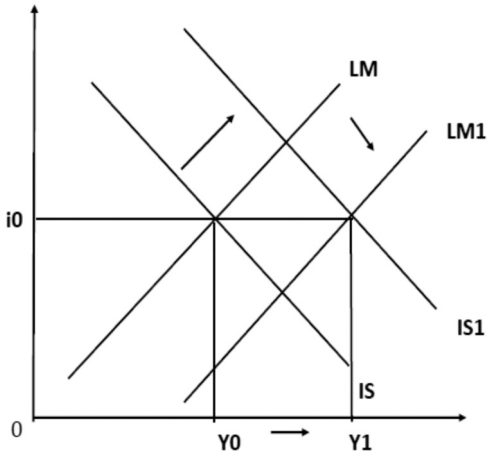


Fig. 2. Fixed exchange rate.

concludes with policy implications.

2. Empirical literature and research gaps

Since the 1980s, many empirical studies have discussed both the positive and negative impacts of debt on economic growth (see Akram, 2014, 2016; Munir & Mehmood, 2018; Siddiqui & Malik, 2001). There is rich literature on the impact of debt on economic growth, but little has been published on the twin deficits problem.

2.1. The macroeconomic model of national income accounting identity

Traditionally, the twin deficits relationship between budget balance and current account balance has been explained by the Keynesian absorption theory and Mundell-Fleming open economy theory. Both theories suggest that a budget deficit leads to a current account deficit, and there is a positive link between them.

According to the Mundell-Fleming model, an expansionary fiscal policy (i.e., an increase in government expenditure) raises the aggregate demand and puts upward pressure on domestic interest rates. The high interest rate, in turn, attracts foreign capital in the economy, and an appreciation of the exchange rate takes place under a flexible exchange rate regime. Exports decline, imports rise, and the trade balance deteriorates. Even if the central bank does not allow the domestic currency to appreciate by absorbing excess supply of foreign currency under a fixed exchange rate regime, there will be a price rise leading to an increase in the real value of the domestic currency. This reduces exports and raises imports causing twin deficits (Mundell, 1963). This can be further explained with the help of an IS-LM diagram.

Fig. 1 shows that the government's expansionary fiscal policy increases the fiscal deficit, shifting the IS curve to the right. In the new equilibrium, the domestic interest rate rises. As the domestic interest rate increases, under a flexible exchange rate regime, foreign capital inflow occurs, resulting in an appreciation of the domestic currency, increasing imports and decreasing exports, worsening the trade balance.

The central bank does not permit the exchange rate to change in the fixed exchange rate regime. Hence, the monetary authority supplies domestic currency to buy up the foreign currency and ensure that the domestic interest rate remains unchanged. The supply of domestic currency increases the money supply and leads to a rise in the price level in the long run (see Fig. 2).

However, Barro (1989) offers a different view of the relationship between budget balance and current account balance and introduces the Ricardian Equivalence Hypothesis (REH). He explains there is no causal relationship between the current account deficit and fiscal deficit. He argues that a decline in government savings is fully compensated for by an increase in private savings as households anticipate that taxes will increase in the future following a reduction in taxes in the current period. According to this theory, it would mean a tax cut financed by higher borrowing would have no impact on increasing aggregate demand because consumers would save the tax cut to pay future tax increases.

We use the basic national income accounting identity model to illustrate the relationship between internal and external balances. Two key aspects of the above model demonstrate why it is relevant for the current study. First, the causality between the internal and external deficits is not obvious and needs to be examined empirically.[4] Second, there is no deductive reason for economies to achieve balanced trade (Gaysset, Lagoarde-Segot, & Neaime, 2017).

We describe the twin deficits in simple Keynesian terms, which outline the link between the aggregate demand and expenditures on Gross Domestic Product (GDP) in Eq. (1):

$$GNI = C + I + G + NX + NFI \tag{1}$$

where, GNI = gross national income, C = consumption, I = investment, G = government spending, NX = net exports, and NFI = net factor income from abroad.

The sum of net exports and net factor income from abroad equates to the current account as follows:

$$CA = NX + NFI \tag{2}$$

In Eq. (2), CA = current account balance. Replacing Eq. (2) in (1) yields the below Eq. (3) having defined domestic savings (S) as the difference between national income and combined consumption and government spending:

$$CA = GNI - C - G - I = S - I \tag{3}$$

As domestic savings are the sum of public savings (S^g) and private savings (S^p) Eq. (3) can be written as:

$$CA = S^g + S^p - I \tag{4}$$

The difference between tax revenues (T) and government spending (G) is equal to the public savings or the fiscal deficit ($BD = T - G$). By replacing S^g with $(T - G)$, Eq. (4) can be rewritten as:

$$CA = (T - G) + S^p - I \tag{5}$$

Alternatively, Eq. (5) can be written as:

$$CA = BD + S^p - I \tag{5′}$$

The above Eq. (5′) depicts the extent of the relationship between the budget balance and current account balance. The gap between private savings and domestic investments causes the gap between current account balance and budget balance to move in the same direction.

2.2. Empirical research on twin imbalances and research gaps

We highlighted that many studies had investigated the link between current account deficit and fiscal deficit. The validity of the twin deficits hypothesis occurred under different economic situations, which we explain in more detail below (see Badinger et al., 2017; Baharumshah, Lau, & Khalid, 2006; Bluedorn & Leigh, 2011; Kalou & Paleologou, 2012; Mukhtar et al., 2007; Mumtaz & Munir, 2016; Nickel & Tudyka, 2014; Ravinthirakumaran et al., 2016). However, none of these studies has attempted to examine the twin deficits from a panel data perspective[5] in the South Asian region.

There are many studies on the relationship between current account balance and budget balance, but they focused on developed

[4] The causality can run from trade deficit to budget deficit or from budget deficit to trade deficit or bi-causality relationships can run between the two variables.

[5] Panel data techniques have several benefits over time-series or cross-sectional data: panel data normally cover sample variability and more degrees of freedom than cross-sectional and time series data, thus improving the efficiency of econometric estimates (Hsiao, 1995). Panel data analyses control the impact of omitted variables because, when considering information on both the individuality and the intertemporal dynamics of the individual (Hsiao, 2014), we could obtain the advantage of analysing nonstationary time series data. An example of this is when time series data are not stationary, least-squares or maximum likelihood estimators are no longer normally distributed (Phillips & Durlauf, 1986).

nations rather than developing countries (see Anoruo & Ramchander, 1998; Badinger et al., 2017; Bohn, 1998; Beetsma, Giuliodori, & Klaassen, 2008; Corsetti & Müller, 2006; Nickel & Tudyka, 2014; Soukiazis, Antunes, & Kostakis, 2017; Trehan & Walsh, 1991; Wickens & Uctum, 1993; Winner, 1993). Further, the main focus of these studies is the relationship between twin deficits issues. For example, among the recent contributions, Badinger et al. (2017) indicated that fiscal deficit leads to current account deficit through import demand, interest rates, and real exchange rate changes. They tested the direct effects of fiscal rules on the current account balance in 73 countries from 1985 to 2012. Their main finding was that no significant direct effect of fiscal rules was evident on the current account balance. Conversely, Nickel and Tudyka (2014) examined the fiscal stimulus of high debt, using fiscal multipliers and twin deficits in 17 European countries from 1970 to 2010 according to the vector autoregressive (VAR) approach. They found that a positive relationship existed between government spending shocks and real GDP, but there was a negative effect on the debt-to-GDP ratio in the long term.

Corsetti and Müller (2006) examine the twin deficit hypothesis both from a theoretical point of view and analyse data for Australia, Canada, the UK, and the US. At the theoretical level, they have shown that, given openness, crowding out of investment is stronger when the fiscal shock is persistent. Moreover, they found that fiscal expansions either reduce domestic capital or the external balance. At the empirical level, they investigate the transmission of fiscal shocks in a VAR framework, differing in their degree of openness. In the US and Australia, which are relatively less open than Canada and the UK, and where government spending shocks are less persistent, they found that the current account impact of fiscal policy is rather limited. Instead, private investment responds substantially. The reverse is true for Canada and the UK.

On the other hand, some academics and policymakers have paid a great deal of attention to the link between budget deficits, current account deficits and exchange rate policies. Kim and Roubini (2008) investigated fiscal policy, current account, and the real exchange rate in the US for the period 1973–2004, based on the VAR models under a flexible exchange rate regime. Their results suggested that fiscal deficits further improve current account deficits and appreciate the real exchange rate in the short run. Similarly, according to Badinger et al. (2017), a rising budget deficit increases the interest rate and reduces national savings, leading to the appreciation of the real exchange rate and further improving the existing current account deficit.

Notably, the study by Kouassi, Mougoue, and Kymn (2004) examine the twin deficits argument by using international data throughout 1969–1996 from a sample of twenty developed and developing countries. They extend the existing literature on causality between the twin deficits by considering the recent causality testing procedure developed by Toda and Yamamoto (1995). They noticed evidence of causality between the twin deficits for some developing countries. However, the results for developed countries are less persuasive.

A few studies of twin deficits issues have been undertaken in the South Asian region. Mumtaz and Munir (2016) examined the dynamics of twin deficits in South Asian countries by focusing on the Ricardian Equivalence Hypothesis and the Feldstein Horioka puzzle. They used an ARDL (Auto Regression Distribution Lag) bound test to investigate both deficits in four countries from 1981 to 2014. The study's major finding is that no relationship exists between fiscal deficit and current account deficit over short-term or long-term periods, except in Bangladesh. Similarly, Ravinthirakumaran and Selvanathan (2016) researched the twin deficits hypothesis in SAARC (South Asian Association for Regional Cooperation) countries by utilising various methodologies, including the error correction method, cointegration analysis and Granger causality test. Their findings are similar to those employed in Mumtaz and Munir's study. However, fiscal deficit causes current account deficit in the short run for Bangladesh. This is also true for Sri Lanka and Pakistan for both the short-term and long-term, while the reverse is true for India and Nepal.

Besides, Katırcıoglu, Fethı, and Fethı (2009) investigate the direction of causality between current account balance and budget balance of a selected 24 small island state economies around different regions of the world by conducting panel data econometric techniques for 1970–2004. The bivariate causality test results suggest unidirectional causation running from the current account balance to the budget balance of small island states. However, this study did not find causation, which runs from budget balance to current account balance in small islands.

Based on the findings of the previous studies, we can conclude that budget deficits lead to a crisis of public spending, and rising fiscal deficits have a positive impact on the current account deficit. Many past studies have supported the Keynesian twin deficits hypothesis, while only a few studies have evidence supporting the Ricardian equivalence hypothesis. However, the conclusions of the South Asian country studies have been controversial and debatable. The empirical studies in South Asia related to twin deficits have mainly tested the causality between fiscal balance and current account balance using time series econometrics techniques. Panel data techniques are recommended because they consider individual heterogeneity and recognise effects that are not simply detected with time series or cross-sectional data (Gaysset et al., 2017). Further, a collective study of South Asian countries is important because panel data analysis makes it possible for us to discover dynamic relationships by controlling for unobserved country-specific effects. It also provides an essential tool for effective policy design for the entire region.

There are some gaps in the literature: the period covering secondary data is limited, few independent variables are tested, and the studies do not consider the inflation effect on independent variables. A few studies are based on a strong theoretical background, and some studies test data without providing any theoretical arguments relating to the twin deficits. However, some research has been conducted on debt sustainability, budget deficits, exchange rate policies and current account deficits, strongly linked in emerging economies and developed countries. To the best of the author's knowledge, no study focuses primarily on the twin deficits relationship in the South Asian region using panel econometrics techniques. With all of the above in mind, the current study addresses the gaps in the existing literature by focussing on the presence of twin imbalances in South Asian economies using more dependent and independent variables for a longer period. Consequently, our study differs in significant ways from previous studies.

Table 1
Variables, description and sources.

Variable	Description	Unit of measurement	Source[a]
Debt/GDP (PD)	Debt/GDP is measured as public debt at the end of a fiscal year divided by the GDP of the same fiscal year.	Ratio	IDS
Budget Balance/GDP (BB)	BB/GDP equals the difference between fiscal revenues and government outlays, including interest, divided by GDP.	Ratio	WDI, CBAR
Inflation Rate (INF)	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole.	Rate	WDI
GDP Growth Rate (GR)	GR is expressed as a percentage that shows the rate of change in a country's GDP.	Rate	WDI
Trade openness (TO)	Exports plus imports divided by GDP.	Ratio	IFS
Current account/GDP (CA)	CA = Trade account balance + net income from abroad + net current transfers divided by the GDP.	Ratio	IFS IDS
Savings and investment gap	SI = Savings minus investment divided by the GDP.	Rate	WDI IMF

[a] IDS: International Debt Statistics, WDI: World Development Indicators, CBAR: Central Bank Annual Reports, IFS: International Financial Statistics and IMF: International Monetary Fund.

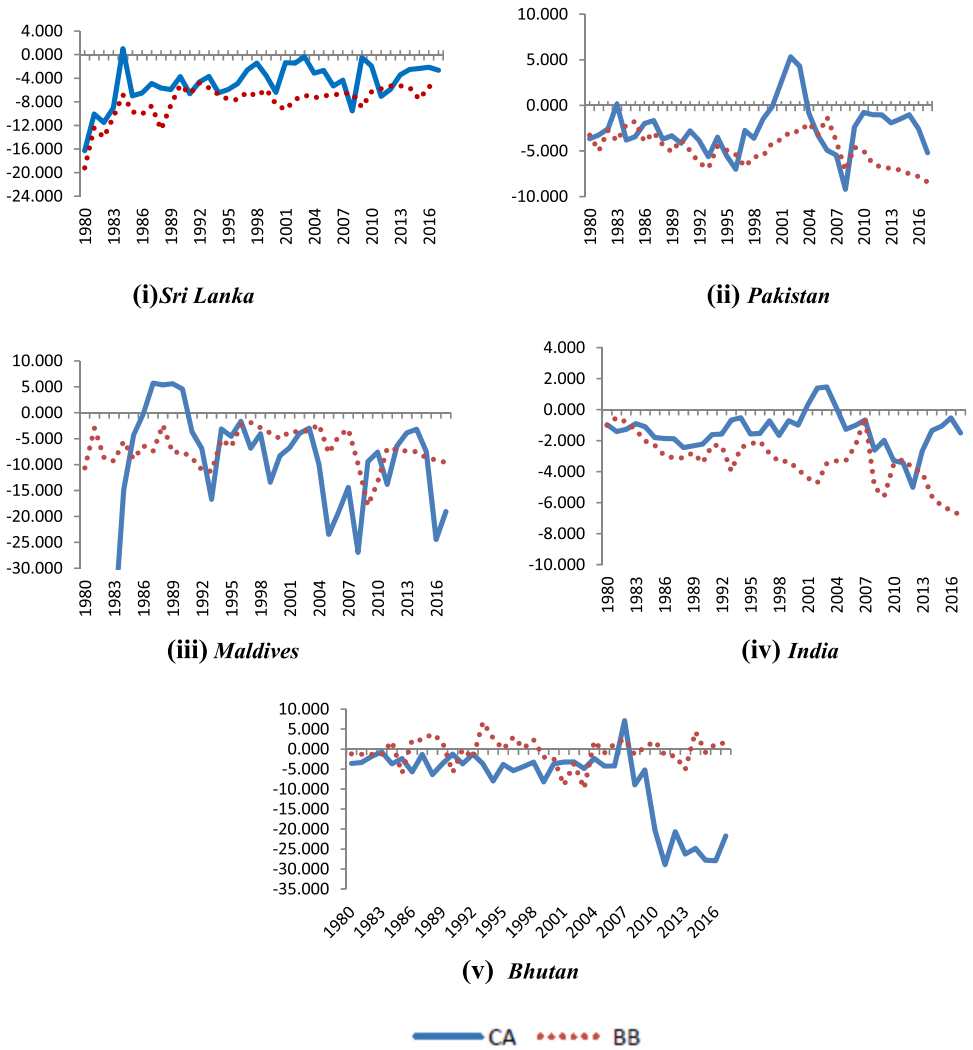


Fig. 3. The current account balance and budget balance as a proportion of GDP.

Table 2
Panel unit root tests.

Variables	Level				First Difference			
	Test statistics	Critical values			Test statistics	Critical values		
		10%	5%	1%		10%	5%	1%
Current Account	-3.2784***	-2.020	-2.160	-2.430				
Budget balance	-4.3254***	-2.020	-2.160	-2.430				
Public Debt	0.6899	-2.020	-2.160	-2.430	-6.8126***	-2.020	-2.160	-2.430
Growth Rate	-7.1031***	-2.020	-2.160	-2.430				
Trade Openness	-1.3909*	-2.020	-2.160	-2.430	-9.9807***	-2.020	-2.160	-2.430
Inflation Rate	-5.1497***	-2.020	-2.160	-2.430				
Savings and Investment gap	-3.4398***	-2.020	-2.160	-2.430				

Note: *, *** denote rejection of the null hypothesis of a unit root at the 10% and 1% levels of significance, respectively.
Sources: Author's estimates.

3. Data, variables and sources

3.1. South Asian twin deficits data

The data cover 38 years from 1980 to 2017 and five selected South Asian countries–Bhutan, Sri Lanka, Maldives, Pakistan, and India, where the current total debt is more than 70% of GDP. All countries have faced the twin deficits problem for several years because those nations depend on fiscal debt to settle budget deficits and finance infrastructure activities. India, Pakistan, and Sri Lanka all run general fiscal deficits of over 5% of GDP. In Pakistan, the fiscal position has worsened, with its deficit reaching 5.8% of GDP in 2017. Although Sri Lanka reached a primary surplus, the overall deficit marginally increased due to higher interest expenditure on government debt. Larger government expenditures mainly drive higher fiscal deficits while government revenue remains relatively stable. Low government revenue has been a unique feature of many South Asian countries. Furthermore, the overall South Asian region's current account deficit is nearly 2% of GDP, while Bhutan's current account imbalance was very large at about 22% of GDP in 2017.

We investigate the issue of twin imbalances in South Asia, a topic that has been widely discussed since the tide of economic liberalisation that began in the 1980s. Most of these countries lost their competitiveness in the international market mainly because of insufficient exchange rate adjustments that went hand-in-hand with economic liberalisation. Following the economic liberalisation policies that took place during the 1980s and 1990s and appeared to be successful until the 1997–98 Asian Financial Crisis and 2008 Global Financial Crisis, there have been massive challenges in the region, particularly in terms of international macroeconomic policy. Several Asian nations have experienced a decline in their macroeconomic fundamentals in which many have faced the twin deficits problem in the last five decades. This was largely driven by their dependence on fiscal debt to settle budget deficits and finance infrastructure activities. The escalating debt-to-GDP ratio in many South Asian economies is a cause for great concern. This led to higher interest rates and resulted in more financial inflows and appreciation of the exchange rate. Imports became relatively cheap and exports less competitive; thus, the current account goes into deficit because net exports decrease. The twin deficits issue is an ongoing and persistent problem in many South Asian economies, and they have struggled to address it.

As the study is based on major macroeconomic variables and their implications, the data were collected from available secondary sources (see Table 1).

Fig. 3 displays the current account balance and budget balance as a proportion of the GDP of five South Asian countries.

3.2. Panel unit root tests

We begin with a stationarity test of the variables as a first step prior to P-VAR modelling. We start our analysis by applying the panel unit root test of Pesaran (2007). The Pesaran test uses cross-sectional ADF statistics, which are specified below in Eq. (6):

$$\Delta y_{it} = a_i \quad + \beta_i \quad y_{i,t-1} + \gamma_i \quad \bar{y} \quad _{t-1} + \delta_i \Delta \bar{y} \quad _t \quad + \varepsilon_{it} \tag{6}$$

where $\beta_i; \gamma_i; \delta_i$ are slope coefficients estimated from the ADF test for country i, $y_{i,t-1}$ is the mean of lagged levels, $\Delta \bar{y}_t$ is the mean of first differences, and ε_{it} are the error terms. Stationarity analysis is a necessary step and applies the panel unit root test of Pesaran. Other than public debt and trade openness, the other variables are stationary at the 1% level. The South Asian countries' budget balance and current account appear to be stationary (see Table 2).

In addition, the summary statistics by individual country for main variables are reported in Table 3. The mean values of both current account balance and budget balance are negative, indicating the persistence of these deficits over the 1980–2017 periods for all sample countries. The highest mean value of the current account deficit is in the Maldives (− 11.82), and the lowest mean value of the current account deficit is in India (− 1.39). Sri Lanka has stated the highest mean value of fiscal deficit (− 7.85), while Bhutan has indicated the lowest mean value of fiscal deficit (− 0.40). Besides, the average value of fiscal debt is higher than 48% of GDP for all sample countries. The highest mean value of fiscal debt applies to Sri Lanka (87.63), whereas the lowest mean value of fiscal debt is reported by Bhutan (48.63).

Table 3
Summary statistics by individual country.

	Mean	Standard deviation	25th Percentile	50th Percentile	75th Percentile
Sri Lanka					
Current Account	-4.80	3.40	-6.46	-4.49	-2.50
Budget Balance	-7.85	2.88	-8.70	-6.93	-5.87
Public Debt	87.63	11.47	77.6	87.35	96.90
GDP Growth Rate	28.89	25.85	9.11	16.88	44.74
Trade Openness	67.71	12.05	59.05	68.43	78.49
Inflation Rate	9.40	4.75	6.24	9.26	10.83
Savings and Investment Gap	-2.31	2.69	-3.39	-2.28	-0.12
Pakistan					
Current Account	-2.54	2.76	-3.80	-2.76	-1.04
Budget Balance	-4.77	1.84	-6.40	-4.74	-3.26
Public Debt	60.83	10.81	55.34	63.24	67.57
GDP Growth Rate	123.50	69.57	71.65	94.72	159.64
Trade Openness	33.64	3.12	32.07	33.85	37.89
Inflation Rate	8.38	4.29	5.3	7.82	10.06
Savings and Investment Gap	5.02	3.31	2.59	5.30	7.25
Maldives					
Current Account	-11.82	14.02	-16.69	-7.21	-3.67
Budget Balance	-6.90	3.48	-8.94	-7.25	-3.66
Public Debt	52.04	12.86	41.84	50.45	62.88
GDP Growth Rate	1.25	1.33	0.21	0.65	2.05
Trade Openness	174.39	65.60	145.56	157.99	183.43
Inflation Rate	9.01	9.37	3.4	7.07	16.70
Savings and Investment Gap	-2.04	9.80	-7.79	-0.77	3.15
India					
Current Account	-1.39	1.20	-1.88	-1.38	-0.72
Budget Balance	-3.30	1.56	-3.96	-3.24	-2.30
Public Debt	63.89	15.65	47.1	69.34	74.54
GDP Growth Rate	0.73	0.67	0.23	0.38	1.17
Trade Openness	29.54	14.80	15.55	24.52	42.49
Inflation Rate	9.15	5.47	4.24	8.27	12.34
Savings and Investment Gap	-3.21	2.82	-5.54	-3.21	-0.88
Bhutan					
Current Account	-8.08	9.24	-8.21	-4.04	-3.25
Budget Balance	-0.40	3.49	-1.71	-0.05	2.02
Public Debt	48.63	31.36	27.54	40.86	74.62
GDP Growth Rate	80.72	70.72	27.73	43.41	126.29
Trade Openness	81.43	18.09	68.95	80.78	92.86
Inflation Rate	5.84	2.80	3.70	5.34	8.05
Savings and Investment Gap	-19.08	9.84	-26.67	-9.84	-4.46

4. Theoretical model and empirical methodology

This section outlines the theoretical model and empirical methodology adopted to analyse twin imbalances in South Asia. We apply the Panel Vector Autoregression model (P-VAR) to study the association between fiscal deficit and current account deficit in the five selected South Asian countries.

4.1. P-VAR modelling

Holtz-Eakin, Newey, and Rosen (1988) developed VAR in panel data settings, and the P-VAR models have been employed in macroeconomics research. Following Abrigo and Love (2015) and Gaysset et al. (2017), we rely on a P-VAR modelling approach to investigate the relationships between the dynamics of the current account deficit, budget deficit, public debt and GDP growth rate.

There are several reasons for selecting the above macroeconomic indicators as independent variables. First, budget balance, GDP growth and fiscal debt are jointly determined by the economic cycle.[6] For instance, during an economic recession, the trade balance improves due to lower demand for imports. In contrast, the government budget balance worsens due to the impact of automatic stabilisers (i.e., higher government spending and lower tax revenue). Increasing budget deficit leads to more borrowings from domestic and foreign sources, raising interest payments on the debt. Further, the GDP growth rate, which describes the phase of the economic cycle and the expected increase in economic growth, will improve the current account balance (Nickel & Vansteenkiste, 2008).

Based on the standard macroeconomic literature, we then selected the vector of three additional exogenous variables (savings-investment gap, inflation rate and trade openness). The current account is usually affected by changes in the savings-investment gap and the inflation rate. With high inflation, the price of products in the domestic market increases and those products are less

[6] Kim and Roubini (2008) demonstrated that budget balance and trade balance are jointly determined by the economic cycle.

competitive in the international market. This situation leads to poor export income and high import expenses, causing current account deficits to occur. Further, suppose domestic savings are lower than domestic investment. In that case, this will generate a current account deficit because a fall in savings means that people are consuming or spending more, which tends to increase imports. For this reason, Nickel and Vansteenkiste (2008) recommended adding trade openness as the exogenous variable. When trade openness increases, the current account balance also increases when exports rise faster than imports or when a drop in imports accompanies increases in exports. We include the above mentioned three macroeconomic variables in our model specification as additional control, exogenous variables.

Our methodology for the P-VAR model can be defined as follows. Assume the following system of n endogenous variables (y_{it}) and m exogenous variables (x_{it}). The reduced form P-VAR consists of lags of the endogenous variables and the contemporaneous values of the exogenous variables shown in Eq. (7):

$$Y_{it} = Y_{it-1} A_1 + Y_{it-2} A_2 + \ldots + Y_{it-p+1} A_{p-1} + Y_{it-p} A_p + X_{it}B + u_i + e_{it} \quad (7)$$

$$i \in \{1, 2, \ldots, N\}, \quad t \in \{1, 2, \ldots, \mathrm{T_i}\}$$

where Y_{it} is the vector of four stationary endogenous variables: current account balance, budget balance, economic growth rate and public debt, X_{it} is the vector of three exogenous control variables (savings-investment gap, inflation rate and trade openness). u_i and e_{it} are vectors of dependent variable-specific fixed-effects and an error term, respectively. The matrices $(k \times k)$ $A_1, A_2, \ldots, A_{p-1}, A_p$ and the $(l \times k)$ matrix B are parameters to be estimated.

We assume that $E[e_{it}] = 0, E[e'_{it} e_{it}] = \varnothing$ for all $t > s$. The errors e_{it} have zero mean, and the variance-covariance matrix of reduced form shocks is assumed to be real, symmetrical, and positive definite. As is standard in VAR analysis, the model's fit to the data is best examined using the impulse response function (IRF). The P-VAR method- like the VAR approach - lends itself to the evaluation via the Granger causality test. Based on the three model selection criteria described by Andrews and Lu (2001), first-order panel VAR is the preferred model since this has the smallest MBIC (modified Bayesian information criterion), MAIC (modified Akaike information criterion) and MQIC (modified Hannan-Quinn information criterion).

We consider the Cholesky decomposition to identify orthogonal shocks and study their effect on the remaining variables in the system holding other shocks constant. We focus on impulse response functions to analyse the response of one variable to an orthogonal shock in another variable. We generate confidence intervals for the orthogonalised IRFs with Monte Carlo simulations, the objective being to identify the response to one shock at a time while holding other shocks constant. Variables that enter first are assumed to be the most exogenous and affect the following variables contemporaneously and with a lag. Variables that are ordered later are less exogenous and affect previous variables only with a lag (Hamilton, 1994).

Our model assumes that shocks to the current account balance affect the contemporaneous value of the budget balance. In contrast, budget balance affects the fiscal debt only with a lag. We believe this assumption is reasonable for the following reason. Increasing budget deficit leads to more borrowings from domestic and external sources leading to higher public debt. High fiscal debt is the result of permanent fiscal deficits financed by borrowing from domestic and foreign sources. To finance the debt repayment, the government may borrow money through the sale of government securities. If the borrowing comes from the domestic market, this will increase the demand for loanable funds, which will increase the real rate of interest on government securities. The rise in interest rate brings about capital inflows and an appreciation of the domestic currency, leading, in turn, to increased expenditure on imports, decreased net exports and deteriorating the current account (Badinger et al., 2017). Finally, we assume that the current account balance responds to budget balance contemporaneously, while the budget balance responds to government debt only with a lag.[7] We assume that economic growth affects all other variables with a lag, and all the other variables contemporaneously influence it. As a result, economic growth is the most endogenous variable in the system, capturing all available information (i.e., all the contemporaneous shocks to the other variables). In other words, the variables that appear earlier in the systems are more exogenous, and the ones that appear later are more endogenous. The variables are CA, BB, dPD, GR, where the contemporaneously exogenous variables are ordered first.[8]

5. Empirical results, discussion and robustness test

5.1. P-VAR model

5.1.1. Panel Granger causality

Based on the Granger causality Wald test (see Table 4 and Fig. 2), we find that the current account balance 'Granger causes' the budget balance. The opposite does hold, thus signifying bi-directional causality. These results are not surprising because several empirical studies have presented bi-causality relationships between current account and budget balance (see Asrafuzzaman et al., 2013; Islam, 1998; Mansouri, 2001; Mukhtar et al., 2007). There is no significant causality relationship running from the current

[7] Current account imbalance (for instance a current account deficit) implies that savings less investment is negative. Since savings consist of private sector savings and government savings, holding private sector savings and investment constant, the negative savings less investment can be brought about by a fall in government savings, which results in the government incurring higher debt to meet expenditure needs.

[8] The results of the VAR model are not affected by the ordering of the variables as the generalized impulse response functions are not sensitive to the ordering of the variables (Pesaran & Shin, 1998).

Table 4
Panel VAR-Granger causality wald test.

Equation\Excluded	chi2	df	Prob > chi2
Current Account			
Budget balance	6.788	1	0.009***
Δ Public debt	1.273	1	0.259
GDP growth rate	8.638	1	0.003***
All	13.104	3	0.004***
Budget Balance			
Current account	3.301	1	0.069*
Δ Public debt	1.485	1	0.223
GDP growth rate	11.641	1	0.001***
All	13.919	3	0.003***
Δ Public Debt			
Current account	1.146	1	0.284
Budget balance	4.131	1	0.042**
GDP growth rate	2.388	1	0.122
All	9.956	3	0.019**
GDP growth rate			
Current account	5.102	1	0.024**
Budget balance	0.463	1	0.496
Δ Public debt	7.533	1	0.006***
All	9.650	3	0.022**

Note: *, **, *** denote rejection of the null hypothesis of a unit root at the 10%, 5% and 1% levels of significance, respectively. Ho: excluded variable does not Granger-cause equation variable, Ha: excluded variable Granger-causes equation variable.
Sources: Author's estimates.

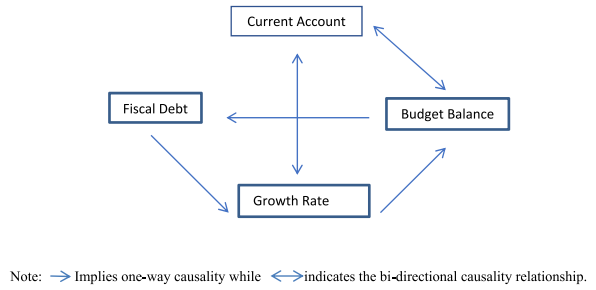


Fig. 4. Direction of causal relationship.

Table 5
SGMM P-VAR estimations.

Variables	*CA*	*BB*	*GR*	*Δ PD*
Lagged CA	0.8962***	0.1217***	0.3633**	0.0359
	[0.049]	[0.248]	[0.124]	[0.036]
Lagged BB	0.4727***	0.1022	0.2148***	-0.5334***
	[0.034]	[0.104]	[0.063]	[0.123]
Lagged GR	0.1135	0.1257**	0.0057	-0.0841**
	[0.076]	[0.538]	[0.128]	[0.031]
Δ PD	0.0148	-0.4026**	-0.0699**	0.0530**
	[0.028]	[0.198]	[0.018]	[0.026]
INF	-0.1927***	0.0259	0.0191	-0.0067
	[0.487]	[0.031]	[0.031]	[0.069]
SI	0.1128*	0.2038***	0.0017	-0.0929
	[0.063]	[0.402]	[0.063]	[0.082]
ΔTO	0.0165**	0.0309***	-0.0100*	0.0274***
	[0.007]	[0.004]	[0.005]	[0.008]
Observations	179	179	179	179

Notes: Standard errors are in parentheses. *, **, *** denote rejection of the null hypothesis of a unit root at the 10%, 5% and 1% levels of significance, respectively.
Sources: Author's estimates.

Table 6
Forecast error variance decomposition.

	Response variable and Forecast horizon		Impulse variable	
	CA	BB	dPD	GR
Response: Δ Current Account				
1	1	0	0	0
2	0.909	0.034	0.003	0.053
3	0.881	0.061	0.004	0.054
4	0.873	0.070	0.004	0.053
5	0.871	0.073	0.004	0.052
6	0.870	0.074	0.004	0.052
7	0.869	0.074	0.004	0.052
8	0.869	0.074	0.004	0.052
9	0.869	0.074	0.004	0.052
10	0.869	0.074	0.004	0.052
Response: Δ Budget Balance				
1	0.017	0.983	0.000	0.000
3	0.045	0.875	0.007	0.075
4	0.045	0.869	0.009	0.077
5	0.045	0.869	0.009	0.077
6	0.045	0.869	0.009	0.077
7	0.045	0.869	0.009	0.077
8	0.045	0.869	0.009	0.077
9	0.045	0.869	0.009	0.077
10	0.045	0.869	0.009	0.077
Response: Δ Public Debt				
1	0.065	0.048	0.887	0
2	0.061	0.088	0.840	0.010
3	0.061	0.090	0.837	0.012
4	0.062	0.090	0.836	0.012
5	0.062	0.090	0.836	0.012
6	0.062	0.090	0.836	0.012
7	0.062	0.090	0.836	0.012
8	0.062	0.090	0.836	0.012
9	0.062	0.090	0.836	0.012
10	0.062	0.090	0.836	0.012
Response: Δ Growth Rate				
1	0.047	0.033	0.144	0.776
2	0.058	0.034	0.152	0.755
3	0.069	0.038	0.149	0.745
4	0.073	0.037	0.148	0.741
5	0.074	0.038	0.148	0.740
6	0.074	0.037	0.148	0.739
7	0.075	0.038	0.148	0.739
8	0.075	0.038	0.148	0.739
9	0.075	0.038	0.148	0.739
10	0.075	0.038	0.148	0.739

account balance to public debt or fiscal debt to the current account balance. Besides, the current account balance 'Granger causes' the GDP growth rate and the opposite holds. Further, we find direct Granger causality running from the budget deficit to public debt, and the opposite does not hold. We also find a significant causality relationship running from public debt to GDP growth, but the opposite does not hold. Fig. 4 further confirms that the significant causality runs from GDP growth rate to budget balance and current account balance.

Wooldridge's test for autocorrelation indicates the absence of first-order autocorrelation (i.e., a p-value of 0.1455). Cross-sectional dependence (CD) is one of the issues in macro panels with long time series data. The Pesaran CD test is used to test whether the residuals are linked across entities (Pesaran, 2007). Results of the test indicated there is no cross-sectional dependence, i.e., p-value of 0.1273. To avoid a potential endogeneity issue, each control variable is lagged by one year (Baum, Checherita-Westphal, & Rother, 2013).

5.1.2. SGMM P-VAR estimations

Table 5 presents the results of the P-VAR model. The observed impacts are positive and significant between the budget balance and current account balance. A 1% increase in budget balance will lead to a rise in current account balance by 0.1% with statistical significance at the 1% level. There are statistically significant positive relationships between current account balance, savings and investment gap and trade openness while statistically significant negative relationships between current account balance and inflation. However, we find that the public debt and economic growth rate do not determine the current account balance. There are statistically

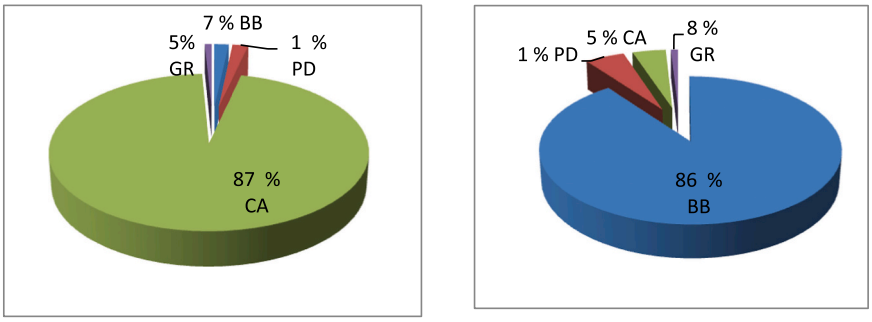


Fig. 5. Variance decomposition of current account and budget balance.

significant positive relationships between budget balance, GDP growth rate, trade openness and savings-investment gap. Nevertheless, an increase in government debt reduces the fiscal balance. Of all the variables, the budget balance has a dominant effect on the public debt (i.e., the coefficient is 0.53). As well, economic growth decreases when higher government debt is evident. Bohn (1998) presents similar findings that rising internal deficits have started to put more stress on the external deficits in an analysis of the behaviour of U.S public debt and deficits. Moreover, the positive savings and investment gap seems to be accompanied by an increased current account balance among South Asian countries at the 10% significance level. In addition, inflation wields a strongly significant negative impact on the current account balance through increases in the prices of goods in the domestic market. The coefficient estimated for trade openness impacts by 0.016 with statistical significance at the 5% level. Das (2012) advocates the degree of openness to international trade could reflect tariff regime and trade policy choice will have a positive effect on the current account. The positive impact of trade openness on the current account implies that an economy with fewer trade restrictions and more exposure to international trade tends to be relatively more attractive to foreign capital.

In line with our 'Panel Granger' causality and SGMM estimation, we find a strong positive relationship between the current account balance and budget balance. These results agree with the twin deficits hypothesis, which assumes a strong positive linear relationship between a country's current account deficit and its fiscal deficit (Keynesian absorption theory, Mundell-Fleming open economy theory). Besides, fiscal debt has a significant positive impact on fiscal deficit, confirming the 'vicious circle' relationship between government debt and fiscal deficit. Overall, in this sample, both the savings-investment gap and economic growth rate positively impact the current account, supporting the findings of previous studies (see Chowdhury & Saleh, 2007; Mumtaz & Munir, 2016).

Finally, we check the stability condition of the estimated P-VAR. The graph of eigenvalues confirms that the estimate is, in fact, stable. All the eigenvalues lie inside the unit circle (see Fig. C1 in Appendix C). The P-VAR model satisfies the stability condition.

5.1.3. Forecast error variance decomposition and impulse response functions

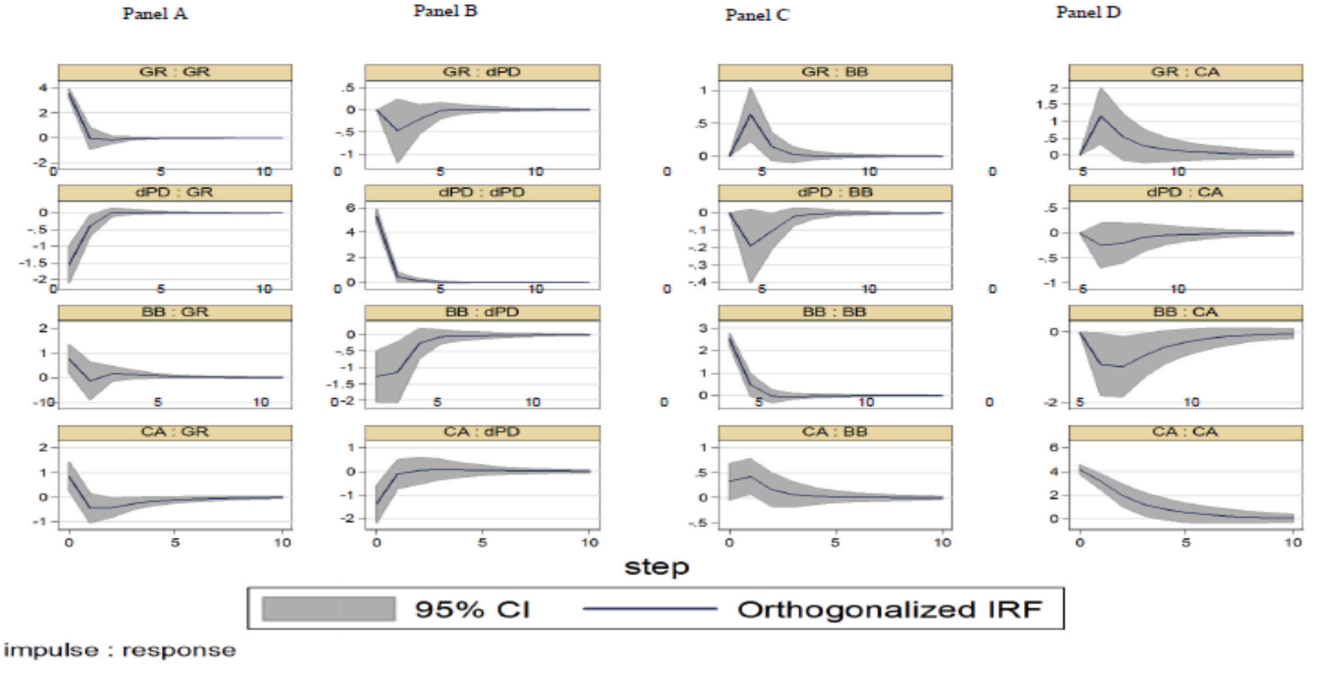
A forecast error variance decomposition measures the fraction of the overall forecast variance for a variable attributed to each driving shocks. Further, it explains how much of the forecast error variance of each variable can be described by exogenous shocks to the other variable. We account for the FEVD over the ten years, and Table 6 documents the FEVD results. We find that a large proportion of the current account forecast error variance is explained by its own shocks (i.e., up to 87%). This is followed by shocks from the budget balance (up to 7%), shocks from the growth rate (up to 5%) and shocks from public debt (up to 1%). The budget balance forecast error variance appears largely to be explained by its own shocks (i.e., up to 86%), with the contributions of GDP growth rate shocks making up for 8%, current account shocks for 5%, and public debt shocks for 1%.

Further, Fig. 5 presents variance decomposition for the primary variables in the panel VAR system. It can be seen that both BB and CA are the main drivers of their respective forecast error variance, influencing each other more significantly than the other variables.

We focus our discussion on the impulse response functions that define one variable's response to the innovations in another variable in the system while holding all other reactions constant. We present graphs of impulse response functions and the 5% error bands generated by the Monte Carlo simulation. The IRFs results are reported in Fig. 6 (see below), which consider contemporaneous and lagged responses.

First, we discuss how the shock of one standard deviation of positive budget balance (i.e., increased government revenue or decreased government purchases) affects the GDP growth rate, the debt-to-GDP ratio, and the current account balance, respectively (see Panel C in Fig. 6). The GDP growth rate responds positively to one standard deviation of positive budget balance shock for the first two periods, signifying that increasing government revenue enhances growth in the short term (Kneller, Bleaney, & Gemmell, 1999). The debt-to-GDP ratio has a significant negative response on one standard deviation of positive budget balance shock (the response persists over three years), indicating the short-run effect of an increase in nominal GDP or paying off existing national debt when an increase in government revenue leads to a reduced debt-to-GDP ratio (Dornbusch & Edwards, 1991). The response gradually increases until the fourth period, when it hits its steady state value from the third period. We observe that the current account balance significantly increases in response to a positive shock to budget balance. Increasing government revenue leads to increased public savings and a better current account balance, leading to a positive savings-investment gap.

Second, we explain how the GDP growth rate, budget balance and current account balance, respectively, respond to the one standard deviation positive fiscal debt shock (see Panel B in Fig. 6). A one standard deviation positive public debt shock results in a



Note: Panel A (column 1): The graphs show the response of GDP growth rate, fiscal debt, budget balance, and current account to a standard deviation shock in GDP growth rate.
Panel B (column 2): The graphs show the response of GDP growth rate, fiscal debt, budget balance, and current account to a standard deviation shock in fiscal debt.
Panel C (column 3): The graphs show the response of GDP growth rate, fiscal debt, budget balance, and current account to a standard deviation shock in budget balance.
Panel D (column 4): The graphs show the response of GDP growth rate, fiscal debt, budget balance, and current account to a standard deviation shock in current account.

Fig. 6. Impulse response function.

lower GDP growth rate. The response significantly persists for four years, suggesting an increase in fiscal debt harms GDP growth rate until the fourth period when it hits its steady-state value.

Based on Ibhagui (2018) study, the increases in external debt significantly led to a rising external imbalance with a lower GDP growth rate. A one standard deviation positive shock to fiscal debt causes a negative budget balance response. The response significantly lasts 1–4 years, suggesting that increased fiscal debt has a positive long-term impact on fiscal deficit. Based on the vicious cycle of fiscal debt and fiscal deficit, increasing budget deficit leads to more borrowings from domestic and external sources, thereby raising interest payments on debt. Higher interest payments further lead to a greater fiscal deficit as the government needs to increase expenditure (Armingeon & Baccaro, 2012; Karl, 2008; Perry, 2014). In response to a positive public debt shock, the current account balance decreases over the period. Rising public debt will lead to a rise in interest rates and an appreciation of the domestic currency, resulting in decreased net exports and a deteriorating current account balance.

Third, the GDP growth rate, public debt and budget deficit response to an exogenous current account shock is significant for most of the period (see Panel D in Fig. 6). During most of this period, the GDP growth rate increases significantly in response to a positive one standard deviation of current account shock. Besides, the debt to-GDP ratio decreases significantly following a positive one standard deviation shock in the current account (i.e., increased government savings). In response to a positive current account shock, the government budget balance improves significantly for most foreseeable future.

Fourth, the effects of economic growth shocks are worth mentioning (see Panel A in Fig. 6). As expected, public debt falls significantly throughout most of the period following a positive one standard deviation of economic growth rate shock. We find a significant increase in the budget balance following a one standard deviation positive shock to GDP growth rate until the third period, which is consistent with the automatic stabiliser role of the government budget. The current account balance increases significantly following a positive one standard deviation shock of GDP growth rate. This current account movement is consistent with theories concerning the current account, suggesting an increase in output leads to positive savings and investment gap and improves the current account balance.

To conclude, the panels representing the impulse response of fiscal debt to a one standard deviation shock in budget balance clearly show a negative impact. We also discern that the impulse response of external balance increases to a one positive standard deviation shock in internal balance, confirming the validity of the twin deficits hypothesis. To confirm the bi-causality relationship between current account balance and budget balance, one standard deviation in the current account shock engenders a positive response on budget balance in the South Asian economies. Similar conclusions are presented in several single country empirical studies in South Asia (see Asrafuzzaman et al., 2013; Mukhtar et al., 2007). Their findings are consistent with twin deficits theories, i.e. the Keynesian Absorption and Mundell Fleming theories, suggesting that a budget deficit leads to a current account deficit, and there is a positive link between them through interest rate and exchange rate channels.

5.2. *Discussion of results*

In this section, we explain the main results in the context of related literature. Then, we compare our VAR model results with what other studies have reported and highlighted factors that explain possible differences, such as the econometric methodology and the sample period.

Our empirical results are in line with the theoretical predictions and similar to what other studies have documented. The evidence points to the bi-causality direction between the current account deficit and budget deficit by and large. Second, the impulse response of external balance increases to a one positive standard deviation shock in internal balance, confirming the validity of the twin deficits hypothesis. Further – confirming the bi-causality relationship between current account balance and budget balance – an increase in a one standard deviation positive shock in the current account balance wields a positive response on the South Asian economies' budget balance. Additionally, we observe that the panels representing the impulse response of fiscal debt to a one standard deviation positive shock in budget balance clearly show a negative impact. Our empirical findings help to formulate policies for policymakers to reduce internal and external account deficits.

When our results are compared with earlier studies, they confirmed twin deficits under certain conditions applying different analytical frameworks. Badinger et al. (2017) estimate the direct effects of fiscal rules on the current account balance in 73 countries over the period 1985–2012, applying the least squares dummy variables (LSDV) estimates and a generalised methods of moments (GMM) approach. Their main finding was that no significant direct effect of fiscal rules was evident on the current account balance. However, they found that fiscal deficit leads to current account deficit through import demand, interest rates, and real exchange rate changes. In contrast, Nickel and Tudyka (2014) examined the fiscal stimulus of high debt, using fiscal multipliers and twin deficits in 17 European countries from 1970 to 2010 according to the vector autoregressive (VAR) approach. They found that a positive relationship existed between government spending shocks and real GDP, but there was a negative effect on the debt-to-GDP ratio in the long term. Moreover, Corsetti and Müller (2006) investigate the transmission of fiscal shocks in a VAR framework in four OECD countries, differing in their degree of openness. In the US and Australia, which are relatively less open than Canada and the UK, government spending shocks are less persistent. Furthermore, they found that the current account impact of fiscal policy is rather limited. Instead, private investment responds substantially. The reverse is true for Canada and the UK. However, our results are slightly different from those of the developed country studies.

On the other hand, Ogbonna (2014) examines the empirical relationship between fiscal deficit and current account imbalance in South Africa from 1960 to 2012 by employing the cointegration analysis and VAR model. The results indicate no evidence of the twin deficits hypothesis for South Africa in the short run suggesting that the Ricardian equivalence hypothesis holds for the economy under consideration within such time horizon. Conversely, Kouassi et al. (2004) re-examine the causality between the twin deficits by testing

for the Granger non-causality test of twenty developed and developing countries. They found evidence of causality between the twin deficits for developing countries. However, the results for developed countries are less persuasive.

Similarly, Mumtaz and Munir (2016) analyse the twin deficit hypothesis in South Asian countries using the Autoregressive distributed lag model with bound testing. They also consider cointegration and Granger causality through the VAR model. They found no evidence of the twin deficit hypothesis in all countries in the long run. Moreover, their results support the Ricardian equivalence hypothesis for India and Pakistan. In contrast, Ravinthirakumaran et al. (2016) investigate the existence of twin deficits in five SAARC countries using time-series data for 1980–2012 using an error correction model and Granger causality test in a VAR framework. The results show that the direction of causality for the SAARC countries is mixed: budget deficit causes current account deficit for Pakistan and Sri Lanka, whereas the reverse is true for India and Nepal. The direction of causality is unidirectional from the current account deficit to the budget deficit in the short run for Bangladesh.

Some past studies have supported the Keynesian twin deficits hypothesis, while only a few studies have evidence supporting the Ricardian equivalence hypothesis. However, the conclusions of the South Asian country studies have been controversial and debatable. The empirical studies in South Asia related to twin deficits have mainly tested the causality between fiscal balance and current account balance using time series econometrics techniques.

6. Conclusion

The main objective of this paper was to examine whether the twin deficits hypothesis is supported in the South Asian region using annual data for the period from 1980 to 2017. This paper contributes to the literature by demonstrating the dynamic linkages of the current account deficit and budget deficit in the South Asian region. Based on contrasting theoretical backgrounds of the twin deficits hypothesis, several empirical studies have examined the relationship between the current account and budget balance. Still, most studies on twin deficits in South Asia have only investigated a single country. To the best of our knowledge, the present paper stands out as the first attempt to look at the issue from a panel perspective in the South Asian region. Further, we incorporated the debt-to-GDP ratio that has been neglected in past literature but has important implications for investigating the twin deficits issue. Specifically, public debt (or debt-to-GDP ratio) serves as a channel through which internal balance is affected by economic growth.

Our empirical results are in line with the theoretical predictions, but they contrast with some of the findings from previous studies. The Panel Granger causality test result confirms bi-causality relationships running between budget balance and current account balance, suggesting that internal depreciation strategies have had the desired effect on macroeconomic imbalances. That fiscal targeting of both current account and budget balance may be appropriate in the South Asian region. We then modelled the twin deficits hypothesis using a P-VAR methodology with forecast error variance decomposition and impulse response function. Our forecast error variance decomposition results suggest that its own shocks mostly explain both the current account and budget balance forecast error variances. The panels representing the impulse response of fiscal debt to a one standard deviation shock in budget balance clearly show a negative impact. We also observe that the impulse response of external deficit increases to a one positive standard deviation shock in internal deficit, confirming the validity of the twin deficits hypothesis. Further, confirming the bi-causality relationship between current account deficit and budget deficit, an increase in the current account balance's one standard deviation shock indicates a significant positive response on budget balance in the South Asian economies.

Overall, these results lead us to reject 'only fiscal' policy recommendations for twin deficits. First, it is critically important to reduce large fiscal deficits by introducing a better tax collection system because tax bases are small, tax releases are common, and tax evasion is widespread in this region. However, government expenditure is not as low as tax income, mainly due to the unstable political environments in these countries. Second, it is important to reduce the current account deficit by increasing national and private savings with better policies to attract foreign direct investment. However, increasing oil prices in the international market may impose a further burden on the high current account deficit because South Asia is a net oil importer. Additionally, South Asian governments may improve their exports and overall trade balance, which would help non-price competitiveness, increase the private sector's productivity and efficiency, and support entrepreneurship with transparent fiscal consolidation. The South Asian governments should target sustainable economic growth and low inflation with a stable exchange rate.

Finally, we consider bi-causality between the current account and budget balance as the most complex situation to emerge in this study. We also observe a positive impact of economic growth on budget balance through the public debt channel. Hence, maintaining a sustainable debt-to-GDP ratio is crucial to achieving higher economic growth and a balanced budget for this region. Consequently, policymakers need to focus on both imbalances simultaneously when designing policy. Solving this problem will require continuing a sustainable debt-to-GDP ratio, which can be very challenging.

Appendix A. Panel Granger causality test

Granger (1969) introduced a model to identify causality in time series data. More recently, Dumitrescu and Hurlin (2012) developed a model to test for Granger causality in panel datasets (i.e., the Dumitrescu-Hurlin test). We can write the underlying regression as follows:

$$y_{it} = \alpha_i + \sum_{k=1}^{k} \beta_{ik} y_{i,t-k} + \sum_{k=1}^{k} \gamma_{ik} x_{it-k} + \varepsilon_{it} \tag{1}$$

where Y_{it} is the vector of four stationary endogenous variables, X_{it} is the vector of three exogenous control variables for individual i in period t. The lag order k is assumed to be identical for all individuals. The panel must be balanced. Further, this model explains the

significant effects of past values of x on the present value of y. The null and alternative hypothesis is therefore defined as:

$$H_0{:}\gamma_{i1} = \ldots = \gamma_{ik} = 0 \forall i = 1, \ldots, \quad N$$

$$H_1{:}\gamma_{i1} = \ldots = \gamma_{ik} = 0 \forall i = 1, \ldots, \quad N1$$

$$\gamma_{i1} \neq 0 \; or \ldots or \; \gamma_{ik} \neq 0 \forall i = N1 + 1, \ldots, N \tag{2}$$

where $N1 \epsilon [0, N-1]$ is unknown. If $N1 = 0$, there is causality for all individuals in the panel. Here, $N1$ is strictly smaller than N. Otherwise, there is no causality for all individuals and H_1 reduces to H_0 (Lopez & Weber, 2017).

Appendix B. Impulse response function and variance decomposition

Following Abrigo and Love (2015), we consider a k -variate homogeneous P-VAR of order p with panel specific fixed effects represented by the following linear equation:

$$Y_{it} = Y_{it-1}A_1 \quad + Y_{it-2}A_2 \quad + \ldots + Y_{it-p+1}A_{p-1} + Y_{it-p}A_p \quad + X_{it}B + u_i + e_{it} \tag{3}$$

$$i \in \{1, 2, \ldots, N\}, \quad t \in \{1, 2, \ldots, \mathrm{T_i}\}$$

where Y_{it} is a $(1xk)$ vector of dependent variables; X_{it} is a $(1xl)$ vector of exogenous covariates; u_i and e_{it} are $(1xk)$ vectors of dependent variable-specific panel fixed-effects and idiosyncratic errors, respectively. The (kxk) matrices $A_1, A_2, \ldots, A_{p-1}, A_p$ and the $(1xk)$ matrix B are parameters to be estimated. We assume that the innovations have the following characteristics: $E[e_{it}] = 0, E[e'_{it}e_{it}] = \sum$ and $E[e'_{it}e_{is}] = 0$ for all $t > s$.

Lütkepohl (2005) and Hamilton (1994) indicate that if all moduli of the companion matrix $\overline{A}$ are strictly less than one, a VAR model is stable, where the companion matrix is:

$$\overline{A} = \begin{pmatrix} A_1 & A_2 & \ldots & A_p & A_{p-1} \\ I_k & O_k & \ldots & O_k & O_k \\ O_k & I_k & \ldots & O_k & O_k \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ O_k & O_k & \ldots & I_k & O_k \end{pmatrix} \tag{4}$$

Stability indicates that the P-VAR is invertible and has an infinite order vector moving-average (VMA) representation, providing a known interpretation of the estimated Impulse Response Function (IRF) and the Forecast Error Variance Decomposition (FEVD). The simple IRF ϕ_i can be obtained by rewriting the model as an infinite VMA, where ϕ_i are the VMA parameters (Abrigo & Love, 2015).

$$\phi_i = \begin{Bmatrix} I_k, \quad i = 0 \\ \sum_{j=1}^{i} \phi_{t-j}A_j \quad , i = 1, 2, \ldots. \end{Bmatrix} \tag{5}$$

The innovations e_{it} are correlated contemporaneously; a shock in one variable is expected to be accompanied by shocks in other variables. Assume we have a matrix P, that is $P'P = \sum$. Then P can be used to orthogonalise the innovations as $e_{it} \quad P^{-1}$ and converting the VMA parameters into the orthogonalised impulse responses $P\phi_i$. The matrix P effectively imposes identification restrictions on the system of dynamic equations (Abrigo & Love, 2015).

The h -step ahead forecast-error can be obtained as follows:

$$Y_{it+h} - E[Y_{it+h}] = \sum_{i=0}^{h-1} e_i(t + h - i)^{\phi_i} \tag{6}$$

where Y_{it+h} is the observed vector at time $t + h$, E [Y_{it+h}] is the h-step ahead predicted vector made at time t. Like IRF, we orthogonalise the shocks using the matrix P to isolate each variable's contribution to the FEVD. The orthogonalised shocks $e_{it,}P^{-1}$ have a covariance matrix I_k, which permits straightforward decomposition of the forecast error variance. Specifically, the contribution of a variable m to the h-step ahead forecast error variance of variable n may be calculated as follows.

$$\sum_{i=0}^{h-1} \theta_{mn}^2 = \sum_{i=1}^{h-1} (i'_n P \phi_i i_m)^2 \tag{7}$$

Where i_s is the s-th column of I_k. In application, the contributions are normalised relative to the h-step ahead forecast error variance of variable n:

$$\sum_{i=0}^{h-1} \theta_{.n}^2 = \sum_{i=1}^{h-1} i'_n \phi'_i \Sigma \phi_i i_n \tag{8}$$

Finally, we estimate the initial VAR parameters with the system GMM estimations (SGMM) based on lag one. Our P-VAR model consists of one lag based on the panel Akaike Information Criteria (AIC).

Appendix C

See Appendix Fig. C1.

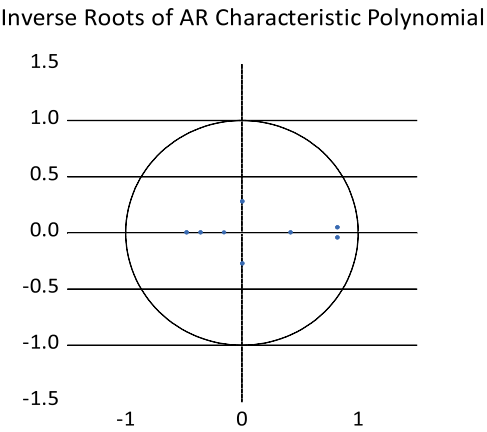


Fig. C1. The graph of Eigenvalues.

References

Abrigo, M.R., & Love, I. (2015). Estimation of Panel Vector Autoregression in Stata: A Package of Programs, Manuscript available at ⟨http://paneldataconference2015.ceu.hu/Program/Michael-Abrigo.pdf⟩.

Andrews, D. W. K., & Lu, B. (2001). Consistent model and moment selection procedures for GMM estimation with application to dynamic panel data models. *Journal of Econometrics, 101*, 123–164.

Anoruo, E., & Ramchander, S. (1998). Current account and fiscal deficits: Evidence from five developing economies of Asia. *Journal of Asian Economics, 9*(3), 487–501.

Akram, N. (2014). Empirical examination of debt and growth nexus in South Asian countries. *Asia-Pacific Development Journal, 20*(2), 29–52.

Akram, N. (2016). Public debt and pro-poor economic growth evidence from South Asian countries. *Economic Research, 29*(1), 746–757.

Aqeel, A., Nishat, M., & Qayyum, A. (2000). The twin deficits phenomenon: Evidence from Pakistan. *The Pakistan Development Review, 39*(4), 535–550.

Armingeon, K., & Baccaro, L. (2012). Political economy of the sovereign debt crisis: The limits of internal devaluation. *Industrial Law Journal, 41*(3), 254–275.

Asrafuzzaman, A., Amit, R., & Gupta, S. D. (2013). An empirical investigation of budget and trade deficits: The case of Bangladesh. *International Journal of Economics and Financial Issues, 3*(3), 570–579.

Badinger, H., Fichet de Clairfontaine, A., & Reuter, W. H. (2017). Fiscal rules and twin deficits: The link between fiscal and external balances. *The World Economy, 40*(1), 21–35.

Baharumshah, A. Z., Lau, E., & Khalid, A. M. (2006). Testing twin deficits hypothesis using VARs and variance decomposition. *Journal of the Asia Pacific Economy, 11*(3), 331–354.

Barro, R. J. (1989). The Ricardian approach to budget deficits. *Journal of Economic Perspectives, 3*(2), 37–54.

Basu, S., & Datta, D. (2005). Does fiscal deficit influence trade deficit? An econometric enquiry. *Economic and Political Weekly*, 3311–3318.

Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: New evidence for the euro area. *Journal of International Money and Finance, 32*, 809–821.

Beetsma, R., Giuliodori, M., & Klaassen, F. (2008). The effects of public spending shocks on trade balances and budget deficits in the European Union. *Journal of the European Economic Association, 6*(2–3), 414–423.

Bluedorn, J., & Leigh, D. (2011). Revisiting the twin deficits hypothesis: The effect of fiscal consolidation on the current account. *IMF Economic Review, 59*(4), 582–602.

Bohn, H. (1998). The behaviour of U. S. public debt and deficits. *The Quarterly Journal of Economics, 113*(3), 949–963.

Chowdhury, K., & Saleh, A. S. (2007). *Testing the Keynesian proposition of twin deficits in the presence of trade liberalisation: Evidence from Sri Lanka*. Faculty of Business economic working paper, University of Wollongong,.

Corsetti, G., & Müller, G. J. (2006). Twin deficits: Squaring theory, evidence, and common sense. *Economic Policy, 21*(48), 598–638.

Das, D., (2012). *Determinants of Current Account Imbalance in the Global Economy: A Dynamic Panel Analysis*. Available at SSRN 2254288.

Dornbusch, R., & Edwards, S. (1991). The macroeconomics of populism. In *The macroeconomics of populism in Latin America* (pp. 7–13). Chicago: University of Chicago Press.

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling, 29*(4), 1450–1460.

Garg, B., & Prabheesh, K. P. (2017). Drivers of India's current account deficits, with implications for ameliorating them. *Journal of Asian Economics, 51*, 23–32.

Gaysset, I., Lagoarde-Segot, T., & Neaime, S. (2017). Twin deficits and fiscal spillovers in the EMU's periphery. A Keynesian perspective. *Economic Modelling, 76*, 101–116.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral models. *Econometrica, 37*, 424–438.

Hamilton, J. D. (1994). *Time series analysis, 2* pp. 690–696). Princeton, NJ: Princeton university press.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector autoregressions with panel data. *Econometrica, 56*, 1371–1395.

Hsiao, C. (1995). Panel analysis for metric data. In *Handbook of statistical modelling for the social and behavioural sciences* (pp. 361–400). Boston, MA: Springer.

Hsiao, C. (2014). *Analysis of panel data (Econometric Society Monographs No. 54)*. Boston, MA: Cambridge University Press.

Ibhagui, O. W. (2018). External debt and current account adjustments: The role of trade openness. *Cogent Economics & Finance, 6*(1), Article 1446247.

International Monetary Fund. (2017). *South Asia regional update, May 2017*. South Asia: Continued Robust Growth, IMF.

International Monetary Fund. (2019). *South Asia regional update, May 2018*. South Asia: Continued Robust Growth, IMF.

Islam, M. F. (1998). Brazil's twin deficits: An empirical examination. *Atlantic Economic Journal, 26*(2), 121–128.

Kalou, S., & Paleologou, S. M. (2012). The twin deficits hypothesis: Revisiting an EMU country. *Journal of Policy Modelling, 34*(2), 230–241.

Karl, T. L. (2008). *The vicious cycle of inequality in Latin America*. Berkeley, California: University of California.

Katırcıoglu, S. T., Fethı, S., & Fethı, M. D. (2009). Twin deficits phenomenon in small islands: An empirical investigation by panel data analysis. *Applied Economics Letters, 16*(15), 1569–1573.

Kim, S., & Roubini, N. (2008). Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the US. *Journal of International Economics, 74*(2), 362–383.
Kneller, R., Bleaney, M. F., & Gemmell, N. (1999). Fiscal policy and growth: Evidence from OECD countries. *Journal of Public Economics, 74*(2), 171–190.
Kouassi, E., Mougoue, M., & Kymn, K. O. (2004). Causality tests of the relationship between the twin deficits. *Empirical Economics, 29*(3), 503–525.
Lopez, L., & Weber, S. (2017). Testing for Granger causality in panel data. *The Stata Journal, 17*(4), 972–984.
Lütkepohl, H. (2005). *New introduction to multiple time series analysis*. Springer Science & Business Media.
Mansouri, B. (2001). *Fiscal deficits, public absorption, and external imbalances: An empirical examination of the Moroccan case*. Economic Research Forum.
Mukhtar, T., Zakaria, M., & Mehboob, A. (2007). An empirical investigation for the twin deficits hypothesis in Pakistan. *Journal of Economic Cooperation, 24*(4), 63–80.
Mumtaz, K., & Munir, K. (2016). *Dynamics of Twin Deficits in South Asian Countries*.
Mundell, R. A. (1963). Capital mobility and stabilisation policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science, 29*(4), 475–485.
Munir, K., & Mehmood, N. R. (2018). Exploring the channels and impact of debt on economic growth: Evidence from South Asia. *South Asia Economic Journal, 19*(2), 171–191.
Nickel, C., & Tudyka, A. (2014). Fiscal stimulus in times of high debt: Reconsidering multipliers and twin deficits. *Journal of Money, Credit and Banking, 46*(7), 1313–1344.
Nickel, C., & Vansteenkiste, I. (2008). *Fiscal policies, the current account and Ricardian equivalence. (ECB Working Paper no. 935)*. Frankfurt am Main: European Central Bank.
Ogbonna, B. C. (2014). Investigating for twin deficits hypothesis in South Africa. *Developing Country Studies, 4*(10), 142–162.
Perry, N. (2014). *Debt and deficits: Economic and political issues*. Global Development and Environment Institute, Tufts University.
Pesaran, H. H., & Shin, Y. (1998). Generalised impulse response analysis in linear multivariate models. *Economics Letters, 58*(1), 17–29.
Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265–312.
Phillips, P. C., & Durlauf, S. N. (1986). Multiple time series regression with integrated processes. *The Review of Economic Studies, 53*(4), 473–495.
Premaratne, S. P., Ravinthirakumaran, N., & Kesavarajah, M. (2011). Twin deficits in Sri Lanka: An econometric analysis. *Sri Lanka Economic Journal, 12*(1–2), 31–63.
Ratha, A. (2012). Twin deficits or distant cousins? Evidence from India. *South Asia Economic Journal, 13*(1), 51–68.
Ravinthirakumaran, N., Selvanathan, S., & Selvanathan, E. A. (2016). The twin deficits hypothesis in the SAARC countries: An empirical investigation. *Journal of the Asia Pacific Economy, 21*(1), 77–90.
Saleh, A. S., Nair, M., & Agalewatte, T. (2005). The twin deficits problem in Sri Lanka: An econometric analysis. *South Asia Economic Journal, 6*(2), 221–239.
Siddiqui, R., & Malik, A. (2001). Debt and economic growth in South. *The Pakistan Development Review, 40*, 677–688.
Soukiazis, E., Antunes, M., & Kostakis, I. (2017). The Greek economy under the twin-deficit pressure: A demand orientated growth approach. *International Review of Applied Economics, 32*(2), 215–236.
Suresh, K. G., & Gautam, V. (2015). Relevance of twin deficit hypotheses: An econometric analysis with reference to India. *Theoretical Economics Letters, 5*(02), 304.
Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autogression with possibly integrated processes. *Journal of Econometrics, 66*, 225–250.
Trehan, B., & Walsh, C. E. (1991). Testing intertemporal budget constraints: Theory and applications to US federal budget and current account deficits. *Journal of Money, Credit, and Banking, 23*(2), 206–223.
Wickens, M. R., & Uctum, M. (1993). The sustainability of current account deficits: A test of the US intertemporal budget constraint. *Journal of Economic Dynamics and Control, 17*(3), 423–441.
Winner, L. E. (1993). The relationship of the current account balance and the budget balance. *The American Economist, 37*(2), 78–84.
World Bank, (2019). *South Asia Economic Focus Fall 2019*.