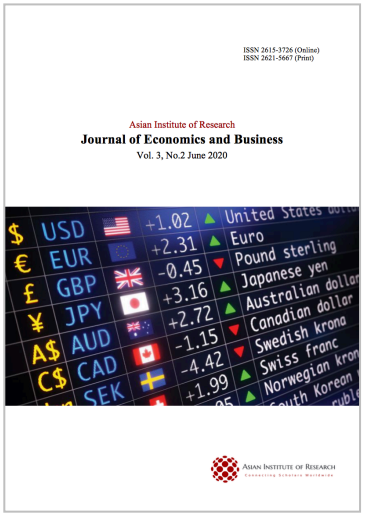

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Study on the Relationship Between the Current Account and the State Budget

Le Duc Hoang[1], Dang Ngoc Phuong Uyen[1]

[1] National Economics University, Vietnam

Abstract
This paper investigates the relationship between current account balance and budget balance in Vietnam using quarterly data from 1997Q1 to 2018Q1. Other explanatory variables are interest rate of government bonds and real exchange rate. The result reveals that all four variables, current account balance, budget balance, government bonds yield and real exchange rate, are co-integrated and there is one co-integrated vector relationship. Otherwises, using the Granger causality test, it is shown that, budget balance has a directional causality relationship with current account balance which means that the research supports Keynesian's view and there are twin deficits happened in Vietnam during 1997 to 2018. In addition, there are two other directional relationships from real exchange rate to current account and current account to interest rate of government bonds. Furthermore, there are also other factors which can cause the two deficits individually.

Keywords: Current Account Balance, Budget Balance, Twin Deficits

1.Introduction

Many studies show the twin deficits occurring in many countries around the world and it has always been a concern for government. The twin deficits phenomenon indicates that an increase in fiscal deficit of one country may lead to its current account deficit. According to Bluedorn and Leigh (2011), many actions have been made in order to stabilize the macro economy including doing restructure and reducing large amount of deficit. However, the government's budget and current account are still unstable and governments in developing countries find it hard to manage. By analyzing the twin deficits problem, governments can take actions in changing and improving economic performances within their countries.

The most two famous theories are always mentioned when it comes to the relationship between fiscal deficit and current account deficit are Keynesian's view and Ricardian Equivalence's Theory. The Keynesian view (1936) supports positive relationship between the two deficits, however, Ricardian Equivalence Theory declines any relationship between them. Many studies have tried to prove that the Keynesian view is true and there is a one-way relationship between fiscal deficit toward current account deficit. Other studies also prove that Ricardian Equivalence Theory is correct. However, the "twin deficits", therefore, is still a controversial topic.

This study examines whether there is twin deficits phenomenon in Vietnam using quarterly data from 1997Q1 to 2018Q1 or not. The main goal of this study is to explain relationship between the two deficits and to be aware of its consequences.

2. Literature Review

Fiscal deficit is known as budget deficit, which refer a situation when a government spends more than its revenue in a year, creating a shortfall which makes such government borrow money to pay for budget deficits, which adds to its national debt, this can be seen as a measurement of a country's financial health. Different from budget deficit, the current account deficit is a country's measurement of trade which refers to the excessive importation over the exportation of goods and services. The current account stands for the international trade of a country and it also consists of the balance of payment (BOP) of a country along with the capital account.

According to Cavallo (2005), budget deficit presents as a decline in national savings which consists of private saving and fiscal balance by the government. Therefore, when the national savings are lower than the investment domestically, the country cannot use its savings to finance domestic investments, which leads to borrowing money from other countries. Therefore, the current account will fall into deficit.

The increase in government spending is what the policy relies on. When there is a growth in a budget deficit, people expect that the government will increase taxes in the near future in order to shorten the fiscal gap and decrease the government debt. Therefore, people have to consider saving to generate wealth and accumulation. There are two paths for people to shield from tax increase, one is spending less and saving up, and the other is an increase in the work hours to boost future income. With the second path, when people work for more extra hours, they will be more productive to the capital stock which can attract more private investment. The growing private investment may lead to an increase in governments savings, and there will be deterioration of the current account balance in response to the fall in government fiscal balance.

Many authors are trying to explain the phenomenon of twin deficits and the two popular theories mentioning about the possible connection between budget deficit and current account deficit are Keynesian view and Ricardian Equivalence Theory. According to Keynesian (1936), the fiscal deficit has a one-way relationship with the current account deficit. It can be explained that if there is an increase in fiscal deficit, it will also increase government revenue and spending, which can cause a further downfall in current account deficit by enhancing imports. On the other hand, the Ricardian Equivalence Theory declines any relationship between the two deficits. According to Barro (1989), any changes in either tax or fiscal deficit do not affect the real interest rate, investments and the current account deficit. The studies have also shown that even the current tax cut or the rise in government spending does not affect the present consumption and investment. Researchers analyzed that with the current tax cut, there might be a possible burden in the future. Therefore, the Ricardian Equivalence Theory disagreed on any relationship from the two deficits. In many foreign countries, a number of studies have been carried out in order to analyze the connection between budget deficit and current account deficit. Some article stated that the relationship ceases to exist, just as same with the Keynesian view, and it may continue for short and long period of time. However, some others disagreed and found out that there is no connection between the two, supporting the Ricardian Equivalence Theory.

According to Keynesian school, the budget deficit significantly affects the current account deficit. Studies which support this theory include *Volcker (1987), Kearney and Monadjemi (1990), Smyth et al (1995) and Fleming (1962), which shows that higher government deficits can increase the trade deficit also through other factors. In contrast, lots of articles improved on the* Ricardian Equivalence Theory which are Evans and Hasan (1994), Miller and Russek (1989) and Wheeler (1999).

There are numerous of studies analyzing the "twin deficits" phenomenon in different countries of the world. Vamvoukas (1999) investigated the twin deficits in Greece and analyzed the link between trade deficit and budget deficit from 1948 to 1994. The results showed that in both the long and short period of time, there is a one-way relationship between budget deficit towards trade deficit. Holmes (2011) shows similar results of supporting the

Keynesian view, using a data from USA from 1947 to 2009 and examined the relationship of "twin deficits" through threshold co-integration view. Another article from Pattichis (2004) also supported the Keynesian view with the topic of relationship between budget deficit and foreign trade deficit which happened in Lebanon and the author used data from 1982 to 1997. Even though the same results happened to Saleh, Nair and Agalewatte (2005) when they researched about the advantages from financial spread on the imbalance of current account in Sir Lanka with 1970-2003 data, they realized there were no long term relationship between the twin deficits but there is a causality relationship from fiscal balance to current account. In addition to this section of one-way relationship from budget deficit to current account deficit, Chowdhury and Saleh (2007) analyzed the Keynesian view in the presence of trade liberalization in Sir Lanka. A different approach applied was ARDL- autoregressive distributive lagged, the result shows a link between four factors including current account, budget balance, savings, investment gap and also the trade openness, with a highlight of positive effect on current account deficit by trade openness but it is statistically insignificant. From these researches, the budget deficit has a one-way causality towards current account deficit. Nevertheless, there are articles which shows that the current account deficit also affects the budget deficit.

According to *Kalou and Paleologou (2012)*, the current account is a causative factor effect on budget balance. Similarly, *Baharumshah, İsmail and Lau (2009) said in their studies that budget deficit is a crucial element when it comes to determine current account deficit in three countries of Malaysia, Philippines and Thailand. In addition to the research of validity of twin deficits in ASEAN, the results showed that the current account deficit will affect the budget deficit, on the other hand, there are no data showing that budget deficit is a causative element to the current account balance. Onafowora and Owoye (2006) stated that while examining the concept in Nigeria, a positive link between both of the deficits and how they will affect each other for periods of both short term and long term. Meanwhile,* Salvatore (2006) *shows that there exist relation between budget and current account deficits in the case of USA, Japan,* Germany, Britain, France, Italy and Canada from 1973 to 2005, however, the author states that the relation might be lag.

Some researchers found different results occurring when they tested with different methods in the same country. Ganchev (2010) did an article about the case of Bulgaria that had the twin deficits. By using theoretical foundations and alternative explanations, the author decided to conduct three economic approaches which are Granger causality test, vector autoregressive and vector error correction on the Bulgaria data. The result showed that, with Granger causality test, there is a two-way relationship which happened between current account deficit and budget deficit. In contrast, the vector autoregressive and error correction denied this hypothesis of twin deficits that happened in short term but forecasted that there might be a long-term relationship in the future. Turkey is also a country that has three different researches using different methods to test the hypothesis. The first research is Akbostancı and Tunç (2002)*, they tested the twin deficits in Turkey using the data from 1987 to 2001 and confirmed that there is a positive connection between the two by using error correction model. Secondly, the article from* Ümit and Yıldırım (2008) tested the validity of the hypothesis by using VAR method from 1987 to 2005, the result confirmed the validity. Finally, Kılavuz and Dumrul (2012) also tried three methods which are border test, VAR analysis and Granger causality test. The authors found out that there is a link between the two but not in a long run.

While some studies only focused on twin deficits on one single country, Khalid and Guan (1999) investigated this phenomenon through the comparisons of different countries. They conducted a test for five different countries in the periods of 1952-1994, the result did not agree on the long-term relationship between budget deficit and current account deficit in developed countries. Mumtaz and Munir (2016) *also investigated multiple countries* by using bound testing approach with ARDL model and testing Granger causality from VAR*, namely the South Asian Countries such as* Bangladesh, India, Pakistan and Sri Lanka with an annual time series data from 1981 to 2014. The main results of the research stated that there is no long-term relationship of the twin deficits. India, Pakistan and Sir Lanka showed no proof of any relationship among budget deficit, current account deficit and private saving investment. However, Bangladesh confirmed a bidirectional connection in short term from budget deficit and current account deficit. The report supported Ricardian Equivalence hypothesis for Pakistan and India. Moreover, when it comes to Feldstein Horioka Puzzle, it rejected these two countries due to high capital mobility and financial integration.

Alongside with twin deficits, there are studies that mentions this hypothesis in order to make a clear statement about fiscal deficit, Nguyen et al (2011) researched about fiscal problems which happened in Vietnam. The authors also examined the causes which lead to current account and budget deficit. Same goes for Tung (2018), the article is about how budget deficit influences economic growth in the case of Vietnam. It is concluded that the fiscal deficit has negative effect on economic growth.

Throughout some of the studies, the 'twin deficits' is confirmed to be happening in Vietnam at different time set. According to Hien Nguyen (2017), Vietnam, as one of the developing countries, encountered problems with BOP's structure from 2000 to 2016, which is the expansion of the current account deficit and the financial account surplus. However, due to the help of Samsung joining Vietnam's manufacturing sector, the current account became surplus in 2012 until date which resolved the BOP problems.

Different from other studies in Vietnam, this paper is going to be analyzed and only the twin deficits in Vietnam from the period of 1997 to 2018. This is a familiar concept, compared to foreign studies, which tests the relationship of current account and budget balance, moreover, the causality link between them. This research will use the Johansen model (1991) to test the co-integration and Granger causality test for the effect of budget deficit on current account and vice versa.

3. Methodology and Data

3.1. Data

The data in this study are collected from different sources which are the publication of the World Bank, Bloomberg, International Financial Statistics (IMF) and the Ministry of Planning and Investment of Vietnam. Moreover, the dataset is a quarterly time series data of Vietnam from 1997q1 to 2018q1. The variables included in the data are budget balance (%GDP), current account balance (%GDP), real effective exchange rate (Index) and interest rate of government bonds (%). The data will be analyzed using Stata 14.

3.2. Research methodology

This paper is going to estimate a functional relationship with all the variables

$$CA = f(BB, ER, IR) \quad (1)$$

From the research of Erdogan and Yildirim (2014), they came up with *equation (2) in order to estimate and test the twin deficits*.

$$CA = \alpha_0 + \alpha_1 BB + \alpha_2 ER + \alpha_3 IR + \mu_t \quad (2)$$

Where CA is current account balance (as percentage of GDP), BB is the budget balance (as percentage of GDP). The real exchange rate and interest rate of government bonds are the two factors that impact on twin deficits (Erdogan and Yildirm, 2014). ER is the real exchange rate (Index), according to Kim and Roubini (2008), the shocks of budget deficit shocks will increase the current account balance in the short-run and lead to the depreciation of real exchange rate. Therefore, this variable is also used to test twin deficits in Vietnam. IR is the interest rate of government bonds (%), depends on whether the budget balance is deficit or surplus, the interest rate of government bonds also increases or decreases to attract more funds from investors abroad. μ_t is the error term and $\alpha_{0...}\alpha_3$ is the parameters regression coefficients.

Kim and Roubini (2004) found out that when managing the effects of business cycle on current account and budget balance, there is a positive impact from budget deficit to current account in short term, despite a grow in government spending and fall in taxes which increased deficit. The explanation for this discovery is when there is a rise in budget deficit, private saving is also increased. Simultaneously, the interest rate grows also due to a rise in government borrowing, however, with higher interest rate, it can weaken the domestic investment. Therefore, Kim and Roubini (2004) combined the reason and stated that with the increase in private savings, the decrease in

domestic investment are enough to make up for the reduction of government savings in short term, also leading to a contribution for the improvement of current account.

In addition, when the budget deficit gets higher, as the result, the interest rate is also higher which can lead to the imbalance of exchange rate. This can cause the domestic products to increase in price than the imported products and with these changes, the sales of domestic products will decrease while the imported goods increase in sales as a result to a decline in trade balance's quality.

Hypothesis

Based on literature review, we will test Hypothesis:

H_0: there are no twin deficits happened in Vietnam

H_1: there are twin deficits happened in Vietnam

In this research, a test from Peseran et al. (2001) is also used to analyze the stationary and co-integration. Unit root test is going to be used to analyze the stationarity between the series and the *Augmented Dickey Fuller (ADF) to avoid spurious problems. Similar to Johansen approach, test the* co-integration *relationship between the series will be applied. Finally, the causal relationship from one variable to another will be tested by the Granger Causality test.*

Unit root test

With a time-series data, a regression analysis may create a questionable result when the variables are non-stationary. Therefore, the stationarity of the variables is crucial in order to run the co-integration test and causality test. This means that by using the unit root test, the variables may be non-stationary and cause spurious problem. When this happens, the difference in series can be presented to test the unit root again for stationary. With this technique, the information or observation from series may get lost, which may create a shortage in data for future test of co-integration. The test which is going to be used is *Augmented Dickey Fuller (ADF).*

Co-integration Test

After testing for stationary, the Johansen approach is used to continue the next step in analyzing the co-integration. This approach was conducted by Johansen (1991) in his article about the co-integration vectors which stated that between variables there might be more than a single co-integration vector.

The Johansen approach follows the similar principles with Engle-Granger which is also a two-step co-integration test. It is used to test for stable long-run relationship which happens between variables. The approach consists of two statistics which are the likelihood ratio test that relied on the maximum eigenvalue and the test that relied on the trace, these are for the stochastic matrix. With these results, the paper can identify the amount of co-integrated vectors. The π is the long run coefficient which can help test from its examination. By checking the rank of π, the analyst of co-integration is calculated. In the Johansen approach, the first step is to do a calculation of Trace Statistics and also the Maximum Eigenvalue statistics in Stata and then continue with a comparison to suitable critical values.

Moreover, the Johansen approach has more benefits than the Engle- Granger. From the VAR based method, it is not important to distinguish the explanatory variables as endogenous or exogenous, and also the co-integration vectors should be having restrictions. This is why it is different and more upgrade than Engle-Granger. By using the Johansen approach, the paper can further use the Granger Causality test in order to determine if explanatory variables and dependent variables have the short run causality relationship.

Granger causality test

In addition, this study wants to conduct a cause-effect method to the variables which is called Granger causality test. The test was developed by Granger in 1960s. With the concept of causality, the Granger test will also help with predicting the future of the variables that are caused by each other. Despite the past, the value of one variable can be information for predicting the future development, but with Granger causality. The past value of the first variable may predict future development of the other variable which is above and beyond what the past of that variable can offer. Moreover, with the Granger test, it can analyze the short run causality between variables and in order to do this, the lag selection for the error correction model should also be used and tested on its significance.

4. Results

4.1. Stationary unit root test

Before testing the unit root test, the model should be tested for statistically significance and whether the independent variables (budget balance, interest rate of government bonds and real exchange rate) can predict the dependent variable (current account balance).

Table 1: Regression table

Current account	***Coefficient***	***Standard Error***	***t-statistic***	***Probability***
Budget Balance	0.2676143	0.1236565	2.16	0.033
Interest Rate of government bonds	-0.5548034	0.2786083	-1.99	0.050
Real Exchange Rate	-0.2582905	0.0782063	-3.30	0.001
Constant	29.1429	8.326216	3.50	0.001
Number of observations = 85 *F (3, 81) = 4.57* *Prob > F = 0.0052*		*R-squared = 0.1448* *Adj R-squared = 0.1131* *Root MSE = 7.3826*		

According to table 1, there are 85 observations from the quarterly data of Vietnam 1997-2018. The F-value of the model is 4.57 and the p-value connected with the F-value is 0.0052 which is smaller than the expected alpha value of 0.05. This means that current account balance is predicted by independent variables which are budget balance, government bond yield and real exchange rate. Moreover, the independent variables have predicted 14.48% of the variance in current account. From the t-statistic and p-value associated with t-value, all the variables are statistically significant because the p-values are smaller than 0.05. Moving on to the coefficient, with budget balance, the coefficient is 0.2676143, this means that each unit rises in budget balance, a 0.2676143 unit rises in current account. However, every unit of government bond yields increases, there is 0.5548034 unit decreases in current account when the coefficient is -0.5548034. Same goes for real exchange rate, each unit of real exchange rate increases, current account decreases by 0.2582905 because the coefficient is -0.2582905. All of the coefficient interpretation happened when all other variables are hold constant. The model is now ready to be used for further tests.

The unit root test is performed through the ADF- Augmented Dickey Fuller test which analyzed whether the variables from this model are stationary. Theoretically, the test statistics will be compared to the critical values which will be determined through levels of significance. If the result shows a greater value of test statistics than critical values, the null hypothesis which states all variables are non-stationary is rejected and vice versa.

Table 2: Unit root from Augmented Dickey-Fuller test for stationary

Variables	***Level of significance***	***1%***	***5%***	***10%***	***Test statistics***
Current Account Balance (CA)	At level	-3.535	-2.904	-2.587	***-3.739***
Budget Balance (BB)	At level	-3.535	-2.904	-2.587	***-1.932***
	At first difference	-3.537	-2.905	-2.588	***-5.498***
Real Exchange Rate (ER)	At level	-3.535	-2.904	-2.587	***-1.914***
	At first difference	-3.537	-2.905	-2.588	***-6.516***
Interest rate of Government Bonds (IR)	At level	-3.535	-2.904	-2.587	***-1.112***
	At first difference	-3.537	-2.905	-2.588	***-4.704***
Source: Researched from data calculation in STATA by the author					

Table 2 shows that the variables are tested for stationary at level and all of them, except for current account balance, are non-stationary because the absolute values of test statistics are smaller than absolute of critical values from all levels of significance (1%, 5%, 10%). However, after changing to first difference, the variables are stationary due to high absolute test statistics values. The current account balance is stationary at level and also the rest of variables in this model are integration of order one I (1).

4.2. Johansen Co-integration test

Before testing the Johansen test, the project should identify the lag order selection.

Table 3: Lag order selection

Lag	***Log- Likelihood***	***LR***	***FPE***	***AIC***	***HQIC***	***SBIC***
0	-1019.9		2.1e+06	25.9216	25.9697	26.0416
1	-750.145	539.52	3451.32	19.4973	19.7377*	20.0972*
2	-733.334	33.622	3392.34	19.4768	19.9094	20.5566
3	-713.136	40.396	3075.14	19.3705	19.9954	20.9302
4	-695.768	34.737*	3016.1*	19.3359*	20.153	21.3754
5	-684.517	22.502	3487.51	19.4561	20.4655	21.9755
6	-672.418	24.198	3997.24	19.5549	20.7565	22.5542
Source: from researched data calculation in STATA by the author * criterion selected lag order indication						

In the lag order selection table, "*" indicates the methods suggests the optimal lag order at level of significance of 5%. From Hannan-Quinn information criterion (HQIC) and Schwarz Bayesian information criterion (SBIC) methods, they support using one lag. However, the Akaike information criterion (AIC) and Final Prediction Error (FPE) prefer using lag of four. In conclusion, one lag is chosen for this model.

With the Johansen test, the null hypothesis happens when there is no co-integration relationship and the alternative hypothesis is the opposite, there is one or more co-integration vectors relationships.

Table 4: Co-integration from Johansen (1991) tests

Maximum rank	***LL***	***Eigen value***	***Trace statistic***	***Critical value 5%***
0	-864.33932		90.6546	47.21
1	-829.88757	0.55969	21.7511*1*5	29.68
2	-823.65651	0.13788	9.2889	15.41
3	-819.73368	0.08917	1.4433	3.76
4	-819.01204	0.01704		

Maximum rank	*LL*	*Eigen value*	*Max statistic*	*Critical value 5%*
0	-864.33932		68.9035	27.07
1	-829.88757	0.55969	12.4621	20.97
2	-823.65651	0.13788	7.8457	14.07
3	-819.73368	0.08917	1.4433	3.76
4	-819.01204	0.01704		
Source: data researched from calculation in STATA by the author According to Johansen (1991), * presents how many co-integrating equations were selected				

After choosing number of lags, the paper continues with the Johansen Co-integration test for relationship. In the statistics table above, the trace statistic presents that when r=0, the value is 90.6546 which is higher than the critical value of 47.21 at 5% level, therefore, the null hypothesis of no co-integration is accepted. However, at r=1, the trace statistic (21.7511*1*5) is smaller than its critical value (29.68) which means that the alternative hypothesis has failed to rejected and there is one co-integrating vector relationship in the model. The trace and max statistics have rejected the null hypothesis at 5% level when r=1.

4.3. Granger causality test

Finally, the research continues with the Granger causality test between variables.

Table 5: Granger causality test

Equation / **Excluded**	**Value**	**CA**	**BB**	**IR**	**ER**
CA	*Chi-squared*	-	0.1494	30.851	6.9e-05
	P-value	-	**0.699**	**0.000**	**0.993**
BB	*Chi-squared*	8.2088	-	0.0142	2.9108
	P-value	**0.004**	**-**	**0.905**	**0.088**
IR	*Chi-squared*	0.0730	0.3715	-	0.6538
	P-value	**0.787**	**0.542**	**-**	**0.419**
ER	*Chi-squared*	10.958	0.0007	1.0609	-
	P-value	**0.001**	**0.978**	**0.303**	**-**
All	*Chi-squared*	13.235	0.5301	33.045	3.8411
	P-value	**0.004**	**0.912**	**0.000**	**0.279**
Source: from researched data calculation in STATA by the author, p-value compared with 5% level					

By applying the Granger causality test, the orders of all variables are arranged with chi-squared statistics above and after that is p-value in order to see which variable is Granger causal to another variable. The result from table 5 indicates that at 5% level, there is a directional causality exists which shows that budget balance Granger causes current account balance because the p-value is smaller than 0.05 (0.004 < 0.05). Same goes for two other directional relationships which are current account Granger causes interest rate of government bonds (0.000 < 0.05), and real exchange rate Granger causes current account balance (0.001 < 0.05). However, there is no bi-directional causality relationship between interest rate of government bonds and real exchange rate; budget balance and interest rate; budget balance and real exchange rate.

The empirical results show that **there is no causality relationship between fiscal balance and current account balance**.

5. Conclusion

The main purpose of this paper is to investigate the twin deficits happened in Vietnam with quarterly data from 1997 to 2018. This study used the current account balance, budget balance, interest rate of government bonds and

real exchange rate as variables to test the co-integration and causality relationship by using Johansen (1991) and Granger Causality test.

Before using the two test above, all four variables were tested for the stationary from the Augmented Dickey Fuller test. The result shows that the current account balance is stationary at level while the three remained variables are non-stationary at level but stationary at first difference. Furthermore, with the Johansen co-integration test, from both the trace and maximum tests, there is one co-integration relationship between variables at level of significance 5%. Finally, the Granger causality test shows that the two main variables from the twin deficits are not on each other by Granger, however, there are three directional relationships which are from current account to interest rate of government bonds and from real exchange rate to both current account and budget balance.

With the result of no causality relationship between the current account and budget balance which means the null hypothesis is accepted, there are also many other factors which can cause them to deficit and the suggested solutions are presented to minimize the problems that current account deficit and budget deficit can have effect on Vietnam's economy.

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Appendix

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. reg currentaccountgdp budgetbalancegdp interestrateofgovbond realexchangerateindex
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Source	SS	df	MS	Number of obs	=	85
				F(3, 81)	=	4.57
Model	747.607407	3	249.202469	Prob > F	=	0.0052
Residual	4414.70618	81	54.5025455	R-squared	=	0.1448
				Adj R-squared	=	0.1131
Total	5162.31359	84	61.4561142	Root MSE	=	7.3826

currentaccountgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
budgetbalancegdp	.2676143	.1236565	2.16	0.033	.0215766	.5136521
interestrateofgovbond	-.5548034	.2786083	-1.99	0.050	-1.109146	-.0004604
realexchangerateindex	-.2582905	.0782063	-3.30	0.001	-.4138964	-.1026846
_cons	29.1429	8.326216	3.50	0.001	12.57634	45.70946

Augmented Dickey-Fuller test for unit root — Number of obs = 82

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.739	-3.535	-2.904	-2.587

MacKinnon approximate p-value for Z(t) = 0.0036

D.currentaccountgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
currentaccountgdp						
L1.	-.4830479	.1292006	-3.74	0.000	-.7402665	-.2258293
LD.	-.1995221	.1346435	-1.48	0.142	-.4675767	.0685324
L2D.	.1366741	.1083591	1.26	0.211	-.0790523	.3524004
_cons	.0221204	.7594526	0.03	0.977	-1.489834	1.534074

Unit root test of current account at level

Augmented Dickey-Fuller test for unit root — Number of obs = 82

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.932	-3.535	-2.904	-2.587

MacKinnon approximate p-value for Z(t) = 0.3171

D.budgetbalancegdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
budgetbalancegdp						
L1.	-.0780528	.0403979	-1.93	0.057	-.1584788	.0023731
LD.	-.1456198	.1140213	-1.28	0.205	-.3726189	.0813792
L2D.	-.0366679	.1134791	-0.32	0.747	-.2625874	.1892517
_cons	-.1122974	.2929362	-0.38	0.703	-.6954887	.4708939

Unit root test of budget balance at level

Augmented Dickey-Fuller test for unit root — Number of obs = 81

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-5.498	-3.537	-2.905	-2.588

MacKinnon approximate p-value for Z(t) = 0.0000

D.budget	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
budget						
L1.	-1.242379	.2259872	-5.50	0.000	-1.692377	-.7923805
LD.	.0651033	.1790552	0.36	0.717	-.2914411	.4216476
L2D.	.0087508	.1167989	0.07	0.940	-.2238257	.2413272
_cons	-.2287776	.2984086	-0.77	0.446	-.822985	.3654299

Unit root test of budget balance at first difference

Augmented Dickey-Fuller test for unit root — Number of obs = 82

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.914	-3.535	-2.904	-2.587

MacKinnon approximate p-value for Z(t) = 0.3256

D. interestrateofgovbond	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
interestrateofgovbond						
L1.	-.1328165	.0694022	-1.91	0.059	-.2709858	.0053527
LD.	-.0541576	.114125	-0.47	0.636	-.2813629	.1730478
L2D.	-.1723172	.1121428	-1.54	0.128	-.3955765	.050942
_cons	.9448444	.5886521	1.61	0.113	-.227072	2.116761

Unit root test of interest rate of government bonds at level

Augmented Dickey-Fuller test for unit root — Number of obs = 81

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-6.516	-3.537	-2.905	-2.588

MacKinnon approximate p-value for Z(t) = 0.0000

D.inter	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inter						
L1.	-1.466009	.2250032	-6.52	0.000	-1.914048	-1.017971
LD.	.3158517	.1687143	1.87	0.065	-.0201013	.6518047
L2D.	.0761313	.1131847	0.67	0.503	-.1492482	.3015109
_cons	-.1151509	.1910596	-0.60	0.548	-.495599	.2652973

Unit root test of interest rate of government bonds at first difference

Augmented Dickey-Fuller test for unit root — Number of obs = 82

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.112	-3.535	-2.904	-2.587

MacKinnon approximate p-value for Z(t) = 0.7103

D. realexchangerateindex	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
realexchangerateindex						
L1.	-.0247116	.0222251	-1.11	0.270	-.0689583	.0195352
LD.	.420971	.1071605	3.93	0.000	.2076308	.6343112
L2D.	-.0484554	.1019876	-0.48	0.636	-.2514971	.1545863
_cons	2.343116	2.196411	1.07	0.289	-2.029602	6.715835

Unit root test of real exchange rate at level

Augmented Dickey-Fuller test for unit root — Number of obs = 81

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.704	-3.537	-2.905	-2.588

MacKinnon approximate p-value for Z(t) = 0.0001

D.rexchange	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rexchange						
L1.	-.6758621	.1436682	-4.70	0.000	-.961942	-.3897821
LD.	.0444437	.128626	0.35	0.731	-.2116835	.3005709
L2D.	.0424848	.1011677	0.42	0.676	-.1589659	.2439355
_cons	-.0514753	.261268	-0.20	0.844	-.5717264	.4687757

Unit root test of real exchange rate at first difference

Selection-order criteria
Sample: 1998q3 - 2018q1 — Number of obs = 79

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1019.9				2.1e+06	25.9216	25.9697	26.0416
1	-750.145	539.52	16	0.000	3451.32	19.4973	19.7377*	20.0972*
2	-733.334	33.622	16	0.006	3392.34	19.4768	19.9094	20.5566
3	-713.136	40.396	16	0.001	3075.14	19.3705	19.9954	20.9302
4	-695.768	34.737*	16	0.004	3016.1*	19.3359*	20.153	21.3754
5	-684.517	22.502	16	0.128	3487.51	19.4561	20.4655	21.9755
6	-672.418	24.198	16	0.085	3997.24	19.5549	20.7565	22.5542

Endogenous: currentaccountgdp budgetbalancegdp interestrateofgovbond realexchangerateindex
Exogenous: _cons

Lag order selection

Johansen tests for cointegration

Trend: constant Number of obs = 84
Sample: 1997q2 - 2018q1 Lags = 1

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value	1% critical value
0	4	-864.33932		90.6546	47.21	54.46
1	11	-829.88757	0.55969	21.7511*1*5	29.68	35.65
2	16	-823.65651	0.13788	9.2889	15.41	20.04
3	19	-819.73368	0.08917	1.4433	3.76	6.65
4	20	-819.01204	0.01704			

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value	1% critical value
0	4	-864.33932		68.9035	27.07	32.24
1	11	-829.88757	0.55969	12.4621	20.97	25.52
2	16	-823.65651	0.13788	7.8457	14.07	18.63
3	19	-819.73368	0.08917	1.4433	3.76	6.65
4	20	-819.01204	0.01704			

Johansen test for co-integration

Granger causality test

vargranger

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
currentaccountgdp	budgetbalancegdp	8.2088	1	0.004
currentaccountgdp	interestrateofg~d	.07305	1	0.787
currentaccountgdp	realexchangerat~x	10.958	1	0.001
currentaccountgdp	ALL	13.235	3	0.004
budgetbalancegdp	currentaccountgdp	.14941	1	0.699
budgetbalancegdp	interestrateofg~d	.37155	1	0.542
budgetbalancegdp	realexchangerat~x	.00075	1	0.978
budgetbalancegdp	ALL	.53011	3	0.912
interestrateofg~d	currentaccountgdp	30.851	1	0.000
interestrateofg~d	budgetbalancegdp	.01423	1	0.905
interestrateofg~d	realexchangerat~x	1.0609	1	0.303
interestrateofg~d	ALL	33.045	3	0.000
realexchangerat~x	currentaccountgdp	6.9e-05	1	0.993
realexchangerat~x	budgetbalancegdp	2.9108	1	0.088
realexchangerat~x	interestrateofg~d	.6538	1	0.419
realexchangerat~x	ALL	3.8411	3	0.279