Budget Balance and Trade Balance: Kin or Strangers
A Case Study of Taiwan

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Abstract

In line with deterioration in Taiwan's budget deficit, the trade surplus has also decreased. It is the ideal time to investigate the relationship between budget balances and trade balances. Unit root tests, cointegration tests, Granger causality tests and the VARs models are used to test the Keynesian proposition and Ricardian equivalence. The main findings are that the Keynesian proposition is supported by the data, i.e. the budget balance and the trade balance are kin for Taiwan. There is no support for Ricardian equivalence. This research casts a warning to the Taiwanese government that without seriously concern about a control of the budget deficit the Taiwanese economy is at risk of losing its competitiveness in international markets which is an essential factor to keep its economy growing. Two aspects should be considered. One is to increase the income and the other is to reduce the spending. In terms of the increase in income, the Taiwanese government needs to scrutinize the current structure of taxation. In terms of a reduction of expenditure, a probe falls on the defense expenditure, diplomatic expenditure on international recognition and the interior expenditure.

Introduction

The budget balance of the Taiwanese government turned into an ongoing deficit from 1989. In 1988 there was a surplus of NT$25.95 billion, plummeting to a deficit of NT$288.58 billion in 1989, equivalent to 7.33% of GDP. In 2001 there was a deficit of NT$635.13 billion, equivalent to 6.68% of GDP. The trade balance of Taiwan has followed its historical record of surpluses, but compared to the second half of 1980s, it has been fluctuating within a relatively low range in the 1990s and then large surpluses in 2001 and 2002. Taiwan has been recognized as an outstanding economy since the middle of 1980s. During the second half of the 1980s the Taiwanese government ran relatively small budget deficits (and sometimes the budget was in surplus) and accumulated large foreign reserves through its successful outward trading. 'Twin deficits', an issue used to catch economists' attention in a range of countries, seemed not to have been a focus of the research on Taiwanese economy. The two facts alluded to above, i.e. a deterioration of budget deficits and less well performed trade balances, indicates it is desirable to investigate the linkage between the budget balance and the trade balance for the case of Taiwan.

The conventional wisdom of the 'twin deficits' is that whether the relationship is weak or strong, a relationship exists, and that budget deficits induce a negative change in trade balances (Akhtar 1994, Bachman 1992, Bernheim 1988, Enders and Lee 1990, Hung and Charette 1997, Kasa 1994, Leachman and Francis 2002, Miller and Russek 1989, Pattichis 2004, Rosenswieg and Tallman 1993, Sachs and Roubini 1987 and Vamvoukas 1997). The economic reasoning provided by Bernheim (1988) is that government debts decrease the domestic supply of funds available to finance new investment, which leads to an inflow of funds from overseas. An offsetting adjustment to the current account entails trade deficits. Abel (1990a, b) and Lau et al (2004) suggest that interest rates and exchange rates are the primary transmission channels. This view is understood as the 'Keynesian proposition'. Other research, for example Tufte (1996), criticizes the methodology used in Bachman (1992) and refutes his findings. Fisher (1995) argues against the accuracy of the traditional measure of the current account and casts doubt on the causal connections between the two deficits. Fidrmuc (2003), Kouassi et al (2004) and Kulkarni and Erickson (2001) investigate a group of countries and find a mixture of results. Research supports a failure of Keynesian proposition can also been found in Dewald and Ulan (1990) and Kaufmann et al (2002). An alternative explanation is provided by the Ricardian equivalence hypothesis when research fails to find a positive relationship between the budget deficit and the trade deficit. The Ricardian equivalence hypothesis bails out the cause of trade deficits via budget deficits, by justifying households' reaction to government debts as being to increase their savings to prepare for a future of higher taxation. Seater (1993) conducted a comprehensive review of both theoretical and empirical studies to support the explanation using Ricardian equivalence.

This paper re-investigates the issue of 'twin deficits' and employs time series data for econometric testing and modelling to explore whether the Keynesian proposition or Ricardian equivalence is applicable to Taiwan over the 1967 to 2003 period. This paper does not presume a failure of the Keynesian proposition implies Ricardian equivalence, or vice versa. Therefore, both the Keynesian proposition and the Ricardian equivalence are tested. In terms of testing Ricardian equivalence, private saving (S) is investigated for its relationship with the budget balance. The theoretical model of Ricardian equivalence holds that, all other variables can be left unchanged, and only private savings absorb the impact of changes in budget deficits. In addition to the conventional ADF tests, this paper uses a range of unit root tests, including DF-GLS tests, KPSS tests and a group of *M*-tests, to evaluate whether the time series data for these variables is I(1) or I(0). Cointegration tests, Granger causality tests and regressions based on VARs are the central methodology used in this paper to evaluate relationships between two or more variables. This paper finds a statistical relationship between the budget balance and the trade balance from 1967:1 to 2003:2. The exchange rate of the new Taiwan dollar appreciated to a historical high percentage by almost 20% from 1986 to 1987. Prior to 1987, the exchange rates were mainly controlled by the Central Bank of Taiwan. Since 1987, the value of the new Taiwan dollar has been increasingly determined under a market-oriented system. Leachman and Francis (2002) arugue that "transmission mechanisms for twin deficits vary according to the exchange rate regime". This research takes their comments into account and use Chow Breakpoint Test in EVIEWS to test for structural change between the two exchange rate regimes. The effect of the budget balance deterioration in 1989 has also been tested as a source of structural change. No evidence of structural changes around both time points was found. To test the Ricardian equivalence proposition, only annual data for private savings is available.

The main findings of the paper are that Keynesian proposition is supported by the data. This result implies that the budget balance and the trade balance are kin for the case of Taiwan. There is no support for the Ricardian equivalence. That is, Taiwanese do not regard the current budget deficits as their future tax responsibilities.

Theoretical Framework

Conventionally, the national income accounting identities are employed to explain the linkage between the government budget balance and the trade balance. National income is

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

where Y is the income, C is the consumption, I is the investment, G is the government purchases, X is the exports and M is the imports. Individuals dispose of income (Y) either as consumption, savings (S) or taxes (T),

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

Therefore, the government budget balance (T – G), the trade balance (X – M) and the private investment and savings balance (I – S) have the following relationship,

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

Equation (3) states that the government budget balance comprises the trade balance and the excess of private investment over private savings (I – S). It provides the fundamentals for the Keynesian proposition of the 'twin deficits', i.e. the budget deficit and the trade deficit are closely linked. The theory behind the Keynesian proposition is that government debts crowd out the funds available to private investment, therefore increase the interest rate. Under the framework of an open economy, a high domestic interest rate attracts international funds to inflow, which drives the domestic currency appreciate. This, in turn, hurts the exporting sector and benefits the importing sector, which together raise the trade deficit.

Equation (3) also indicates the possibility of Ricardian equivalence in that the trade balance could be left unchanged if the variation of the budget deficit is fully reflected by variations of private savings. Theoretically, as asserted by Seater (1993), Ricardian equivalence is a straightforward generalization of the permanent income/life cycle hypothesis (PILCH). In contrast to the Keynesian proposition, Ricardian equivalence asserts that private savings moves one-to-one with changes in the government debt, with no change in interest rates, therefore no change in exchange rates and in trade balances and no crowding out of private investment.

Data

All data are from official sources, including the Directorate-General of Budget Accounting and Statistics (DGBAS) and the Taiwan Statistical Data Book 2002. The government budget balance (BB), or (T – G), and the trade balance (TB), or (X – M), are quarterly data from 1967:1 to 2003:2. Whether seasonal adjustment is needed or not has been tested, although preliminary estimates with seasonal dummies included found all the seasonal dummies to be insignificant. Only annual data of government budget balance (BB[A]) and the annual data of the private savings (S) from 1967 to 2002 were available to test the Ricardian equivalence. The raw data are presented in the Appendix. The first-order difference of the budget balance (DBB) and of the trade balance (DTB) are the difference between the same quarters of two consecutive years.

Unit Root Tests

Conventionally, ADF and PP tests are used for unit root testing, especially ADF tests. However, both tests are often criticized by econometricians for their unsatisfactory performance. Other unit root tests have been developed during the past decade, such as DF-GLS tests, a modified ADF test with a GLS detrended data, proposed by Elliott, Rothenberg, and Stock (1996), KPSS tests developed by Kwiatkowski, Phillips, Schmidt and Shin (1992), and a group of *M*-tests, which are the modified forms of PP tests and are based upon the GLS detrended data, developed by Ng and Perron (2001)[a] . Hayashi (2000: Ch.9) finds that a new generation of unit root tests with reasonably low size distortions and good power includes the DF-GLS tests and the NP's *M*-tests[b] . In addition to paying attention to these two types of tests, results from other tests are also taken into account. These unit root tests are delivered using the package EVIEWS. All tests in this paper use a significance level of 5%. Since the results could be different for different tests, a simple rule is used, namely that a series is I(1)/I(0) if a larger number of tests favour I(1)/I(0).

Table 1 presents the results of unit root tests. By following the simple rule alluded to above, a consistent conclusion is that series of BB, BB[A] , TB and S are regarded as I(1) whereas DBB, DBB[A] , DTB, and DS are I(0)[c] . These results provide appropriate pre-conditions to test for cointegration of budget balances and trade balances, and for cointegration of budget balances and private savings.

Cointegration Tests

Cointegration tests are conducted by using the SHAZAM programme. Tests for no cointegration are given by tests for a unit root in the estimated residuals obtained from the cointegration regressions. Table 2 shows the results which find that the data do not support a long-run relationship between (T-G) and (X-M), and between (T-G) and S. Theoretically, the Keynesian proposition implies the link between (T-G) and (X-M) should hold over the long term due to the adjustment process which requires changes in interest rates and in exchange rates. The theory of Ricardian equivalence seems to support a short-run relationship between budget deficits and private savings due to the one-to-one move of private savings following budget deficits. However, empirically the length of time to restore an equilibrium under both the Keynesian

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[a] *For details, refer to the papers.*

[b] *The M-tests indicated by Hayashi (2000) include the first three types of tests in Table 1 based on Perron and Ng (1996).*

[c] *'A consistent conclusion' means that when a series in level presents I(1), its first-order difference should present I(0).*

and Ricardian frameworks remains inconclusive. Thus, it is still interesting to test both by adding some lags to the model. The Granger causality test, depending on the length of lags used, can be used to investigate a short-run relationship between variables. This test detects the precedence of one variable to the other[d]. The next section presents the Granger causality tests and the first-order difference of variables showing I(0) properties is used.

Granger Causality Tests

Granger causality tests are executed through running a model of VAR(p) and a statistic of joint-F is conducted to deliver conclusions by using the programme in SHAZAM. The lag p is determined by using a range of lag-order selection criteria, such as sequential modified Likelihood Ratio test (LR), Akaike Information Criterion (AIC), Schwarz Criterion (SC), Final Prediction Error (FPE) and Hannan-Quinn Criterion (HQ)[e]. The system of equations is as follows with Y and X being the two time series.

$$Y_t = \alpha_{1t} + \sum_{i=1}^{p} \beta_{1i} \cdot Y_{t-i} + \sum_{i=1}^{p} \gamma_{1i} \cdot X_{t-i} + \mu_{1t} \,. \tag{4}$$

$$X_t = \alpha_{2t} + \sum_{i=1}^{p} \beta_{2i} \cdot X_{t-i} + \sum_{i=1}^{p} \gamma_{2i} \cdot Y_{t-i} + \mu_{2t} \,, \tag{5}$$

where $\{\mu_{1t}, \mu_{2t}\}$ is a vector of nonautocorrelated error terms with zero mean and covariance matrix $\Omega = \begin{pmatrix} \sigma_{\mu_1}^2 & \sigma_{\mu_1\mu_2} \\ \sigma_{\mu_2\mu_1} & \sigma_{\mu_2}^2 \end{pmatrix}$.

Tests for Keynesian Proposition

A model of VAR(4), with variables of DBB and DTB in Table 1, is used. The lag length four is picked by the most of lag-order selection criteria[f]. There are two steps to follow. Firstly, to test the Granger causality from DTB to DBB; secondly, to test the other way around. The null hypothesis is that there is no Granger causality from one variable to the other. The results are that DTB does not Granger causes DBB but DBB Granger causes DTB. Table 3 summaries the results.

Table 4 shows that DBB has a significant and positive impact on DTB at lag four. However, DTB has no significant effect on DBB. The result shows that one dollar increase/decrease in DBB results in a 14.4 cent increase/decrease in DTB. Given the current situation of Taiwan, a decrease of one dollar in the budget deficit between period 0 and 1, i.e. one dollar increase in the budget balance, then an increase of 14.4 cents in the trade surplus would be expected between period 4 and 5. Since quarterly data are used, four lags means one year. This positive relationship between DBB and DTB supports the Keynesian Proposition under a time spread of one year. This result supports the proposition that the budget balance and the trade balance are kin for the case of Taiwan.

Tests for Ricardian Equivalence

A model of VAR(3) is used due to the suggestions from criteria of LR, FPE and AIC[g]. The conclusion is that DS precedes DBB[A] but not the other way around. Therefore, the data do not support the Ricardian Equivalence. Table 5 shows the result.

Since DS precedes DBB[A], Table 6 provides the details of the VAR(3) model. A positive change of DS at lag three has a negative impact on DBB[A]. The result shows that one dollar increase/decrease in DS results in a 60 cent decrease/increase in DBB[A]. Given the current situation of Taiwan, a decrease of one dollar in private savings between period 0 and 1, an increase of 60 cents in the budget balance would be expected between period 3 and 4. This result implies a substitution between private savings and government surplus (or savings) but points to the opposite transition predicted by the Ricardian equivalence. To investigate this issue is beyond the scope of this paper.

To sum up, for the case of Taiwan, the public do not respond to an increase in the government budget deficit by increasing their savings. They do not regard current budget deficits as their future tax responsibilities.

Managerial Implications and Conclusion

The issue of budget deficits of the Taiwanese government is currently attracting enormous public attention. The main reason is that the deficit follows a growing trend and there shows no sign to be reduced, or even just to be stabilized. In line with a slowdown in the economic growth and a high level of the unemployment rate in its history, the Taiwanese public is facing a tough living environment and is questioning why the huge over expenditure of government is not delivering an improvement of their living situation. This paper takes the first step toward investigating the relationship between the budget balances and the trade balances for Taiwan, a country which used to be regarded as an outstanding performer in its outward trading and a good controller of its government budgets. The result of this paper implies that the budget balance and the trade balance are kin for the case of Taiwan and a growing budget deficit has a negative impact on the trade balance. This is even worse news because the surplus from international trade has been a major contributor to the Taiwanese economy since 1970s. This research casts a warning to the Taiwanese government that without seriously concern about a control of the budget deficit the Taiwanese economy is at risk of losing its competitiveness in international markets which is an essential factor to keep its economy growing. Therefore, how to manage the deficit problem has become a challenge to the government.

There are two aspects to consider when looking at the issue of deficits. One is to increase the income and the other is to reduce the spending. In terms of the increase in income, the Taiwanese government needs to scrutinize the current structure of taxation. Some policies of providing tax free or tax reduction to specific industries/groups should be updated for their fitness to the current situation. There also exists

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[d] *As pointed out by Maddala (1992: Ch.9) "Leamer suggests using the simple word 'precedence' instead of the complicated word Granger causality since all we are testing is whether a certain variable precedes another and we are not testing causality as it is usually understood."*
[e] *Refer to the manual of EVIEWS for details.*

room for discussion of increasing the tax rate. The tax burden of Taiwan, measured by the tax-to-GDP ratio, has been around or below 13% since 2001. It is lower than the ratios of Taiwan's neighbours such as Korea and Japan, and it is also lower than the ratios of the most industrialized countries. Theoretically, restructuring the tax system towards increasing the government income makes sense for the case that a government is facing a threat of out-of-control deficits. However, practically, it comes with bitter political costs, especially to a country like Taiwan for sorts of elections held in every year. No matter which political party is, none of them dare to confront the issue of increasing tax. It does not leave much room to politicians to improve the government income. The more practical strategy is to cut in government expenditure, especially right now the public have lost their patience of seeing the government does not efficiently use the taxpayers' money. Cutting in government expenditure falls in three dimensions. The first is the expenditure on the national defense. The expenditure of national defense is necessary, especially in the special across-the-strait situation Taiwan is standing. However, the concern is whether Taiwan pays too much for what it purchases and whether Taiwan pays for what it really needs. Secondly, it is the expenditure for maintaining a diplomatic relationship with some countries. This operation comes from an extension of the political battle between Taiwan and China, and both bid each other up for gaining international recognition, especially with greater significance to Taiwan. These unreliable diplomatic relationships have cost Taiwan a high price. Taiwan should resume the dialogue with China in order to use a political measure to resolve a political deadlock. The above two have shed light on the indirect role of China playing in the Taiwanese economy, not to mention that there are many Taiwanese business have moved to China. This is a complex issue and it demands the leader of Taiwan to deal it with political wisdom. The third is the interior expenditure of the government. This is something under the government control. Fighting with corruption and using taxpayers' money prudently are the two main directions to make efforts with.

The other main finding of this research is that there is no support for Ricardian equivalence for Taiwan even though it is regarded as having high savings. Taiwanese do not regard the current budget deficit as an increase in their future tax responsibility. The data show that the public in Taiwan do not obey the life cycle hypothesis. An interesting finding is that a reduction in private savings can pass a positive impact to a future budget balance. A detailed discussion of this issue is beyond the scope of this paper and should be left for a future research.

Appendix

The Data (Quarterly; Unit: NT$ million)

—— Budget Balance -------- Trade Balance
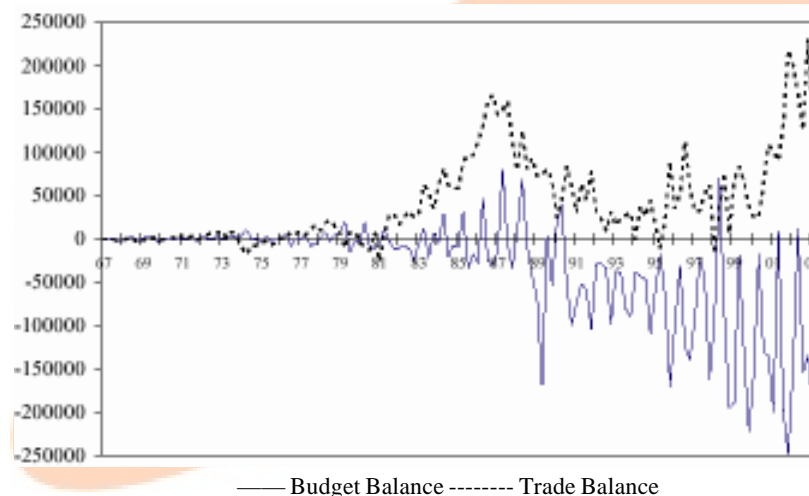
The Data (Annual; Unit: NT$ million)

—— Budget Balance —■— Private Saving

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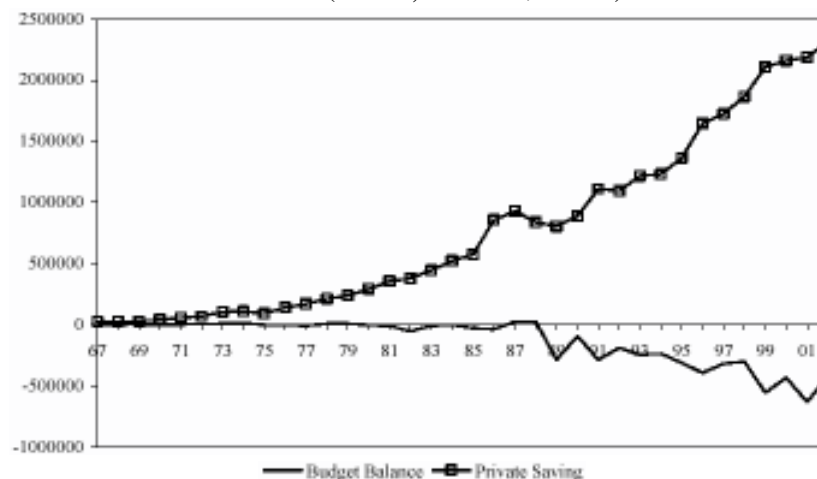
[f] *AIC, SC, HQ and FPE tests suggest lag four.*

[g] *SC and HQ suggest lag one. However, the model of VAR(1) has a worse result than the model of VAR(3) in terms of the diagnosis tests.*

[h] *For annual data, the period covers from 1967 to 2002.*

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Table 1: Results of the unit root tests: 1967:1-2003:2 h

	ADF		DF-GLS	KPSS		NP's M-tests			
						MZ_a	MZ_t	MSB	MP_T
	IN	IN+T	IN	IN	IN+T	IN	IN	IN	IN
BB	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)
TB	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)	I(0)
DBB	I(0)	I(0)	I(0)	I(0)	I(1)	I(0)	I(0)	I(1)	I(1)
DTB	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(1)	I(1)
BB^A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(0)
DBB^A	I(0)	I(0)	I(0)	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)
S	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)	I(0)
DS	I(0)	I(0)	I(0)	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)

Notes:

1. "IN" stands for the intercept. "IN+T" stands for the intercept plus the trend. "BB" stands for the quarterly budget balance. "TB" stands for the quarterly trade balance. "BB^A " stands for the annual budget balance. "I-S" stands for the annual excess of investment over private saving. "S" stands for the annual private saving. "DBB" and "DTB" respectively stands for the first-order difference of the budget balance and of the trade balance between the same quarters of two consecutive years. DBB^A and DS are the first-order difference of the budget balance and the private saving from annual data.
2. DF-GLS performs a test of the modified ADF in which the data are detrended.
3. NP's M-tests are the modified forms of PP tests in which the data are detrended.
4. All testing results are based on a 5% significance level and lags are automatically picked based on SIC by EVIEWS.
5. When the first-order difference of variables are tested under a specific test with a result of being non-stationary, it implies that the variables in levels are integrated at least with order 2, i.e. I(2). Since there is no contradiction presented by the conclusive results in terms of the integrated order and keep searching for the integrated order under a specific test is not a main task in this research, only I(1) is symbolized if a rejection of stationarity holds.

Table 2: ADF tests on residuals

Regressand BB Regressor TB	t-statistic	Critical Value at 5%	No Cointegration
No Trend	-1.4575	-3.34	Cannot reject
With Trend	-1.1925	-3.78	Cannot reject

Note: The case of Regressand TB and Regressor BB concludes the same.

Regressand BB Regressor S	t-statistic	Critical Value at 5%	No Cointegration
No Trend	-2.7544	-3.34	Cannot reject
With Trend	-3.2285	-3.78	Cannot reject

Note: The case of Regressand S and Regressor BB concludes the same.

Table 3: Results from Granger causality tests: 1967:1-2003:2

Step 1: Null Hypothesis: No Granger Causality from DTB to DBB				
Variable	SUM(COEFS)	STD Error	Joint-F	P-Value
DBB	-0.43290	0.131	14.6	0.000
DTB	0.11259	0.130	0.956	0.434
Conclusion: fail to reject the null hypothesis				
Step 2: Null Hypothesis: No Granger Causality from DBB to DTB				
DTB	0.56956	0.935E-01	24.6	0.000
DBB	0.24950	0.946E-01	**3.11**	**0.018**
Conclusion: reject the null hypothesis				

The result shows that DBB precedes DTB. Table 4 shows the details of the VAR(4) model.

Table 4: Results of the VAR(4) model: 1967:1-2003:2

	DBB_{-1}	DBB_{-2}	DBB_{-3}	DBB_{-4}	DTB_{-1}	DTB_{-2}	DTB_{-3}	DTB_{-4}	C
DBB_t	0.103	0.024	0.011	-0.571	-0.142	0.016	0.100	0.138	-5726.1
	(0.177)	(0.762)	(0.886)	(0.000)*	(0.211)	(0.898)	(0.415)	(0.243)	(0.059)
DTB_t	0.083	-0.060	0.082	0.144	0.520	0.114	0.331	-0.395	3316.1
	(0.129)	(0.292)	(0.158)	(0.013)*	(0.000)*	(0.197)	(0.000)*	(0.000)*	(0.127)

Notes:

1. Numbers in parenthesis are the p-values.
2. * means the statistic is significant at 5% confidence interval.
3. C stands for the constant.
4. The subscript attached to each variable stands for the lag.

Table 5: Results from Granger causality tests of DS and DBB A : 1968-2002

Step 1: Null Hypothesis: No Granger Causality from DS to DBB^A				
Variable	SUM(COEFS)	STD Error	Joint-F	P-Value
DBB^A	-0.68804	0.581	7.57	0.001
DS	-0.20322	0.261	**5.04**	**0.008**
Conclusion: reject the null hypothesis				
Step 2: Null Hypothesis: No Granger Causality from DBB^A to DS				
DS	0.54639	0.322	1.96	0.150
DBB^A	-0.66659	0.717	2.84	0.061
Conclusion: fail to reject the null hypothesis				

Table 6: Results of the model of VAR(3): DS and DBB A

	DBB^A_{-1}	DBB^A_{-2}	DBB^A_{-3}	DS_{-1}	DS_{-2}	DS_{-3}	C
DBB^A_i	-0.783	-0.004	0.10	0.147	0.250	-0.600	-16567
	(0.001)*	(0.987)	(0.677)	(0.441)	(0.160)	(0.002)*	(0.429)
DS_i	-0.128	-0.605	0.066	0.332	-0.201	0.415	31709
	(0.619)	(0.075)	(0.822)	(0.167)	(0.354)	(0.056)	(0.224)

Notes:

1. Numbers in parenthesis are the p-values.
2. * means the statistic is significant at 5% confidence interval.
3. C stands for the constant.