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Puah, Chin-Hong and Lau, Evan and Tan, Kim Lee

Faculty of Economics and Business, Universiti Malaysia Sarawak

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Budget-Current Account Deficits Nexus in Malaysia

Chin-Hong Puah[1], Evan Lau and Kim-Lee Tan

ABSTRACT

The purpose of this study is to contribute further on the twin deficits debate in a developing economy. The data for Malaysia over four decades is used as a case study. Empirical result obtained from the Johansen-Juselius (1990) cointegration test indicates that budget deficit and current account deficit do not contain common stochastic trend in the long run. However, the findings from the Granger non-causality test by Toda-Yamamoto (1995) support the Summer's (1988) reverse causation proposition. This implies that a unidirectional causality running from current account to budgetary variable where the deterioration in current account deficit could worsen the budgetary position in the case of Malaysia.

Keywords: Twin deficits; Fiscal policy; Toda-Yamamoto test

JEL classification**:** H62; E62; C32

[1] Corresponding author: Department of Economics, Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. E-mail: chpuah@feb.unimas.my

INTRODUCTION

The twin deficits hypothesis asserts that an increase in budget deficit will cause a similar increase in current account deficit, vice versa. The context of the twin deficits nexus can be viewed as when a country experiencing an investment boom, a current account deficit may cause the country either run down its financial foreign assets or borrow from the rest of the world in order to finance the new investment by selling financial and fixed assets (treasury securities, land and materials for new investment and so on). In such case, the excess of investment over saving leads to a reduction of the net foreign assets, and then foreign debt goes up. Therefore, the persistent of current account deficits will lead the country to increase its stock of net foreign debt and result of the budget deficit.

Theoretically the mechanism behind the twin deficits could also simply be explained through the Keynesian income-expenditure approach. An increase in budget deficit will cause an increase in domestic absorption, and therefore the domestic income. When the domestic income increases, it will encourage imports and eventually will reduce the surplus in the trade balance. That is how the public sector and external sector deficits become twins. In addition, the Keynesian open economy model states that an increase in the budget deficit will cause an increase in the aggregate demand and domestic real interest rates. High interest rates will lead to net capital inflow and result in appreciation of domestic currency. Higher value of the domestic currency will then adversely affect net exports, and thus there will be worsening in the current account.

A country with a current account deficit is borrowing resources from the rest of the world that it will have to pay back in the future. It is worth to point out that current account deficit is not unquestioned a sign negative phenomenon for a country's economic development. The reason behind is that, if the country investing the borrowed resources into more productive investment available in the rest of the world, paying back loans to foreigners pose no problem because a profitable investment will generate a high return to cover the interest and principal on those loans. As a result, the country will grow out of its debt in the future. On the other hand, if the current account deficit is run for the purpose of increasing share of consumption and no improvement in capital stock, it will cause the country to have less capacity in repay its debt in the future.

Large budget and current account deficits are not a new phenomenon. The developed country like the US in the 1980s has experienced a strong appreciation of the dollar and the simultaneous widening of the current account deficit as well as government budget deficit. Besides, Laney (1984) has provided a good evidence for the significance of the causal link between the twin deficits for the developed and developing countries, and the result shows that the relationship between these two variables is much stronger for the developing countries.

Although there has been much empirical work on gauging the relationship between budget and current account deficits, little attention has been given especially for the developing economies. In this study, we empirically examine the long run dynamic causal relationship between budget and current account deficits in a small open developing economy of Malaysia. To this end, we utilize the Johansen and Juselius (1990) maximum likelihood cointegration test and the modified WALD (MWALD) test proposed by Toda and Yamamoto (1995) in identifying the linkage between these two variables. Our finding shows that there is a unidirectional causality running from current account to budgetary variable, implying the possibility of adopting the current account targeting policy for the case in Malaysia.

THE TREND OF TRADE AND BUDGET IN MALAYSIA

Since year 1980, the commodities of Malaysia had changed from primary commodities toward manufactured goods and textiles and then Malaysia had begun to diversify its production and exports sector. At the same time, the government had shifted their macroeconomic policy that began to promote a drive toward heavy industry. The drive that had practiced Malaysia undertaken large investment both directly and through state-owned enterprises leads to a rapid increase in the share or public investment in gross domestic product (GDP) and widening the federal budget deficit from 6.6 percent of GDP in 1980 to over 17 percent in 1982. The government had undertaken external borrowing in order to finance the deficit. In addition, the slowdown in the world economy had increased in world real interest rates and caused the appreciation of the real exchange rate and thus there was a progressive deterioration in the terms of trade. Therefore, the twin deficits problem had occurred in Malaysia in year 1982.

Malaysia experienced the second episode of current account deficits in early 1990s but the macroeconomic environment was different from the previous one. There was a high growth due to the booming private investment and that circumstance had encouraged rapid growth in imports, particularly of intermediate and capital goods and thus caused a narrowing term of trade. Malaysia had met the large current account and budget deficits in year 1991. Since the short-term capital inflows increased significantly in 1992 and 1993 had caused appreciation of the foreign exchange rates and then current account deficit occur in year 1994 due to the unsuccessful discouraging short-term flows. Subsequently, a continued rapid growth and booming investment in 1995 had widened the current account imbalances and resulting Malaysia faced large deficits during that period.

Sustainable twin deficits will lead to massive distortion of financial resources, accumulation of debt and constraint the development of the economy growth in a country. These inconsistent trends of the budget and current account deficits may generate new policy tensions and poses challenges to macroeconomic decision making in any country. Rubin, *et al*. (2004) provide evidence that substantial ongoing deficits may negatively influence the expectations and confidence that can generate a self-reinforcing negative cycle among the underlying fiscal deficits, financial markets and real economy. For example, the participants in foreign exchange markets and international credit markets may loss of confidence as they worried by both ongoing budget and current account deficits. As a result, the investors and creditors may relocate fund away from ringgit-based investment, and eventually it will cause a depreciation of the currency and thus demand stridently higher interest rates on Malaysian government debt. In view of this, a better understanding in twin deficits issue provides the policy authorities some useful insights to implement more appropriate policy in order to deal with the problems associated with them.

THEORETICAL BASIS FOR THE TWIN DEFICITS HYPOTHESIS

According to the twin deficits conception, movement in the budget deficit leads similar change in the current account deficit and vice versa. To clarify the relationship between these two variables, it is helpful to start with the national income identity for an open economy:

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

where Y stands for national income; C is private consumption; I is real investment spending in the economy such as spending on equipment, plant, building and so on; G is government expenditure on final goods and services; X is the export of goods and services, and M is the imports of goods and services.

From the first equation, current account (CA) is defined as the different between export (X) and import (M), which can be represented as:

$$CA = Y - (C + I + G) \quad (2)$$

where (C + I + G) defined as the spending of domestic residents. In a closed economy that is no international trade, saving (S) is equal to investment (I), where S = I. However in an open economy it might be differ, which can be defined as:

$$S = I + CA \quad (3)$$

From Equation (3) we know that in an open economy, a country can seek funds for investment both domestically and internationally in order to increase its future income. The national saving can be divided into its private and government components. Private saving, denoted S_p while government saving, denoted S_g:

$$S_p = Y - T - C \quad (4)$$

and

$$S_g = T - G \quad (5)$$

where T is the government tax revenue. Then we can use the Equations (4) and (5) to substitute into Equation (3) and would get the result:

$$S_p = I + CA - S_g \quad (6)$$

or

$$S_p = I + CA + (G - T) \quad (7)$$

or

$$CA = S_p - I - (BD) \tag{8}$$

From Equation (8), we define the government budget deficit as (G – T), which point out the government saving is a minus sign. Equation (8) then states that an increase in the budget deficit will cause a similar increase in current account deficit, only if private saving and investment do not change much or held constant. This supports the Keynesian view. On contrary, Summers (1988) argues that a reverse causality may run from current account to budgetary variable when the deterioration in current account deficit leads to slower pace of economic growth and subsequently increases the budget deficit.

In the other context, which known as the Ricardian Equivalence Hypothesis states that when the government cuts taxes and raise its deficit, citizens anticipate that they will face higher taxes in the future and later they have to pay back the government debt. Therefore, citizens reduce their consumption spending and rise their own (private) saving to offset the fall in government saving. Thus, the budget deficit has no effect on the current account deficit. Nevertheless, some empirical works, among others, Darrat (1988), Islam (1998), Mansouri (1998) and Normandin (1999), discover that a bi-directional causality exists between the two deficits.

LITERATURE REVIEW

Past literature on the twin deficits issue has mainly centered on two major theoretical paradigms: Keynesian and the Ricardian Equivalence Hypothesis. However, the 'twin deficits hypothesis' can be categories under four testable hypotheses.

First, Barro (1974) discovers that there is no correlation between the public sector deficit and current account imbalances, as he starts from a benchmark 'debt-neutrality' case. This can be understood by decreasing public savings due to large fiscal deficit will be matched by equal increase in private savings (see Barro, 1989). The reason behind this is consumers expect that a tax cut today which results in fiscal deficits will lead to future increases in taxes to serve public debt, so they will save money today to pay for the future tax increases. The empirical studies by Miller and Russek (1989), Dewald and Ulan (1990), Enders and Lee (1990), Evans and Hasan (1994), Wheeler (1999) and Kaufmam *et al*. (2002), to name some, also find supportive evidence on the Ricardian equivalence theorem, in which fiscal and external deficits are uncorrelated.

Second, Laney (1984) notices there is a unidirectional causality running from budget deficit to current account deficit when he investigates the relationship between the overvalued US dollar, large budget and current account deficits for the US and the other developed as well as developing countries. Using ordinary least squares (OLS) estimation technique, the results show that the fiscal balance as a determinant of external balance is statistically significant noticeably more regularly in developing countries than in the industrial countries. Meanwhile, Ahmed (1986) reports that a sharp and temporary spike in a government spending will lead to current account deficit via consumption smoothing. Other studies that adhered to the Keynesian proposition in which an increase in budget deficit leads to a worsen current account position include Abell (1990), Zietz and Pemberton (1990), Bachman (1992), Rosensweig and Tallman (1993), Dibooglu (1997), Vomvoukas (1997), Piersanti (2000), Akbostanci and Tunc (2001), and Leachman and Francis (2002).

Third, a unidirectional causality that runs from current account to budgetary variable may also exist. This outcome occurs when the deterioration in current account leads to a slower pace of economic growth and hence increases the budget deficit. This is especially true for a small open developing economy that highly depends on foreign capital inflows (e.g. foreign direct investment) to finance its economic developments. In other words, the budgetary position of a country will be affected by large capital inflows or through debt accumulations and with that a country will eventually run into a budget deficit. The experience of Latin American and to some extent East Asian countries illustrates this point (see Reisen, 1998). This reverse causality running from current account to budget deficit is termed as ‘current account targeting’ by Summers (1988), where he pointed out that external adjustment may be sought via a budget (fiscal) policy. The articles by Anoruo and Ramchander (1998) on the Philippines, India, Indonesia and Korea, Khalid and Teo (1999) on Indonesia and Pakistan and Alkswani (2000) on Saudi Arabia provide sufficient evidence to support this hypothesis. Meanwhile, Hatemi and Shukur (2002) find the reverse causation for US data while Kouassi *et al*. (2004) support this hypothesis for Korea. According to them, this will occur if the government of a country utilizes its fiscal stance to target the current account balance.

Lastly, researchers like Darrat (1988), Islam (1998) and Mansouri (1998) have conducted some empirical studies in examining the bi-directional links between the twin deficits. Darrat (1988) uses Granger-type multivariate causality tests combined with Akaike's final prediction error criterion to study the causality between budget and current account deficits in US for the period from 1960:1 to 1984:4. Empirical result shows that a bi-directional link exists between these two variables. Islam (1998) analyzes the relevancy of twin deficits hypothesis in Brazil for the period from 1973 to 1991. His result also supports the bi-directional relationship between budget and trade imbalances. For the case of Morocco, using cointegration tests and error correction models, Mansouri (1998) states that there is a bi-directional short- and long run causality between fiscal and external deficits. Similarly, Normadin (1999) also points out that there is a bi-directional causal relationship between the twin deficits in the case of Canadian economy.

DATA AND METHODOLOGY

This section describes the econometrics frameworks and data used in the study. We utilize annually time series data that cover a sample period of 1970 to 2005. These data include budget deficit (BD) which obtained by subtracting government expenditure from government expenditure, and current account deficit (CAD) by subtracting the total import from total export under the balance of payment. Both the BD and CAD are expressed as ratio of the nominal GDP to avoid the problem of negative value in taking logarithm. All variables were compiled from various issues of the Quarterly Bulletin published by Bank Negara Malaysia and the International Financial Statistics from International Monetary Fund (IMF).

In this study, the augmented Dickey-Fuller (ADF) (Said and Dickey, 1984) unit root test will be used to check for the stationarity property of the data. After identifying the order of integration, we employ both the Johansen and Juselius (1990) cointegration test and the Toda and Yamamoto (1995) Granger non-causality test to examine the long run dynamic causal relationship between budget and current account deficits. As the ADF test is already well known by now, further description is omitted here.

The Johansen and Juselius (1990) Procedure

Following Johansen's (1988) framework, a general polynomial distributed lag model of a vector of variables X is defined as:

$$X_t = \Pi_1 X_{t-1} + \cdots + \Pi_k X_{t-k} + \varepsilon_t \qquad t = 1,\ldots,T \tag{9}$$

where X_t is a vector of N variables of interest; Π_i are N x N coefficient matrices, and ε_t is an IID $(0,\Omega)$. Within this framework the long run or cointegrating matrix is given by:

$$\Pi = I - \Pi_1 - \Pi_2 \ldots - \Pi_k \quad (10)$$

where I is the identity matrix.

Π will therefore be an N x N matrix. The number, r, of distinct cointegrating vectors which exists between the variables of X, will be given by the rank of Π. In general, if X consists of variables which must be differenced once in order to be stationary then, at most, r must be equal to N-1, so that $r \leq N-1$. Now we define two matrices α and β both of which are N x r such that:

$$\Pi = \alpha\beta' \quad (11)$$

and so the rows of β form the r distinct cointegrating vectors.

If the variables are not stationary and are integrated of the same order, say $I(1)$, then the Johansen's cointegration causal test can be used in order to determine the number of cointegration vectors. Johansen (1988 and 1991) and Johansen and Juselius (1990) suggest two statistic tests in order to determine the number of cointegration vectors. The first one is the trace test (τ_{trace}). It tests the null hypothesis, in which the number of distinct cointegrating vectors is less than or equal to (q), against a general unrestricted alternative (q=r). The trace statistic test is calculated as follow:

$$\tau_{trace}(r) = -T \sum_{i=r+1}^{p} \ln(1 - \lambda_1) \tag{12}$$

where λ_1 = the smallest value eigenvectors (p-r) and T is the number of observations. The null hypothesis stated that the number of cointegration vectors equal at most to (r) or less than (r), where r = 0,1,2,…,p-1,p. The second statistical test is the maximum eigenvalue test (λ_{max}) that is calculated according the following formula:

$$\tau_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}) \tag{13}$$

where T is the sample size and λ_{r+1} is an estimated eigenvalue. In this test, the r versus r+1 is tested. As a result, this test is concerns about the null hypothesis of r = 0 against the specific hypothesis of r = 1,2,…,p-1,p. Critical values for both the maximum eigenvalue and trace tests are tabulated in Osterwald-Lenum (1992).

The Toda and Yamamoto Granger Non-Causality Test

Toda and Yamamoto (1995) proposed the use of a modified WALD (MWALD) test for testing Granger non-causality among a set of time series variables. Their test allows the causal conclusion to be made in the level VARs that may contain integrated and non-cointegrated processes. They have proven that in the integrated and non-cointegrated system, the MWALD test for the restrictions on the parameters of a VAR(p) has an asymptotic χ^2 distribution if a VAR in their levels with total of p = (k + d_{max}) lags, where k = optimal lag length. Besides, they also point out that for d = 1, the lag selection procedure is always valid since k ≥ 1 = d. When d = 2, the procedure is also valid unless k = 1. Moreover, the MWALD statistic is valid regardless whether a series is *I*(0), *I*(1) or *I*(2), non-cointegrated or cointegrated of an arbitrary order.

The Toda and Yamamoto (1995) Granger non-causality test can be causally linked in a two-dimensional VAR system with these two variables (assuming p=3), as follow:

$$\begin{bmatrix} CAD_t \\ BD_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} CAD_{t-1} \\ BD_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} CAD_{t-2} \\ BD_{t-2} \end{bmatrix} + A_3 \begin{bmatrix} CAD_{t-3} \\ BD_{t-3} \end{bmatrix} + \begin{bmatrix} \varepsilon_{CAD} \\ \varepsilon_{BD} \end{bmatrix} \quad (14)$$

where A_0 is an identity matrix. The null hypothesis $H_0 : \beta_{12}^{(1)} = \beta_{12}^{(2)} = 0$ where $\beta_{12}^{(i)}$ are the coefficients of BD_{t-i}, i=1,2,…, in the first equation of the system is established in order to determine whether BD does not Granger cause movement in CAD (if k = 2 and d_{max} = 1). The existence of the causality from BD to CAD can be established through rejecting the above null hypothesis that requires finding the significance of the MWALD statistics for BD_{t-1} and BD_{t-2}, which have been identified above when BD_{t-3} is left unrestricted as a long run correction mechanism. Similarly the testing procedure and analogous restrictions can be applied to test whether CAD does not Granger cause movement in BD, the null hypothesis where $\beta_{21}^{(i)}$ are the coefficients of CAD_{t-i}, i = 1,2,…, of the second equation of the system. A large number of lags in the VAR system can easily generalize by undergoing this procedure.

EMPIRICAL RESULTS AND DISCUSSIONS

Time series data are often found to be non-stationary, containing a unit root (Gujarati, 1999). As such, we first perform the ADF unit root test to examine the stationarity property of the data use in this study. Since the unit root results are sensitive to different values of the autoregression lag length, it is crucial to use an appropriate selection rule of the truncation lag parameter in determining the order of integration of the data. In this study, the Schwartz Information Criterion (SIC) will be employed to determine the optimal lag length in order to ensure the errors are white noise.

The unit root test results are reported in Table 1. We present the results which contain a drift term and both a drift and a deterministic trend for the series in levels and first differences. In the levels form, the test statistics obtained are clearly less than the critical values even at the ten percent significant level. Therefore, the null hypothesis of a unit root cannot be rejected for both series. Thus, the budget deficit and the current account deficit are non-stationary time series. In their first differences, however, both variables appear to be stationary at one percent significant level. In other words, the budget and current account deficits variables are said to be integrated of order one, that is $I(1)$.

Table 1: ADF Unit Root Test Results

Series	Level		First difference	
	t_{μ}	t_{τ}	t_{μ}	t_{τ}
CAD	-1.640(0)	-2.725(1)	-5.267(0)***	-5.219(0)***
BD	-1.561(2)	-1.713(2)	-6.302(1)***	-6.206(1)***
Critical values: 1%	-3.646	-4.263	-3.646	-4.263
5%	-2.954	-3.553	-2.954	-3.553
10%	-2.616	-3.210	-2.616	-3.210

Notes: Asterisk (***) indicates significant at 1% level. Figures in parentheses are the optimal lag lengths that are chosen based on SIC. The subscripts μ and τ denote the models that allow for a drift term and both a drift and a deterministic trend.

To test for the long run cointegration relationship between the budget and current account deficits, the maximum likelihood cointegration procedure proposed by Johansen and Juselius (1990) is used. For the augmented VAR model, the required numbers of lag length (k) is determined by means of the Schwert's (1987) formula, where $k = [4(T/100)^{1/4}]$. Empirical results from Table 2 show that both the maximum eigenvalue and trace tests statistics are insignificant at ten percent level, implying that there is no common trend exists within the two deficits under study. This suggests the absence of the long run relationship between current account deficit and budget deficit. Further evidence using different lag structure on the interplay between budget and current account deficits also produced similar results where there is no long run equilibrium between these two deficits (see Appendix A).

Table 2: Johansen and Juselius Cointegration Test Results

Maximum Eigenvalue Test (k=3, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r = 1	3.673	14.880	12.980
r ≤ 1	r = 2	2.148	8.070	6.500

Trace Test (k=3, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r ≥ 1	5.821	17.860	15.750
r ≤ 1	r = 2	2.148	8.070	6.500

Notes: The k is the lag length and r is the cointegrating vector. These statistics are computed with a constant in the unrestricted VAR equation.

Following the normal norm in the estimation technique, once there is no cointegrating vector exists in the VAR model, further investigation is not warranted. Thus, if we accept these results, we might conclude that Malaysia is following the Ricardian Equivalence Hypothesis behavior. Nevertheless, more detailed testing procedure is needed in order to ensure robustness and consistency of results. In order to ascertain the robustness of the results, we turn to the MWALD test that may contain the cointegrated or non-cointegrated and regardless the order of integration of the variables [*I*(0), *I*(1) or *I*(2) process]. Details of the estimation results are presented in Table 3.

The augmented VAR model proposed by Toda and Yamamoto (1995) utilizes a MWALD test for restrictions on the parameters of a VAR(p) model, where p = ($k + d_{max}$). As reported in Table 1, the maximum order of integration suspected to occur in the system, d_{max}, is one from the ADF test. Meanwhile, the optimal lag length (k) is equal to three determined via Schwert's (1987) formula. Hence, a VAR(4) model will be analyzed to examine the Granger non-causality between the BD and CAD. The test results in Table

3 reveal that the BD does not have ability to influence the CAD in the long run. However, the null hypothesis of Granger non-causality from CAD to BD can be rejected at ten percent significant level, indicating there is a unidirectional causality running from CAD to BD in the economy of Malaysia. To ensure the robustness and insensitivity of the Toda-Yamamoto technique, we present both d=1 and d=2 model by varying the lag length between one and five. Overwhelmingly, the results, not presented but available upon request, reveal that consistent evidence of reverse causation or 'current account targeting' in Malaysia from 1970-2005.

Table 3: Toda-Yamamoto Granger Non-Causality Test Results

Null Hypothesis	Test Statistics MWALD	*p*-value	Conclusion
Budget deficit does not Granger cause current account deficit	0.105	0.991	Do Not Reject H_0
Current account deficit does not Granger cause budget deficit	7.037	0.071	Reject H_0

CONCLUDING REMARKS

The inference drawn from the nonstationarity time-series econometrics analysis leads to the following conclusions. First, we fail to find any significant long run equilibrium linkages between budget and current account deficits. Second, using the MWALD test, however, we found a unidirectional causality running from current account deficit to budget deficit giving credence to the 'current account targeting' notion.

This finding suggest that Malaysia, that are relatively open in which trade plays a crucial role are more likely to have their domestic developments dictated by the foreign balance to a certain extent (Kouassi *et al*., 2004). Subsequently, higher export prices (or export volumes) generate by increased in world demand will not only raise export earnings and improve the current account but also reduce the budget deficit (since taxes on export earnings are significant portion of governments revenue for a small economy that depends on export sector like Malaysia). Also, an increase in export prices (or volume) will raise domestic income for expansionary or countercycle fiscal policy. In both cases, the improvement in the current account could be reflected in an improvement in fiscal balance suggesting that the causal relationship from current account deficits to budget deficits (reverse causation). One simply cannot rely on curtailing federal budget deficit in an attempt to turn down the current account deficit. Thus, one cannot treat the budgetary variable as a fully controlled policy variable. Although discretionary fiscal policy has important macroeconomic implications, one cannot ignore the budgetary implications of exogenous changes in the current account. Policy options focusing on exchange rate targeting, monetary and productivity enhancement complement with the budget cut policy would be a better solution for Malaysia. Also, export promotion maybe another option that policymakers may pursue due to the ‘virtuous’ cyclical impact to the economy.

Finally, our study focuses on Malaysia and hence the results may not be generalized to the other developing countries. We have used a relatively simple approach to analyze the issue of twin deficits as compared to more sophisticated models developed by other researchers the findings of this paper are consistent with earlier research. Future direction could consider the pattern of the phenomenon in the pre and post 1997 crisis period especially using the data from the crisis affected-economies.

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APPENDIX A:

Table 1: Johansen and Juselius Cointegration Test Results

Maximum Eigenvalue Test (k=1, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r = 1	5.251	14.880	12.980
r ≤ 1	r = 2	2.641	8.070	6.500

Trace Test (k=1, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r ≥ 1	7.892	17.860	15.750
r ≤ 1	r = 2	2.641	8.070	6.500

Notes: See Table 2.

Table 2: Johansen and Juselius Cointegration Test Results

Maximum Eigenvalue Test (k=2, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r = 1	7.899	14.880	12.980
r ≤ 1	r = 2	3.908	8.070	6.500

Trace Test (k=2, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r ≥ 1	11.807	17.860	15.750
r ≤ 1	r = 2	3.908	8.070	6.500

Notes: See Table 2.

Table 3: Johansen and Juselius Cointegration Test Results

Maximum Eigenvalue Test (k=4, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r = 1	3.807	14.880	12.980
r ≤ 1	r = 2	2.305	8.070	6.500

Trace Test (k=4, r=0)				
Null	Alternative	Test Statistic	95% C.V.	90% C.V.
r = 0	r ≥ 1	6.112	17.860	15.750
r ≤ 1	r = 2	2.305	8.070	6.500

Notes: See Table 2.