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ARE MALAYSIAN EXPORTS AND IMPORTS COINTEGRATED? A COMMENT

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ABSTRACT

This commentary aims to provide an insight on the work by Choong, Soo and Zulkornain Yusop (2004), which appeared in the inaugural issue of this journal. The study has found a long-run relationship (cointegration) between Malaysian imports and exports for the annual period 1959–2000. An empirical illustration in this commentary reveals that a cointegration between Malaysian exports and imports as documented by *CSZ* requires further investigation before it can be generalized.

Key words: Cointegration, exports, imports, lag length, vector autoregression (VAR).

INTRODUCTION

In the inaugural issue of this journal (Vol. 1), Choong et al. (2004) (in short *CSZ*) examined the long-run relationship (or cointegrating relation) between exports and imports in Malaysia using Johansen's multivariate test (Johansen and Juselius, 1990). With the finding of a cointegration, they highlighted the effectiveness of Malaysia's past macroeconomic policies in stabilising trade conditions, which does not exceed the inter-temporal budget. I read *CSZ*'s article with great interest. The article adds further evidence in analysing the cointegrating relation between imports and exports in a developing country such as Malaysia.

However, I find that *CSZ* is not conclusive in examining the long-run relationship between imports and exports for Malaysian data (Arize, 2002; Tang and Mohammad, 2005). Here, I will not provide the theoretical model for the imports-exports relationship(s) since it has been clearly cited in Ahmad et al. (2003). The existing studies on this issue are Arize (2002), Ahmad, et al. (2003), Tang (2003), Tang and Mohammad (2005). These studies do not directly examine the Malaysian case, but rather that of a group of countries. What do these studies say? Using quarterly data between 1973:2 and 1998:1 for 50 countries, Arize (2002) found evidence in favour of cointegration between imports and exports in 35 countries, but not in Malaysia, based on the Johansen technique. Using Stock and Watson test (1988), however, cointegration was confirmed for all countries except Mexico and Malaysia. The imports and exports used in the study were scaled by the nominal GDP in domestic currency. Further, Ahmad et al. (2003) examined the sustainability of the current account imbalance for four ASEAN countries (Indonesia, Malaysia, the Philippines and Thailand) over the 1961–1999 period (annual data). For the case of Malaysia, they found no cointegration between imports and exports (measured in real terms as a percentage of real

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GDP) for the period 1961–1999, but a cointegration existed for the period 1961–1997 (according to the trace statistic only, which is rather weak evidence). By considering the possible structural breaks, they applied the Gregory and Hansen (1996) test and the results supported a cointegrating relationship between imports and exports with a possible shift in mean and/or slope in all countries for the 1961–1999 period except Malaysia. For the pre-crisis period (1961–1997), however, a cointegrating relationship between exports and imports was only found for Malaysia. Using bounds test (Pesaran et al., 2001), Tang (2003) confirmed that the Malaysian real imports and real exports were cointegrated for the annual sample period 1968–1998. However, recently, Tang and Mohammad (2005) found no cointegration between imports and exports in Malaysia using Engle-Granger (1987) approach and annual data for 1960–2000. In the context of import demand analysis, Mohammad and Tang's (2000) work indirectly supported the cointegration between imports and exports in Malaysia for the period 1970–1998. Using the Johansen test, they found that volume of imports, final consumption expenditure, expenditure on investment goods, exports and relative price of imports were cointegrated.

Using the cointegration tests, Arize (2002), Ahmad et al. (2003), Tang and Mohammad (2005) found no cointegration between imports and exports in Malaysia (full period). *CSZ*'s work provided a different finding, that a cointegrating relation existed between exports and imports in Malaysia. In this commentary, we examine the reasons for this discrepancy in findings by these different groups.

ROBUSTNESS OF *CSZ*'s TESTS

CSZ found a cointegrating relation between imports and exports in Malaysia for the period 1959–2000. They used Johansen's multivariate cointegration technique to examine the cointegration within a bivariate framework via exports and imports. Johansen's multivariate cointegration technique is often used partly because of its earlier popularity and partly because it is still the best way for testing cointegration. According to Verbeek (2000), the Johansen approach is more efficient than the Engle-Granger (1987) method. One of the problems of using the Engle-Granger method is the sensitivity of the results to the left-hand-side variable of the regression, that is, to the normalization applied to the cointegrating vector.

In *CSZ*'s work, they used one lag for the unit root ADF (Augmented Dickey-Fuller) tests, and a lag length of five for Johansen's cointegration tests and the vector error correction models. However, they did not state their reasons for choosing this lag structure. For the case of ADF, this is a minor point, but it is a crucial issue for cointegration analysis, particularly Johansen's multivariate technique.

It is well documented in the econometric literature that a crucial factor in using the Johansen procedure is the lag length. Enders (1999) noted, "The results of the test (Johansen methodology) can be quite sensitive to the lag length so it is important to be careful… Begin with the longest lag length deemed reasonable and test whether the lag length can be shortened." Cheung and Lai (1993) found that the Johansen's cointegration tests were rather sensitive to under-parametrization in the lag length, though not so to over-parametrization. Their results point to the importance of proper lag specifications in estimating cointegrated systems.

Theory, however, offers little guidance on the lag structure of economic relationships, and statistical selection criteria seldom speak with one voice (Sumner, 2004). Nevertheless, using long lags may be inconsistent with economic sense (Charemza and Deadman, 1992). In estimating a VAR (vector autoregression) model, Enders (1995) said, "Using quarterly data, you might start with a lag length of 12 quarters based on the a priori notion that 3 years is sufficiently long to capture the system's dynamics." An intuitive guide to establishing the best lag length in a VAR model is to choose such a lag order in VAR that results in estimated model residuals without significant autocorrelation (Charemza and Deadman, 1992). In addition, Enders (1995) highlighted, "Alternatively, you can select lag length using the multivariate generalizations of the AIC (Akaike information criterion) or SBC (Schwartz Bayesian criterion)." Cheung and Lai's (1993) study supported this point, that for autoregressive processes, standard lag selection criteria such as the AIC and the SIC (Schwarz information criterion) can be useful for choosing the right lag order for Johansen's tests.

CSZ's study revealed a cointegrating relation between imports and exports in Malaysia for the period 1959–2000 by setting a five-lag length of VAR for the Johansen's multivariate tests. A lag length of five years is usually considered long in terms of economic sense. In examining the cointegration between exports and imports in Malaysia, Ahmad et al. (2003) confirmed a two-lag length of VAR for the Johansen tests based on the AIC. Arize (2002) determined the number of lags applied in each cointegration test based on information provided by the AIC, the Sims LR test, and the vector autocorrelation test (Arize did not report the number of lag selected based on this information).

In Table 5 in *CSZ*, the error correction term (ECT) estimates show vulnerability of a cointegration between Malaysian imports and exports. Except for Case 1, (D(EXP)), the t-statistics are all positive, showing that the estimated coefficient of the error correction term is positive. However, the error correction term should be negative—its magnitude indicates the speed of adjustment from short-run disequilibrium towards the long-run equilibrium state. The insignificance of the error correction term and its positive sign in *CSZ*'s Table 5 provide additional evidence of no long-run relationship between the examined variables. This finding (from ECT) contradicts the results of the Johansen's tests. This may be due to the use of a long lag length of VAR, namely, 5 years.

The sample size used for the Johansen's likelihood ratio (LR) tests is another issue of concern for cointegration analysis. According to Cheung and Lai (1993), finite-sample analyses can bias the LR tests toward finding cointegration either too often or too infrequently. They proposed a scaling factor to adjust the critical values to obtain approximate finite-sample critical values. Hakkio and Rush (1991) stated that increasing the number of observations by using monthly or quarterly data did not add any robustness to the results in tests of cointegration. Following this argument, the annual data used in the previous studies (Ahmad et al., 2003; Tang, 2003; *CSZ*, 2004; Tang and Mohammad, 2005) (31 to 42 observations) and in the present study (42 observations) are considered to be long enough to reflect the long-run relationship between imports and exports.

Based on the finding of a cointegration between imports and exports, *CSZ* concluded that the Malaysian government had been implementing effective macroeconomic policies. Theoretically, the existence of a cointegrating relation between imports and exports indicates that the macroeconomic policies have been effective in the long run and suggests that the country is largely not in violation of her international budget constraint. Even so,

CSZ's conclusion may not be the only explanation possible, since it is solely based on the cointegration between imports and exports. Other economic theory might explain the effectiveness of macroeconomic policies implemented. For instance, Mohammad and Tang (2000) estimated that the import relative price elasticity was −0.69, and the estimated long-run price elasticity of demand for Malaysian exports was −4.06 (Arize, 1990). Thus, these studies concluded that the Marshall-Lerner condition[1] might be satisfied, indicating exchange rate polices could therefore be used to correct for balance of payments disequilibrium.

AN EMPIRICAL ILLUSTRATION

This section gives an empirical analysis of the validity of *CSZ*'s work by focusing on the cointegration between Malaysian imports and exports. The real exports of goods and services (*Ln*X), and real imports of goods and services (*Ln*M) are on a natural logarithm (*Ln*) scale. The nominal exports and imports (in local currency) were deflated using the export price and import price deflators (1995=100), respectively. The annual data are from *World Tables* (World Bank) and cover the period 1960–2001. The time series plot is presented in Figure 1.

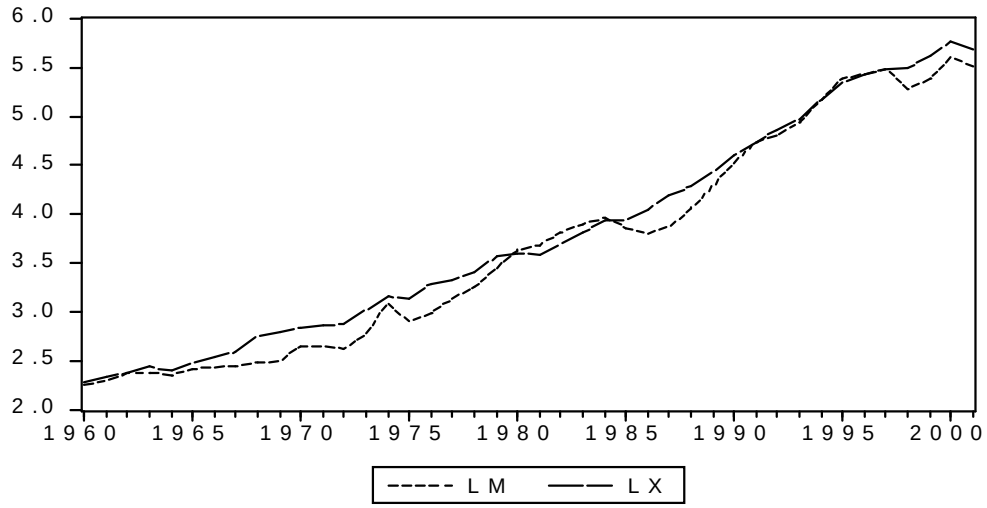

Figure 1. Log of real imports and exports (LM = *Ln*M and LX = *Ln*X), 1960–2001

Two clarifications should be made here. First, it is more appropriate to use the export price deflator and import price deflator to derive the real exports and the real imports, respectively, instead of using the consumer price index (CPI). *CSZ* employed the CPI as

[1]The Marshall-Lerner condition indicates a stable foreign exchange market if the sum of price elasticity of imports and that of demand for exports, in absolute terms, exceeds one.

deflator for both imports and exports. In fact, the data from *World Tables* (World Bank) show that the values of the export price index, import price index, and CPI are different. For example, the values are 38.5, 29.99 and 30.88 for 1960; 84.199, 77.98 and 60 for 1980; and 132.19, 132.61 and 118.3 for 2001 (1995=100). Thus, *CSZ*'s work is questionable since they used the CPI as deflator for both import and export series. Second, like Ahmad et al. (2003) and Arize (2002), we have not scaled the import and export variables by GDP for econometric reasons (countering heteroskedasticity). The justification is that the theory talks about exports and imports and not export and import rates.

Table 1. Optimum Lag Length for Augmented Dickey-Fuller (ADF) Unit Root Test (based on Akaike Information Criterion, AIC)

	Level		First-Difference	
Series	Constant	Constant and Trend	Constant	Constant and Trend
*Ln*M	0	0	0#	0#
*Ln*X	0	6	0#	0#

# denotes rejection of the null hypothesis of a unit root based on a 10 per cent level of significance (MacKinnon, 1996).

Table 2. The Results of Johansen's Cointegration Tests

Series: *Ln*M and *Ln*X		
Selected (0.05 level*) Number of Cointegrating Relations by Model		
Data Trend:	Linear	Linear
Test Type:	Intercept	Intercept
	No Trend	Trend
Lag length: 1		
Trace	0	0
Max-Eig	0	0
Lag length: 2		
Trace	0	0
Max-Eig	0	0
Lag length: 3		
Trace	0	0
Max-Eig	0	0
Lag length: 4		
Trace	0	0
Max-Eig	0	0
Lags length: 5 (*CSZ*'s work)		
Trace	0	0
Max-Eig	0	0

*Critical values based on Osterwald-Lenum (1992).

Table 1 reports the optimum lag order for the ADF unit root tests using AIC. Contrary to *CSZ*'s work (which used one lag), zero lag order has been suggested using AIC (except constant and trend for level data, 6 lags). The results of ADF tests (as well as those documented in Ahmad et al., 2003; Tang, 2003; Choong et al., 2004; Tang and Mohammad, 2005) reveal that the real imports and real exports are nonstationary, *I*(1).

The results of the Johansen's cointegration tests (trace and max statistics) are reported in Table 2. The AIC and SC do suggest two lag length of VAR and one lag length of VAR, respectively. Both of these values of lag length of VAR are slightly lower than the five-lag length used in *CSZ*. In order to see the sensitivity of the results to the different lag length used, the lags of one to five have been carried out for this purpose. As illustrated in Figure 1, the data show a linear trend. Therefore, it is more appropriate to consider the linear trend assumption in data for the Johansen's cointegration computation. The results of the Johansen tests (both trace and max statistics) reveal no cointegrating relation between imports and exports in Malaysia for the period 1960–2001. This finding is consistent with different lag structure for VAR (between one and five), and run contrary to *CSZ*'s study, which supports a cointegrating relation between imports and exports in Malaysia for the period 1959–2000 based on a five-lag length of VAR.

CONCLUSION

This commentary has highlighted *CSZ*'s work, which confirms a long-run relationship between imports and exports in Malaysia for the period 1959-2000. The main source of concern of *CSZ*'s work is the lag length used for the Johansen cointegration test. Contrary to *CSZ*'s work, no cointegration was found between the Malaysian imports and exports from the empirical illustration in this commentary. Our finding is consistent with those of Arize (2002) and Ahmad et al. (2003), which were also based on the Johansen tests.[2] In short, the empirical illustration of this commentary reveals that a cointegration between Malaysian exports and imports as documented by *CSZ* requires further investigation before it can be generalized.

For further work, I do suggest more powerful techniques for cointegration, for example, a new test of the null hypothesis of no cointegration between a pair of time series proposed by Leybourne et al. (2002). In fact, they have found evidence that this general version of their test is more powerful than the Johansen test. Other than that, several cointegration techniques such as single-equation and multivariate approaches can be carried out together as a crosscheck for the existence of a cointegrating relation between the Malaysian imports and exports.

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[2]An exception is Tang (2003), who found a cointegrating relation between imports and exports in Malaysia using the bounds test proposed in Pesaran et al. (2001).

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