AN EMPIRICAL ANALYSIS OF SUSTAINABILITY OF TRADE DEFICIT: EVIDENCE FROM SRI LANKA

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Abstract

In this paper, the long-run relationship between Sri Lankan exports and imports during the period 1950 to 2006 is examined using unit root tests and cointegration techniques that allow for an endogenously determined structural break. The results failed to support the existence of a long-run equilibrium between exports and imports in Sri Lanka. This finding questions the effectiveness of Sri Lanka's current long-term macroeconomic policies and suggests that Sri Lanka is in violation of its international budget constraint.

Keywords: Trade Deficit, Unit root, Structural Breaks, Cointegration, Sri Lanka

JEL Classifications: C12, C22, F14, F32

1. Introduction

The existence of cointegration or the long-run equilibrium relationship between exports and imports has been empirically tested by many researchers. These include Arize (2002); Bahmani-Oskooee (1994); Bahmani-Oskooee and Rhee (1997); Herzer and Felcitas (2006); Irandoust and Ericsson (2004); and Narayan and Narayan (2005). Cointegration between exports and imports implies that trade deficits are only a short-term phenomena and thus sustainable in the long-run. As the macroeconomic policies have been effective in bringing exports and imports into a long-run equilibrium, it can be said that countries are not in violation of their international budget constraint.

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The objective of this study is to investigate whether cointegration or a long-run equilibrium relationship exists between exports and imports in Sri Lanka. Sri Lanka is an interesting case study because it was the first South Asian country to embark on trade liberalisation as early as 1978 and, despite changes in government and internal conflict; liberal economic policies have been continually followed for the last 30 years. The approach adopted in the paper is different to previous studies in two ways. Firstly, we use annual data rather than quarterly data. Secondly, we use recently developed unit root and cointegration tests that allow for an endogenously determined structural break in individual time series and the long-run relationship between exports and imports. In the next section of this paper we provide a brief note on the behaviour of exports and imports in Sri Lanka during the period 1950 to 2006. This will be followed by the theoretical rationale for investigating whether exports and imports are cointegrated in section 3. Following this, we explain the econometric methodology and discussion on the empirical results, in section 4, and our conclusions are presented in the final section.

2. Trends in Exports and Imports in Sri Lanka 1950-2006

In early period of the decade following 1950, nearly 90 per cent of exports from Sri Lanka consisted of tea, rubber and coconut while rice accounted for 25 per cent of imports. The import of rice and other food imports were necessary to maintain the food subsidy scheme promoted by the state. As a result of population growth, imports of those items continued to grow faster rate than exports. The situation was further worsened by the continuing decline of terms of trade. The net result was imports into Sri Lanka were always higher than exports[1] as can be seen from Figure 1. As a result, successive governments, opted for selective import controls which were intended, in the first instance, as a protective measure but which ended up encouraging and protecting particular industries and firms (Cuthbertson and Athukorala: 1991: page 328). Even for the period 1961 to 1977, the government attempted to control

[1] For a discussion on those points, see Kelegama (2006).

imports simply by adding further restrictions typically in the form of permits and licenses. Permission to import was granted to specific agencies and ceilings were placed on goods that could be imported. In addition to tariff restrictions, restrictions on foreign exchange transactions also played a roll in limiting imports. Given the low commodity prices in the world market and lack of industrial production for export market, exports from Sri Lanka did not grow fast enough to match the growth of imports.

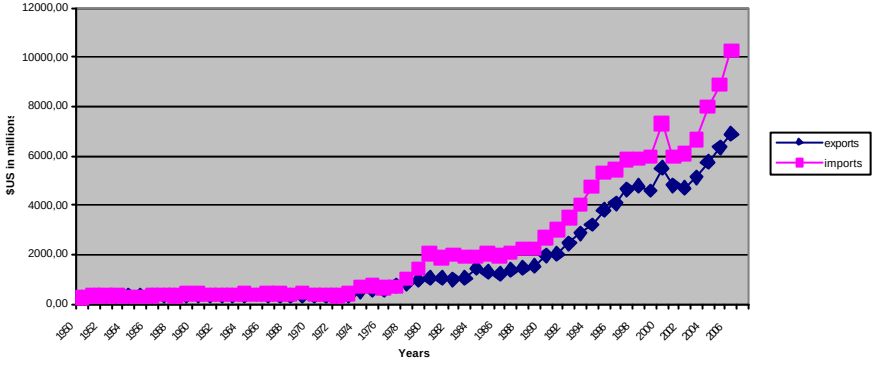

Figure 1: Exports and Imports in Sri Lanka :1950-2006

The period since 1977 can be classified as a more liberal period when all restrictions on trade and transactions were abolished[2]. During this period, imports have continued to grow at a faster rate than exports, and trade balance has always been in deficit. However, with the composition of exports shifting to more industrial exports, this has reduced the dependence on the traditional exports of tea, rubber and coconut.

3. Theoretical Foundations

[2] For the details on policy measurers implemented during the period, see Jayewardene et al. (1987) and Athukorala and Jayasuriya (1994).

Husted (1992) provides a testable model for a small open economy which has the following key features: absence of government; ability to produce and export a composite good; with consumers having access to international funds implying a long-run relationship between exports and imports.

Husted starts with the individual current period budget constraint as follows:

$$C_0 = Y_0 + B_0 - I_0 - (1+r)B_{-1} \qquad (1)$$

where C_0, Y_0, B_0, I_0 and r are the current consumption, output, international borrowing, investment, and a one period interest rate, respectively; and $(1+r)B_{-1}$ is the initial debt size.

Husted makes several assumptions in deriving the following testable model. One of them is that interest rate is stationary with mean r:

$$X_t = a + dM_t + e_t \qquad (2)$$

where X_t is the exports of goods and service; and M_t is the imports of goods and services. For the necessary and sufficient condition for the inter-temporal budget constraint of the country to hold, we require that d = 1 and e_t is stationary. It follows, that expression (2) provides an idealized framework for determining the sustainability of a current account deficit or surplus. In the event this proviso is not met, it would indicate that the economy is not functioning properly and fails to satisfy its budget constraint, and therefore, is expected to default on its debt (Hakkio and Rush, 1991).

Husted (1992) tests for cointegration between exports and imports in the US plus interest payments abroad and finds no evidence of cointegration for the 1960-1989 period. An analysis of subsamples and with structural break in 1983 supports cointegration. Fountas and Wu (1999) test the sustainability of the current account for United States. Using quarterly data for the period 1967—1989 and 1967-1994, they found that the series are not cointegrated and current accounts are not sustainable. Apergis et al. (2000) test for the sustainability of the Greek current account with annual data for the period 1960-1994. They found that the Greek current account deficit was sustainable. Bahmani-Oskooee (1994) used cointegration techniques to investigate the long-run relationship between exports

and imports for Australia. He found evidence of cointegration and concluded that Australian exports and imports will converge in the long-run. Quarterly data was used by Bahmani-Oskooee and Rhee (1997) to model exports and imports for Korea. They found evidence of cointegration and also that the coefficient on exports was positive. Using quarterly data for the period 1973-1998 for 50 OECD and developing countries, Arize (2002) found that for 35 of the 50 countries, there was evidence of cointegration between exports and imports. He also found that 31 of the 35 countries had a positive export coefficient. Tang (2003) used the bounds testing approach to investigate the presence of the relationship between exports and imports for five ASEAN economies[3]. He found that exports and imports are cointegrated for Malaysia and Singapore only. Narayan and Narayan (2004) found that a long-run relationship exists between exports and imports for Fiji and PNG using the bounds testing approach. They also found that coefficient on exports is unity only in the case of Fiji. On the basis of Johansen's technique, Irandoust and Ericsson (2004) found that there is a cointegration relationship between imports and exports of Germany, Sweden and the USA; but there is no cointegration relationship for the UK. Shiraz and Manap (2005) do not reject the null of no cointegration between exports, imports and real output in Sri Lanka. Narayan and Narayan (2005) investigate whether there is a long-run relationship (cointegration) between exports and imports for 22 least developed countries (LDCs) using the bounds testing approach to cointegration. Their results indicate that exports and imports are cointegrated only for six out of the 22 countries. Herzer and Felcitas (2006) conclude that there is long-run equilibrium between exports and imports in Chile.

4. Econometric Methodology and Empirical Testing

Unit Root Tests

Most existing studies examine the stationary properties of variables by using the Augmented Dickey Fuller (ADF) (1979, 1981) or Philip-Perron (1988) unit root tests. A problem with these tests is that

[3] Indonesia, Malaysia, Philippines, Singapore and Thailand.

neither test allows for the possibility of a structural break. Perron (1989) argued that in the presence of a structural break, the standard ADF tests are biased towards the non-rejection of the null hypothesis. It should be noted that in Perron (1989) procedure, dating of the potential break is assumed to be known *a priori* in accordance with the underlying asymptotic distribution theory. Here the standard Dickey-Fuller procedure is extended whereby test statistics are constructed by adding dummy variables representing different intercepts and slopes.

However, Christiano (1992) criticized Perron's known assumption of the break date as "data mining". Christiano argued that the data based procedures are typically used to determine the most likely location of the break and this approach invalidates the distribution theory underlying conventional testing (Glynn et. al). Since then, several studies have been developed using different methodologies for endogenising the break date. Some of these include Banerjee et al. (1992), Zivot and Andrews (1992), Perron (1997) and Lumsdaine and Papell (1998). These studies have shown that bias in the conventional unit root tests can be reduced by endogenously determining the time of the structural break.

Perron (1997) proposed a class of test statistics which allows for two different forms of structural break: the Innovational Outlier (IO) model where changes are assumed to take place gradually; and the Additive Outlier (AO) model, which allows for the structural change to take place instantaneously;

The IO model allows for a gradual change in the intercept (IO1) and gradual changes in both the intercept and the slope of the trend function (IO2) such that:

$$\text{IO1: } x_t = m + q\,DU_t + b\,t + d\,D(T_b)_t + a\,x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \quad (3)$$

$$\text{IO2: } x_t = m + qDU_t + bt + \gamma DT_t + dD(T_b)_t + a\,x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \quad (4)$$

where T_b denotes the time of break ($1 < T_b < T$) which is unknown, $DU_t = 1$ if $t > T_b$ and zero otherwise, $DT_t = T_t$ if $t > T_b$ and zero elsewhere, $D(T_b) = 1$ if $t = T_b + 1$ and zero otherwise, x_t is any

general ARMA process and e_t is the residual term assumed white noise. The unit root null is rejected if the absolute value of the t-statistic for testing a =l is greater than the corresponding critical value. The time of structural break (T_b) can be determined by two methods as suggested by Perron (1997). The first approach is where equations (3) or (4) are sequentially estimated assuming different T_b with T_b chosen to minimize the t-ratio for a =1. In the second approach, T_b is chosen from among all other possible break point values to minimize the t-ratio on the estimated slope coefficient (g). Data-dependent method proposed by Perron (1997) is used to determine the truncation lag parameter (k). The optimum k (or k*) is selected such that the coefficient on the last lag in an autoregression of order k* is significant and that the last coefficient in an autoregression of order greater than k* is insignificant, up to a maximum order k (Perron, 1997).

The third model is the Additive Outlier (AO) model. In contrast to the gradual change in the IO model, the AO model assumes structural changes take place instantaneously; that is it allows for a sudden and rapid change in the trend function. When considering the AO model for testing a unit root, a two-step procedure is used. First the series is detrended using the following regression:

$$\underline{y}_t = m + b_t + \gamma DT_t^* + \underline{\tilde{y}}_t \qquad (5)$$

where $\underline{\tilde{y}}_t$ is the detrended series and $DT_t^* = 1(t - T_b)$ if $t > T_b$ and zero otherwise. This assumes that a structural break only impacts on the slope coefficient. Thus, the test is then performed using the t-statistic for $a = 1$ in the regression:

$$\underline{\tilde{y}}_t = a\,\underline{\tilde{y}}_{t-1} + \sum_{i=1}^{k} c_i \Delta \underline{y}_{t-i} + e_t$$

The unit root null hypothesis is rejected in favour of the alternative if the t-statistic for a is significant and greater than the critical values tabulated by Perron (1997).

We used annual data for the period from 1950 to 2006. The exports and imports data was obtained from Trend in Key Economic Variables in Special Statistical Appendix from Central Bank of Sri Lanka (2006). In our analysis, two series of exports and imports were used: in one series the value of exports and imports are measured in current Sri Lankan rupee values and in the second series, the value of exports and imports are measured in US dollars.
Table 1 provides unit root tests using the Perron (1997) method. The results obtained indicate that both the exports and imports, measured either in Sri Lankan rupees or US dollars, are non-stationary under structural change at a five per cent significance level for all cases.

Table 1: Perron's (1997) Unit Root Tests: Additive Outlier Model (AO); and the Innovational Model (IO2)

Part 1: Series in US Dollars

Series	Model	Break Point T_b	Lag $\hat{k}$	Test Stat $t_{\hat{\alpha}}$	Critical Values at 5%	*Result*
X_t	AO	1967	3	-3.3515	-4.83	*Unit Root*
M_t	AO	1968	1	-3.4012	-4.83	*Unit Root*
X_t	IO2	1964	4	-4.5646	-5.59	*Unit Root*
M_t	*IO2*	*1976*	*1*	*-5.2155*	*-5.59*	*Unit Root*

Part 2: Series in Sri Lankan Rupees

Series	Model	Break Point T_b	Lag $\hat{k}$	Test Stat $t_{\hat{\alpha}}$	Critical Values at 5%	*Result*
X_t	AO	1991	4	-3.4851	-4.83	*Unit root*
M_t	AO	2004	4	-3.7493	-4.83	*Unit root*
X_t	IO2	1999	4	-2.8519	-5.59	*Unit root*
M_t	*IO2*	*2003*	*4*	*-2.9401*	*-5.59*	*Unit root*

Cointegration

Once the order of integration of each variable is determined, we tested for cointegration. As mentioned earlier, ignoring the issue of potential structural breaks can render invalid statistical results not only for unit roots tests but also in terms of cointegration tests. Kunitomo (1996) argued that in the presence of structural change, traditional cointegration tests which do not allow for a structural break may produce 'spurious cointegration results'. The effect of potential structural breaks on the result of the ADF test for cointegration was also recognized by Gregory and Hansen (1996). They show that ADF test tends to under-reject the null hypothesis of no cointegration in the presence of a structural break. Considering the importance of the effects of a potential structural break, we applied the Gregory and Hansen (1996) cointegration procedure that allows for an endogenously determined structural break. The problem of estimating cointegration relationships in the presence of potential structural break is addressed by Gregory and Hansen by introducing a residual based technique. The technique is to test the null hypothesis of no cointegration against the alternative of cointegration with a structural break. Here, the break point is unknown and is determined by finding the minimum values for the ADF t-statistic.

The Gregory and Hansen procedure takes into account the existence of a potential unknown and an endogenously determined single break, allowing for structural shifts in either the intercept alone, in both trend and level shift or a full break. That is, Gregory and Hansen present three models for testing cointegration where they allow for the existence of structural break in the cointgerating vector. The first model is known as a level shift model (Model C). This model contains an intercept and a level shift dummy as follows:

$$y_{1t} = u_1 + u_2 j_{1t} + a^T y_{2t} + e_t \qquad t = 1,\ldots, n. \qquad (6)$$

The second model (C/T) contains an intercept and a trend with a levelshift dummy:

$$y_{1t} = u_1 + u_2 j_{1t} + bt + a^T y_{2t} + e_t \qquad t = 1,\ldots, n. \qquad (7)$$

The third model is the full break model called a regime shift (C/S), allowing for change in both intercept and slope as follows:

$$y_{1t} = u_1 + u_2 j_{1t} + a_1^T y_{2t} + a_2^T y_{2t} j_{tt} + e_t \quad t = 1,\ldots, n. \qquad (8)$$

Model C/S includes two dummy variables, one for the intercept and one for the slope.

In the context of our analysis, y_{1t} and y_{2t} are the exports and imports; u_1 and a_1 are the intercept and slope coefficients before the shift; u_2 and a_2 denote the changes to the intercept and slope coefficients at the time of the shift. The dummy variable is denoted by j_{1t} and is defined by:

$j_{1t} = 0$, if $t \le [ht]$ and $j_{1t} = 1$, if $t > [ht]$

where the unknown parameter $t \; e(0,1)$ denotes the relative timing of the change point.

The three models (expressions 6-8) are estimated to determine the time of the structural break and also to test for the existence of cointegration relationship between exports and imports. The results and the critical values are reported in Table 2. First part of Table 2 reports results for exports and imports series measured in US dollar terms.

These results suggest that models C and C/S do not reject the null of no cointegration at the five per cent significance level. However, model C/T rejects the null of no cointegration at the five per cent significance level. The break dates of 1979, 1985 and 1991 detected by the Gregory and Hansen procedure correspond with the liberalization of the Sri Lanka economy in 1978, the civil war intensifying in 1983 and the escalation of violence between the Sri Lankan army and the separatists in 1990. The second part of Table 2 reports results for export and import measure in Sri Lankan Rupee terms. These results suggest the models C and C/T do not reject the null of no cointegration at the five per cent significance level. However, model C/S rejects the null of no cointegration at the five per cent significance level. The break dates of 1995 and 1998 detected by Gregory and Hansen procedure are different from the previous series. This break date is well explained by Kelegama

(2006), "Increasing authoritarianism of the state, escalating the war from time to time, allegations of 'crony capitalism' in various private sector transactions and corruption slowed down the liberalization process by early 1994 – after which the administration became pre-occupied with the general elections in that year" (pp.56).

Table 2: Gregory and Hansen (1996) Cointegration Tests with Structural Break

Part 1: Series in US Dollars

Model	Break Point	ADF	Critical Value 5%	Result*
C	1991	-4.45	-4.61	Do Not Reject the Null Hypothesis
C/T	1979	-5.15	-4.99	Reject the Null Hypothesis
C/S	1985	-4.62	-4.95	Do Not Reject the Null Hypothesis

Part 2: Series in Sri Lankan Rupees

Model	Break Point	ADF	Critical Value 5%	Result*
C	1995	-4.02	-4.61	Do Not Reject the Null Hypothesis
C/T	1995	-4.00	-4.99	Do Not Reject the Null Hypothesis
C/S	1998	-5.14	-4.95	Reject the Null Hypothesis

* The null hypothesis being no cointegration between exports and imports. Critical values are provided by Gregory and Hansen (1996).

The results from the above analysis are inconclusive: in four cases, there is no cointegration between exports and imports but in two cases suggests that there is a cointegration between exports and imports. What does cointegration or lack of cointegration between imports and exports tell us about the state of the economy? According to Husted (1992), cointegration is to be expected under the hypothesis that the economy is working properly, and that breaking international budget constraints can lead to a lack of cointegration. This implies that sustained external imbalances are the outcome of distorted markets, or 'bad policy'. Irandoust and Ericsson (2004) argue that the lack of cointegration suggests fundamental policy problems, unless there are permanent productivity shocks that

lead to a non-stationary import–export relationship. In a well functioning economy, without permanent one-sided productivity shocks, cointegration is to be expected. However, given the current global environment, the external balance is determined not only by trade balance, but also by the balance in the services and payments sector. This is more relevant to countries like Sri Lanka, where services exports and private remittances are very significant part of the current account. Generally speaking, the conclusion is that a lack of cointegration suggests fundamental policy problems which could be challenged in the current globalize economic environment. Therefore, future research into this issue should be directed to include those elements of the current account.

5. Conclusion

The purpose of this paper was to investigate the sustainability of current account of Sri Lanka by employing the Husted (1992) testing procedure. The procedure used here is to estimate cointegration between exports and imports. In our analysis, two series of exports and imports were used: in one series the value of exports and imports are measured in US dollars and in the second series, the value of exports and imports are measured in current Sri Lankan rupee values. The period covered was 1950 to 2006. The results from the above analysis are inconclusive. In four cases, there is no cointegration between exports and imports; however, in two cases it is suggested that there is cointegration between exports and imports. In summary, a cointegration test based on the Gregory and Hansen approach does not support the existence of long-run equilibrium between exports and imports. The empirical findings suggest that the current account of Sri Lanka is not sustainable (and this violates its intertemporal budget constraint) in the long-run. However, given the changes in the world trade system further research is needed to include services and remittances of the current account.

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