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Economic Growth and External Debt Servicing: A Cointegration Analysis of Sri Lanka, 1952 to 2002

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Abstract

In the immediate aftermath of the tsunami disaster, many of Sri Lanka's creditor nations granted debt write-offs and interest-free periods on loans to assist the reconstruction process. Two macroeconomic effects stem from excessive external debt; a debt overhang problem and a credit-rationing problem. Using econometric analysis and Sri Lankan data for the period 1952 to 2002, this paper investigates whether Sri Lanka faces a debt overhang problem. Long-run estimations rely on cointegration methodology whereas short-run analysis employs an error correction method. The results indicate that Sri Lanka does not have a debt overhang problem, probably because total external indebtedness is not too high.

Key Words: Debt overhang; external debt; Sri Lanka

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1. Introduction

The 2004 Boxing Day tsunami disaster has prompted numerous creditor countries, including Canada, France, Germany, Japan, the United Kingdom and the United States, to grant external debt assistance to Sri Lanka to support the reconstruction of that devastated country. In general, this assistance has consisted of debt write-offs and interest-free periods on loans. These developments have rekindled interest in the question of external debt, especially in Sri Lanka and other highly indebted developing nations.

According to the World Bank, total external debt may be defined as debt owed to non-residents repayable in terms of foreign currency, food, or services. In terms of this definition, the total external debt of all developing countries has increased from US$411.4 billion to US$523.4 billion over the period 1990 to 2002 (World Development Indicators, 2004). This creates problems since whenever a country has accumulated a substantial debt, a significant proportion of public expenditure and foreign exchange earnings are absorbed by debt servicing, with heavy opportunity costs. Moreover, foreign debt may have a negative impact on investment through two conceptually distinctive effects: The debt overhang problem and the credit-rationing problem (Eduardo, 1989).

Debt overhang is said to occur when debt payments are linked to the economic growth of the country in question; part of the economic gains contingent on economic growth are expended on debt repayments. The debt overhang phenomenon is sometimes also referred to as a foreign tax on domestic production whereby foregone investment accrues to foreign creditors. Consequently debt overhang may discourage governments from

implementing growth-oriented economic policies. However, if an economy attains sufficiently high growth rates, then debt overhang may not be a serious problem because the returns on investment would be sufficiently high in any event (Lamont, 1995).

The credit rationing effect arises when a debtor nation is unable to repay its debt. In order to narrow the savings investment gap, so as to generate a greater surplus for debt repayment, the authorities in the country in question may increase interest rates that can, in turn, adversely affect new investment and thus subsequently depress future growth prospects. It is therefore obvious that both the debt overhang problem and the credit rationing effect can impede investment in debtor nations and thereby reduce economic growth rates.

Pathberiya and Wijeweera (2005) have identified four distinct phases in the accumulation of external debt by Sri Lanka. Phase one began with Independence in 1948 with total foreign debt at only US$37.8 million and this remained virtually unchanged until 1968. Phase two ran from 1968 to 1977, and during this period the rate of growth in outstanding foreign debt rose slowly. However, between 1978 and 1995, total external debt increased rapidly from US$1,136 million in 1978 to US$9,405 million in 1995, largely as a result of massive public investment programs in agriculture and energy, as well as a significant depreciation of the Sri Lankan rupee. In the final phase between 1996 and 2003, total foreign debt fluctuated considerably, falling until 2000 and thereafter rising to US$10.6 billion in 2003. In the light of these developments, this paper considers whether Sri Lanka has a debt overhang problem.

The paper itself is divided into main sections. Section 2 provides a synoptic description of the theoretical approach to the question of debt servicing. Section 3 briefly describes the extant empirical literature on external debt serving and sketches the empirical contribution attempted in the present paper. Section 4 outlines data definitions and data sources as well as methodological considerations and the results obtained from the estimation procedures. The paper ends with some short concluding remarks in section 5.

2. Theoretical Considerations

Cunningham (1993) classified debt servicing as a primary factor of production and used the following standard production function model to investigate the relationship between economic growth and external debt.

$$Y = (K, LF, DS)$$

where Y, K, LF, and DS represent GNP, capital stock, the labour force and debt servicing respectively. Moreover, Cunningham (1993) argued that when a country is significantly indebted to foreigners, this adversely affects both capital and labour productivity. Moreover, domestic investors are deprived of any benefits arising as a consequence of increases in these factor productivities. Karagol (2002) extended the Cunningham model to incorporate Romer's (1996) conceptualisation of human capital. With an additional human capital (H) variable, the new production function takes the following form:

$$Y = (K, LF, DS, H).$$

3. Empirical Background

An embryonic empirical literature has been devoted to the empirical analysis of the debt overhang problem[1]. For instance, Daniel Cohen (1999) investigated the extent of debt overhang problem and associated debt crises from the on the 1980s to the growth slowdown of the 1990s. He found that debt variables did indeed play a significant role in the reduction in economic growth. Furthermore, Cohen concluded that more than half of this growth slowdown in the large debtor countries could be attributed directly to the debt crisis. In a more detailed paper, Deshpande (1997) tested the debt overhang hypothesis by means of an empirical examination of the investment experience of thirteen severely indebted countries. He established that in countries with debt overhang, external debt captured many of the effects of other explanatory variables that traditionally explained investment levels. In particular, Deshpande demonstrated that the relationship between external debt and investment during the 1980s was consistently negative for the sample countries.

Afxentiou and Serletis (1996) examined whether indebtedness has been detrimental to per capita income growth in moderately and severely indebted countries. Using a Granger causality test they found no such causality in a sample of 55 developing countries. In a similar study, Afxentiou (1993) considered Granger causality between GNP growth and foreign indebtedness in a sample of middle income developing countries over the period 1971 to 1988. He found evidence for a strong debt overhang problem in several cases. Finally, Karagol (2002) used a vector error correction model to analyse the long-run

[1] Pattillo, Poirson and Ricci (2004) provide an excellent summary of both the theoretical and empirical literature on the question of external indebtedness and its effects.

relationship between foreign debt service payments and GNP. Employing the Johansen and Juselious (1990) maximum likelihood cointegration technique, he showed that a long-run relationship did exist in the Turkish economy.

The present paper seeks to add to this nascent literature using Engle and Granger cointegration analysis to examine the long run relationship between economic growth and external debt service payments for Sri Lanka. Although Karagol (2002) did investigate the long run relationship between debt servicing and other macro economic variables, he used a Vector Auto Regressive representation , which considers all variables to be endogenous. By contrast, we argue that the Engle and Granger (1987) technique is more appropriate since it takes into account the theoretical background of the issue under analysis.

The approach adopted in this paper seeks to advance empirical understanding of the external debt problem in other respects as well. For example, only a few studies have investigated the relationship between external debt and growth; instead, most have focused on the relationship between investment and external debt. Secondly, the analysis presented here represents the first time series study using Sri Lankan data. Sri Lanka is a particularly appropriate country to study because it has maintained a healthy growth rate while meeting massive external debt service payments during two decades of civil unrest. Thirdly, whereas lack of long-term data is the major reason for the limited use of time series analysis for many highly indebted countries, fortunately Sri Lanka has data that spans for five decades. Accordingly, we use a longer data set and better specification

methods to estimate both long run and short-run growth elasticities for Sri Lanka over the period 1952-2002.

4. Data, Methodology and Results

Data Definitions and Data Sources

This study used annual data for the period 1952 to 2002. All the data were obtained from Central Bank of Sri Lanka's annual publications and IMF financial statistics. Monetary data is expressed exclusively in US$ millions whereas labour data is given units of a thousand. Gross National Product (GNP) is the dependent variable. Following Cunningham (1993) and Karagol (2002), GNP is determined by four factors of production; labour, human capital, capital and external debt service. We used fixed capital formation to control for the capital stock and population data in thousands to control for labour. Human capital was represented by annual education expenditure by the Sri Lankan government. External debt service payments include interest payments and repayments to foreign creditors. Summary statistics of variables are provided in Table 1.

Empirical Strategy and Results

The present study sought to investigate the relationship between GNP and debt servicing while controlling for other explanatory variables. The empirical analysis first explored whether a long-run relationship exited between economic growth and external debt payments. The analysis then focused on the short-run dynamics of the model. More specifically, it examined whether external debt service payments have

any significant long run and short-run impacts on the rate of economic growth in Sri Lanka.

Standard practice in the time series literature obliges researchers to check for unit roots in each series before estimating any equation. If there is a unit root, then that particular series is considered to be non-stationary. Moreover, estimation based on non-stationary variables may lead to spurious results which produce high R^2 and t-statistics, but without any coherent economic meaning (Granger and Newbold , 1974). In accordance with standard practice, this study checked whether the variables are stationary.

The Augmented Dicky-Fuller (ADF) test for checking unit roots was employed in this study. Since the ADF unit root testing procedure is well established in the literature, its technical details are not considered further.

Three different specifications of ADF tests are available. The first excludes both the trend and the intercept. A second specification includes the intercept but excludes the trend term. The third specification includes both the trend term and the constant term. Following Harris (2003) we used the third specification throughout the analysis.

Selecting an appropriate lag length is extremely important in order to approximate the true data generating process. Too few lags mean that the residuals do not behave like a white-noise process while too many lags reduce the power of the test to reject the null

of a unit root because more lags lead to loss of degrees of freedom (Enders, 2003). The Akaike Information Criterion was used to decide the optimal lag length. The outcome of this procedure indicated a unit root in each series in levels, but rejects the null of unit root in first differences. Hence these variables were considered as integrated of order one or I(1). Put differently, these variables are non-stationary. Accordingly, we cannot expect that the future behaviour of these variables would be the same as their current behaviour. This necessitated that we checked for the cointegration because a long-run equilibrium relationship could still exist in spite of a non-stationarity problem.

One of the most popular ways of testing for cointegration relationships is the Engle and Granger (1987) technique. Two estimation steps are required to carry out this test. First, the best possible linear equation is estimated and residuals are collected. Then a unit root test is used to test whether residuals are stationary. If they are stationary, then a long-run equilibrium relationship is said to exit. As the first step, we estimated the model using equation (1)

$$GNP_t = \beta_0 + \beta_1 DEBT_t + \sum_{i=2}^{4} \beta_i X_t + \varepsilon_t \qquad (1)$$

where GNP and DEBT denote gross national product and external debt service ratios respectively. X represents other the non-debt inputs (i.e. capital stock, labour and human capital) outlined earlier. A quadratic trend term is added to control for the trend effects. In order to test whether GNP represents a long-run equilibrium relationship with the explanatory variables, we conducted an ADF test on residuals from the best

possible linear relationship equation. Engle and Granger (1987) suggest an ADF test of the form given in equation (2).

$$\Delta e = \psi e_{t-1} + \sum_{i=1}^{k} \psi_i \Delta e_{t-i} + \mu + \delta t + \zeta_t \quad \zeta_t \sim IID(0, \sigma^2) \qquad (2)$$

where e_t are the residuals from the cointegration equation and t is the time trend. However, in this step of the empirical analysis, we assumed that μ and δ are zero terms because we had already included deterministic components of constants and trend terms in the cointegration equation. Deterministic components can be added to either the long-run equation or error term equation, but not to both equations (Harris and Sollis, 2003). Results of the test are given in Table 2.

The Engle and Granger two-step methodology suggests several interesting outcomes. In the first place, the explanatory variables and GNP share a long-run relationship. Secondly, although the debt variable has the expected negative sign, it is not statistically significant, in contrast to studies that have found a significantly negative coefficient. As we have seen, a negative coefficient on the debt service variable has been defined as a debt overhang problem. For instance, in case of Turkey, Karagol (2002) found significantly negative coefficient, but very small debt servicing elasticity. In the present context, it can be argued that Sri Lanka has not yet reached the point where external debt inflicts detrimental long-term effects on economic growth. In general, if debt service ratio is greater than 50 per cent, then the possibility of debt overhang problem looms large. By contrast, the current debt service ratio in Sri Lanka has remained close to 20 per cent - well below the required rate for debt overhang problem. Moreover, the Sri Lankan debt service ratio has not only stayed

relatively low compared to highly indebted countries, but has also diminished over the years. For example, debt service ratio decreased from 28.6 per cent in 1988 to 13.2 per cent in 2001. Despite the fact the present study has used external debt payments rather than the debt service ratio, we can still see a decrease in debt payments. By way of illustration, in 1999 total external debt service payments represented US$ 821 million, before falling to US$ 744 million by 2002.

Thirdly, there is a positive relationship between the capital variable and GNP, further implying a small multiplier effect. On this estimate a one dollar capital investment increases GNP by some US$1.15. This relationship is statistically significant at 10% level. Indeed, capital stock appears to be one of the most important determinants of GNP since it imparts the second largest positive effect on economic growth in Sri Lanka according to our estimates. This is perhaps best explained by noting that Sri Lanka is a labour abundant country and not a capital abundant country. Being a relatively capital scarce country, it is not surprising to see a substantial positive impact on economic growth by capital.

Fourthly, human capital and GNP is positively related at all reasonable significance levels. Indeed, of all the variables employed, human capital has the most substantial effect on GNP in the long run. In addition, human capital displays a significantly positive relationship with GNP while labour shows a negative relationship with GNP. This is a most interesting finding and requires some qualification. It can be argued that Sri Lanka is a labour abundant country with more than 20 million residents. More

unskilled labour is thus unlikely to increase the level of output in the country since the economy cannot absorb an increased population at current low economic growth rates. Nevertheless, our results suggest that there may be scope for improvement in labour productivity by showing that a one dollar increase in education expenditure would increase GNP by approximately 10 dollars in the long run. The underlying explanation for this may be that although Sri Lanka is a relatively labour abundant country, labour productivity has remained very low. Accordingly, human capital spending can boost labour productivity and therefore make a big difference to GNP in the long run.

In terms of statistical procedure, we used a RESET test to check whether the regression specification was correct. This was necessary because we had not used double log specification which is common in the literature. RESET suggests that our specification is correct. We separately estimated elasticities for each variable and found that elasticities fluctuated dramatically over the data period, which suggested that the double log transformation is inappropriate[2].

One of the major arguments against the Engle and Granger methodology is it assumes a unique cointegration relationship without testing for this relationship. Although we have not reported the results, we have nonetheless tested whether there are more than single cointegration relationships using the Johansen and Juliesus (1990) maximum likelihood method. We have used trace statistic and maximum eigen value options available for this method and found that only one cointegration relationship exists.

[2] Elasticity estimates are available from the authors on request.

Short-Run Dynamics

The final step in the analysis involved estimating the short-run relationship between foreign debt service payments and GNP. The short-run model serves several important purposes. Firstly, it can be used to identify whether external debt effects are permanent or temporary. If responses are significant in the short run only, then impacts of changes in debt payments are temporary. On the other hand, if responses in both the long and short run are significant, then there will be both transitory and permanent effects. Second, the ECM procedure can be used to confirm the outcomes of the cointegration equation. According to the Granger Representation Theorem, for any integrated of order one I (1) variables, error correction and cointegration are equivalent representations (Enders, 2003). Finally, ECM provides information about the speed of adjustment in response to a deviation from the long run equilibrium, which can be very useful for the policy analysis. We used the Error Correction Model (ECM) suggested by Engle and Granger (1987) in this analysis.

Once the existence of a long run model is established, it is easy to estimate the short run model by applying the standard ECM procedure. If y_t and Z_t are cointegrated (1,1), then the variables have ECM in the form given by equation (3).

$$\Delta y_t = \alpha_1 + \alpha_y \hat{e}_{t-1} + \alpha_2 \Delta z_t + \varepsilon_t \qquad (3)$$

All of the regressors, except the error correction term, are expressed in the first difference form. Error correction term is nothing more than a one-year lag residual obtained from the cointegration equation. X contains all the explanatory variables,

which makes all of the terms in equation (3) stationary or integrated of order zero. Two steps were required by this investigation: The cointegration equation be estimated and the residuals are captured, whereas the second step estimated the error correction model as in equation (3).

The results are reported in Table 3. External debt service payments do not exert significant effect on GNP in the short run. Therefore, in case of Sri Lanka, external debt effects are neither permanent nor transitory. Short-run impacts of labour and human capital are statistically significant at 10 percent level, but size of these impacts is smaller than in the long run. This phenomenon is readily explicable in the case of human capital – the Sri Lankan government obviously cannot expect a higher rate of economic growth immediately after they increase spending on education. However, capital does exert both short run and long run effects on economic growth. Nonetheless, as expected short-run impacts are smaller than the long-run effects.

Significant error correction term confirms our findings regarding the cointegration relationship. Testing the significance of the speed of adjustment coefficient is simply another way to show that the model converges towards a steady-state solution (Harris and Sollis, 2003). The coefficient of error correction term (ECM) suggests that if we insert a shock into the model through one of these variables, approximately 34 per cent of the deviation is corrected within the first year. This is a rather slow adjustment process.

Robustness Check

Cointegration and error correction estimation results are valid only if the residuals of the equations are white noise. Several diagnostic tests can be used to determine whether results are robust. In this study, we employed standard structural break tests, autocorrelation tests, and normality tests. Satisfactory performance in these tests serves to raise the level of reliability of the findings. Moreover, throughout the empirical analysis, we used the Newey West estimation procedure to ensure heteroskedasticity autocorrelation consistent errors. Results of these tests are not included, but they are available upon request from the authors.

5. Conclusion

This study sought to investigate the long run and short-run relationships between external debt and GNP for Sri Lanka over the period 1952 to 2002 in the context of the empirical literature on external indebtedness and economic performance. Some important conclusions emerged from the analysis. In the first place, external debt service payments are found to exert a negative, but nonetheless insignificant effect on GNP in the long run. Accordingly, we found no evidence of a debt overhang problem in case of Sri Lanka for the time period used. Moreover, we did not establish a significant short-run relationship between debt service payments and GNP.

As far as other explanatory variables are concerned, only capital exerted a significant positive effect on Sri Lankan economic growth in the long run and short run at a five

per cent significance level. Human capital exerted a positive influence on growth in the long run at feasible levels of significance, but it was barely significant at ten per cent level in the short run. It would thus appear that Sri Lanka has already surpassed the optimal population that its resources can handle at current human capital levels. Indeed, labour imposed a negative effect on GNP in the long run and the short run.

A significant adjustment parameter confirms the long-run relationship that we obtained from the cointegration equation. Although debt service payments itself is not significant, explanatory variables jointly share a unique long-run relationship with the GNP. In addition, an estimate of the adjustment parameter suggests that a little more than 34 per cent of any deviation to the long-run equilibrium is corrected within a one-year period.

In sum, our results indicate that external debt has not been a major obstacle to Sri Lankan economic growth over the past 50 years. This is presumably because Sri Lanka has not reached a sufficiently high magnitude of external debt to induce a debt overhang problem. Against this background, it will be most interesting to observe the impact on Sri Lankan GNP of the debt write off provided by its leading creditors in the aftermath of the Tsunami disaster.

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Table 1: Summary Statistics

Variable	Mean	Median	Maximum	Minimum	Std. Deviation
DEBT (US$ Millions)	229.594	127.842	821.141	3.109	244.784
CAPITAL(US$ Millions)	1160.591	479.579	4270.332	90.947	1227.678
LABOUR (1000's)	13491.140	13701.200	18752.400	7648.030	3415.141
HUMAN CAPITAL (US$ Millions)	120.587	75.803	399.556	21.877	98.581
GNP (US$ Millions)	4948.249	2911.645	15077.590	945.789	4531.020

Table 2: **Long Run Results**

Variable	Coefficient	t-statistic
CONSTANT*	3823.812	3.849
DEBT	-0.668	-0.449
CAPITAL**	1.147	1.682
LABOUR*	-0.390	-3.295
HUMAN CAPITAL*	10.433	2.781
TREND^2*	4.430	3.215

Note: * significant at 5% level. ** Significant at 10% level.

Table 3: Short Run Results

Variable	Coefficient	t-statistic
CONSTANT	452.076	1.916
DEBT	0.233	0.207
CAPITAL**	1.081	1.864
LABOUR**	-3.129	-1.700
HUMAN CAPITAL**	5.301	1.644
ERROR CORRECTION** TERM	-0.347	-1.821