PROJECTING DEBT SERVICING CAPACITY FOR BARBADOS
(1975-90)

A PRELIMINARY REPORT

by

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Debt servicing capacity of borrowing countries has become a subject of immense importance since 1982 when Mexico signalled its wish to have its maturing debt rescheduled. On the one hand borrowing countries are concerned abour their ability to service outstanding growth. On the other hand international lending agencies have an important need to ensure that they continue lending to countries that stand the best chance of servicing their debts.

Much of the discussion that have taken place in the literature and at the international fora on the economic variables that should be considered important in determining the borrowers performance in debt servicing has taken the form of verbal arguments. Quantitative measures only became popular in the the last decade when improvements in computer software overcame the difficulty of modelling binary-valued dependent variables.

Previous quantitative work had relied on the method of principal components to investigate the relations among several economic variables considered relevant for debt servicing as seen in the work of Dhonte (1975). Others like Frank and Cline (1971) adopted discriminant analysis to identify each observation as belonging to one of two possible outcomes: default

or no default. The logit analysis as illustrated in studies by Feder and Just (1977) and by Cline (1984) seek to improve upon the latter methods by calculating the probability that a particular outcome will occur. Our study will ultimately attempt to adopt the logit framework to examine some of the popular indicators of debt servicing capacity, with a view to ascertain which of them are improtant determinants of debt servicing capacity in Barbados and the other relatively more developed territories in the Caribbean.

Theoretical Framework

The logit model basically uses continuous independent variables to explain a dichotonous dependent variable in which only one choice is associated with each set of independent variables. Examples of such dependent variables are debt rescheduling versus rescheduling or a secondary school student attending a university or not. For instance the logit model assumes that a composite indicator of probability of rescheduling (Pr) may be stated as:

$$Pr = (1 + e^{-Z_t}) \qquad (1)$$

where Z_t is a vector that sums up the information that is available on a particular country. Equation (1) is also known as the cumulative logistic function. By manipulating (1) we obtain the equation to be estimated as:

$$\text{Log}\left(\frac{Pr}{1 - Pr}\right) = Z_t \qquad (2)$$

In this work, Z_t is the variable that indicates the possibility of a default or rescheduling in year t. It takes on a value of unit for a rescheduling or default and zero otherwise. Available studies by Feder and Just (1977) and Cline (1984) have shown that debt indicators such as the debt service ratio, the average maturity of debt, the ratio of reserves to imports, the ratio of the current account deficit relative to exports, real growth rate of exports, and the global availability of credit are the important variables that explain debt servicing capacity in a representative developing country. Therefore we may derive an equation giving us an indication of an overall probability of debt rescheduling as:

$$Z_t = F(\overset{+}{DSR}, \overset{-}{AMR}, \overset{-}{RSM}, \overset{-}{CAX}, \overset{-}{GRO}, \overset{-}{XGR}, \overset{-}{XBOR}) \qquad (3)$$

where the variable are defined as:

DSR: debt service ratio.

AMR: the amortisation rate (the inverse of average maturity of debt).

RSM: the ratio of foreign reserves to imports.

SQCAX: the square of the ratio of current account deficit relative to export.

GRO: growth rate of real economic activity.

XGR: growth rate of real exports.

XBOR: a measure of global credit availability represented as the total net external borrowing by all non-oil developing countries as a fraction of total improts of these countries.

The signs on top of variables indicate the direction of causation on the overall probability of debt rescheduling. Equation (3) embodies both demand as supply factors of debt rescheduling. The estimable relationship becomes

$$Z_t = a_1 DSR_{-1} + a_2 AMR_{-1} + a_3 RSM_{-1} + a_1 SQCAX_{-1} + a_5 GRO + a_6 XGR + a_7 XBOR \quad (4)$$

In (4), the square of the current account deficit relative to exports is used because its influence is believed to be non-linear. All other independent variables are specified in the linear form, with the lagged effect on the dependent variables indicated where necessary.

To estimate equation (4) requires a large number of observations because the dependent variable is not normally distributed for small samples. It does, however, approximate the normal distribution when the sample size is large (see Pindyck and Rubinfeld (1976) p. 250). The maximum likelihood estimation procedure has been successfully applied in existing studies. Because of the size of the required data (60-80) observations, this paper relies on a direct application of the Cline (1984) work to Barbados data. That work used data for 60 countries (including Jamaica and Guyana) over a period of 15 years giving it approximately 670 country-year observations.

Data: Measurements and Sources

The definitions of most of the data used are fairly standard and require no explanation. For instance, the debt service ratio is defined as the ratio of total interest and amortisation payments, divided by exports of goods and services. The variable SQCAX represents the square of the ratio of current account deficit (on the balance of payments) divided by exports. Real exports are calculated by dividing the dollar value of exports by the unit value index of exports of industrial countries to reflect the real purchasing value of developing countries' export earnings.

The variable on global external borrowing measures total net external borrowing, from private and official sources, by non-oil developing countries. It is normalised by dividing by total merchandise imports for these countries. For this exercise we have used global external borrowing by middle income oil importing countries as reported in the World Debt Tables (1984-85), World Bank p. 15. Imports of non-oil developing countries were taken from the International Financial Statistics by the IMF. All other variable were taken from sources at the Central Bank of Barbados. The Annual Statistical Digest (ASD) and the Balance of Payments (BOP) of Barbados provided the bulk of the data used.

The debt service ratio for Barbados averaged 2.2% for the decade ending in 1983. Between 1984-85 it increased to an average of 4.1%. The projected ratios for 1986-90 average 8.1%.*

* Please note that the ratios for 1974-85 excludes private non-guaranteed debts but the projected ratios for 1986-90 includ them.

The ratio of reserves to improts did not vary much, averaging 14.0% between 1974-85. The variable is projected to increase slightly on the average between 1986-90 (14.3%). The variable for global borrowing seems to reflect the sharp increase in international lending in the 1970's. The indicator declined from 1980, varying by small margins up to 1985. It is projected to remain fairly stable from 1986 to 1990.

Results

The results of the estimated logit model of rescheduling used in the calculations is the alternative - reported in table A-3 of Cline (1984). That is

$$Z_t = \underset{(5.24)}{12.405DSR_{-1}} - \underset{(2.48)}{12.875AMR_{-1}} - \underset{(4.19)}{16.554RSM_{-1}} - \underset{(2.16)}{1.383SQCAX_{-1}} - \underset{(3.25)}{0.135GRO} - \underset{(0.94)}{1.424XGR} - \underset{(3.74)}{15.025XBOR} \qquad (5)$$

The numbers in parentheses below the variables are the assymptotic t-ratios.

The results seem to confirm the hypothesis that the key influences on rescheduling are the debt-service ratio, ratio of imports to reserves, amortisation rate, current account deficit, real growth rate and the global environment for financing.

The logit measure Z_t given in equation (5) was transformed into a composite probability of rescheduling as explained by equation (2). Then using the coefficients the implied probabilities of rescheduling (or default) have been calculated

Table 1

Implied Probabilities of Debt-Servicing Difficulty for Barbados (1975-1990)

1975	1976	1977	1978	1979	1980
0.033	0.008	0.014	0.003	0.002	0.018
1981	1982	1983	1984	1985	1986
0.015	0.024	0.005	0.010	0.012	0.004
1987	1988	1989	1990		
0.015	0.020	0.017	0.020		

Source: Based in Cline (1984), Table A-3(E)

with Barbados data. The cut-off probability above which a country was likely to reschedule or postpone debt servicing obligations was fixed at 0.242 in the Cline study. The generally low probabilities calculated for Barbados seem to confirm the fact that Barbados has not had a serious debt servicing problem in the period covered by the study.

The absolute size of these probabilities may not mean very much. What is important is to what extent these calculations give us an idea of the relative difficulty of servicing debt over the period considered. A ranking of the probabilities indicate that 1975 was a relatively difficult year for Barbados, followed by 1982, 1980 and 1981 in that order. The relatively high probability for 1975 could be attributed in part to the weak balance of payments in the previous three years. Indeed real output fell in 1974 and 1975. Also, in 1981 and 1982 not only did real output contract but also the balance of payments were extremely weak, especially in 1981 when the current account deficit increased five-fold on the 1980 level. While the projected probabilities (1986-90) are also low, they give an indication of increasing difficulty of debt servicing up to 1990.

It may be argued that the probability of rescheduling depends not only on the economic circumstances prevailing immediately before the year on which a forecast is made but also on trends that are based on relatively long periods of time preceeding the forecast. To that extent, the results of the analysis, albeit tentative, should be interpreted with caution.

Table 2

Indicators of Debt Servicing Capacity (1974-90)

(Percent)

	DSR[1]	AMR[2]	RSM[3]	SQCAX[4]	GRO[5]	XGR[6]	XBOR[7]
1974	2.2	6.3	10.2	-7.0	-2.2	0.4	7.4
1975	1.7	7.2	16.4	-3.9	-2.0	2.6	8.4
1976	1.7	7.2	10.0	-10.1	4.2	-5.7	9.8
1977	2.1	14.3	11.9	-4.1	3.7	16.5	12.1
1978	2.1	11.0	17.2	-1.0	4.7	12.9	13.2
1979	2.2	8.0	14.9	-0.63	7.9	17.8	12.8
1980	2.1	8.2	13.7	-0.23	4.8	14.5	9.6
1981	2.3	5.0	9.4	-5.4	-2.6	-1.3	9.6
1982	2.6	4.4	14.1	-0.47	-4.3	17.3	10.9
1983	2.7	4.4	15.6	-0.54	0.2	16.7	9.9
1984	3.6	7.0	15.2	0.02	3.8	20.8	9.8
1985	4.5	7.9	20.0	0.06	0.3	0.2	9.7
1986	10.4	10.3	15.2	-0.02	2.3	14.4	10.0
1987	10.1	8.5	15.0	-0.05	3.0	8.8	10.0
1988	7.2	6.9	14.9	-0.003	3.0	7.8	9.9
1989	5.6	5.7	13.5	-0.014	3.2	10.3	9.9
1990	7.4	4.4	13.0	-0.012	2.5	8.8	9.9

Sources: 1974-85 Annual Statistical Digest - Central Bank of Barbados
Balance of payments of Barbados - " " " "

World Debt Tables 1984-85 - The World Bank
International Financial Statistics - IMF

Notes (Table 2)

1986-90

1. Exports based on a three-year moving average growth rate; debt service payments as projected by Central Bank of Barbados.

2. Amortisation payments as projected by Central Bank of Barbados; external debt assumed to grow 5% per year after 1986.

3. Assumes three-year moving average growth rate for imports and reserves.

4. Assumes a three-year moving average for current account balance.

5. Taken from Boamah (1986), Table 3.

6. Based on a five-year moving average for global external borrowing and imports of non-oil developing countries.

References

Boamah, D.O. "Short-term Forecasting of Wages, Employment and Output in Barbados". Paper presented at a conference on Economic Modelling for OECD countries, London U.K. March 1986.

Cline, W.R. International Debt: Systematic Risk and Policy Response, Institute of International Economics, Washington, D.C. 1984.

Dhonte, P. "Describing External Debt Situations: A Roll-over Approach," IMF Staff Papers XXIV, 159-186.

Feder, G, & Just, R.E. "A Study of Debt Servicing Capacity Applying Logit Analysis" Journal of Development Economics, Vol. 4, 1977, 25-38.

Frank, C.R. & Cline, W.R. "Measurement of Debt Servicing Capacity: An application opf Discriminant Analysis, Journal of International Economics, Vol. 1, 1971, 327-344.

Pindyck, R.S. & Rubinfield, D.L. Econometric Models and Economic Forecasts McGraw-Hill Book Co. New York, 1976.