

CHAPTER III
THEORETICAL BACKGROUND AND METHODOLOGY

A. Review of Literature

In the literature of debt servicing capacity and debt servicing problem of a country, a group of potential indicators are available. These are classified in different ways by various scholars. Most of them are identified on the basis of short-term and long-term.

The roots of indicator approach to evaluating debt servicing capacity are frequently traced back to Avramovic and others. While the central focus of that volume was perhaps the study of the long-term evolution of debt, great emphasis was also placed on short-run factors. Here, three categories of variables were pinpointed as being important for assessing a country's short-term debt servicing capacity : fluctuating variables (exports, capital flows, import induced by internal shocks), offsetting variables (reserves, compensatory finance, compressible imports), and rigid variables (interest payments, amortization, and essential imports)¹. Attention has tended to focus on three of these variables -- amortization, interest, and exports -- in the form of debt service ratio. The rationale for using this indicator is

¹Dragoslav Avramovic, et. al., Op. cit., pp. 13 -37.

fairly self-evident. It can be seen as a measure of the burden of a country's debt position and also of its vulnerability of external shocks. Its weaknesses, however, are well known. Apart from measurement difficulties (it frequently includes only service payments on public or publicly guaranteed debt of more than one year's maturity), it ignores other elements in the overall balance of payments and the terms under which countries can refinance maturity debts. It is frequently pointed out that, historically, situations involving debt service ratios that were quite high have been successfully managed and that many countries have been in severe servicing difficulties with low ratios. Furthermore, the debt service ratio has no direct link with the allocative efficiency of the economy. To try to overcome some of these weaknesses, a natural step was to develop some multidimensional evaluation procedures using a number of debt indicators, as well as indicators of general economic performance.

To analyze instances of rescheduling, Frank and Cline use discriminant analysis². The assumption underlying discriminant analysis is that in the total population there exist distinct sub-populations, and the objective is to construct from sample information a rule that will enable one to distinguish between these

²Charles R. Frank Jr. and William R. Cline, "Measurement of Debt Servicing Capacity: An Application of Discriminant Analysis", Journal of International Economics, August 1971, pp. 327-344.

subpopulations. The present case concerns two subpopulations -- rescheduling countries and nonrescheduling countries. The rule is chosen so as to minimize the expected costs of misclassification. Frank and Cline start out with eight indicators, which are debt service ratio(X1), the growth rate of exports(X2), export fluctuation index(X3), non-compressible imports(X4), per capita income(X5), the ratio of debt amortization to debt outstanding (X6), imports to GNP ratio(X7) and imports to reserves ratio(X8), but the best performing classification rule includes only two -- X1 and X6. For predict purpose, they derived the composite index, Z, of debt servicing capacity,

$$Z = 27.3X_1 - 20.4X_6$$

The critical value of Z is 3.44. Using this result, they concluded that the longer the maturity of debt, the lower the critical debt service ratio and by contrast the shorter the maturity of debt, the higher the critical debt service ratio. However, the fact that the rule relies on only financial indicators is not reassuring, particularly since the indicators have very little to say about the real side of the economy or the sustainability of policies.

Frank³ estimated the "weighted index" of debt servicing

³Charles R. Frank Jr., Debt and Terms of Aid, Overseas Development Council Monograph Number One, (Washington D.C., ODC, 1970)

capacity, by using the same formula. His result is presented here.

$$Z = 45.82X_1 + 2.50X_3$$

where, X_1 is the debt service ratio and X_3 is the natural logarithm of the average maturity of all loans. In this case the critical value of Z was found to be 16.72.

Frank and Cline⁴ found that most simple index to predict debt servicing capacity was one which combined with debt service ratio and average maturity of debt. When a country has both a high debt service ratio and long average maturity of debt (i.e., low value of this variable), the index exceeds a critical value and the likelihood is high that such a country will be forced to reschedule its debt service payments.

Dhonte⁵ looks at rescheduling experiences in two ways. He compares the characteristics of rescheduling countries with those of nonrescheduling countries by looking at individual indicators one at a time. His analysis suggests that rescheduling countries were heavily indebted in relation to exports, had large capital inflows relative to imports and suffered from bunching of maturities. The analytic technique that he uses is principal components applied to a set of indicators that are frequently used

⁴ Charles R. Frank Jr. and William R. Cline, Debt Service and Foreign Assistance: An Analysis of Problems and Prospects in Less Developed Countries, AID Discussion Paper, No.19, 1975, pp. 159-186.

⁵ Pierre Dhonte, "Discribing External Debt Situations; A Roll-Over Approach", IMF Staff Papers, Vol XXII, No 1, 1975, pp.159-86.

to summarize debt situations. On the basis of his analysis, Dhonte suggests two hypotheses. First, the degree of successful involvement in debt must be suitably in keeping with borrowing conditions. Second, the growth of debt should be kept in line with that of exports. While this technique has provided useful qualitative evidence, it does not really help in the search for a quantitative technique.

Feder and Just⁶, in the first application of logit technique to rescheduling, consider the following explanatory variables-- the debt service ratio(X_1), a reserves/import ratio(X_2), average maturity of debt (amortization/debt outstanding, X_3), capital inflow/debt servicing(X_4), imports/GNP(X_5), exports growth rate(X_6), index of export fluctuation(X_7), growth of per capita GDP(X_8) and per capita GNP(X_9). The estimated logit function is

$$P(X) = 59.21X_1 + 0.39X_2 - 39.6X_3 - 2.9X_4 - 52.6X_6 - 0.01X_9$$

which gives the best results of predictability. All these coefficient estimators are significant at 5 percent level for one-tail test. The second test gives more significant results after removing the variable X_3

$$P(X) = 35.98X_1 + 0.36X_2 - 2.13X_4 - 30.58X_6 - 0.01X_9.$$

⁶Gershon Feder and Richard E. Just, "A Study of Debt Servicing Capacity Applying Logit Analysis", Journal of Development Economics, March, 1977, (Amsterdam : North-Holland Publishing Co., 1977), pp. 25-38.

Here, all the coefficient estimators are significant at 7.5 per cent level for one-tail test.

Feder, Just and Ross⁷ continued this work. Their principal adjustment was in the scope and definition of the dependent variables. They augmented the list of renegotiation cases with some instances of "serious arrears" taken from the World Bank files. They also excluded renegotiations that were identified as having occurred "in circumstances of no great economic stringency" and that were primarily a means of giving aid. The list of explanatory variables was also altered. For a cut-off probability of 10 percent, the error rates for type I and type II errors were both 8 percent.

B. Theoretical Framework

The theory of external capital needs in developing countries consist of the theories of the internal gap, the external gap, debt services on external debts, and foreign exchange reserve⁸.

The reason for dealing with the theories of both internal

⁷Gershon Feder, Richard Just and Knud Ross, "Projecting Debt Servicing Capacity of Developing Countries", Journal of Financial and Quantitative Analysis, Vol.16(December 1981), pp.651-69.

⁸Seung Hee Kim, Foreign Capital for Economic Development-- A Korean Case Study, (New York : Preager Publishers, 1970), pp.3-4.

and external gaps is the ex ante inequality of the two gaps. Ex post, they are always identical

In terms of the internal gap, foreign capital needs(FK) can be expressed as

$$FK = I_r - S_d$$

where I_r is total investment required to achieve the output target, and S_d is potential domestic savings. Most studies on foreign capital need have focused on estimating the need for foreign capital to achieve a "target" growth rate.

The external gap can also be expressed as

$$FK = M_r - X$$

where M_r and X stand for total import requirement and potential export earnings, respectively. This formulation postulates a required relationship of imports to total output and an exogenously determined level of exports.

Foreign debt service requirements(DS) are interest and principal payments on external debts. In addition, it may be expected that the foreign exchange reserve should grow as development proceeds. The change in reserve $d(FX)$ can be obtained conveniently by relating the level of foreign exchange reserve to trade volume. Thus, total external capital needs(EK), including debt services, and the change in foreign reserve, are defined as

$$EK = FK + DS + d(FX)$$

where FK is either internal gap or external gap.

Debt service represents additional foreign exchange needs on top of foreign capital needs related to the internal and external gaps discussed previously. Therefore, debt servicing capacity of a developing country may conveniently be discussed in terms of benefits and cost of foreign capital in the process of economic growth. Foreign capital supplements national resources and thus helps raise the rate of capital formation. By making possible a higher rate of investment than would otherwise be feasible, foreign capital raises the rate of income growth.

Against this benefit to the national economy, there is the cost of foreign capital in terms of payment of debt service. This payment implies that the borrower country has to forego a certain amount of purchasing power, which could otherwise be used for consumption or investment. Debt servicing capacity depends on the ease with which a country can reconcile competing claims on its resources; on the one hand there is the demand for higher domestic consumption and investment, on the other there is the obligation to foreign creditors. A default implies the undermining of confidence, denial of foreign long-term loans in the future and at the extreme, isolation from the major world centers of finance and commerce. Debter countries have to balance what may appear to be immediate advantages of higher home consumption and/or investment against the adverse impact on future economic

growth of being isolated from international finance.⁹

The problem of reconciling competing claims on resources has a different complexion, depending on the time horizon under consideration. At a point of time, or in the short period, debt servicing difficulties take the form of a liquidity crisis. Dis-equilibria in the balance of payments are the heart of the matter. Whether a debtor can make both ends meet depends on the relative strength of elements of rigidity (i.e., the contractually fixed external obligations, minimum tolerable level of imports) and countervailing elements of flexibility (i.e., availability of compensatory finance and inessential imports). It also depends on the skill of the authorities of the debtor country in managing the balance of payments.

Difficulties in transferring debt service payments at a point of time may result from cyclical or accidental fluctuations in exports, capital inflow and imports, or from capital flight or bunching of repayment obligations. Alternatively, the liquidity crisis may be a symptom of structural weakness of the economy. Frequently, but not in all cases, it is a combination of purely transitory disturbances and long-term factors.

In real life, debt servicing difficulties almost always manifest themselves in liquidity crises in the balance of pay-

⁹Dragoslav Avramovic, et.al., Op.cit, p.10.

ments. However, a thorough appraisal of creditworthiness cannot be based on short-period analysis only. Debt servicing capacity cannot be divorced from the general problem of economic growth, particularly when the main focus of attention is a low income country. Reconciliation of competing claims on resources is easier when total resources are growing than in a stationary economy.¹⁰ As long as the incidence of debt service falls on a part of the increment in per capita income, it is possible for consumption and nationally financed investment to rise with equal pace with service payments. And if the rate of increase in real income and savings, remaining available after the claims of foreign capital have been met, is reasonably high, if growth occurs in a continuous fashion, and if its benefits are widespread, it can plausibly be argued that debt service payments will also be made smoothly.¹¹ In this case, the opportunity cost of fulfilling external obligations is less obvious and presumably less burdensome, than in a situation in which service payments impinge on existing living standards and employment levels. Therefore, it can be argued—and this is the fundamental judgement on which this study rests—that

¹⁰Gerald M. Alter, "The Servicing of Foreign Capital Inflow by Underdeveloped Countries" in A.N. Agrawala and S.P. Singh, Accelerating Investment in Developing Countries (Oxford University Press, 1969)

¹¹Dragoslav Avramovic, Debt Service Capacity and Postwar Growth in International Indebtedness, (Baltimore, The Johns Hopkins Press, 1958), pp. 64-72.

continuing growth in per capita production and the underlying process of rapid accumulation of productive capital is the basic long-run condition of debt servicing capacity.

The main task of long-run analysis is to define the conditions under which the economic growth process, which is partly financed by foreign capital borrowed on conventional fixed terms, can succeed; and which can thus provide a basis for continuing servicing of external debt, and, if necessary, for its ultimate retirement. Relationships between several crucial variables -- return on capital, savings, investment, growth of output, required foreign capital inflow and the associated cycles of debt service ratios -- should be formulated and their time-paths followed. Values for the variables can then be chosen on the basis of available evidence and the implications of such choices explored. What are the conditions for a successful outcome of the growth-cum-debt process? If the values of variables in particular countries appear such that a successful outcome cannot reasonably be expected within a certain period, then the external financing of the growth process should either be postponed until the variables have attained the values at which the conventional terms of borrowing can operate without excessive risks; or the growth process, if it is to be financed externally at all, should be financed at soft terms, provided the governments suppliers of external capital are willing, and find it possible, to subsidize, out of tax

proceeds, such soft terms transactions. It is the purpose of long run analysis to develop a framework within which alternative developments of the growth-cum-debt process can be projected over specified periods of time under different assumptions regarding the values of the major growth variables, the assumptions themselves being initially derived from empirical evidence of the past and then projected for the future in accordance with trend movements that can plausibly be expected.

Since national economic growth occurs in the framework of the world economy and since we are concerned with debt service obligations to external creditors, the discussion cannot be limited to domestic variables only. For growth to materialize, it is not sufficient just to raise the rates of savings and investment. The pattern of production, and its international competitiveness, must be such as to enable the debtor country to purchase abroad goods that it cannot produce efficiently, and also to translate the surplus of domestic savings over domestic investment requirements into foreign exchange without much difficulty. If international demand for the products of the debtor country rises only sluggishly, or if domestic production is not competitive, or if export sales fluctuate persistently, this country will experience limits on the rate of real income growth that it can sustain over time and hence on the savings surplus that is needed for debt servicing abroad.

C. Hypotheses

As mentioned in previous section, debt servicing capacity depends on the ease with which a country can reconcile competing claims on its resources. Thus, it cannot be separated from the general problem of economic growth. Reconciliation of competing claims on resources is easier when total resources are growing than in a stationary economy. For growth to materialize, it is not sufficient just to raise the rates of savings and investment. The pattern of production and its international competitiveness must be such as to translate the surplus of domestic savings over domestic investment requirements into foreign exchange without much difficulty. Given these situations, there are four hypotheses to be examined in this study.

1. The debt servicing difficulties can be expected when the growth rate of GDP is low.

2. Difficulties in transferring debt service payments may result from cyclical or accidental fluctuations in exports.

3. A country which increases debt with fast pace may face difficulties in debt servicing.

4. Debt problems have their source in overambitious government expenditure plans.

D. Methodology

The technique which we use is a modified form of discrimi-

nant analysis in which Frank and Cline¹² took into account the differences in variability of the factors used to devise the index among debt rescheduling countries.

Let Z stand for the composite index of debt servicing capacity and X for the vector of observations of 18 indicators of debt servicing capacity that are to be combined into the composite index. That is, $Z = f(X)$. We wish to find the function $Z = f(X)$ and a critical value Z^* of this function such that if $Z = f(X) \geq Z^*$, we classify a country as coming from population π_1 (the population of rescheduling countries) and if $Z = f(X) < Z^*$, we classify a country as coming from π_2 (the population of countries which have not reached the limit of their debt servicing capacity).

For any function $f(X)$ and critical value Z^* , there are two kinds of errors which can be made. A type I error results when a country actually belonging to π_1 is classed in π_2 , and a type II error results when a country actually belonging to π_2 is classed in π_1 . The expected cost of making error is

$$C = q_1 C(I)p(I) + q_2 C(II)p(II)$$

where $C(I)$ and $C(II)$ are the cost of making type I and type II

¹²Charles R. Frank Jr. and William R. Cline, "Measurement of Debt Servicing Capacity : An Application of Discriminant Analysis", Journal of International Economics, August 1971, pp. 327-344

errors, respectively, and $p(I)$ and $p(II)$ are the probabilities of making type I and type II errors, respectively. We wish to choose a function $f(X)$ and critical value Z^* such that expected cost of errors is minimized (a Bayesian procedure).

It is possible to show¹³ that $f(X)$ which minimize the expected cost of errors is the quadratic form

$$Z = f(X) = X'QX + RX + S \quad (1)$$

where Q is an $n \times n$ matrix, R is an n -dimensional column vector and S is a constant.

$$Q = (\Sigma_2^{-1} - \Sigma_1^{-1})/2 \quad (2)$$

$$R = u_1' \Sigma_1^{-1} - u_2' \Sigma_2^{-1} \quad (3)$$

$$S = \frac{1}{2} u_2' \Sigma_2^{-1} u_2 - \frac{1}{2} u_1' \Sigma_1^{-1} u_1 + (\log |\Sigma_2| - \log |\Sigma_1|)/2 \quad (4)$$

Σ_2 and Σ_1 are the covariance matrices of X in π_2 and π_1 , respectively; and u_2 and u_1 are the means of X in π_2 and π_1 , respectively. It is easy to see that if $\Sigma_2 = \Sigma_1$, $f(X)$ becomes a linear function. The critical value of Z is determined such that if a country's Z value is above the break-point she is classed in π_1 and if it is below she is assigned to the other.¹⁴

In discriminant analysis, the percentage correctly class-

¹³T. W. Anderson and R. R. Bahadur, "Classification into Two Multivariate Normal Distributions with Different Covariance Matrices", Annals of Mathematical Statistics, 33, 2, 1962, pp.420-431.

¹⁴David A. Aaker, Multivariate Analysis in Marketing: Theory and Application (Belmont, California: Wadsworth Publishing Company, Inc., 1971), p.118

ified is somewhat analogous to R^2 . One tells how well we classified the population; the other tells how much variance we explained.¹⁵

E. Definition of Variables and Data Used for the Study

In the literature of debt servicing capacity of a country, a number of indicators are available. Out of those potential indicators, eighteen are selected for this study, which may be defined as follows :

1. The debt service ratio, X1. This is the ratio of external debt service payments to export earnings. The debt service payments include principal payments and interest payments, and export earnings comprise of merchandise and service exports. A country with high value will have difficulties to service debt.

2. The ratio of debt amortization to total outstanding debt, X2. This is the inverse of the average maturity of loans. A low value for this indicator suggest that a country has predominantly long-term debt liabilities. A country in this situation does not have very much short-run flexibility in reducing debt service commitments by temporary reduction of borrowings. Thus, *ceteris paribus* such a country is more likely to reschedule. The absence of short-term liabilities also indicates that a country does not have significant access to short-term commercial credit

¹⁵David A. Aaker, *op. cit.*, p. 12.

facilities, i.e., the country is not particularly "creditworthy". A lack of good credit reputation makes it difficult for a country to obtain quick access to additional credits when shortfalls in exchange occurs.

3. The ratio of annual outstanding debt changes to GNP, X3. If a country has high value of this, she is expected to have rescheduling.

4. The ratio of annual outstanding debt changes to export earnings, X4. Export earnings comprises of merchandise and service. A country which has higher value of this will have more probability to reschedule.

5. The growth rate of export earnings, X5. Export earnings are comprised of goods and services. The growth rates are estimated as a percentage changes relative to previous year. A country with higher growth rate of export earnings will have less difficulties to service debt.

6. Per capita GNP, X6. Since continuing growth in per capita production and the underlying process of rapid accumulation of productive capital is the basic condition of debt servicing capacity, when a country is able to have a higher per capita GNP, she can service debt easily.

7. The growth rate of outstanding debt, X7. If a country increase debt fast, she will have difficulties.

8. The ratio of external reserves to imports, X8. Exter-

nal reserves are comprised of government reserves, reserves of government agencies and institutions, the reserves of Central Bank, and reserves of commercial banks. Imports include service, too. Since a country with more external reserves can allocate it for servicing debt, she will have less difficulties to service debt.

9. The import essentiality index, X9. This can be regarded as a proxy to evaluate the import essentiality. Capital goods and intermediate goods are assumed as essential imports. In case of shortfall of export earnings, crop failure, or any emergency, the country can reduce its consumer goods imports rather than capital goods and intermediate goods, so that the country with higher value will have more difficulties in servicing debt. The measure is defined as the ratio of capital and intermediate goods imports to total imports.

10. The export fluctuation index, X10. The measure can be defined as the average absolute percentage deviation from an 17 year trend (1965 - 1981). We reasoned that a country with stable export earnings was less vulnerable to foreign exchange crises and could tolerate a higher debt service ratio.

11. The real growth rate of GDP, X11. Reconciliation of competing claims on resources is easier when total resources are growing than in a stationary economy. Thus, the country with

higher value will have better chance to service debt successfully.

12. The ratio of imports to GNP, X12. Import is composed of goods and services. The country with lower ratio of it will have less difficulties in debt servicing.

13. The ratio of net capital inflow to debt service, X13. Net capital inflow is defined as disbursement minus principal payments. A country with high ratio is expected not to have difficulties in debt servicing.

14. The percentage of manufactured goods export to total export earnings, X14. Manufactured goods export is defined as the sum of following items, i.e., SITC number 5, 6, 7 and 8. This index is introduced here as an attempt to evaluate export diversification, originally. However, due to the inappropriate measurement, it may rather be called as level of industrialization index.

15. Growth rate of money supply, X15. Money supply is money plus quasi-money, which are estimated in terms of domestic currency. We dropped this variable later because of same effect as X17.

16. The ratio of balance of payments to GNP, X16. The balance of payments is in terms of current account. A country with surplus in balance of payments will not have difficulties in debt servicing because she can allocate it to debt servicing.

17. The inflation rate, X17. It is defined as the increasing rate of consumer price index. The higher is the infla-

tion rate, the more dangerous in debt servicing is a country since inflation will result in balance of payments deficit.

18. The ratio of government budget balance to the government expenditure, X18. Since foreign borrowing is carried out by the government to assist in financing domestic expenditure plans, a country with higher value of this has less probability to reschedule.

The main data sources of this study are various issues of World Debt Tables (World Bank), International Financial Statistics (International Monetary Fund) and Commodity Trade Statistics (United Nations).

World Debt Tables are used for the external debts and debt services. And most of national account, trade and balance of payments statistics are available from International Financial Statistics. A remained commodity trade data are obtained by Commodity Trade Statistics. Others are found in various publications published by Korea Economic Planning Board, Ministry of Finance and other government agencies. To be specific, the data sources of each variable are given in APPENDIX E.