Do Defence Expenditures Increase Debt Rescheduling in Turkey? Probit Model Approach

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Abstract: This paper empirically investigates the importance of financial and political variables in determining debt rescheduling probabilities in Turkey. The problem of sovereign debt default and rescheduling has been subject of substantial academic research during the last two decades. There have been criticism of models of developing countries indebtedness and rescheduling that relies solely on some economic or financial predictors related to country debt, the foreign exchange sector or the domestic economic situation. Using probit analysis, this paper indicates that financial variables are important determinants factors of rescheduling probabilities. However, political variables (importantly defence) are not significant in our models.

1. Introduction

Many developing countries have the problem of external debt in recent years. Increasing debt stocks create serious debt service problems. Another important issue of these countries, they spend an important portion of their GDP to defence and their level of arms imports are high. Turkey is an example with increasing external debt especially after 1980's and at the same time, Turkey is one of the biggest importers of weapons in the world. In 1999 it was the world' second largest arms importer after Saudi Arabia. Developing defence industry and internal security problems are main reasons for this trend. The goal of this paper is to use a probit model to test what are the financial and political characteristics of Turkish economy that reschedule its debt. Probit analysis is used, which is a method specifically developed to deal with the binary-valued dependent variable case. The probit approach assumes that a discrete event takes place after the combined effect of certain economic variables reach a given threshold level. This approach is especially suitable when several observations (of both rescheduling and non rescheduling years) for a given country are included. However, the probit model used here is estimated with more recent data and financial and political ratios different from those used in other studies. This paper proceeds as follows: Section 2 briefly reviews the previous studies. In section 2 methodology and the variables are given. Section 3 presents the empirical results. Finally section 4 devoted to concluding remarks.

2. Previous Studies

The literature concerning defence-debt issue is rather limited. The main reason for limitation is that unavailability of military debt data. However, Brzoska (1992) comprehensively analyse the issue and found that military expenditure is an important

component of external debt for many developing countries. Alami (2002) estimates that over 40% of the total debt stock of Arab countries come from military. In Pakistan, higher defence spending affects the capability of external borrowing (Looney 1998). Brück (2000) study concluded that civil war in Mozambique caused high debt burden. Military debt negatively effect economic growth (Looney & Frederikson, 1986; 1993). Recent study of Dunne, Freeman & Soydan showed that military causes higher debt stocks in many countries. Kollias, Manolos & Paleologou (2002) analysed effect of defence spending on the external debt of Greece and found a positive relationships with the political factors. Sezgin (2004) examined defence-debt relationships between 1979-2000 using Cointegration analysis and found no clear evidence of defence debt relationships. Moghadam (1995) has extended to account for the major political variables identified as being potential determinants of a country's debt rescheduling and its creditworthiness. The debtor LDCs are partitioned by geographic region, and the probit analysis is applied to ascertain whether the determinants of debt rescheduling are homogeneous or whether they differ by region. The estimation results ındicate that central military expenditures / central government expenditures ratio significant for Africa, South of the Sahara and for all debtor LDCs (less developing countries). It means that as military expenditures increse relative to central government expenditures , the probability of debt rescheduling increase for Africa, South of the Sahara and for all debtor LDCs. However, the coefficient of the military expenditures / central government expenditures ratio is not a significant determinant of debt rescheduling for Latin America and Carribean. The evidence presented here indicates that there are substantive differences in the determinants of debt rescheduling between regions. Furthermore, the estimated probit equation for the data yields results that are inconsistent with those obtained for either region. The

aggregation of financial data across all regions may produce significant statistical results; however, generalisation from these results to specific regions is inconsistent with the available evidence.

This study is another attempt to analyse defence-debt relation for Turkey with relatively longer period and different approach. All studies reported a significant relationship with some economic variables related to country debt, the foreign exchange sector or the domestic economic situation. There is no single country study in the literature. The single country analysis could be useful for financial analysts preoccupied by LDC's debt servicing problems. Moghadam (1995) implies that creditors cannot formulate a uniform set of credit policies applicable to all LDCs. Creditors must examine the determinants of debt rescheduling and rescheduling by region and if possible country-by-country to determine which policies are appropriate.

3. Methodology and Variables

A probit model is used to test the correlations of the traditional macro and political variables with debt rescheduling of Turkey. A probit model is an appropriate method for studying the debt-rescheduling behaviour of the debtor countries because countries either do or do not reschedule their debt and a probit model is a statistical procedure developed to estimate the relationship between a dichotomous dependent variable and continuous explanatory variables. Probit models transform a dichotomous dependent variable into a probability. The dependent variable is categorical. Specifically, Y is a discrete random variable that assumes one of the two possible values, 0 if a country does not reschedule during a given year and 1 if it does. The independent variables may be either continuous or discrete, but they are assumed to be nonstochastic.

The probit model used to test the correlations between the predictor variables and debt rescheduling may be summarised as follows:

$$Y_{it} = \sum_{j=1}^{n} \beta X_{it} + e_{it}$$

(1)

Where

Y_{it} = Dichotomous or binary choice random variable, decision to reschedule debt, that takes the value of 1, when country i has rescheduled its debt payments in year t; 0, when country i has not rescheduled its debt payments in year t; and

X_{it} = the financial ratio and structural ratio of country i in year t.

Thus, the qualitative response model determines the probability that a country i with given attributes $X_{1i}, X_{2i}..., X_{ni}$ will reschedule its debt, against the alternative response that it will not. Coefficients $\beta_1, \beta_2....\beta_{n1}$ may be interpreted as the partial derivatives of the probability of rescheduling with respect to the independent variables, $X_{1i}, X_{2i}..., X_{ni}$.

2.1. Variables

2.1.1. Financial Variables

Debt service ratio (DS/EX): This ratio is defined as the ratio of external debt service payments to the value of exports of goods and services. The most commonly used indicator of debt servicing capacity is the debt service ratio. The debt service ratio relates to the fixed foreign exchange outflow obligations of debt service payments to what is generally the major foreign exchange inflow. Debt service refers to the

payment of the principal and the interest in a given year for all medium term debt, long term debt and short term debt. The higher the ratio the more likely the government will face difficulties in repayment and, thus, the higher the likelihood of rescheduling.

Frank and Cline (1971) declare that the rationale for the use of the debt service ratio as an indicator of a country's debt servicing capacity is that an increase in the debt service ratio refers to increased vulnerability to foreign exchange crises. Higher exports fluctuations should generally be associated with higher probabilities of a balance of payments crises and hence, higher rescheduling probabilities. A shortfall in exports earnings will force the government to draw down exchange reserves or decrease imports in order to accommodate debt service payments. Increased capital imports might, of course, compensate for the exports shortfall. Thus, an increase in the ratio would increase the risk of the government resorting to debt rescheduling.

The exports to GNP ratio (EX/Y): The debt service ratio does not capture the full impact of exports on a country's debt servicing capacity. The absolute levels of exports, or, in order to facilitate inter- country comparison, exports relative to GNP, would also have a bearing. Of two countries with equally high debt service ratios, the country having the highest exports/GNP ratio would have the most foreign exchange left over after debt service payments relative to its GNP, ceteris paribus. This is a more stable characteristic of the economy and may thus influence the attitude toward rescheduling. A high exports/GNP ratio would tend to reduce the need for painful domestic adjustments, associating a large exports sector with a low probability of rescheduling.

2.1.2. Political Variables

The political situation of debtor country is important for determinants of debt rescheduling of Turkey. Not only financial variables but also political dimension of country important to must be included to have robust specified model.

The ratio of government expenditures to GNP (GE/Y): This ratio is defined as the ratio of government expenditures to GNP. The ratio of government expenditures to GNP is used as a determinant of debt rescheduling in order to measure the relative size of public sector. The larger public sector the higher probability of debt rescheduling. Thus, we expect that GE/Y will positively related to the probability of rescheduling.

The ratio of defence expenditures to government expenditures (DE/GE): This ratio directly measures political instability. Defence expenditures are an objective and direct measure of a country's preparations to deal with perceived or actual instability (either from internal or external sources) (Moghadam, 1995).

The ratio of defence expenditures to GNP (DE/Y): Defence expenditures ratio to GNP directly measures the government preparations for and cost of reaction to instability. This ratio means that higher defence expenditures higher the probability of rescheduling.

Data for this study came following sources: Defence expenditures data were taken from The Stockholm International Peace Research Institute (SIPRI) various years. Government expenditures are taken from State Planing Organization (2002). The external debt data are obtained from the UT (the Undersecretariat of Treasury,

Turkey). Data for GNP, investment, debt stock and exports are taken from State

Planing Organization (2002). International reserves are taken from IMF, *International*

Financial Statistics Yearbook.

3. Estimation Results

For this study, four models are estimated. Model 1 uses DS/EX, EX/Y, GE/Y and

DE/GE to explain the probabability of debt rescheduling. Model 2 includes DS/EX,

EX/Y, DE/GE to explain the financial variables and defence expenditures to

government sector size to determine the likelihood of debt rescheduling. Model 3

includes financial variables (DS/EX, EX/Y) and instability variable (GE/Y). Model 4

differs from the others only by its inclusion of the both (DE/GE and DE/Y) and

financial variables (DS/EX, EX/Y). Estimation results for the four models are shown

in Table 1, the ratio of government expenditures to GNP (GE/Y), the ratio of defence

expenditures to government expenditures   (DE/GE) and the ratio of defence

expenditures to GNP (DE/Y) are not significant in our models.

The debt service ratio is significant in four models. In previous studies the debt-

service ratio has traditionally been used to assess the ability of a country to repay its

debt. The results here indicate that the debt service ratio is playing a big role as a

predictor for Turkey. The debt service ratio has been found to be a significant

determinant of LDC creditworthiness in several studies (Odedokun, 1995) and (Feder

et al.,1981). Odedokun (1995) states that a high level of debt service payments

increases the chance of rescheduling of debt for Sub-Saharan Africa, since the debt

service ratio refers to the size of foreign exchange earnings absorbed by the principal

plus interest in a given period for all long-term, medium-term and short-term debts.

The ratio of exports to GNP (EX/Y) has played a significant role on debt rescheduling in all four models. A country with a high rate of exports growth is less likely to default or ask for rescheduling than otherwise. The country having the highest exports/GNP ratio would have the most foreign exchange left over after debt service payments relative to its GNP, ceteris paribus. This more stable structural characteristic of the economy may thus affect the attitude toward rescheduling. A high exports/GNP ratio would influence or reduce the need for severe domestic adjustments, associating a large exports sector with a low probability of rescheduling. This is because the growth of the export sector is considered to be an important element in debt servicing capacity since, if the economy is not stagnating, its imports expenditures are bound to increase (Feder *et al.*, 1981).

Table 1. Probit Estimates of Rescheduling Probability
(Traditional Macro Variables and Structural Variables)

Variables	Model 1	Model 2	Model 3	Model 4
	Coefficients	Coefficients	Coefficients	Coefficients
Constant	-2.3383 (-0.853)	-1.4576 (-0.889)	0.1345 (0.121)	-2.1899 (-1.097)
DS/EX$^{(+)}$	3.9718)** (2.192)	4.1606** (2.242)	4.4707** (2.237)	3.7535** (0.0188)
EX/Y$^{(-)}$	-33.9117*** (-2.985)	-32.9447*** (-3.124)	-34.4803*** (-3.024)	-33.1243*** (-3.409)
GE/Y$^{(+)}$	3.5517 (0.420)		-3.3814 (0.434)	
DE/GE$^{(+)}$	6.5380 (0.875)	4.6784 (0.819)		31.0263 (0.673)
DE/Y$^{(+)}$				31.0263 (0.799)
X^2	20.51459*** (0.00039)	20.40847 *** (0.00013)	19.82768*** (0.0001)	20.89855*** (0.0003)
Right Predictions	0.74	0.72	0.74	0.80

t statistics are in parenthesis.
These results are carried out by Limdep 7 version. See Greene, W (1995)
The Likelihood Ratio Statistic is reported for the general form of heterocedasticity.
( )^e indicates hypothesised or expected sign.
*significant at 10 percent level.
**significant at 5 percent level.
***significant at 1percent level.
 DS/EX= The ratio of total debt service to exports of goods and services, called debt service ratio,
EX/Y= The ratio of exports of goods and services to GNP,
GE/Y; The ratio of government expenditures to GNP
DE/GE ; The ratio of defence expenditures to government expenditures
DE/Y : The ratio of defence expenditures to GNP

We also examined the relative performance of the model with the successive and failure criteria. These criteria are the predictive capability of the four models should be investigated with this perspective; one should look for models that minimise the type error I (not predicting a rescheduling which occurs) and type II errors (predicting rescheduling that a rescheduling not occur). The evaluation of the predictive

performance of such a model is based on Feder and Just (1977). They claim that the type I error has a greater cost than the type II error (predicting a rescheduling that a rescheduling not occur). Feder and Just (1977) state that most of the actual rescheduling observation has a high probability of rescheduling while most of the non-rescheduling observations have a low probability. To have further insight into the performance of the model, one can consider the following hypothetical situation; suppose that for each of the 46 observations the predicted probability of rescheduling is known a priori while it is not known whether a rescheduling will indeed happen.

Suppose further that the following rule of thumb is adopted: given a critical probability value P*, all countries with probability greater than P* are denied credit while all others are granted loans. Then, for any given P*, there are two possible types of error :

(1)   type I error-the case where a country has a probability lower than P* but actually rescheduled; and

(2)   type II error-the case where a country has a predicted probability higher than P* but does not reschedule.

Table 2 reports the frequency of the two types of errors in the four models for various values of P*.   However, Figure1- Figure 4 shows graphically frequency of the two types of errors in the four models.   From the Table 2 results and all figures, one could see that 12 errors (type I and type II) are made in a total of 46 observations in model 1 at P*=0.50 critical value; and 13 (type I and type II) errors are made with model 2, 12 errors (type I and type II) in model 3 and 9 (type I and type II) errors are made in Model 4.

When we compute the errors separately, in model 1 type I errors occurs 5, 6, 6, 4 errors in model 1, model 2, model 3 and model 4 respectively. Whereas in the case of type II errors, the model 1 generates 7, model 2 gives 7, model 7, model 3 provide 6 and model 4 gives 5 errors. The average probability of default predicted by model 1 for Turkey with a predicted probability of rescheduling greater than 0.5 for the relevant period is 11 percent, suggesting that Turkey, on average, could not be expected to fall in rescheduling. The average probability of rescheduling predicted by the model 1 for Turkey with a predicted probability of rescheduling lower than 0.5 for the relevant period is 15 percent, suggesting that Turkey, on average, could be expected to fall in rescheduling. This procedure reflects the relative valuations of the two types of error either by policy makers or by private sector risk analysts. Consider again the opportunity costs associated with the two errors. If funds are not lent to a country which is predicted to reschedule but, actually does not, the opportunity cost will be the interest differential over the next best alternative investment (Lyod *et al.*,1988). Overall, the type I errors (the case where a country has a probability lower than P* but actually rescheduled) are the same as the type II errors (the case where a country has a predicted probability higher than P* but does not reschedule).

| Table 2. Frequencies of Actual and Predicted Outcomes												
Model 1				**Model 2**			**Model 3**			**Model 4**		
Predicted				Predicted			Predicted			Predicted		
Actual	**0**	**1**	Total	**0**	**1**	Total	**0**	**1**	Total	**0**	**1**	Total
0	26	5	31	25	6	31	25	6	31	27	4	31
1	7	8	15	7	8	15	6	9	15	5	10	15
Total	33	13	46	32	14	46	31	15	46	32	14	46

Predicted and Observed Rescheduling Figure 1.
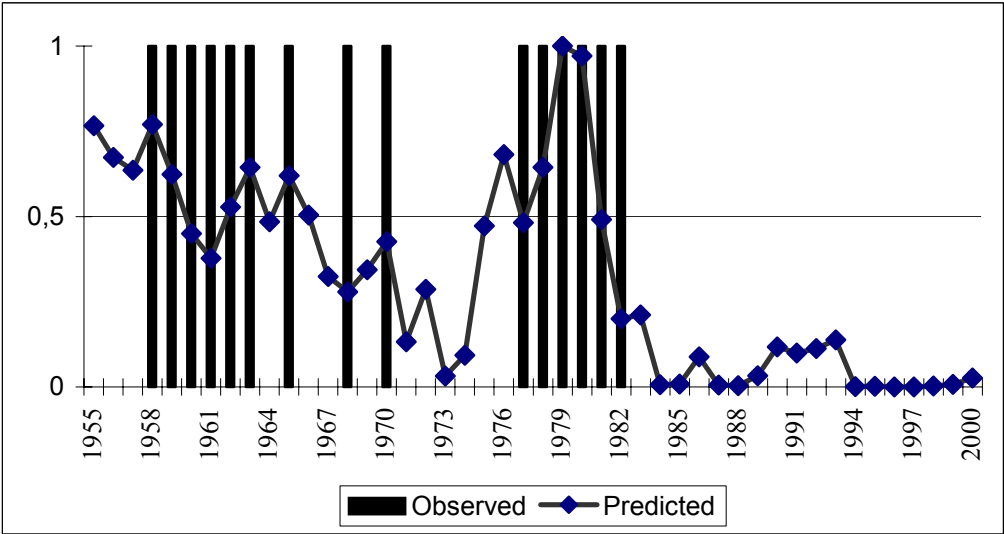
Predicted and Observed Rescheduling Figure 2
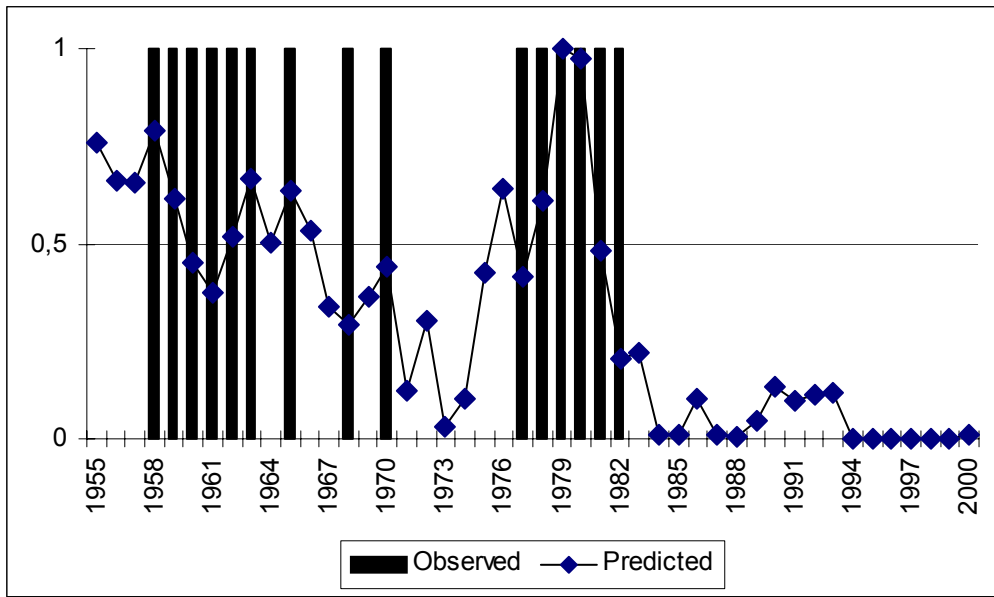
Estimated and Observed Rescheduling Figure 3.

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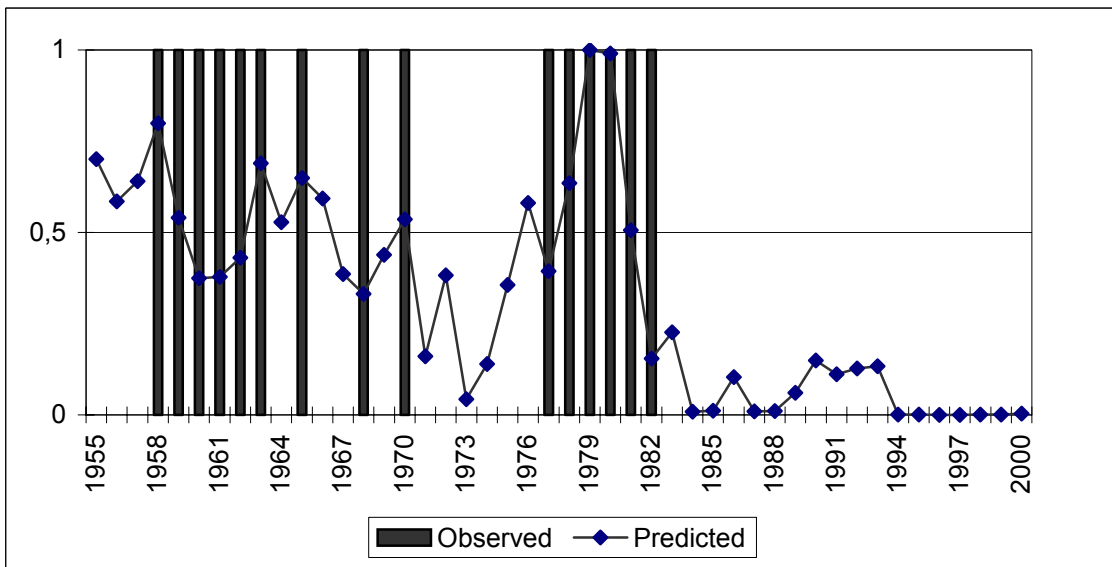
Estimated and Observed Rescheduling Figure 4
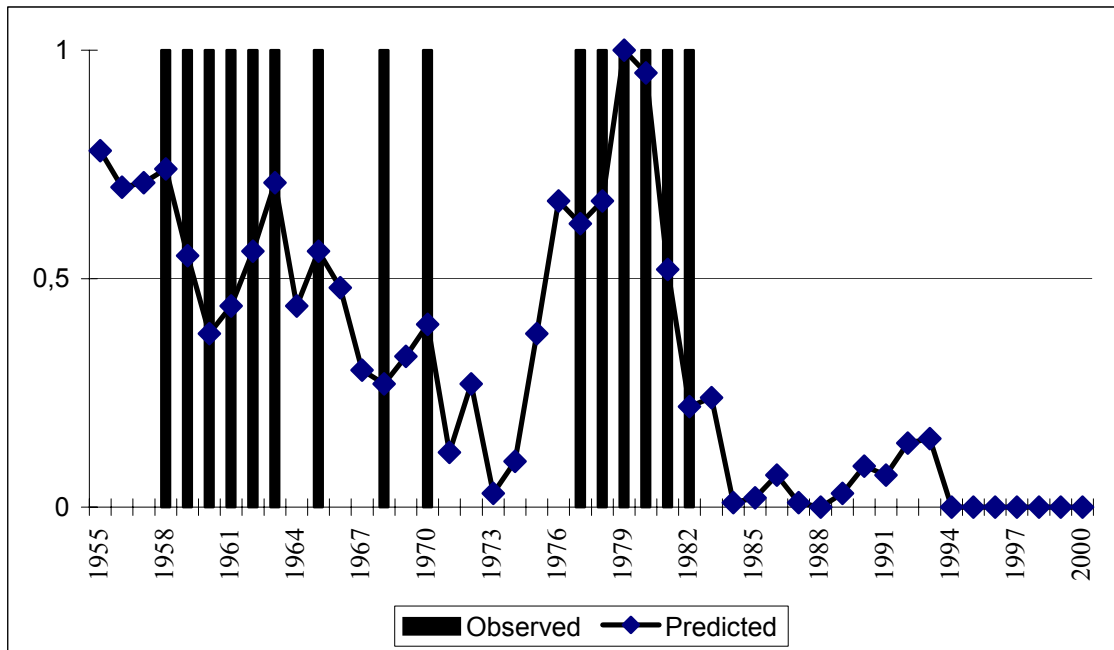
Conclusions

This paper has investigated the importance of financial and political variables in determining debt rescheduling probabilities in Turkey. Using probit analysis, our results indicate that financial variables are important determinants factors of rescheduling probabilities. However, political variables are not significant in our models. Defence variable is not important factor for determining debt rescheduling in Turkey. In summary, on the basis of probit analysis, our model estimation results indicate that the ratio of total debt service to exports of goods and services, called debt service ratio (DS/EX), the ratio of exports of goods and services to GNP (EX/Y) are significant The ratio of government expenditures to GNP (GE/Y) and the ratio of defence expenditures to government expenditures (DE/GE) and the ratio of defence expenditures to GNP (DE/Y) are not significant in our models

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