Presenting Effective way to Model Strategic Debt Recovery in World Trade : A Strategic Management Approach

Pedram Gharaei
KMD Holding, Tehran, Iran

ABSTRACT

The current system of global trade, which has become the World Trade Organization (WTO), has been struggling to balance business ever since. The research has been designed to provide an appropriate model for predicting financial compensation for insolvent countries of the WTO member country. Therefore, along with important financial ratios for predicting financial compensation, the efficiency of countries that can add accuracy and model prediction power is used as a predictor variable. First, the data envelopment analysis method can be used to calculate the efficiency index of insolvent member countries of the WTO, and then the result of the efficiency indicator can be used as a variable for predicting financial debt compensation along with other financial ratios. In the proposed method, data envelopment analysis is used as a means to evaluate input-output efficiency of each country. Using statistical tests, the variables which have more power in separating insolvent member countries from healthy countries. Then, bankruptcy of countries has been predicted using logistic regression in two models. Findings from research indicate that use of efficiency in bankruptcy prediction model increases model prediction accuracy.

Keywords: Financial Debt, Financial Ratio, Efficiency, Data Envelopment Analysis, Logistic Regression

I. INTRODUCTION

Compensation for financial debt and bankruptcy of countries leads to waste of resources and lack of use of investment opportunities. According to previous studies, misallocation of resources and missing the investment opportunities will decrease the level of economic and financial development of countries and consequently influence individual's decision regarding saving and consumption [1]. The prediction of financial debt compensation by designing appropriate indicators and models can inform countries about the occurrence of financial debt and bankruptcy compensation, in order to adopt a proper policy based on these warnings which will help them to recovery in increase the rate of their financial and economic growth [2].

On the other hand, Capital market activists and the money market need to be aware of the financial situation of their countries and their efficiency [3]. Moving toward a higher level of sustainability is a big concern for all the countries who are participating in the global market [4]. The current global trade system, which has been clogged up by the World Trade Organization, has been struggling to strike a balance in trade so that commodity trade from the south to the north and industrial production trade from the north to the south. The basic principle in the current world trade system, which has both economic and legal aspects, is the principle of fairness. The principle of fairness and fair trade is the source of all the principles governing global trade, and other principles and mechanisms of world trade have been laid down to guarantee this principle. The World Trade Organization, on August 30, 2002, allowed European Community countries to impose tariff concessions and other obligations to the United States on the amount of US$ 4 billion, albeit in violation of the second violation and in accordance with the decision of the appellate court that The United States suspends the rules of the World Trade Organization, in particular the World Trade Organization's Subsidies Law, by abolishing prohibited subsidies for foreign sales under tax breaks. The extensive and rigorous suspension of the European Commission in response to the US offense has been unprecedented and has even gone beyond two previous cases, namely bananas and hormones in the World Trade Organization, which required the strengthening of

this organization. One of the ways in which it can be used to better utilize investment opportunities and better allocate resources is to predict compensating for financial debt or bankruptcy of countries. Firstly, A timely diagnosis of countries that seek to offset financial debt is highly desirable because it prevents investors from investing in false and non-performing cases for market activists. Whittaker (1999) considers financial debt compensation a situation in which the cash flows of a country are lower than the total interest expense associated with long-term debt. From an economic point of view, compensation for financial debt can be interpreted as a loss of the country, in which case the country has failed. In fact, in this case, the rate of return of the country is less than the cost of capital. Another form of compensation for financial debt occurs when a country fails to comply with one or more clauses related to a debt contract, such as keeping the current ratio or the ratio of the value of the asset to the total assets, which is said to be defaulted. Other cases of compensation for financial debt are when the cash flows of the country are not sufficient to repay the debt, and also when the value of the country is numerically negative [5]. Therefore, in the present paper, the Data Envelopment Analysis (DEA) method is used to calculate the efficiency index of insolvent member countries of the WTO, and the result of the efficiency indicator as a variable for predicting financial debt compensation is used along with other financial ratios. In the proposed method, Data Envelopment Analysis (DEA) is used as a means for evaluating the input / output efficiency of each country. Using statistical tests, variables that have more power in separating insolvent countries from healthy countries are selected, then bankruptcy of countries is predicted using logistic regression in two models (with and without efficiency variable). Merwin (2013) examined the financial ratios for bankrupt and non-bankrupt countries during a six-year period [6]. He stated that the three ratios of working capital to total assets, the particular interest to total debts and the current ratio are suitable financial indicators to predict the bankruptcy of countries. Merwin argued that among these ratios, the ratio of working capital to total assets is the best indicator for predicting bankruptcy. Ohlson (2012) was also the first person to use the logistic regression model in the area of bankruptcy prediction [7]. Given his sample of 105 insolvent countries and 205 healthy countries, his work was the most comprehensive research ever carried out, and his extracted prediction model predicted bankruptcy

of countries for the first to third years, with 85.1%, 87.6%, 82.6%, and the variables of total debt to total assets and the ratio of net income to total assets were the best segregation ratios in their model. Zimzhoskey (2011) used liquidity, activity and leverage ratios to provide a suitable model [8]. These ratios were not based on theoretical basis, but rather on the basis of his experiences in his previous studies. An example model was developed on the basis of a sample of 40 bankrupt countries and 800 non-bankrupt countries. Rennes (2009) designed a model in which information from 949 countries between years (2002-2008) was used [9]. In this study, the impact of industry, economic cycle and size of the country in the prediction of bankruptcy was considered. He presented several models using variables that showed size, profitability, cash flows and financial leverage of the country. The results of the research showed that the bankruptcy of non-profitable countries and with cash flow problems is higher. Other results of this research have indicated that it can obtain better prediction accuracy by using financial leverage and cash flows in model. It should be mentioned that only those countries who have a long-term plan regarding their socio-economic goals can take a step forward to compensate their debt and be closer to stability and growth [10]. In this study, despite previous studies, results indicated that probit and logit models have outperformed Multiple Discriminant Approach (MDA). Wang (2008) suggested failure prediction model using Efficiency [11]. In this proposed method, they used Data Envelopment Analysis as a means to evaluate efficiency of each country. The population under study includes countries in Shanghai Stock Exchange List. the sample under study includes 60 healthy countries and 60 insolvent countries between 1999-2005.

II. Research Method

The main aim of research is to calculate the technical efficiency of selected countries who are member of WTO. For selecting inputs and outputs for this research both theoretical evidence and previous experimental research are considered. Later on the efficiency variable can be used as a predictive variable for predicting financial debt repayment of countries in order to predict the country's debt repayment, and can add to the accuracy and predictability of the model. To do this, data envelopment analysis (DEA) is first used to calculate the country's efficiency index, and the result of the efficiency indicator as a variable for predicting

financial debt recovery along with other financial ratios is used in econometric models such as logit. Under Article 141 of the trade Code, insolvent countries are countries whose accumulated losses exceed 50% of their capital.

To select variables in the model, definitions and ratios should be used to make the information available and easy to extrapolate through the financial statements of the countries. A dummy variable can be used to distinguish healthy from not healthy countries. This variable will get value equal to (1) for healthy countries and value (0) for bankruptcy ones.

Different independent variables such as financial and efficiency ratios can be selected according to theoretical and empirical studies in the field of financial debt compensation and bankruptcy. The financial ratios used will assess the four attributes of countries: stability, profitability, growth, activity. It should be mentioned that the efficiency of the way of using resources is of interest and shows the useful use of resources. In this research, the efficiency of both CCR and BCC methods are calculated. The difference between these two models is in the assumption of constant or variable returns to scale. In the CCR model, assumption of constant returns to scale (CRS), and in BCC model, assumption of variable return to scale (VRS) is reported. The implication of a constant return to scale is that outputs change in proportion to which inputs change [12].

III. Data Envelopment Analysis (DEA)

DEA is an effective means for evaluating the efficiency used to measure the efficiency of decision-making units (DMUs) with multiple input and output settings. In DEA, the level of efficiency is measured relative to a facility boundary. The boundary of facilities formed by the linear components of the decision-making units and determining the smallest input used to reach a given output level is required [13]. Suppose there is a category n of DMUs that outputs are generated by inputs. During a production process, the smallest input is used and the largest output is generated. Production Possibility set (PPS) can be one of the following cases:

$$T_c = \left\{ (x, y) \middle| \sum_{j=1}^{n} \lambda_j x_j \leq x, \sum_{j=1}^{n} \lambda_j y_j \geq y, \lambda_j \geq 0, j = 1,2,...,n \right\}$$

$$T_v = \left\{ (x, y) \middle| \sum_{j=1}^{n} \lambda_j x_j \leq x, \sum_{j=1}^{n} \lambda_j y_j \geq y, \sum_{j=1}^{n} \lambda_j = 1, \lambda_j \geq 0, j = 1,2,...,n \right\}$$

IV. Logistic Regression

Logistic regression model is designed to predict the probability of a case or output occurring on the basis of the observations of the sample. In general, the logistic regression model for the explanatory variables is written as follows:

$$P(Y = 1) = \frac{1}{1 + \exp\left[-\left(\alpha_0 + \alpha_1 x_{1j} + \alpha_2 x_2 + \cdots + \alpha_D x_{Dj} + \varepsilon_j \right) \right]}$$

In this equation, α_D, ..., α_1 and α_0 are regression coefficients. In presenting the logistic regression equation, Maximum-Likelihood Ratio is used to determine the statistical significance of the variables [14]. Once established logistic regression model, it can be used as logistic regression model can be used as a prediction of occurrence probability. For example:

$$P(y_j^p = 1) = \frac{1}{1 + \exp\left[-\left(\alpha_0 + \alpha_1 x_{1j} + \alpha_2 x_2 + \cdots + \alpha_D x_{Dj} + \varepsilon_j \right) \right]}$$

In this equation, the estimated coefficient is the logistic regression model. It is assumed that the dependent variable only takes two values of zero and one. Unlike most logistic regression models, 0.5 is usually selected as the Threshold Probability for determining the event occurrence.

V. Calculation of Efficiency

At first, the efficiency of countries is calculated, and will be along with other financial ratios. In order to analyze the efficiency of countries, input and output variables must be selected. Mainly input variables for a country include capital, debt, human resources and technology, and mainly output variables include profit and sale, thus in this research total assets, total debts and sale costs have been selected as input variables to calculate efficiency and income on sale is considered for output variable. Using EMS software, efficiency of countries has been calculated via models BCC and CCR. The method of choosing the final variables

One of the statistical problems in analyzing financial ratios is the choice of statistical techniques in relation to the distribution of ratios [14, 15]. When applying financial ratios, most data are assumed to be normal and parametric methods are use, but there is little

information on the distribution characteristics of financial ratios. For this reason, the data are initially examined about normality. For this purpose, the Kolmogorov-Smirnov test (KS) has been used and the variables are divided into two categories: normal and abnormal. To test the difference on the average financial ratios in the two insolvent and healthy groups, the averaging test is used from two independent samples. The purpose of this method is to select the variables in which the difference between insolvent and healthy averages is the ability to assess the country's debt repayment.

To select useful and applicable financial ratios which are closely related to the financial conditions of the countries, and to estimate the amount and significance of the difference on the ratios between the insolvent and healthy countries in the normality, t-student test is used, otherwise, Mann-Whitney U test is used.

VI. Multicollinearity Between Variables

To avoid the Multicollinearity between independent variables, we must examine the Multicollinearity between the variables. One of the common ways to do this is to study the inflationary variance (VIF) factor.

Increasing the inflation factor of variance causes the variance of the regression coefficients to increase and makes regression unsuitable for prediction. The inflation factor of variance for variable Xj is equal to:

$$VIF_j = \frac{1}{1 - R_j^2}$$

Unfortunately, there is no precise definition of how much the VIF is due to the Multicollinearity between the variables. Chatterjee and Princess (1991) stated that VIF10 = is large enough to illustrate the Multicollinearity [16]. yet, it should be noted that, as far as possible, the variables entered in each pattern, but in some cases, because of the strong Multicollinearity between the model variables, it was not possible to implement the model. For this reason, in some cases, variables are eliminated with high Multicollinearity and are considered separately in the model, and the set of variables that do not cause Multicollinearity with the efficiency variable with a constant return to the scale are used in four scenarios in one year to compensate for Financial debt and three scenarios per year were used for financial compensation.

VII. First scenario in year of financial debt compensation

Here Logit model is analyzed in two ways without efficiency (Logit) and with efficiency (Logit-E).
The first model in the year of financial compensation without efficiency variable (Logit)
Logit model is specified as follows:

$$\ln\left(\frac{p_j}{1-p_j}\right) = \beta_0 + \beta_1 x_3 + \beta_2 x_9 + \beta_3 x_{11} + \beta_4 x_{13} + \beta_5 x_{17} + \varepsilon$$

TABLE I. VIF values for variables of first model in bankruptcy year Logit-E

variable	X1	X2	X3	X4	X5	X6
VIF	1/58	1/69	1/61	1/81	1/38	1/66

Source: calculations via software Eviews.

TABLE II. Determination of optimal CUT OFF of the first model in bankruptcy year with efficiency variable (Logit-E)

CUT OFF value			
0/6	0/5	0/4	
0/04	0/04	0/04	First type error
0/04	0/00	0/00	Second type error
0/08	0/04	0/04	Sum or errors
0/96	0/98	0/98	Rate of proper classification
0/04	0/02	0/02	Rate of improper classification

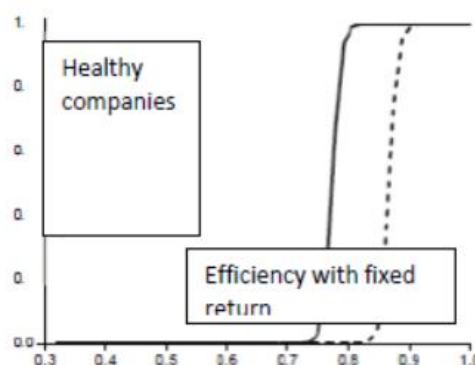Source: calculations using software Eviews

Figure 1: calculations using software Eviews

Fig 1. Probability Response Curve(PRC) of the first model at bankruptcy model.

In fig 1, solid line associates to model with efficiency and dash-dot line associates to model without efficiency. Under the conditions provided that financial ratios with positive effect in health of countries in model with a fixed growth, probability for progress of countries to be healthy than the state without efficiency is faster by entering efficiency in the model.

VIII.   CONCLUSION

Prediction of financial debt compensation refers to one of major research at financial area. By predicting financial debt compensation and finding the problem and solving it, it can achieve satisfactory results. As mentioned earlier these predictions can help a country to predict upcoming problems and shocks and try to develop the most efficient ways to deal with them. These policies and predictions have direct impact on the level of financial development of a country and it will change the consumption and saving rate of its citizens [17, 18] Prediction of financial debt compensation of countries is of great importance to investors, creditors, managers and auditors. In the proposed method, efficiency is calculated using data envelopment analysis, then the calculated efficiency and some selected financial ratios using logistic regression method are used to predict financial debt compensation for one year to compensate for financial debt and year of financial debt compensation. Results from use of model in insolvent member countries of the World Trade Organization in form of two logit models with efficiency variable(Logit-E) and without efficiency variable(Logit) indicate that presence of efficiency variable with Comparison Category Rating (CCR) increases accuracy of model in predicting financial debt compensation. Further, results from this research indicated that financial ratios can be a good predictor to compensate financial debt of countries. In addition, with regard to high ability of proposed models, credit rating banks and institutes can use the proposed method in this research in process of credit rating process of countries, thus with regard to the results from the present research, it is suggested to examine factors below in future research in this context:

- ✓ using other DEA models such as fuzzy DEA model to estimate efficiency

- ✓ selected financial ratios for prediction model as well as inputs and outputs of DEA model have a major effect on performance of prediction strategy, thus it is better to use other variables for it.
- ✓ Due to the fact that bankruptcy as subject to Article 141 of the Commercial Code is a concept based on profitability, it is recommended that the present study be repeated with greater financial profit margins.

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