

**Estimating the Long-Run Creditworthiness of Pakistan  
and the Impact of Global Financial Crisis on the  
Creditworthiness**

A Thesis submitted to the Pakistan Institute of Development  
Economics, Islamabad for partial fulfillment of the requirement for  
the degree of Master of Philosophy in Economics



By

Rimsha Karim

13/MPhil-Eco/PIDE/2013

Supervised by Dr. Abdul Qayyum

**Department of Economics**

**Pakistan Institute of Development Economics, Islamabad**

**2015**

## **AUTHORSHIP STATEMENT**

*I Rimsha Karim solemnly declare and affirm on oath that I myself have authored this M.Phil. Economics Thesis with my own work and means, and I have not used any further means except those I have explicitly mentioned in this study. All items copied from internet or other written sources have been properly mentioned in quotation marks and with reference to the source of citation.*

***Rimsha Karim D/O Farhat Karim Hashmi***

# ACKNOWLEDGEMENT

A major research work like this is never the work of anyone alone. As a matter of fact, people tend to forget those who are behind their achievements and have stood for them whenever they have needed assistance. Realizing the fact, it will be right to say that without their cooperation this effort may have ended up in disaster. Completion of this thesis was possible with the support of several people.

First of all, thanks to Allah Almighty for His blessings upon me during this thesis and my whole life. I thank my Parents (Mama and Baba) from the bottom of my heart, their unconditional love, understanding and financial support throughout my life particularly this degree made my path easier to walk on. Special thanks to my younger siblings (Fabiha, Saud and Bakhtiar); without their support, I would not have been able to accomplish my research work.

I would like to express my gratitude to my supervisor Dr. Abdul Qayyum, whose supervision and support helped me to progress smoothly even having many difficulties involved in this thesis.

Support and cooperation is vital in such projects, so I am thankful to my friend (Kiran Fatima) who was always there for me in this emotionally draining period of thesis writing.

Last, but not least, I want to thank the Institution, PIDE, which provided me the platform and opportunity for learning.

*Rimsha Karim*



*This Thesis Dedicated to My Parents*

# Table of Contents

<i>Title Page</i> .....	<i>i</i>
<i>Authorship Statement</i> .....	<i>ii</i>
<i>Acknowledgement</i> .....	<i>iii</i>
<i>Dedication</i> .....	<i>iv</i>
<i>Table of Contents</i> .....	<i>v</i>
<i>List of Tables</i> .....	<i>vii</i>
<i>List of Figures</i> .....	<i>viii</i>
<i>Abstract</i> .....	<i>ix</i>
<b>Chapter 1</b> .....	<b>11</b>
<b>Introduction</b> .....	<b>11</b>
1.1.External Debt of Pakistan .....	13
1.2.Significance of the Study.....	16
1.3.Objectives .....	16
1.4. Methodology.....	17
1.5. Plan of the study .....	17
<b>Chapter 2</b> .....	<b>18</b>
<b>Literature Review</b> .....	<b>18</b>
2.1. Introduction:.....	18
2.2. International Literature on creditworthiness.....	18
2.3. Literature in context of developing countries’ .....	22
Creditworthiness ratings .....	22
2.4. Pakistani Literature on Creditworthiness.....	25
2.5. Literature in context of Global Financial Crisis and.....	25
Creditworthiness .....	25
2.6. Conclusions.....	29
<b>Chapter 3</b> .....	<b>30</b>
<b>Methodology</b> .....	<b>30</b>
3.1. Introduction.....	30
3.2. Theoretical Background.....	31
3.3. Modelling the Long-run Creditworthiness of Pakistan.....	32
3.4. Long Run Creditworthiness Model of Pakistan.....	36

3.5. Model for the Impact of Global Financial crisis on the .....	38
Long-run Creditworthiness of Pakistan .....	38
3.6. Maximum Likelihood Method.....	40
3.6.1. Diagnostic Tests.....	41
3.7. Data.....	42
3.8. Conclusions.....	42
<b>Chapter 4 .....</b>	<b>43</b>
<b>Results and Discussion .....</b>	<b>43</b>
4.1. Introduction.....	43
4.2. Estimation Modes for Models of Long-Run.....	44
Creditworthiness of Pakistan .....	44
4.2.1. Model 1 .....	45
4.2.2. Model 2 .....	50
4.3. Impact of Global Financial Crisis on the Long-Run.....	55
Creditworthiness of Pakistan .....	55
4.3.1. Model 3 .....	55
4.3.2. Model 4.....	62
4.4. Conclusions.....	67
<b>Chapter 5 .....</b>	<b>70</b>
<b>Conclusions and Policy Recommendations .....</b>	<b>70</b>
5.1. Introduction.....	70
5.2. Conclusions.....	70
5.3. Policy Recommendation .....	71
5.4. Further Research prospects.....	71
<b>References.....</b>	<b>72</b>

## List of Tables

Table	Title	Page No
4.1	Elasticities of Rescheduling Probabilities for equation (4.1)	46
4.2	Elasticities of Rescheduling Probabilities for equation (4.2)	49
4.3	Elasticities of Rescheduling Probabilities for equation (4.4)	52
4.4	Elasticities of Rescheduling Probabilities for equation (4.7)	57
4.5	Elasticities of Rescheduling Probabilities for equation (4.8)	60
4.6	Elasticities of Rescheduling Probabilities for equation (4.10)	64

## List of Figures

Figure	Title	Page No
Figure 1.1	Amount of Debt Rescheduled in Pakistan (1972-2013)	15



## **Abstract**

This thesis analyzes the long-run creditworthiness of Pakistan and the impact of Global Financial Crisis on the long-run creditworthiness of Pakistan. The external debt of Pakistan was \$48 billion at the end of the year 2014 which has raised the concerns of Pakistan's policy makers and its creditors as to how would Pakistan repay its growing external debt obligations. A creditworthy country ensures that its debt commitments are met according to the original agreement and it is on the path of ever-increasing capital inflows so that the debt servicing does not dry up the resources needed for growing consumption and development requirements of the economy.

The analysis is conducted on time series data of the years 1972-2013. Four Probit Models are estimated by Maximum Likelihood Method. Three specifications of Probit Model of long-run creditworthiness of Pakistan are estimated. These alternative specifications are due to measurement of expected net capital inflows/GDP ratio which are current values of net capital inflows/GDP ratio, lagged values of net capital inflows/GDP ratio and a mix of current and lagged values of net capital inflows/GDP ratio. In the first Probit Model only DS/GDP ratio was found to be significantly impacting the long-run creditworthiness of Pakistan, however it was found that with the inclusion of lagged net capital inflows/GDP ratio, both the DS/GDP ratio and INV/GDP ratio significantly impact the long-run creditworthiness of Pakistan. In the second Probit Model, when POP/GDP ratio is included as an alternate to INV/GDP ratio, the expected net capital inflows/GDP ratio, DS/GDP ratio and POP/GDP ratio all significantly impact the long-run creditworthiness of Pakistan. In the

third and fourth probit Model where the dummy variable for Global Financial crisis is used has come out to be insignificant.

**Key Word:** Long-run creditworthiness of Pakistan, Global Financial Crisis and creditworthiness, Probit Model, Maximum Likelihood Method (MLM), Pakistan.

# Chapter 1

## Introduction

In order to understand why the measurement of any country's creditworthiness is important, we first have to breakdown the reasons as to why Pakistan needs to incur foreign debt. Pakistan has to incur foreign borrowing for higher economic growth, finance its balance of payment position and to effectively channel the borrowed money into investment and saving. Foreign debt acquired by a country can positively impacts its growth if it is utilized effectively. The real GDP growth of Pakistan during fiscal year 2013-14 was 4.14 percent which is less than targeted amount needed for its development goals. Pakistan is also vulnerable on its fiscal front. The overall fiscal deficit of Pakistan which is a difference between total receipts and expenditures including borrowing and other liabilities as a percentage of GDP has increased from 4.0 in year 2005-06 to 6.3 in year 2013-14.

Pakistan imports oil, fertilizers, chemicals and manufactured goods while its export structure still consists of primary agricultural products which is insufficient to pay the huge import bill in foreign currency. Pakistan constantly needs to borrow from World Bank, IMF and other financial institutions to offset the adverse effects of negative balance of payment position, finance the fiscal deficit and for the growth and development of the economy. World Bank provides financial and technical assistance to the government of Pakistan for a wide range of development and infrastructure projects like education, health, poverty reduction and other government reforms. IMF provides loans to Pakistan when it is unable

to find adequate financing on affordable terms to meet its net international expenditures while maintaining required reserves for the future. In short IMF give loans when Pakistan is facing a negative balance of payment position. Debt servicing is another huge problem which Pakistan faces in addition to the growing debt. The debt service as a percentage of GDP has increased to 5.5 percent in year 2013.

Due to the ever- increasing debt, financial and lending institutions of the World do undertake the exercise to measure the creditworthiness of the recipient country through the financial and economic indicators and assess as to how the country would be able to repay its debt commitments on time. It is also common that a debtor country requests for re-scheduling of its huge external debt so that its burden be reduced temporarily and also it is in the interest of creditor countries and institutions to get away from the complete loss of external debt owed to the developing country in case of bankruptcy and default.

The outstanding external debt of Pakistan has reached at \$47.8 billion at the end of March 2014 which has raised the concerns of Pakistan's public policy makers and its creditors as to how would Pakistan repay this growing amount of external debt obligations? The main problem is that huge borrowing may not be sustainable in the future as the debt servicing consumes the precious foreign exchange needed for import requirements as well as the for the development of its economy.

Pakistan's creditworthiness started deteriorating in 1971 when it rescheduled its debt amounting to \$13.8 million, it faced an enormous amount of reduction in its foreign exchange earnings due to a brief halt in its exports from East Pakistan. Pakistan experienced debt-

rescheduling in second half of 70's and then in the beginning of 80's decade because of the harder terms of the credit and shorter maturity periods led to high debt servicing.

There was also a shift of composition of foreign inflows from grant-type assistance to loans repayable in foreign currency. A rescheduling of \$1.8 billion debt under Paris Club creditors took place on January 23, 2001.

Many international studies have done empirical work regarding determinants of rescheduling of debt of developing countries. Today the creditworthiness of a country is mainly determined by empirical analysis of credit ratings developed by *Euromoney*, *Institutional Investor* and *Economist Intelligence Unit*. Siddiqui et al [2001] has empirically analyzed the determinants of debt rescheduling for the case of Pakistan. Creditworthiness of Pakistan needs to be analyzed empirically with a solid theoretical background. I want to empirically analyze the theory of long-run creditworthiness of LDC's for the case of Pakistan and the impact of global financial crisis on the long-run creditworthiness of Pakistan. The data for the variables of creditworthiness of Pakistan is taken from 1972 to 2013 which is the longest and most recent time series data taken to date.

## **1.1. External Debt of Pakistan**

The portion of the total debt which has a direct charge on government revenues as well debt obtained from IMF is taken as public debt. Public debt comprises domestic and external debt. The total public debt in year 1990 was Rs.801 billion which increased to Rs.15, 534 billion in year 2014. The share of external debt in total public debt was Rs.428 billion in year 1990 which increased to Rs.4711 billion in year 2014.<sup>1</sup>

---

<sup>1</sup> Economic Survey of Pakistan 2013-14

Government borrows debt to meet the growing consumption demands of the public, pay for the import bill and also to create business and investment so that the return on investment can be used to pay back the external debt and interest commitments. The governments can suffer from debt problems if debt servicing capacity is less than the growth of debt.

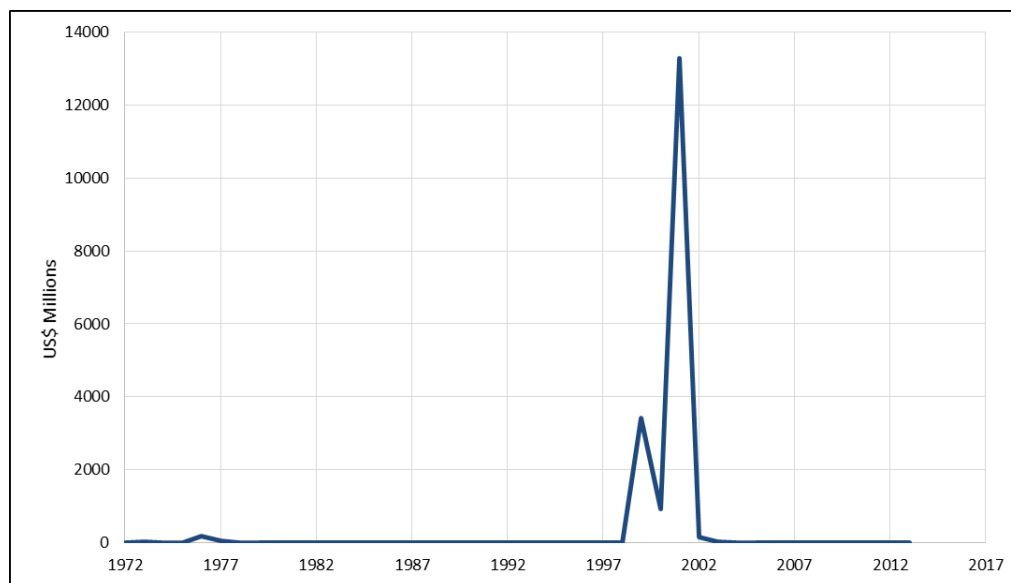
The external debt of Pakistan increased dramatically in 1960's especially during the second half of the decade when the annual increase in external debt was 24%. At the end of year 1969, the total external debt of Pakistan reached \$2.7 billion which also included the debt owed to Bangladesh and at the end of year 1971, this figure rose to \$3.6 billion out of which \$0.6 billion loan was related to the ventures for Bangladesh. The external debt further rose to \$6.3 billion in the beginning of year 1977. However, the average growth rate of debt decreased from 11% annually to 6.5% through the 1970' decade. The total external debt (disbursed) from 1981 to 1991 grew at an average rate of 6.2% annually.

The structure of the assistance also noticeably changed over time. In the early years, a considerable portion of foreign economic assistance, which was in the shape of grant like assistance, has gradually declined and replaced by hard term loans repayable in scarce foreign exchange with high interest rates and limited time period. During the First Five Year Plan period (1955-60), the share of grants and grant-like assistance in the total obligations was about 80 percent and it dropped to 46 percent in the Second Plan (1960-65), 31 percent in the Third Plan (1965-70), 10 percent during the Fourth Plan (1970-75) and 15 percent during the non-plan period (1975-78). However, due to relief aid for Afghan refugees, its share increased to about 22 percent in the Fifth Plan period (1978-83) and then 23 percent in the Sixth Plan period (1983-88), but it again decreased to 16 percent in the Seventh Plan

period (1988-93). The share of grants that was 9 percent during 1996-97, further decreased to 6 percent of the total obligations in 1997-98, due to lesser availability from the donor countries.<sup>2</sup>

Pakistan's medium and long-term external debt was estimated to the extent of \$37 billion or 44.3% of GDP at the end of June 2001. Pakistan's external debt and liabilities stood at \$38.86 billion at the end of March 2007. This is concerning for Pakistan's public policy makers as to how the growing amount of external debt will impact the long-run creditworthiness of Pakistan.

**Figure 1.1: Amount of Debt Rescheduled in Pakistan (1972-2013)**



Source: World Bank

<sup>2</sup> Economic Survey of Pakistan 1971-72, 1977-78, 1981-82, 1999-2000

## 1.2. Significance of the Study

Internationally Brewer and Rivoli [1990], Haque, Kumar and Mathieson[1996] have empirically analyzed the impact of economic and political determinants on creditworthiness ratings compiled by *Euromoney*, *Institutional Investor* magazine and *Economist Intelligence Unit* for developing countries. Frank and Cline [1971], Sargen [1977], Feder et al [1981], Moghadam et al [1991], Moghadam [1995] have empirically analyzed the determinants of rescheduling of debt of developing countries. Siddiqui et al [2001] has empirically analyzed the determinants of debt rescheduling for the case of Pakistan. The problem with these studies is that pure empirical analysis lack theoretical underpinnings. Kharas [1980] developed a theory of long-run creditworthiness for developing countries and then empirically tested it. I want to empirically analyze the theory of long-run creditworthiness of LDC's for the case of Pakistan and the impact of global financial crisis on the long-run creditworthiness of Pakistan, this will be the first empirical study in Pakistan to have analyzed the theory of long-run creditworthiness of LDC's and the impact of global financial crisis on the long-run creditworthiness of Pakistan. The data for the variables of long-run creditworthiness of Pakistan is taken from years 1972 to 2013 which is the longest and most recent time series data taken to date.

## 1.3. Objectives

The objectives of my study are

- ✚ To Estimate the long-run creditworthiness of Pakistan from period 1972 to year 2013.
- ✚ To analyze the impact of Global Financial Crisis on the long-run creditworthiness of Pakistan.



## **1.4. Methodology**

The study comprises of the estimation of long-run creditworthiness of Pakistan and also the impact of Global Financial crisis on the creditworthiness of Pakistan. Probit Model is used to analyze the impact of the independent variables; expected net capital inflows/GDP ratio, total debt service on external debt/GDP ratio, investment/GDP ratio, population/GDP ratio and global financial crisis dummy on the long-run creditworthiness of Pakistan which is a dependent variable. Maximum likelihood method is used to estimate the parameters of the models used in this study. Time series data is used to fulfil the objectives of the study and collected from World Bank and State Bank of Pakistan from years 1972-2013.

## **1.5. Plan of the study**

Plan of the study is structured as follows; first chapter is introduction of the study, second chapter comprises of the literature review, third chapter comprises of the methodology of the study, fourth chapter consists of the results and discussion of the study and the last chapter comprises of the conclusions and policy recommendations.

## **Chapter 2**

### **Literature Review**

#### **2.1. Introduction:**

The literature has been reviewed to conclude the past and ongoing studies on the determinants of debt rescheduling in developing countries which measures a country's creditworthiness empirically.

Section 2.2 includes beginning international literature related to the economic and political determinants of debt rescheduling in developing countries. Section 2.3 includes recent line of literature on measuring the creditworthiness of developing countries. Section 2.4 includes literature in context of Pakistan. Section 2.5 is related to the international literature of global financial crisis and transmission channel through which global financial crisis can have an impact on the creditworthiness of developing countries. The last section 2.6 consist of the conclusions of the chapter.

#### **2.2. International Literature on creditworthiness**

Frank and Cline [1971] used modified form of discriminant analysis which takes into account the variances in determinants of debt rescheduling among the countries to develop an index. Data for 26 LDC's was compiled from 1960 to 1968. The main objective was to find an indicator of the likelihood that a less-developed country will go through debt rescheduling and that indicator should be comparatively simple and accurate in its prediction abilities. By using discriminant analysis very high prediction rate can be obtained with just

two determinants, the debt service ratio and the average maturity of debt. The predictions of debt-servicing assume that terms of foreign advancing will remain the same as of 1964-66 period but recent developments in foreign market has nullified this assumption. In the prediction of debt servicing, the inclusion of non-guaranteed export credit could have explained this development.

Sargen [1977] used discriminant analysis which identify the economic determinants that can differentiate efficiently between rescheduling countries and non-rescheduling countries. The data on international debt rescheduling cases was compiled for the period of 1960 to 1976. The main objectives include analysis of economic determinants of debt rescheduling and which of these economic determinants are best in differentiating between rescheduling and non-rescheduling countries and also finding whether the econometric techniques employed are robust in predicting debt rescheduling? The Results tell us that there is a regular pattern of past debt rescheduling. Liquidity debt rescheduling is caused by inflation and over-valued exchange rate and there are three reasons why past debt rescheduling data cannot properly predict the future rescheduling: small sample size, limitations in properly predicting the exogenous variables & changes in structural parameters of estimating equations.

Feder, Just and Ross [1981] used logit modelling with dependent variable as a dichotomous, dummy variable which takes 1 if debt rescheduling occurred and 0 if otherwise. Presenting the results of the study whose objective is to develop an empirically based, composite gauge of the probability of debt-rescheduling. The data for 56 developing countries was taken for year 1965 to 1976. Data base was quite substantial, there were 580 observations out of which 40 were associated to cases of debt-rescheduling. The independent

variables used were debt service/exports, foreign exchange reserves to imports ratio, the ratio of net non-commercial foreign exchange inflows to debt service payments, the ratio of net commercial foreign exchange inflows to debt service payments, exports to GNP ratio and real per capita GNP to US per capita GNP. Two models are estimated; first order approximation and second order approximation. The estimated coefficients of model 1 are of the expected signs and also significant except exports to GNP ratio. In the second model where second order approximation allowed for squared and interaction terms. Only the three additional second-order terms mainly debt service/exports ratio, reserve/imports ratio and the ratio of commercial foreign exchange inflow to debt service came out to be significant. With the inclusion of regional dummy the estimated coefficients changed only slightly except the real per capita GNP to US per capita GNP which was statistically insignificant. Empirical based model is applicable for projecting debt rescheduling of LDC's. This model can also be used as an extension to measure creditworthiness in national planning.

Citron and Nickelsburg [1986] country risk model is used incorporating economic as well as political variables. The model of country risk incorporates the political instability and regards it most important variable as the marginal benefit of default relative to alternative policies becomes positive. Cross section data is taken for five countries Argentina, Brazil, Mexico, Spain and Sweden from year 1960 to 1983. The dependent variable is default where country renegotiate the terms of loan commitments because it becomes unable to pay back its outstanding debt. The independent variables used were GDP, reserves plus IMF credits and current account balance. The political instability variable was constructed as five year moving aggregate of the number of changes of the government. The change in GDP and current account balance came out to be insignificant whereas the international liquidity and

political instability came out to be significant. The economic policies which are forced on LDC's as a result of debt rescheduling cause the instability to increase more.

Moghadam et al [1991] used a Probit model to identify financial determinants of debt rescheduling for Latin America because of its geographical and sociopolitical significance to USA. The annual data for 16 Latin American Countries was collected from 1980 to 1987 from *World Debt Tables*. The probability of debt rescheduling in Latin America correlates positively with Total Debt service as a percentage of GNP and negatively with International reserves to Debt Outstanding.

Moghadam [1995] compiled the data for each of the world's 91 debtor countries from 1980 to 1990. The World Bank has classified the debtor countries into six regions and in this study economic and political factors for each region is analyzed. Government and Military expenditure was used as a proxy for political factor. It was to determine whether factors of debt-rescheduling are consistent across debtor LDC's regions. The model results show that two regions which includes Latin America and the Caribbean and Africa, South of Sahara accounted for most of the debt-rescheduling episodes, also the model results for the two regions vary considerably. The variable RES/DOD comes out to be significant and negative. Political instability does help in determining the creditworthiness of regions.

Verma [2002] used four alternative measures of democracy to determine a sovereign country's decision to repay or default on its debt commitments. The data is taken for 30 developing countries from 1975 to 1995. Probit model is used with the dependent variable as the probability of debt rescheduling which was taken as a proxy for the probability of default and the explanatory variables included structural variables like external debt to GNP

ratio, GDP growth rate, interest payments/exports ratio, budget surplus, interest rates (Libor) and average growth rate of industrialized nations and political variables included democracy which was measured as political rights index, democracy index. Political pluralism and party fractionalization index. All four measures of democracy are found to be significant with the more democratic countries having high probability of default. Among the non-political variables budget surplus and average growth rate of industrialized nations was found to be insignificant. The probability of default is negatively related to the growth rate of debtor countries. The probability of default is directly correlated with interest payments/export ratio. The estimated coefficient of Libor was negative implying that with lower value of Libor the probability of default increases. The empirical evidence proves that democracies fail in fulfilling the external commitments because they do not efficiently utilize the borrowed capital.

## **2.3. Literature in context of developing countries'**

### **Creditworthiness ratings**

The developing country creditworthiness ratings developed by *Euromoney*, *Institutional Investor* magazine & *Economist Intelligence Unit* have been used in recent literature to determine the economic as well as political determinants of less-developed countries creditworthiness indicators.

Brewer and Rivoli [1990] used least square regression to test the impact of the political instability on the perception of creditworthiness of thirty most heavily indebted countries. Country creditworthiness data were taken from the Institutional Investor and Euromoney ratings of year 1987. The main objective of the study was to know whether international rating agencies give importance to political instability in their valuation of country's

creditworthiness and what type of instability affect the perceived creditworthiness of a developing country. The models of the effect of instability on creditworthiness ratings from *Euromoney* and *Institutional Investor* were estimated in two sets of least square regression, the first to test for proximate instability and second for chronic instability. The proximate instability impact on the creditworthiness ratings was found to be significant. The frequency of government regime change as a proxy for political instability was found to be as important as economic variable in explaining creditworthiness ratings.

Lee[1993] examined the determinants of country credit ratings prepared by *Institutional Investor* and *Euromoney*. The major focus on the relative importance of political instability on these credit ratings developed in order to assess the country creditworthiness. The sample period of the study was 1986 and twenty nine observations were used for twenty nine countries. Ordinary least square estimation is used with credit ratings of *Institutional Investor* and *Euromoney* as dependent variable and ratio of total debt to GNP, growth rate of GNP, ratio of government debt to GDP and political instability variables includes number of times the head of the government changes, political rights scores and armed conflict. The political variables are measured once as proximate meaning short term impact and then as chronic. The results indicate that credit rating agencies assign more weight to the economic indicators of the country as opposed to political instability indicators.

Haque, Kumar and Mathieson[1996] empirically analyzed the impact of economic determinants on creditworthiness ratings compiled by *Euromoney*, *Institutional Investor* magazine and *Economist Intelligence Unit* for 60 developing countries from 1980 to 1993. The main objective of the study is to empirically analyze the economic determinants which impact the creditworthiness ratings and see if the impact of these factors display persistence

in country credit ratings and also to examine the degree to which the determinants of credit ratings considerably vary across different regions in the world. Non gold foreign exchange reserves to imports, ratio of current account balance to GDP, the country's rate of growth and its rate of inflation were found to be most significant factors of perceived creditworthiness ratings and the results indicate that ratings were considerably persistent over the time irrespective of recent economic or political developments in a country.

Balkan [2006] examines the role of political environment on borrower's ability to repay its loan. Two political risk variables are used; one the level of democracy index and second level of political instability index are used in a probit model along with other economic variables. The probit model is estimated over a panel of 33 nations from 1971-84 period. In the last performance of model for the period 1984 is compared with three widely used credit rating publications; *Institutional Investor*, *Euromoney* and *International Country Risk Guide*. The estimated coefficients and forecasting results support the inclusion of quantifiable proxies of political risk variables in the assessment of a country's creditworthiness. Negative relationship is found between the level of democracy and probability of debt rescheduling of a country. Most of the economic variables are statistically significant.

Citron and Nickelsburg (1987) conclusion regarding contraction of government expenditure when there is political instability in the country as a requirement for debt rescheduling will cause more instability and economic chaos in the country so the LDC's should focus more on the democratization in order for increased creditworthiness of the country supports the results of this study.



## **2.4. Pakistani Literature on Creditworthiness**

Siddiqui et al [2001] used Probit model to empirically analyze both economic and political determinants of debt rescheduling in Pakistan. Annual data was collected from period 1972-2001. The results show that financial/economic determinants debt servicing/exports ratio, debt servicing to GNP ratio are significant and positively related with the probability of debt rescheduling in Pakistan and international reserves/total debt is negatively related with the probability of debt rescheduling and the government expenditures/GNP ratio as a proxy for political Stability was found to be insignificant. When debt servicing/Government expenditures was used in place of international reserves as a financial variable, then the political instability proxy variable was significant and negatively correlated with the probability of debt rescheduling in Pakistan, this results diverts from previous results and needs deep study as taking government expenditure as a whole might blur the reality, instead government expenditure should be broken down into structural and non-structural, similarly developmental and non-developmental.

## **2.5. Literature in context of Global Financial Crisis and Creditworthiness**

The global financial crisis of year 2008 also known as the economic emergency began when the banking institutions in USA encouraged home possession. Loans were provided to the borrowers on easier terms, sub-prime mortgage were overestimated based on the expectations that housing prices would increase. The real estate bubble collapsed when the sub-prime home owners found it difficult to pay back their debt. As the worth of homes plummeted, the debtors found themselves with negative net assets. With a large number of debtors not being able to pay back their loans, banks were faced with a condition where the

retrieved real estate had no worth on present market than the bank had advanced initially. The banks were faced with liquidity emergency, and advancing and getting home loans started becoming difficult as the consequence of sub-prime loaning bubble burst. This is what is known as credit crunch.

The East Asian financial emergency started in July 1997 and elevated apprehensions of global economic failure due to financial contagion. The crisis initiated in Thailand with the monetary collapsing of the Thai baht after the government of Thailand was required to float the baht as the foreign currency was insufficient to support the fixed exchange rate system after exhaustive struggle to back it in the situation of severe financial over advancement that was real estate motivated to some extent. At the time period, Thailand had assimilated a burden of foreign loan that made the country on the verge of going default even before the collapse of its currency. With the crisis spreading, most of the Southeast Asian economies and Japan were faced with tumbling currencies, weakening of stock markets and prices of other assets and a rise in private debt. The countries most affected by the crisis were Indonesia, South Korea and Thailand.

The major grounds of the Asian financial crisis have been evidently identified. First, extensive foreign funds became available at moderately low interest rates, as investors in search of new opportunities shifted massive amounts of capital into Asia. As in all economic expansion periods, the prices of stocks and real estate in Asia increased initially, as a result more funds starting flowing into the region. However, the domestic allocation of the borrowed foreign capital was inefficient because of the fragile banking system. The limited absorptive capacity of these countries also contributed to the wasteful allocation of foreign funds. Second, the fixed exchange rate regime gave debtors a false sense of refuge,

encouraging them to take on dollar-denominated debt. Third, in the countries affected by the crisis, exports were weak in the mid-1990s.

The massive capital inflows and weakening exports were reflected in widening current account deficits. To make matters worse, a substantial portion of the capital inflows was in the form of short-term borrowing, leaving the countries susceptible to external shocks.

Once the crisis broke out in Thailand in July 1997, the Asian countries were all vulnerable. And the markets reacted disproportionately. The thinking was that if this could happen in Thailand, it was bound to happen in other Asian countries facing, to varying degrees, the same problems which were weak banking system, a large current account deficit, and a heavy external debt burden. Creditors withdrew funds from the region, and the crisis spread.

With the onset of Asian financial crisis in year 1997 it was projected that south Asian economies will experience slowdown in its GDP growth rate. The transmission channel pinpointed was mainly through smaller private capital flows and reduced trade volumes, debt servicing difficulties of the borrowers and depressing world interest rates.<sup>3</sup>

Te Velde [2008] Global Financial crisis of the industrialized nations can have an impact on a developing country like Pakistan economy through trade in goods and services, FDI, portfolio investment, workers remittances, commercial lending and aid.

Amjad and Din [2010] examined the economic and social impact of global financial crisis during 2008 and 2009 on four major South Asian Economies; Pakistan, India,

---

<sup>3</sup> <http://www1.worldbank.org/prem/premnotes/premnote1.pdf>

Bangladesh and Sri Lanka The study has explained the transmission channels through which Global Financial Crisis spread to the South Asian economies; trade channel, remittances, FDI and portfolio investment. The study then gives policy recommendations to lessen the adverse impact of global financial crisis on South Asian economies; Macroeconomic stability, political will, tradeoff between stabilization and economic growth. Regional economies are also vulnerable towards declining remittances as the oil prices in Gulf region are predicted to increase in the future.

Romer and Romer [2014] examined the impact of financial crisis in a sample of 24 advanced OECD countries for the period 1967-2007 by constructing a new semi-annual measure derived from real-time narrative country conditions as prepared by OECD. The measure of financial crisis analyses the credit supply troubles also called as ‘credit crunch’ on a scale from 0 to 15 as this continuous measure allows to examine the severity of financial crisis. Simple panel regressions are run to capture the impact of financial crisis on industrial production and GDP in advanced countries. The results from panel regression came out to be moderate both for industrial production and GDP but these two measures give conflicting results in terms of persistence i.e. for industrial production the effects are temporary and start to diminish after six months but for GDP the effects are more persistent lasting up to five years but this result is due to the inclusion of Japan’s financial crisis. The study analyses the after math of 2008 financial crisis and explains that the massive collapse and the subsequent poor recovery was caused by slow economic performance afterwards and also because the crisis was global, there were less financial institutions remained crisis free who were willing to help when credit supply was troubled.

## **2.6. Conclusions**

Determining the long-run creditworthiness of Pakistan is important as the borrowed resources are necessary for fulfilling the consumption and development needs of the country. If the country fails to fulfil its debt obligations on time then the international credit market may become wary to extend future loans to such a country. A study which determines the long-run creditworthiness of Pakistan and also the impact of global financial crisis on creditworthiness is useful as the literature review on creditworthiness of developing countries suggest that there is gap regarding estimation of the theory of long-run creditworthiness of LDC's for the case of Pakistan. With a solid theoretical background, the creditworthiness of Pakistan is empirically analyzed. Finding the impact of global financial crisis on the creditworthiness of Pakistan can prove to be useful as it has never been estimated before and the transmission channel through which global financial crisis can have an impact on Pakistan's economy is export and import volume, FDI, remittances and portfolio investment. When any country's FDI which is a component of capital inflows shrinks, it may have an indirect impact on the creditworthiness of the borrower country as debt servicing can become difficult due to the global credit crunch.

# Chapter 3

## Methodology

### 3.1. Introduction

This chapter explains the methodology to estimate the long-run creditworthiness of Pakistan. Pakistan is a developing country and it constantly needs to acquire foreign debt in order to finance its negative balance of payment position and also for growth and investment in the economy. Due to the ever increasing amount of external debt, Pakistan needs to estimate its long-run creditworthiness in order to identify the determinants and to effectively channel the borrowed resources in the economy.

The section 3.2 explains the theoretical background of economic theory of long-run creditworthiness of developing countries. The section 3.3 consists of modelling the long-run creditworthiness of Pakistan. Section 3.4 consists of the Econometric long-run creditworthiness Model of Pakistan. Section 3.5 consists of model for the impact of Global Financial Crisis on the long-run creditworthiness of Pakistan. Section 3.6 consists of estimation method of the model. The Sub-section 3.6.1 contains the diagnostic tests to review the results from empirical analysis. Section 3.7 gives the data summary for the model to be estimated on long-run creditworthiness of Pakistan and the impact of Global Financial crisis on the creditworthiness of Pakistan. The last section 3.8 consists of the conclusion of the chapter.

## 3.2. Theoretical Background

The background of the creditworthiness literature includes research papers relating to the theory of debt capacity which follows two main approaches. The first approach deals with the optimum level of external debt and the second approach deals with sustainable policies relating to the external debt payment. The first approach focuses more on the theoretical side and is more about in observance with problems of choice from the point of view of an economist, however the second approach is motivated on the applied side which focuses on sustainability of debt policies. The second approach follows the strand of growth-cum-debt models which focus on the external finance as a source to solve the problems of lack of capital both physical and human in less developed countries. The growth literature is particularly emphasized on the savings congestion. As a result external finance is regarded as a main source of increased investment.

Harrod-Domar explained the role of investment of external finance in this growth framework. The literature focuses on the sustainability of debt situation as it evolves over the course of time. The fundamentals of the model are that yield is produced according to the Leontief production technology which requires the inputs to be combined in fixed proportions. A growth rate is targeted which along with the fixed capital to yield ratio determines the required investment ratio. The marginal propensity to save out of yield is fixed. The expected external financing is needed to fill the gap between the required points of investment and the points of savings in the domestic country and also to service this external debt. If this framework is used then the time path of debt sustainability and the indicators relevant to debt sustainability can be derived systematically.

The debt-servicing capacity approach models used Harrod-Domar framework explaining the transition of developing countries from debtor to finally becoming creditor countries through defining the parameters of these models. However, this transition does not happen in real life and the external debt grows indefinitely. In order for the debt/yield ratio to reach a specific limit the targeted growth rate of yield should be greater than the real interest rate which means that with no specific limit on the debt/yield ratio, the external financing policies are not sustainable. Using output as a specification of consumption will yield different results than with using income as a specification of consumption. Another model used income as a specification of consumption defining target in terms of gross national product (GNP). The level of debt to become sustainable, marginal product of capital should be greater than marginal cost of external financing. One condition has to be satisfied in order for the debtor country to become creditor is that the level of investment required by the target growth rate be less than marginal savings rate and even if this condition is not satisfied than the debt to income ratio will reach a specific limit instead of going explosive.

### **3.3. Modelling the Long-run Creditworthiness of Pakistan**

The economic theory of creditworthiness of LDC's proposed by (Kharas, 1984) following the Harrod-Domar production framework where external financing is carried out by the government to carry out the expenditure requirements of its country and the benefits of investment goes to private sector. In order for the level of debt to become sustainable, the tax base should increase continuously which is determined by capital inflows and the government's propensity to invest. A developing country is creditworthy when it is on a path of ever increasing capital inflows so that the debt servicing does not dry the external resources needed for growing domestic consumption, development and investment needs of



a country. A creditworthy country ensures that its debt commitments are met according to the original agreement.

The two basic equations of the long-run creditworthiness for the case of Pakistan are as follows

$$CW_t = f \left[ \left( \frac{NFE}{GDP} \right)_t, \left( \frac{DS}{GDP} \right)_t, \left( \frac{INV}{GDP} \right)_t, \epsilon_t \right] \quad (3.1)$$

$$CW_t = f \left[ \left( \frac{NFE}{GDP} \right)_t, \left( \frac{DS}{GDP} \right)_t, \left( \frac{POP}{GDP} \right)_t, \epsilon_t \right] \quad (3.2)$$

Where,

$CW_t$  = Creditworthiness of Pakistan (Measure as binary variable such as; 1=Debt

Rescheduled during the year and 0= Debt Not Rescheduled during the year

$NFE/GDP$  = Expected net capital inflows/GDP ratio. The net capital inflows includes private and public unrequited transfers and all the components of capital account from the balance of payments data as defined by the IMF.

$DS/GDP$  = Total debt servicing of external debt/GDP ratio. The total debt service variable includes legal quantity of external obligations due and also the actual payments made in years where debt rescheduling occurred. However, the years where debt rescheduling did not occur only includes the actual payments made which is the sum of principal repayments and interest actually paid in currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF.

$INV/GDP$  = Investment/GDP ratio. The gross fixed capital formation data is taken as a proxy for investment.

$POP/GDP = \text{Total Population}/\text{GDP ratio}$

According to the theory NFE/GDP ratio has a negative relationship with the probability of debt rescheduling meaning that with higher capital inflows, the country will be able to service its debt according to original commitments even if its level of income is less. The loans in the form of capital inflows helps the country to fulfil its consumption as well as investment requirements. A creditworthy country is on the path of ever-increasing capital inflows and there will be no need to consume up the domestic resources to fulfil the debt obligations. This is the reason net capital inflows/GDP ratio reduces the probability of a country to reschedule its debt.

DS/GDP ratio is positively related with the probability of debt rescheduling. As the country accumulates increasing amount of external debt, the pressure to service the debt as a ratio of GDP also becomes enormous and the probability that country will reschedule its debt is increased. Higher debt servicing is only sustainable when the country's level of income is high.

The variable INV/GDP ratio and POP/GDP ratio are used alternatively in the theory and both have opposite impact on the probability of debt rescheduling. With the increasing amount of new borrowings, the investment as a ratio of GDP is increased with the country's capital stock increasing at a sustainable level which decreases the probability that the country will reschedule its debt is decreased. The variable POP/GDP ratio is the inverse of per capita income and is positively related with probability of debt rescheduling as the population/GDP ratio increases, the pressure on country's resources is increased due to increased consumption and it becomes difficult to fulfill the debt obligations on time. [Kharas, 1984]

As we have a binary choice variable model we are interested in estimating the conditional probability,  $PR (CW_t = 1|x_t)$ , the probability that a representative in time period  $t$  chooses  $CW_t=1$  conditional on dependent variable  $x_t$

$$P (CW_t = 1|x_t) = F (x_t) = E [CW_t|x_t] \quad (3.3)$$

$F(x_t)$  is the functional form and the choice of functional form depends upon the econometrician.

*Framing a Probability Model:*

We would like to alter  $X\beta$  into probability.

That is, we need a function  $F$  such that

$$Prob(CW_t = 1) = F (X_t\beta) \quad (3.4)$$

A normal selection of a function that interprets  $X\beta$  into a number between 0 and 1 in a workable way is a distribution function, or the cumulative density. In fact, binary response models can be explained this way. If we choose  $F$  to be the identity function, so that

$$Prob(CW_t = 1) = X_t\beta \quad (3.5)$$

We get the linear probability model but such a choice for  $F$  does not produce the type of function we want, for nothing limits  $X\beta$  to lie between 0 and 1.

Choosing  $F$  to be standard normal yields an attractive possibility, **the probit model:**

$$Prob (CW_t = 1) = \Phi(X_t\beta) = \int_{-\infty}^{X_t\beta} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{z^2}{2}\right) dz \quad (3.6)$$

The standard normal transformation  $\Phi (.)$  constrains the probability to lie between 0 and 1, or

$$\lim_{z \rightarrow +\infty} \Phi(z) = 1$$

and

$$\lim_{z \rightarrow -\infty} \Phi(z) = 0$$

In this study we'll use a probit model to test the long-run creditworthiness of Pakistan. Probit was introduced by Bliss (1934), and the reason for using probit model in this study is that it transforms a dichotomous dependent variable into a probability and constrains it to lie between 0 and 1. The dependent variable  $y_t$  is a dummy which assumes one of two possible values, '1' if Pakistan reschedules debt in given year  $t$  and '0' if it doesn't.

### 3.4. Long Run Creditworthiness Model of Pakistan

We have a variable CW takes on of two possible values, 0 and 1. Describing a latent variable  $CW'$  such that

$$CW'_t = X_t\beta + \epsilon_t \quad (3.7)$$

We do not observe  $CW'$ , but rather CW, which takes on values of 0 or 1 according to the following rule

$$CW_t = \begin{cases} 1 & \text{if } CW'_t > 0 \\ 0 & \text{otherwise} \end{cases} \quad (3.8)$$

We also assume that  $\epsilon_t \sim N(0, \sigma^2)$ , now remember that in comparison with linear probability model,  $CW'_t$ (conditional on X) is distributed normally in the probit model, although its realization  $CW_t$  is not. We'll now generate our first Probit Model

Model 1:

$$\begin{aligned} Prob(CW_t = 1) &= prob(CW'_t > 0) \\ &= prob(X_t\beta + \epsilon_t > 0) \end{aligned}$$

$$\begin{aligned}
&= \text{prob}(\epsilon_t > -X_t\beta) \\
&= \text{prob}\left(\frac{\epsilon_t}{\sigma} > -\frac{X_t\beta}{\sigma}\right) \quad 4
\end{aligned} \tag{3.9}$$

We can now write equation (3.9) as

$$\begin{aligned}
&= \text{prob}\left(\frac{\epsilon_t}{\sigma} > -\frac{X_t\beta}{\sigma}\right) \\
&= \text{prob}\left(\frac{\epsilon_t}{\sigma} < \frac{X_t\beta}{\sigma}\right) \\
&= \Phi\left(X_t \frac{\beta}{\sigma}\right)
\end{aligned} \tag{3.10}$$

$$\text{Prob}(CW_t = 1) = \Phi\left(\alpha_o + \beta_1 \left(\frac{NFE}{GDP}\right)_t + \beta_2 \left(\frac{DS}{GDP}\right)_t + \beta_3 \left(\frac{INV}{GDP}\right)_t\right) \tag{3.11}$$

$$CW_t = \alpha_o + \beta_1 \left(\frac{NFE}{GDP}\right)_t + \beta_2 \left(\frac{DS}{GDP}\right)_t + \beta_3 \left(\frac{INV}{GDP}\right)_t + \epsilon_t \tag{3.12}$$

$$\epsilon_t \sim N(0, \sigma^2)$$

---

<sup>4</sup> Dividing by  $\sigma$  is useful because the quantity  $\epsilon/\sigma$  is distributed as *standard* normal (Econometric Methods, Johnston and DiNardo)

Where the dependent variable is the creditworthiness of Pakistan,  $\alpha$  denotes the intercept, all  $\beta$ 's denote the coefficients associated with independent variables

Model 2:

$$CW_t = \alpha_o + \beta_1 \left( \frac{NFE}{GDP} \right)_t + \beta_2 \left( \frac{DS}{GDP} \right)_t + \beta_3 \left( \frac{POP}{GDP} \right)_t + \epsilon_t \quad (3.13)$$

$$\epsilon_t \sim N(0, \sigma^2)$$

### **3.5. Model for the Impact of Global Financial crisis on the Long-run Creditworthiness of Pakistan**

In order to find the impact of global financial crisis on the long-run creditworthiness of Pakistan, a dummy variable for financial crisis is introduced in the equations (3.12) and equation (3.13)

Model 3:

$$CW_t = \alpha_o + \beta_1 \left( \frac{NFE}{GDP} \right)_t + \beta_2 \left( \frac{DS}{GDP} \right)_t + \beta_3 \left( \frac{INV}{GDP} \right)_t + FC_t + \epsilon_t \quad (3.14)$$

$$\epsilon_t \sim N(0, \sigma^2)$$

Model 4:

$$CW_t = \alpha_o + \beta_1 \left( \frac{NFE}{GDP} \right)_t + \beta_2 \left( \frac{DS}{GDP} \right)_t + \beta_3 \left( \frac{POP}{GDP} \right)_t + FC_t + \epsilon_t \quad (3.15)$$

$$\epsilon_t \sim N(0, \sigma^2)$$

$FC_t =$  A dummy variable for Financial Crisis which takes the value '1' when Asian

Financial Crisis arose and persisted from year 1997-99 and Global Financial Crisis

from 2007-09

The last variable is a dummy variable for global financial crisis. Two major financial crisis, the Asian Financial crisis of 1997-99 and Global Financial Crisis of 2007-09. The transmission channel through which financial crisis can have an impact on the creditworthiness of the country is mainly through FDI which is a fragment of capital inflows and trade account. The contagious East Asian Crisis was found to have an impact on developing Asian economies mainly through short-term capital inflows and bank lending (Khan, 2004).

Global Financial Crisis of the developed nations can have an impact on developing countries economy through export and import prices, remittances, FDI and equity investment and commercial lending and aid (Te Velde, 2008). The Global Financial Crisis which resulted in credit supply trouble is found to have an impact on developed countries' GDP and industrial production (Romer and Romer, 2014)

These transmission channels are important in finding the impact of Global financial crisis on the creditworthiness of Pakistan as the capital inflows, FDI, commercial lending and aid are directly related with developed countries' banks advancing loans to less developed countries and because the Crisis was of Global nature there were less financial institutions available who would supply sufficient credit to the developing countries which may lead to the deterioration of their creditworthiness.

### 3.6. Maximum Likelihood Method

A Probit model is estimated using the maximum likelihood method. The numerical procedure of M.L.M was proposed by Fisher [1922]. From equation (3.10) we observe that deriving likelihood function is straightforward, as

$$Prob(CW_t = 1) = \Phi\left(X_t \frac{\beta}{\sigma}\right)$$

It follows that

$$Prob(CW_t = 0) = 1 - prob(CW_t = 1) = 1 - \Phi\left(X_t \frac{\beta}{\sigma}\right)$$

If we have i.i.d. sampling, the likelihood for the sample is the product of the probability of each observation. Denoting  $1, \dots, m$  as the  $m$  observations such that  $CW_t=0$ , and  $m+1, \dots, n$  as the  $n-m$  observations such that  $CW_t=1$ , yields

$$L = Prob(CW_1 = 0). Prob(CW_2 = 0) \dots Prob(CW_m = 0)$$

$$. Prob(CW_{m+1} = 1) \dots Prob(CW_n = 1)$$

(3.16)

$$= \prod_{i=1}^m \left[1 - \Phi\left(X_t \frac{\beta}{\sigma}\right)\right] \prod_{i=m+1}^n \Phi\left(X_t \frac{\beta}{\sigma}\right) \quad (3.17)$$

$$= \prod_{i=1}^n \Phi\left(X_t \frac{\beta}{\sigma}\right)^{CW_t} \left[1 - \Phi\left(X_t \frac{\beta}{\sigma}\right)\right]^{1-CW_t} \quad (3.18)$$

$$\text{When we work with log-likelihood function, we have } l\left(\frac{\beta}{\sigma}\right) = \ln(L) \quad (3.19)$$



$$= \sum_t \left\{ CW_t \cdot \ln \left[ \phi \left( X_t \frac{\beta}{\sigma} \right) \right] + (1 - CW_t) \cdot \ln \left[ 1 - \phi \left( X_t \frac{\beta}{\sigma} \right) \right] \right\}^5 \quad (3.20)$$

Note: The log-likelihood is bounded above by zero

$$\ln[\phi(\cdot)] \leq 0 \text{ and } \ln[1 - \phi(\cdot)] \leq 0$$

The statistical software package STATA is used for estimating our Probit Model

### 3.6.1. Diagnostic Tests

Pseudo R-Squared also known as McFadden's R-Squared [1997] is used to test the goodness of fit of the model.

McFadden's  $R^2$  is

$$R^2 = 1 - \frac{\ln \hat{L}(M_{Full})}{\ln \hat{L}(M_{Intercept})} \quad (3.21)$$

The Log-likelihood Ratio Chi-Square test is a test against null hypothesis that slope coefficients are all equal to zero

$$2[l(\alpha, \beta) - l(\alpha, 0)]^a \sim \chi^2(k - 1) \quad (3.22)$$

In equation (3.22) the term  $l(\alpha, \beta)$  is the maximized value of the log-likelihood of the model being estimated,  $l(\alpha, 0)$  is the value of the log-likelihood for a probit with only intercept and  $k-1$  is the number of slope coefficients.

---

<sup>5</sup>  $\beta/\sigma$  always appear together and for the simplicity  $\sigma$  is normalized to one (Econometric Methods, Johnston and DiNardo)

### **3.7. Data**

The time series data used in this study is collected for the years 1972-2013. The total observations used in this analysis are 42 years for the country Pakistan of the variables; Debt Rescheduling, Gross Domestic Product GDP (current US\$), Total Debt Service on external debt (current US\$) and Gross Fixed capital formation (current US\$) and Total Population taken from World Development Indicators, The World Bank.

The data for the variable Net capital Inflows is taken from Pakistan's Balance of Payments from State Bank of Pakistan for years 1972-2013. State Bank is the central bank of Pakistan which was inaugurated on July 1, 1948 by Quaid-e-Azam Muhammad Ali Jinnah the first Governor General of Pakistan.

### **3.8. Conclusions**

This chapter conveyed the model to estimate the long-run creditworthiness of Pakistan and the impact of Global Financial Crisis on the creditworthiness through a Probit Model which is a binary choice model, where the explained variable has just two potential outcomes, one or zero. Four long-run creditworthiness Models for the case of Pakistan are described in this chapter. The four models are estimated through maximum likelihood method. Time series data for years 1972-2013 for country Pakistan is taken from WDI and State Bank of Pakistan.

# Chapter 4

## Results and Discussion

### 4.1. Introduction

In this chapter we will estimate the long-run creditworthiness of Pakistan and the impact of Global Financial crisis on the creditworthiness. The analysis is done by applying a Probit Model which is estimated by Maximum Likelihood Method (MLM). The results will indicate the relationship between the long-run creditworthiness of Pakistan which is measured as probability of debt rescheduling (explained variable) with expected net capital inflows/GDP ratio, debt service/GDP ratio, investment/GDP ratio, Population/GDP ratio and dummy variable FC for financial crisis (explanatory variables).

This Chapter comprises of detailed discussion on the results of long-run creditworthiness of Pakistan and the impact of financial crisis on its long-run creditworthiness. The section 4.2 comprises of estimation modes for models of long-run creditworthiness of Pakistan. The sub-section 4.2.1 comprises of estimation of Probit model of long-run creditworthiness of Pakistan with expected net capital inflows/GDP ratio, debt service/GDP ratio and investment/GDP ratio. The sub-section 4.2.2 comprises of Probit model of long-run creditworthiness with expected net capital inflows/GDP ratio, debt service/GDP ratio and population/GDP ratio. The section 4.3 consists of Impact of Global Financial crisis on the long-run creditworthiness of Pakistan. The sub-section 4.3.1 comprises of Probit model of long-run creditworthiness of Pakistan with expected net capital inflows/GDP ratio, debt service/GDP ratio, investment/GDP ratio and dummy variable FC

for financial crisis. The sub-section 4.3.2 comprises of probit model of long-run creditworthiness of Pakistan with expected net capital inflows/GDP ratio, debt service/GDP ratio, population/GDP ratio and dummy variable FC for global financial crisis. The last section 4.4 contains conclusions of the chapter.

## 4.2. Estimation Modes for Models of Long-Run

### Creditworthiness of Pakistan

The readiness of creditors to advance is based on the confidence in the country's long-run creditworthiness. As explained earlier, this in result depends on the expectation of capital flows in the present time period. The three specifications of Probit Model of long-run creditworthiness of Pakistan are being estimated. The alternative specifications are due to the measurement of expected net capital inflows/GDP ratio<sup>6</sup> such as;

1. Current values of net capital inflows/GDP ratio as  $\left(\frac{NFE}{GDP}\right)_t$ , using the actual values as a proxy for expected values of net capital inflows/GDP ratio.
2. Lagged values of net capital inflows/GDP ratio as  $\left(\frac{NFE}{GDP}\right)_{t-1}$ , as annual time series data is used and the debt rescheduling occurs within the same year, there can be a problem of simultaneity so lagged values are used as a proxy for expected net capital inflows/GDP ratio.
3. Current and lagged values of net capital inflows/GDP ratio. Change of state from rescheduling to non-rescheduling can have a simultaneity problem so a mix of current and lagged values is used as a proxy for expected net capital inflows/GDP ratio.

---

<sup>6</sup> Expectations model by Kharas (1984)

### 4.2.1. Model 1

We estimated the Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method. In this model we used current values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.1 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = 1.223 - 5.577 \left(\frac{NFE}{GDP}\right)_t + 21.547 \left(\frac{DS}{GDP}\right)_t - 14.222 \left(\frac{INV}{GDP}\right)_t \quad 4.1$$

(0.63) (-0.99)                      (1.38) \*\*\*\*\*                      (-1.05)

#### Diagnostic Tests

Pseudo R<sup>2</sup> = 0.154                      Log-Likelihood = -21.252                      LR  $\chi^2_{(3)} = 7.75^{**}$

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.154. The Log-Likelihood of the fitted model has come out to be -21.252 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(3)}$  value of 7.75 indicates that the estimated equation is significant at 5% level. The z-statistics indicate that the estimated coefficients of equation 4.1 such as  $\left(\frac{NFE}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  show that the coefficients are insignificant. However, the coefficient of  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 18% level.

All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  shows that with the growing pressure of debt

servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan which ultimately reduces the country's creditworthiness.

In Table 4.1 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.1) having the largest likelihood in Model 4.2.1. The impact of debt-service/GDP ratio on the probability of debt rescheduling is now interpretable. The absolute change of debt-service/GDP ratio is 6.24, meaning that a unit change in debt-service/GDP ratio increases the probability of debt rescheduling by 6.24 units. The percentage change of debt-service/GDP ratio is 1.01, meaning that one percent increase in debt service/GDP ratio will increase the probability of debt rescheduling by 1.01 percent. The expected net capital inflows/GDP ratio and investment/GDP ratio do not have any impact on the probability of debt rescheduling for the case of Pakistan.

**Table 4.1: Elasticities of Rescheduling Probabilities for equation (4.1)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-1.62	-0.06
Debt Service/GDP ratio	6.24*****	1.01*****
Investment/GDP ratio	-4.12	-2.92

We estimated the Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method. In this model we used lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.2 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = 1.944 - 4.313 \left( \frac{NFE}{GDP} \right)_{t-1} + 21.16044 \left( \frac{DS}{GDP} \right)_t - 18.97586 \left( \frac{INV}{GDP} \right)_t \quad 4.2$$

(0.95) (-0.74)                      (1.34) \*\*\*\*\*                      (-1.37) \*\*\*\*\*

### **Diagnostic Tests**

Pseudo R<sup>2</sup>=0.156                      Log-likelihood= -20.905                      LR  $\chi^2_{(3)}$  = 7.76\*\*

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.156. The Log-Likelihood of the fitted model has come out to be -20.905 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(3)}$  value of 7.76 indicates that the estimated equation is significant at 5% level. The z-statistics indicate that the estimated coefficients of equation (4.2) such as  $\left( \frac{NFE}{GDP} \right)_{t-1}$  is not significant. However, the coefficients of  $\left( \frac{DS}{GDP} \right)_t$  and  $\left( \frac{INV}{GDP} \right)_t$  are significant at the 18% level.

All the estimated coefficients  $\left( \frac{NFE}{GDP} \right)_t$ ,  $\left( \frac{DS}{GDP} \right)_t$  and  $\left( \frac{INV}{GDP} \right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left( \frac{DS}{GDP} \right)_t$  shows that with the growing pressure of debt servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan

which ultimately reduces the country's creditworthiness. The negative sign of  $\left(\frac{INV}{GDP}\right)_t$  shows that with increasing investment/GDP ratio, the probability of debt rescheduling in Pakistan is decreased and the country's creditworthiness is improved.

In Table 4.2 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.2) having the second largest likelihood in Model 4.2.1. The impact of debt-service/GDP ratio and investment/GDP ratio on the probability of debt rescheduling is now interpretable. The absolute change of debt-service/GDP ratio is 6.18, meaning that a unit change in debt-service/GDP ratio increases the probability of debt rescheduling by 6.18 units. The percentage change of debt-service/GDP ratio is 0.99, meaning that one percent increase in debt service/GDP ratio will increase the probability of debt rescheduling by 0.99 percent. The absolute change of investment/GDP ratio is -5.54, meaning that a unit change in investment/GDP ratio decreases the probability of debt rescheduling by 5.54 units. The percentage change of investment/GDP ratio is -3.88, meaning that one percent increase in investment/GDP ratio will decrease the probability of debt rescheduling by 3.88 percent. The expected net capital inflows/GDP ratio do not have any impact on the probability of debt rescheduling for the case of Pakistan.



**Table 4.2: Elasticities of Rescheduling Probabilities for equation (4.2)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-1.26	-0.04
Debt Service/GDP ratio	6.18*****	0.99*****
Investment/GDP ratio	-5.54*****	-3.88*****

We estimated the Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method. In this model we used current and lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.3 is as: (Z-statistics are given in parentheses)

$$\begin{aligned}
 \widehat{CW}_t = & 1.765 - 4.911 \left( \frac{NFE}{GDP} \right)_t - 0.2118355 \left( \frac{NFE}{GDP} \right)_{t-1} + 20.12552 \left( \frac{DS}{GDP} \right)_t \\
 & (0.85) \quad (-0.51) \quad (-0.02) \quad (1.30) \text{*****} \\
 & -17.27658 \left( \frac{INV}{GDP} \right)_t \quad 4.3 \\
 & (-1.21)
 \end{aligned}$$

**Diagnostic Tests**

Pseudo R<sup>2</sup>=0.162

Log-likelihood=-20.770

LR  $\chi^2_{(4)} = 8.03***$

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.162. The Log-Likelihood of the fitted model has come out to be -20.770281 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 8.03 indicates that the estimated equation is significant at 10% level.

The z-statistics indicate that the estimated coefficients of  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{NFE}{GDP}\right)_{t-1}$  and  $\left(\frac{INV}{GDP}\right)_t$  are insignificant. However, the coefficient of  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 18% level. All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  shows that with the growing pressure of debt servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan which ultimately reduces the country's creditworthiness.

#### 4.2.2. Model 2

We estimated the second Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes  $\left(\frac{POP}{GDP}\right)_t$  instead of  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used current values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.4 is as: (Z-statistics are given in parentheses)

$$\widehat{Cw}_t = -2.049 - 15.881 \left(\frac{NFE}{GDP}\right)_t + 30.402 \left(\frac{DS}{GDP}\right)_t + 475.279 \left(\frac{POP}{GDP}\right)_t \quad 4.4$$

(-2.13)\* (-2.57)\*                      (1.71) \*\*\*                      (2.73)\*

## Diagnostic Tests

Pseudo R<sup>2</sup>= 0.341

Log-likelihood= -16.542

LR $\chi^2_{(3)} = 17.17^*$

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.341. The Log-Likelihood of the fitted model has come out to be -16.542 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(3)}$  value of 17.17 indicates that the estimated equation is significant at 1% level. The Z-statistics indicate that the estimated coefficients of equation 4.4 such as  $\left(\frac{NFE}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  are significant at 1% level, while the estimated coefficient of  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 10% level.

All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  have signs according to the *a priori* expectations. The negative sign of  $\left(\frac{NFE}{GDP}\right)_t$  shows that with increasing expected net capital inflows/GDP ratio, the probability of debt rescheduling is reduced for the case of Pakistan. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  shows that with increasing debt service/GDP ratio and population/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan.

In Table 4.3 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.4) having the largest likelihood in Model 4.2.2. The impact of expected net capital inflows/GDP ratio, debt-service/GDP ratio and population/GDP ratio on the probability of debt rescheduling is now interpretable. The

absolute change of expected net capital inflows is -3.55, meaning that a unit change in expected net capital inflows/GDP ratio decreases the probability of debt rescheduling by 3.55 units. The percentage change of expected net capital inflows/GDP ratio is -1.82, meaning that one percent increase in expected net capital inflows will decrease the probability of debt rescheduling by 1.82%.

The absolute change of debt service/GDP ratio is 6.80, meaning that a unit change in debt service/GDP ratio will increase the probability of debt rescheduling by 6.80 units. The percentage change of debt service/GDP ratio is 1.53, meaning that one percent increase in debt service/GDP ratio will increase the probability of debt rescheduling by 1.53%.

The absolute change of population/GDP is 106.80, meaning that a unit change in population/GDP ratio will increase the probability of debt rescheduling by 106.80 units. The percentage change of population/GDP ratio is 1.55, meaning that one percent increase in population/GDP ratio will increase the probability of debt rescheduling by 1.55%.

**Table 4.3: Elasticities of Rescheduling Probabilities for equation (4.4)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-3.55*	-1.82*
Debt Service/GDP ratio	6.80***	1.53***
Population/GDP ratio	106.80*	1.55*

We estimated the second Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes  $\left(\frac{POP}{GDP}\right)_t$  instead of  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.5 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = -2.352 - 18.413 \left(\frac{NFE}{GDP}\right)_{t-1} + 32.866 \left(\frac{DS}{GDP}\right)_t + 663.025 \left(\frac{POP}{GDP}\right)_t \quad 4.5$$

(-2.32)\*   (-2.51)\*                      (1.71) \*\*\*                      (2.73)\*

### **Diagnostic Tests**

Pseudo R<sup>2</sup>=0.371                      Log-likelihood=-15.574                      LR $\chi^2_{(3)} = 18.42^*$

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.3716. The Log-Likelihood of the fitted model has come out to be -15.574602 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(3)}$  value of 18.42 indicates that the estimated equation is significant at 1% level.

The Z-statistics indicate that the estimated coefficients of  $\left(\frac{NFE}{GDP}\right)_{t-1}$  and  $\left(\frac{POP}{GDP}\right)_t$  are significant at 1% level, while the estimated coefficient of  $\left(\frac{DS}{GDP}\right)_t$  is significant at 10% level.

All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  have signs according to the *a priori* expectations. The negative sign of  $\left(\frac{NFE}{GDP}\right)_{t-1}$  shows that with increasing expected net capital inflows/GDP ratio, the probability of debt rescheduling is reduced for the case of

Pakistan. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  shows that with increasing debt service/GDP ratio and population/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan.

We estimated the second Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes  $\left(\frac{POP}{GDP}\right)_t$  instead of  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used current and lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.6 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = -2.241 - 26.992 \left(\frac{NFE}{GDP}\right)_t + 2.569 \left(\frac{NFE}{GDP}\right)_{t-1} + 27.457 \left(\frac{DS}{GDP}\right)_t + 874.437 \left(\frac{POP}{GDP}\right)_t$$

(-2.20)\*\* (-1.74) \*\*\*                      (0.19)                      (1.44) \*\*\*\*\*  
 (3.05)\*

4.6

### **Diagnostic Tests**

Pseudo R<sup>2</sup>= 0.460                      Log-likelihood=-13.373                      LRχ<sup>2</sup><sub>(4)</sub> = 22.82\*

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.460. The Log-Likelihood of the fitted model has come out to be -13.373 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of

independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 22.82 indicates that the estimated equation is significant at 1% level.

The Z-statistics indicate that the estimated coefficients of  $\left(\frac{NFE}{GDP}\right)_t$  is significant at 10% level,  $\left(\frac{DS}{GDP}\right)_t$  is significant at 15% level and  $\left(\frac{POP}{GDP}\right)_t$  is significant at 1% level. The estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  have signs according to the *a priori* expectations. However,  $\left(\frac{NFE}{GDP}\right)_{t-1}$  has a positive sign and is not statistically significant.

### 4.3. Impact of Global Financial Crisis on the Long-Run Creditworthiness of Pakistan

#### 4.3.1. Model 3

We estimated the third Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used current values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.7 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = 1.368 - 5.533 \left(\frac{NFE}{GDP}\right)_t + 21.798 \left(\frac{DS}{GDP}\right)_t - 14.858 \left(\frac{INV}{GDP}\right)_t - 0.469 FC_t$$

(0.70) (-0.98)                      (1.35) \*\*\*\*                      (-1.08)

(-0.66)

4.7

## Diagnostic Tests

Pseudo  $R^2=0.163$       Log-likelihood= -21.020       $LR\chi^2_{(4)} = 8.21***$

The goodness of fit of the model is calculated as Pseudo  $R^2$  that is 0.163. The Log-Likelihood of the fitted model has come out to be -21.020 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 8.21 indicates that the estimated equation is significant at 10% level.

The Z-statistics indicate that the estimated coefficients of  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 18% level. However, the coefficients of  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{INV}{GDP}\right)_t$  and  $FC_t$  are insignificant. All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  shows that with the growing pressure of debt servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan which ultimately reduces the country's creditworthiness. The estimated coefficient of dummy variable  $FC_t$  has a negative sign and is not statistically significant.

In Table 4.4 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.7) having the largest likelihood in Model 4.3.1. The impact of debt-service/GDP ratio on the probability of debt rescheduling is now interpretable. The absolute change of debt-service/GDP ratio is 6.21, meaning that a unit change in debt-service/GDP ratio increases the probability of debt rescheduling by 6.21 units. The percentage change of debt-service/GDP ratio is 1.02, meaning that one percent



increase in debt service/GDP ratio will increase the probability of debt rescheduling by 1.02 percent. The expected net capital inflows/GDP ratio, investment/GDP ratio and dummy variable  $FC$  do not have any impact on the probability of debt rescheduling for the case of Pakistan.

**Table 4.4: Elasticities of Rescheduling Probabilities for equation (4.7)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-1.57	-0.59
Debt Service/GDP ratio	6.21****	1.02*****
Investment/GDP ratio	-4.23	-3.08
Dummy variable FC	-0.13	-0.1

We estimated the third Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.8 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = 2.172 - 3.915 \left( \frac{NFE}{GDP} \right)_{t-1} + 21.161 \left( \frac{DS}{GDP} \right)_t - 20.218 \left( \frac{INV}{GDP} \right)_t$$

(1.04) (-0.67) (1.34) \*\*\*\*\* (-1.42) \*\*\*\*\*

-0.490  $FC_t$  4.8

(-0.68)

### Diagnostic Tests

Pseudo  $R^2=0.166$       Log-likelihood= -20.658       $LR\chi^2_{(4)} = 8.26^{****}$

The goodness of fit of the model is calculated as Pseudo  $R^2$  that is 0.166. The Log-Likelihood of the fitted model has come out to be -20.658 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 8.26 indicates that the estimated equation is significant at 10% level.

The Z-statistics indicate that the estimated coefficients  $\left( \frac{DS}{GDP} \right)_t$  is significant at the 18% level and  $\left( \frac{INV}{GDP} \right)_t$  is significant at 15% level. The coefficients  $\left( \frac{NFE}{GDP} \right)_{t-1}$  and  $FC_t$  are insignificant. All the estimated coefficients  $\left( \frac{NFE}{GDP} \right)_{t-1}$ ,  $\left( \frac{DS}{GDP} \right)_t$  and  $\left( \frac{INV}{GDP} \right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left( \frac{DS}{GDP} \right)_t$  shows that with the growing pressure of debt servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan which ultimately reduces the country's creditworthiness. The negative sign of  $\left( \frac{INV}{GDP} \right)_t$  shows that with increasing investment/GDP ratio, the probability

of debt rescheduling in Pakistan is decreased and the country's creditworthiness is improved. The estimated coefficient of dummy variable  $FC_t$  has a negative sign and is not statistically significant.

In Table 4.5 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.8) having the second largest likelihood in Model 4.3.1. The impact of debt-service/GDP ratio and investment/GDP ratio on the probability of debt rescheduling is now interpretable. The absolute change of debt-service/GDP ratio is 6.07, meaning that a unit change in debt-service/GDP ratio increases the probability of debt rescheduling by 6.07 units. The percentage change of debt-service/GDP ratio is 0.99, meaning that one percent increase in debt service/GDP ratio will increase the probability of debt rescheduling by 0.99 percent. The absolute change of investment/GDP ratio is -5.80, meaning that a unit change in investment/GDP ratio decreases the probability of debt rescheduling by 5.80 units. The percentage change of investment/GDP ratio is -4.18, meaning that one percent increase in investment/GDP ratio will decrease the probability of debt rescheduling by 4.18 percent. The expected net capital inflows/GDP ratio and dummy variable  $FC$  do not have any impact on the probability of debt rescheduling for the case of Pakistan.

**Table 4.5: Elasticities of Rescheduling Probabilities for equation (4.8)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-1.12	-0.41
Debt Service/GDP ratio	6.07*****	0.99*****
Investment/GDP ratio	-5.80****	-4.18*****
Dummy variable FC	-0.14	-0.11

We estimated the third Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$ . In this model we used current and lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.9 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = 1.995 - 5.713 \left(\frac{NFE}{GDP}\right)_t + 0.930 \left(\frac{NFE}{GDP}\right)_{t-1} + 19.894 \left(\frac{DS}{GDP}\right)_t - 18.419 \left(\frac{INV}{GDP}\right)_t - 0.533FC_t$$

(0.95) (-0.59) (0.09) (1.31) \*\*\*\*\*

(-1.36)\*\*\*\*\* (-0.73)

4.9

## Diagnostic Tests

Pseudo  $R^2=0.173$       Log-likelihood= -20.481       $LR\chi^2_{(5)} = 8.61*****$

The goodness of fit of the model is calculated as Pseudo  $R^2$  that is 0.173. The Log-Likelihood of the fitted model has come out to be -20.481 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(5)}$  value of 8.61 indicates that the estimated equation is significant at 18% level.

The Z-statistics indicate that the estimated coefficients of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  are significant at the 18% level. However, the coefficients of  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{NFE}{GDP}\right)_{t-1}$  and  $FC_t$  are insignificant. All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{INV}{GDP}\right)_t$  have signs according to the *a priori* expectations. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  shows that with the growing pressure of debt servicing/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan which ultimately reduces the country's creditworthiness. The negative sign of  $\left(\frac{INV}{GDP}\right)_t$  shows that with increasing investment/GDP ratio, the probability of debt rescheduling in Pakistan is decreased and the country's creditworthiness is improved. The estimated coefficient of dummy variable  $FC_t$  has a negative sign and is not statistically significant. The estimated coefficient of  $\left(\frac{NFE}{GDP}\right)_{t-1}$  has a positive sign and is also not statistically significant.

### 4.3.2. Model 4

We estimated the fourth Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$ . In this model we used current values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.10 is as: (Z-statistics are given in parentheses)

$$\begin{aligned} \widehat{CW}_t = & -2.093 - 15.95466 \left(\frac{NFE}{GDP}\right)_t + 30.44388 \left(\frac{DS}{GDP}\right)_t + 484.446 \left(\frac{POP}{GDP}\right)_t \\ & (-2.14)** (-2.58)* \qquad \qquad (1.73) *** \qquad \qquad (2.71)* \\ & + 0.176103 FC_t \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad 4.10 \\ & (0.23) \end{aligned}$$

### Diagnostic Tests

Pseudo  $R^2=0.342$                       Log-likelihood= -16.516                       $LR\chi^2_{(4)} = 17.22^*$

The goodness of fit of the model is calculated as Pseudo  $R^2$  that is 0.3427. The Log-Likelihood of the fitted model has come out to be -16.516 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 17.22 indicates that the estimated equation is significant at 1% level.

The Z-statistics indicate that the estimated coefficients of  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 10% level. The estimated coefficients of  $\left(\frac{NFE}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  are significant at 1% level. However, the coefficient of the dummy variable  $FC_t$  is insignificant. All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  have signs according to the *a priori* expectations. The negative sign of  $\left(\frac{NFE}{GDP}\right)_t$  shows that with increasing expected net capital inflows/GDP ratio, the probability of debt rescheduling is reduced for the case of Pakistan. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  shows that with increasing debt service/GDP ratio and population/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan. The estimated coefficient for dummy variable  $FC_t$  has a negative sign and is not statistically significant.

In Table 4.6 we have found the elasticities of rescheduling probabilities which includes the absolute and percentage changes for equation (4.10) having the largest likelihood in Model 4.3.2. The impact of expected net capital inflows/GDP ratio, debt-service/GDP ratio and population/GDP ratio on the probability of debt rescheduling is now interpretable. The absolute change of expected net capital inflows is -3.57, meaning that a unit change in expected net capital inflows/GDP ratio decreases the probability of debt rescheduling by 3.57 units. The percentage change of expected net capital inflows/GDP ratio is -1.83, meaning that one percent increase in expected net capital inflows will decrease the probability of debt rescheduling by 1.83%.

The absolute change of debt service/GDP ratio is 6.89, meaning that a unit change in debt service/GDP ratio will increase the probability of debt rescheduling by 6.89 units. The

percentage change of debt service/GDP ratio is 1.53, meaning that one percent increase in debt service/GDP ratio will increase the probability of debt rescheduling by 1.53%.

The absolute change of population/GDP is 108.4, meaning that a unit change in population/GDP ratio will increase the probability of debt rescheduling by 108.4 units. The percentage change of population/GDP ratio is 1.58, meaning that one percent increase in population/GDP ratio will increase the probability of debt rescheduling by 1.58%. The dummy variable  $FC_t$  has no impact on the probability of debt rescheduling for the case of Pakistan and hence no effect on its creditworthiness.

**Table 4.6: Elasticities of Rescheduling Probabilities for equation (4.10)**

	Absolute Change	Percentage Change
Expected net capital inflows/GDP ratio	-3.57**	-1.83**
Debt Service/GDP ratio	6.89***	1.53***
Population/GDP ratio	108.4*	1.58*
Dummy variable FC	0.03	0.04

We estimated the fourth Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$ . In this model we used lagged values of



variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.11 is as: (Z-statistics are given in parentheses)

$$\widehat{CW}_t = -2.476 - 19.059 \left( \frac{NFE}{GDP} \right)_{t-1} + 33.284 \left( \frac{DS}{GDP} \right)_t + 701.263 \left( \frac{POP}{GDP} \right)_t$$

(-2.41)\*    (-2.55)\*                      (1.77) \*\*\*                      (2.78)\*

$$+0.4429753 FC_t$$

4.11

(0.56)

### Diagnostic Tests

Pseudo R<sup>2</sup>=0.377                      Log-likelihood= -15.422                      LR $\chi^2_{(4)}$  = 18.73\*

The goodness of fit of the model is calculated as Pseudo R<sup>2</sup> that is 0.377. The Log-Likelihood of the fitted model has come out to be -15.422 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(4)}$  value of 18.73 indicates that the estimated equation is significant at 1% level.

The Z-statistics indicate that the estimated coefficient of  $\left( \frac{DS}{GDP} \right)_t$  is significant at the 10% level. The coefficients of  $\left( \frac{NFE}{GDP} \right)_{t-1}$  and  $\left( \frac{POP}{GDP} \right)_t$  are significant at 1% level. However, the coefficient of dummy variable  $FC_t$  is insignificant. All the estimated coefficients of  $\left( \frac{NFE}{GDP} \right)_{t-1}$ ,  $\left( \frac{DS}{GDP} \right)_t$  and  $\left( \frac{POP}{GDP} \right)_t$  have signs according to the *a priori* expectations. The

negative sign of  $\left(\frac{NFE}{GDP}\right)_{t-1}$  shows that with increasing expected net capital inflows/GDP ratio, the probability of debt rescheduling is reduced for the case of Pakistan. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  shows that with increasing debt service/GDP ratio and population/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan. The estimated coefficient of the dummy variable  $FC_t$  has a negative sign and is not statistically significant.

We estimated the fourth Probit Model for long-run creditworthiness of Pakistan by using Maximum Likelihood Method which includes a dummy variable  $FC_t$  for Financial crisis in addition to  $\left(\frac{NFE}{GDP}\right)_t$ ,  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$ . In this model we used current and lagged values of variable of net capital inflows/GDP ratio as an expected value. The estimated model presented in equation 4.12 is as: (Z-statistics are given in parentheses)

$$\begin{aligned} \widehat{CW}_t = & -2.331 - 26.188 \left(\frac{NFE}{GDP}\right)_t + 1.491 \left(\frac{NFE}{GDP}\right)_{t-1} + 27.849 \left(\frac{DS}{GDP}\right)_t \\ & (-2.24)^* \quad (-1.71) *** \quad (0.11) \quad (1.48) **** \\ & + 894.122 \left(\frac{POP}{GDP}\right)_t + 0.336 FC_t \quad 4.12 \\ & (3.10)^* \quad (0.40) \end{aligned}$$

### **Diagnostic Tests**

Pseudo  $R^2=0.463$       Log-likelihood= -13.294       $LR\chi^2_{(5)} = 22.98^*$

The goodness of fit of the model is calculated as Pseudo  $R^2$  that is 0.463. The Log-Likelihood of the fitted model has come out to be -13.294 and it is used in the Log-Likelihood Ratio Chi-Square test. The Log-likelihood Ratio Chi-Square ratio test is used for the

significance of the estimated equation by applying the null hypothesis that all coefficients of independent variables except the intercept are zero. The  $\chi^2_{(5)}$  value of 22.98 indicates that the estimated equation is significant at 1% level. The Z-statistics indicate that the estimated coefficients of  $\left(\frac{POP}{GDP}\right)_t$  is significant at the 1% level. The coefficient  $\left(\frac{NFE}{GDP}\right)_t$  is significant at 10% level and the coefficient  $\left(\frac{DS}{GDP}\right)_t$  is significant at the 15% level. However, the coefficients for  $\left(\frac{NFE}{GDP}\right)_{t-1}$  and dummy variable  $FC_t$  is insignificant. All the estimated coefficients  $\left(\frac{NFE}{GDP}\right)_{t-1}$ ,  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  have signs according to the *a priori* expectations. The negative sign of  $\left(\frac{NFE}{GDP}\right)_{t-1}$  shows that with increasing expected net capital inflows/GDP ratio, the probability of debt rescheduling is reduced for the case of Pakistan. The positive sign of  $\left(\frac{DS}{GDP}\right)_t$  and  $\left(\frac{POP}{GDP}\right)_t$  shows that with increasing debt service/GDP ratio and population/GDP ratio, the probability of debt rescheduling is increased for the case of Pakistan. The estimated coefficient for dummy variable  $FC_t$  has a negative sign and is not statistically significant.

#### 4.4. Conclusions

This chapter comprises of the estimation of four Probit Models of long-run creditworthiness of Pakistan and impact of Global Financial Crisis on the creditworthiness using (MLM). Each of the Probit Model is then estimated using three specifications of expected net capital inflows/GDP ratio such as; current values of net capital inflows/GDP ratio, lagged values of net capital inflows/GDP ratio and a mix of current and lagged values of net capital inflows/GDP ratio.

In the first Probit Model only DS/GDP ratio came out to be significant and it was found that with one percent increase in debt service/GDP ratio, the probability of debt rescheduling will increase by 1.01 percent. However, using lagged values of net capital inflows/GDP ratio we found out that DS/GDP ratio and INV/GDP ratio are significant and it was found that with one percent increase in debt service/GDP ratio, the probability of debt rescheduling will increase by 0.99 percent and with one percent increase in investment/GDP ratio, the probability to reschedule debt will decline by 3.88 percent. The results of first Probit Model indicate that expected net capital inflows are not important in the long-run creditworthiness as the debt problems cannot be solved by constantly borrowing from abroad and structural changes must be taken in order to increase the long-run creditworthiness of Pakistan. (Kharas, 1984)

In the second Probit Model NFE/GDP ratio, DS/GDP ratio and POP/GDP ratio were all significant and it was found that with one percent increase in current values of net capital inflows/GDP ratio, to reschedule debt will decline by 1.82 percent. With one percent increase in Debt servicing/GDP ratio, the probability to reschedule debt will increase by 1.53 percent and with one percent increase in Population/GDP ratio, the probability to reschedule debt will increase by 1.55 percent. With the inclusion of POP/GDP ratio as an alternate to INV/GDP ratio, the expected net capital inflows/GDP ratio along with the Debt Servicing/GDP and the POP/GDP ratio seem to be impacting the long-run creditworthiness of Pakistan.

The third and fourth Probit Models where we included the dummy variable for Global Financial crisis was found to be insignificant. The reason behind it could be that Pakistan's

economy is small and not integrated with the advanced economies where the financial crisis hit hard.

## Chapter 5

### Conclusions and Policy Recommendations

#### 5.1. Introduction

This study estimated the long-run creditworthiness of Pakistan and also the impact of global financial crisis on the creditworthiness of Pakistan. Time series data is taken from year 1972-2013. Four Probit models are estimated using Maximum Likelihood Method. Each Probit model was estimated using three alternative specifications as current values of net capital inflows/GDP ratio, lagged value of net capital inflows/GDP ratio and a mix of current and lagged values of net capital inflows/GDP ratio for the measurement of expected net capital inflows/GDP ratio.

Section 5.2 consists of conclusions regarding the study. Section 5.3 consists of policy recommendations and the last section 5.4 includes further research prospects.

#### 5.2. Conclusions

In the first Probit model only DS/GDP ratio was significant but when using lagged value of NFE/GDP ratio as an alternative specification for expected capital inflows the INV/GDP ratio also came out to be significant, this could possibly mean that last year's net capital inflows impact the long-run creditworthiness of Pakistan through DS/GDP ratio and INV/GDP ratio. In the second Probit model all the estimated coefficients NFE/GDP ratio, DS/GDP ratio and POP/GDP ratio were significant for the first two specifications of expected net capital inflows. With the inclusion of POP/GDP ratio which is an inverse of per capita income as an alternate to INV/GDP, the Log-likelihood ratio test came out to be

significant at 1% and all the estimated coefficients were also significant with the signs according to *a priori* expectations. It means that in case of Pakistan the per capita income is very important in analyzing the country's creditworthiness. The second Probit model with the third specification of using a mix of current and lagged values of net capital inflows/GDP ratio as an alternate to expected net capital inflows/GDP ratio, the current values of net capital inflows/GDP ratio was significant whereas the lagged values of net capital inflows came out to be insignificant.

The third and fourth Probit models in which dummy variable for global financial crisis was included give similar results to first and second model but the Asian and Global financial crisis dummy was found to be insignificant and did not have any impact on the creditworthiness of Pakistan.

### **5.3. Policy Recommendation**

In order to increase the creditworthiness of Pakistan the Policymakers should develop policies to efficiently manage the external debt so that the debt servicing does not consume up the domestic resources.

### **5.4. Further Research prospects**

This study has estimated the long-run creditworthiness of Pakistan and the impact of global financial crisis on long-run creditworthiness of Pakistan. There is a need to estimating the long-run creditworthiness of all South Asian economies as they are interconnected and comparable.

## References

- Aghevli, B. B. (1999). Asian crisis: causes and remedies. In *The Asian Financial Crisis: Origins, Implications, and Solutions* (pp. 157-166). Springer US.
- Balkan, E. M. (1992). Political instability, country risk and probability of default. *Applied Economics*, 24(9), 999-1008.
- Brewer, T. L., & Rivoli, P. (1990). Politics and perceived country creditworthiness in international banking. *Journal of Money, Credit and Banking*, 22(3), 357-369.
- Citron, J. T., & Nickelsburg, G. (1987). Country risk and political instability. *Journal of Development Economics*, 25(2), 385-392.
- Feder, G., Just, R., & Ross, K. (1981). Projecting debt servicing capacity of developing countries. *Journal of Financial and Quantitative Analysis*, 16(05), 651-669.
- Frank, C. R., & Cline, W. R. (1971). Measurement of debt servicing capacity: An application of discriminant analysis. *Journal of International Economics*, 1(3), 327-344.
- Haque, N. U., Kumar, M. S., Mark, N., & Mathieson, D. J. (1996). The economic content of indicators of developing country creditworthiness. *Staff Papers-International Monetary Fund*, 688-724.
- Johnston, J., & DiNardo, J. (1972). Econometric methods. *New York*, 19(7), 22.
- Kharas, H. (1984). The long-run creditworthiness of developing countries: theory and practice. *The Quarterly Journal of Economics*, 415-439.



Lee, S. H. (1993). Relative importance of political instability and economic variables on perceived country creditworthiness. *Journal of International Business Studies*, 801-812.

McDonald, D. C. (1982). Debt Capacity and Developing Country Borrowing: A Survey of the Literature (Capacité d'endettement et emprunts des pays en développement: aperçu des études consacrées à cette question) (Capacidad de endeudamiento y empréstitos de los países en desarrollo: Examen de las obras publicadas). *Staff Papers-International Monetary Fund*, 603-646.

Mondiale, B. (2009). Global Development Finance-Charting a global recovery-Review, analysis and outlook.

Muslehuddin, & Amjad, R. (2010). *Economic and social impact of global financial crisis: Implications for macroeconomic and development policies in South Asia*. Pakistan Institute of Development Economics.

Pakistan, Government of *Economic Survey*

Rahnama-Moghadam, M. (1995). Debt rescheduling in less-developed countries: world or regional crisis? *The Journal of Developing Areas*, 11-22.

Rahnama-Moghadam, M., Samavati, H., & Haber, L. J. (1991). The determinants of debt rescheduling: the case of Latin America. *Southern Economic Journal*, 510-517.

Romer, C. D., & Romer, D. H. (2015). *New evidence on the impact of financial crises in advanced countries* (No. w21021). National Bureau of Economic Research.

Sargen, N. (1977). Economic indicators and country risk appraisal. *Economic Review*, (Fall), 19-35

Siddiqui, R., Siddiqui, R., & Kazmi, A. A. (2001). Determinants of Debt Rescheduling in Pakistan [with Comments]. *The Pakistan Development Review*, 689-704.

Te Velde, D. W., Ahmed, M. M., Alemu, G., Bategeka, L., Calí, M., Castel-Branco, C., & Ingombe, L. (2010). The global financial crisis and developing countries. *London: Overseas Development Institute*, 5.

Verma, S. (2002). Determinants of Sovereign Defaults: What Does the Empirical Evidence Tell Us? *Economic and Political Weekly*, 4817-4822.