BANKING SECTOR DISTRESS IN THE NORTH CYPRUS ECONOMY

Thesis Submitted for the Degree of

Doctor of Philosophy

at the University of Leicester

by

Nil Gunsel MSc., B.A.

Management Centre

University of Leicester

Jan 2006

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

QUICK TABLE OF CONTENTS

Acknowledgements

My first and primary acknowledgement must go to my supervisor Mr. Mark Burridge, who has helped to make this dissertation possible. I can honestly say that what I have accomplished would not have been possible without his guidance and support.

I am also indebted to Professor Peter M. Jackson for his good recommendation that has served me so well over my years in the doctoral programme. And I would like to thank to my fellow committee member, Dr. Cambell Jones, for his attention and thoughtful participation in this process. I am grateful for all the opportunities I have been given that allowed me to develop in this field.

There are others, outside those most closely and academically connected to my dissertation, who have also provided valuable support during this process. Special thanks to Dr. Arnstein Aassve for all his excellent advice, both professional and practical. It has been the greatest fortune in my education to work with and learn from him. Along with my profound appreciation, he will always have my utmost admiration and respect. I would also like to show my appreciation to Dr. Siong Hook Law for his assistance. Moreover, I am also grateful to Professor Fred C. Pampel, Professor Stefen P. Jenkins and Dr. R. Brian Langrin for all their supportive comments and suggestions.

I would also like to offer my appreciation to Dr. Meryem D. Fethi and to Dr. Sami Fethi for their support. Furthermore, thanks go to my considerate friend Ozlem Olgu with whom I shared my graduate school experience in Leicester. Finally, I would like to acknowledge my uncle Dr. Suat Gunsel, who was one of the greatest motivations in my academic career, and give my deepest thanks to my parents for their enduring support and patience during this process.

BANKING SECTOR DISTRESS IN THE NORTH CYPRUS ECONOMY

Abstract

The purpose of this thesis is to empirically investigate the micro and the macro determinants of bank fragility in the North Cyprus economy over the period 1984-2002 using a multivariate logit model and logistic survival analysis. The empirical methodology employed in this analysis allows for the distinction between the determinants of the likelihood of bank failure and the survival time. Firstly, the model links the probability and the timing of banking problems to a set of bank-specific factors, then following the identification of bank-specific variables, the approach proceeds by combining these bank-level factors with the macro-environment that may have exacerbated the internal troubles of the financial institutions. The macro factors considered in the analysis are macroeconomic characteristics, financial and structural weaknesses, external shocks and potential contagion effect from Turkey.

The empirical findings suggest that capital inadequacy, low asset quality, low profitability, low liquidity, small asset size, a fall in the real GDP growth, high inflation, rising real interest rates, high credit expansion to public and private sector, a sharp increase in the real exchange rates, adverse trade shocks and high budget deficit, the ratio of M2 to foreign exchange reserves, implicit/explicit deposit insurance, financial liberalization, weak regulation and supervision and external shocks and exchange rate pressure on Turkish Lira played an important role in the escalation of the 2000-2002 banking distress in North Cyprus. Moreover, an empirical examination of the results for survival analysis reveals that low leverage, low liquidity and high credit that extended to the private sector are the main determinants of the time to banks failure in North Cyprus.

Keywords: North Cyprus economy, banking sector, bank fragility, logit, survival.

TABLE OF CONTENTS

Abbreviations

CAMELS: Represent CAMEL System Criteria with Capital (C), Asset (A), Management (M), Earning (E) and Management (M) and Size (S)

CPH Model: Cox Proportional Hazard Model

ERM: Exchange Rate Mechanism

GDP: Gross Domestic Product

GNP: Gross National Product

IMF: International Monetary Fund

KM: Kaplan Meier Product-Limit Estimators

MPI: Market Pressure Index

SDIF (North Cyprus) : Saving Deposit Insurance Fund founded as an independent legal in North Cyprus (established in 2000)

SDIF (Turkey) : Saving Deposit Insurance Fund founded as an independent legal in Turkey (established in 1985)

TL: Turkish Lira

TRNC: Turkish Republic of Northern Cyprus (North Cyprus)

US: United States

US Dollar: United States Dollar

List of Tables

Chapter 2:

Chapter 3:

Chapter 4:

Chapter 5:

Chapter 6:

List of Figures

Chapter 6:

Chapter 1:

Introduction

1.1 Background

The last two decades have witnessed an unprecedented increase in the number of financial distress episodes, both in developed and developing countries. Therefore, the issue of analyzing the determinants of the financial crises have become increasingly important for economies. In general, the financial problems that have received the most attention in the literature are currency and banking crises. For instance, in the early 1980s, several Latin American countries including Mexico, Brazil and Chile experienced a banking crisis. In particular, the 1990s were marked by an unusual number of financial and economic crises such as the attack of the European Exchange Rate Mechanism in 1992-1993, the Mexican 'tequila' crisis in 1994-1995, the Turkey currency and banking crisis in 1994, the Asian financial crisis affecting Korea, Thailand, Malaysia, and Indonesia in 1997-1998, the Russian default in 1998 and its spill-over into Latin America (the Brazilian crises in 1998-1999), the Turkish currency and banking crisis in 2000-2001 and the difficulties concerning the Argentinean economy in 2001-2002 and the attack on the Brazilian real in 2002 reminded the world how rapidly and unexpectedly a financial crisis can erupt, causing disruption in the credit channels, economic contraction and spill-over to other countries and how difficult it can be to provide an effective policy response. (see for instance, Lindgren, Garcia and Saal (1996), Hutchison and McDill (1999), Goldstein (1998), Kaminsky and Reinhart (1998), Goldenstein, Kaminsky and Reinhart (2000), Saxena (2004)). These events increased concerns about banking and currency crises and led economists to focus on the causes of these crises.

Theoretical models of crises can be examined under three categories: first-generation models, second-generation models and third-generation models. The first-generation models focus on the role of weak fundamentals in the policy of government as a triggering factor of currency crises. The fiscal deficit, growth of money supply, current account balance and the level of foreign exchange reserves are the economic indicators that are

derived from this framework. This model assumes that the government budget deficit is the root of speculative attacks on pegged exchange rates. In general, the main features of the crisis in Latin America in the early 1980s can be defined by first-generation models (see Saxena (2004)).

However, the first-generation models failed to explain the crises in Europe (1992-1993) and in Mexico (1994-1995). This failure led to the development of second-generation models. The second-generation currency crises models offered no critical developments to fundamental macroeconomic variables; instead it provided model of self-fulfilled speculative attacks in foreign exchange markets. In this model market expectations directly influence macroeconomic policy decisions in a rational direction.

When financial crises erupted in South East Asia in 1997, neither first nor second-generation models explained the reasons for failure. During this crisis period in Asian countries inflation, government deficit and unemployment were low and credit was high[1]. Hence, this crisis in Asia has revealed the need for a new framework that integrates weaknesses in the banking sector into the early generation models. This new framework, which takes into account the weaknesses of the financial sector, is called the third-generation models or the term twin crises, which emphasize the occurrence of both banking and currency crises. The theoretical framework of third-generation models is the analysis of financial crises that combine two important principles (weak macroeconomic fundamental and self-fulfilled attack) of first and second-generation models with the banking sector. In addition, this new framework considers new issues such as moral hazards[2], the herding behaviour of bankers and portfolio managers and international contagion effects appearing a result of trade or financial linkage between countries. In this context, the financial fragility-based explanation relies on the third-generation models.

The financial crises in Turkey in 1994 and 2000-2001 can be explained by the third-generation model, which combines early generation models with weaknesses in the banking sector. The financial fragility appears to play an important role, in particular, in turning the currency crises into a financial crisis. In fact, in 1994 fundamental variables were deteriorating, and large fiscal deficit with high and variable inflation, and increasing

1 In the Asian case primary importance was given to only macroeconomic factors, hence the importance of specific bank data was dismissed (see Hardy and Pazarbasioglu (1998)).
2 A Moral hazard is a source of over-investment or excessive external borrowing.

public sector deficit, led to a growing external deficit and increasing demand for foreign exchange. This led to great loss of reserves in Turkey, turning the currency crisis into a banking crisis (Kibritcioglu, Kose and Ugur (1999)). During the crises years of 2000-2001, factors such as a weak macroeconomic environment (which is characterized by the inconsistency of macroeconomic policies and exchange rate pegs, a large government deficit, a large trade deficit, a large current account deficit, a large budget deficit, high inflation, excessively high real interest rates, depreciated exchange rate and slow GDP growth) and weaknesses in the financial sector, moral hazards (the presence of an explicit deposit insurance scheme), and the asymmetric information problem can explain Turkey's vulnerability to financial crises.

The vulnerability of the banking sector associated with a weak macroeconomic environment is characterized by a large government deficit, a large trade deficit, high inflation, excessively high real interest rates, depreciated exchange rate and slow GDP growth. These are among the main factors that increased the problems in the banking sector and led to the emergence of the banking crisis in North Cyprus in 2000. Concerning the monetary policy in North Cyprus, due to the fact that it does not have its own currency (North Cyprus uses the same currency unit (Turkish Lira) as Turkey), it also does not have the ability to develop an independent monetary policy. Hence, money-related problems, which arise in Turkey, directly affect the economy of North Cyprus. In particular, the onset of the Turkey currency and banking crises in 1994 and 2000-2001 had a negative impact on the North Cyprus banking sector and led to the contraction of the North Cyprus economy.

The North Cyprus economy has experienced two banking sector distress periods. The first took place in 1994 and the second took place between the years 2000 and 2002. In 1994, the economic fundamentals in Turkey were deteriorating. Particularly, there was a continuing devaluation of the TL, which resulted in a serious currency crisis.[3] As there is a close monetary and economic link between Turkey and North Cyprus, as a consequence of the financial distress experienced in Turkey in 1994, banks in North Cyprus were also affected. In 1994 two banks (namely, Everest Bank Ltd. and Mediterranean Guarantee Bank Ltd.) were placed under the control of the TRNC Ministry of Finance. Later, these

3 In 1993, change in exchange rate was around 59.83%, and in 1994 it jumped to 169.34% (see Table 2.1 in Chapter Two).

banks had to be bailed out by the Government. Mediterranean Guarantee Bank Ltd. became a public bank and the Everest Bank Ltd. was taken over by a private owner.

In Turkey the International Monetary Fund (IMF) supported the pegged exchange rate base anti-inflation programme implemented in December 1999. However, after fourteen months, the programme had to be abandoned, with the collapse of the TL. During the period of 2000-2002 ten financial banks were forced by the Government of North Cyprus to suspend their operation. In 2000, five banks, namely the Cyprus Credit Bank Ltd., Cyprus Liberal Bank Ltd., Everest Bank Ltd., Kibris Yurtbank Ltd. and Cyprus Finance Bank Ltd., were put under the Saving Deposit Insurance Fund (SDIF), and then these banks were closed in the year 2001. The bankruptcy of these five banks started a serious banking crisis in North Cyprus. Criminal investigations have been conducted to investigate the management, and the total loss of these five troubled banks was reported to be around 112 trillion Turkish Lira[4]. Another four banks, namely Cyprus Commercial Bank Ltd., Yasa Bank Ltd., Tilmo Bank Ltd. and Asia Bank Ltd., were put under the SDIF in 2001, and Cyprus Industrial Bank Ltd. was put under SDIF in 2002. Furthermore, Finba Ltd. was taken over by Artam Bank Ltd. in 2000 and Med Bank Ltd. and Hamza Bank Ltd. were taken over by Seker Bank Ltd. in the years 2001 and 2002 respectively. During 1999 there were 37 surviving banks in North Cyprus. However, towards the end of 2002 ten of these banks were revoked from operation[5], two banks were taken over by other bank, and only 25 banks remained. The increase in the failure of commercial banks in North Cyprus increased attention on efforts to investigate the determinants of bank failure.

Several studies of countries experiencing problems reckoned that governments have frequently failed to quickly identify the institutions facing problems or to take early corrective action when problems arise, resulting in larger and more difficult crises. In particular, the rescue operations of the financial crises are extremely costly for the budget of the Government. For instance, during the Exchange Rate Mechanism (1992-1993) about 150 billion to 200 billion US Dollar was spent on official market intervention to stave off devaluation and floating of the Exchange Rate Mechanism (ERM) currencies. (Goldenstein *et al.* (2000)). In 1995, Mexico's peso crisis was accompanied by a decline

4 See Radical Newspaper (2002).
5 Two other banks, namely Cyprus Investment Bank Ltd. and Home and Overseas Bank Ltd., were closed because of fraud in 1996 and 1997, respectively.

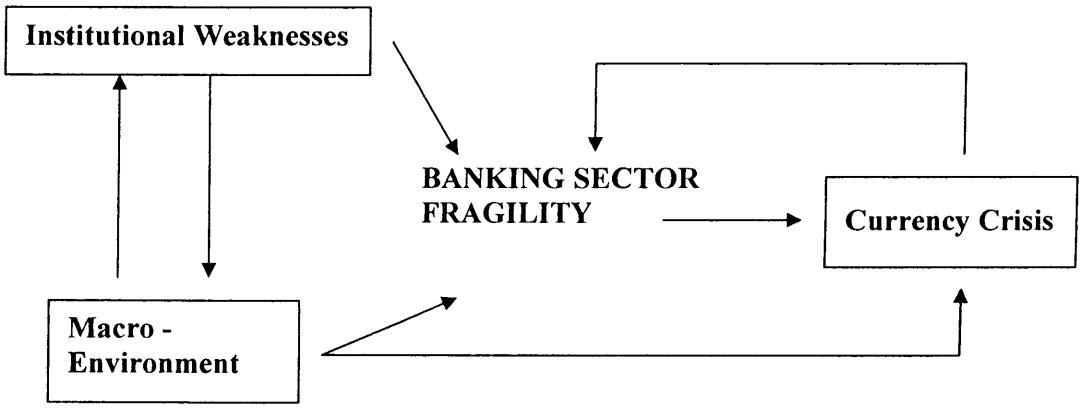
in real GDP of 6 percent. The cost of bank recapitalization was around 58 percent in Indonesia, 30 percent for Thailand, 15 percent for South Korea and 10 percent of GDP for Malaysia (World Bank (2000)). Safakli (2003) states that during the failure of 10 banks economic loss in North Cyprus was around 200 trillion TL, which was almost 50 percent of the total Gross National Product (GNP). Another striking result of these financial crises has not been restricted to national boundaries, but has been spread to other countries through contagion. Hence, large costs were not only generated at national level but also for internationally. In this respect, there is a need to anticipate and identify a crisis before it develops.

1.2 Aims of the Study

This research aims to carry out an extensive analysis of the determinants of the bank fragility in the North Cyprus economy. Specifically, the micro and the macro determinants of bank fragility are empirically investigated over the period 1984-2002.

The empirical literature on banking fragility is investigated under two categories. These are micro approaches and macro approaches. Figure 1.1 demonstrates the schematic illustration of potential factors influence banking sector fragility.

Figure 1.1 Schematic Representation of Banking Sector Fragility



At the micro level institutional weaknesses are the main causes of bank failure. These studies focus on individual banks' balance sheet data and aim to identify micro variables that determine the reasons for individual bank failure. In particular, various financial ratios that are consistent with the CAMELS[6] rating system are employed to produce an evaluation of the condition of the banks. (see, for instance, Martin (1977), Avery and Hanweck (1984), Espahbodi (1991), Thompson (1991), Kolari *et al.* (2002), Persons (1999), Canbas *et al.* (2004) and Rahman *et al.* (2004), Lane Looney and Wansley (1986), Whalen (1991), Cole and Gunther (1995), Henebry (1997), Wheelock and Wilson (1995), Molina (2002)[7].)

From the macro perspective, banks are strongly influenced by contractions that the economy experiences over time. In particular, banking sector and currency crises are highly influenced by a number of macro variables. For instance, high interest rate, increasing inflation, output downturns, adverse terms of trade shocks, decline in asset prices, credit expansion, market pressure and losses of foreign exchange reserves are some of the macro variables that influence the functioning of financial and economic systems as a whole (see, for instance, Demirguc-Kunt and Detragiache (1998 a, b, 2000), Hutchison and McDill (1999), Hutchison (2002), Eichengreen and Arteta (2000), Hardy and Pazarbasioglu (1998) and Domac and Mertinez-Peria (2000) for studies on banking crisis and Frankel and Rose (1996), Sach, Tornell and Velasco (1996), Kaminsky, Lizando and Reinhart (1997) and Eichengeen and Rose (1998) for studies on currency crises). Further, causality between currency and banking crises can run in either direction: i.e. banking sector fragility can lead to a currency crisis or a currency crisis can lead to banking sector fragility (see, for instance, Glick and Hutchison (2001), Kaminsky and Reinhart (1995) and Miller (1996) etc).

However, the recent empirical studies have started to give more importance to both micro and macro factors. Originally, Gonzalez-Hermosillo (1996) developed a theoretical framework that combined the role of both bank-specific (mainly financial ratios from bank balance sheets) and macro environment, for determining the banking sector distress in Mexico. (see, for example, Gonzalez-Hermosillo *et al.* (1996), Gonzalez-Hermosillo

6 In CAMELS six criteria of robustness are represented as C (Capital Adequacy), A (Asset Quality), M (Management Efficiency), E (Earning), L (liquidity) and S (Asset Size).
7 See also Laviola *et al.* (1999).

(1999), Langrin (2001), Heffernan (1996), Borovikova (2000) and Yilmaz (2003) for other studies on empirical examination of both micro and macro variables)

An important aim of the thesis is to empirically investigate the links between the micro and the macro determinants of bank failure in the North Cyprus economy over the period of 1984-2002. The empirical methodology employed in the thesis allows for the determination of the factors that influence both the probability of bank failure and the time to bank failure. In this regard, this research attempts to answer the following questions: What are the main determinants of banking sector distress in North Cyprus? Despite the fact that all banks in the country are hit by the same macro shocks, what is the reason that some banks fail and others do not? Do banks that fail have different characteristics than survived banks? [8] Is there any warning sign of failure or problems in the near future? How can such indicators be used to lessen banking distress or prevent future fragility in the North Cyprus banking sector? Do currency crises in Turkey, i.e. an increase in exchange rate pressure have any impact on bank fragility in North Cyprus? To address these issues the study focuses in particular on the special circumstances that distinguish the episode over the period 1984-2002.

1.3 Research Methodology and Data Sources

Recent empirical works, particularly at the World Bank and the IMF, give increasing attention to variables that determine the likelihood of banking sector difficulties. The model of bank fragility presented in this thesis was first proposed by Gonzalez-Hermosillo (1996). Gonzalez-Hermosillo examined the bank fragility by comparing observations across banks and also observations over time. To examine these dimensions simultaneously, a pooled time series cross-section analysis was used. A panel dataset contains a bank-level data of 23 commercial banks and annual data that covers the period from 1984-2002.

In the empirical literature several approaches were developed for a failure prediction model, which demonstrates that econometric models can predict bank failure. Most of the studies have used a dichotomous variable approach by defining the dependent variable as a bank failure (or problem) bank and non-failure bank, making it possible to compare the characteristics of banks that experience financial trouble with successful banks. In this

8 See also Gonzalez-Hermosillo (1999).

regard, the attempt is to link the explanatory variable (bank-specific factors, financial and structural weaknesses, macroeconomic characteristics and external shocks) and bank fragility by estimating two types of empirical methodology. In the first method a multivariate logit analysis is used to estimate the determinants of the probability of bank failure, and in the second method a logistic survival analysis (a discrete time logistic model) is used to estimate the determinants of the survival time.

Most recent empirical studies indicate widespread use of the multivariate logit model. By utilizing a logit model it is possible to predict the likelihood of banking sector distress and investigate the causes and consequences of bank failure. (see for instance, Martin (1977), Avery and Hanweck (1984), Espahbodi (1991), Thompson (1991), Kolari *et al.* (2002), Persons (1999), Canbas *et al.* (2004), Rahman *et al.* (2004), Demirguc-Kunt and Detragiache (1998 a, b; 2000), Hardy and Pazarbasioglu (1998), Domac and Martinez-Peria (2000), Gonzalez-Hermosillo *et al.* (1996), Gonzalez-Hermosillo (1999), Langrin (2001), Heffernan (1996), Borovikova (2000) and Yilmaz (2003)). In addition, use of a survival model will help to determine factors influencing the timing to bank failure. (see, for example, Lane, Looney and Wansley (1986), Whalen (1991), Wheelock and Wilson (1995), Cole and Gunther (1995), Gonzalez-Hermosillo *et al.* (1996), Henebry (1997), Molina (2002), Langrin (2001) and Borovikova (2000))

Published balance sheet and income statements are the only publicly available report on the financial conditions of a bank operating in North Cyprus. The sources of data used in this study come from the balance sheets and income statement of each bank, the Bank Association of North Cyprus and the Central Bank of the Turkish Republic of Northern Cyprus. The annual macro data employed in this analysis are taken from the State Planning Organization in North Cyprus, the Central Bank of the Turkish Republic of Northern Cyprus, the Central Bank of Republic of Turkey and the International Financial Statistics of International Monetary Fund.

1.4 Importance of the Research

This research is important for the following reasons. First, utilizing two methods, namely the logit model and the logistic survival analysis, will help in estimating the determinants of the probability and the timing of bank failure / problems in North Cyprus. Second, there is the identification of the bank-specific factors, macroeconomic characteristics,

financial and structural weaknesses and external shocks that contributed to bank failure in North Cyprus. Third, there is a measure of spill-over effect from Turkey, which allow the examination of whether speculative pressure on Turkish Lira increased vulnerability of bank failure in North Cyprus.

An understanding of the determinants of bank failure would help bank examiners, supervisors, regulators, investors and policy makers in their decisions to alert management in time, to prevent bank failure. The ability for early detection of any financial weaknesses in North Cyprus will help to minimize any costs brought about by financial instability.

1.5 Structure Plan

Specifically, this thesis is composed of seven chapters, including the introduction and the conclusion. Following the introduction, the remainder of the thesis is organized as follows:

Chapter 2 analyzes the developments in the North Cyprus economy and financial system since the 1980s. The crisis in the North Cyprus can be traced to a set of interrelated problems with Turkey. In particular, the effects of the sudden devaluation of the Turkish Lira in Turkey in 1994 and 2000-2001 appears to have had a negative impact on the North Cyprus banking sector and to have shaken the economy of North Cyprus. From this regard the chapter overviews the developments in the Turkish economy and financial system. The chapter also considers the structure of the North Cyprus banking sector and the impact of regulatory changes over recent years, as well as structure of banks in terms, for instance, total assets, total loans, total deposits and shareholders equity. As far as the restructuring process is concerned, a three-year economic rehabilitation programme that the economy undertook on the 4th of October 2000 brings an important development to the North Cyprus banking sector. The programme prompted rescue by the Central Bank, which averted a massive loss of confidence and a bank run. The last section of the chapter discusses the origin of the 2000-2002 banking sector distress.

Chapter 3 provides an overview of the theoretical and empirical literature on financial crises. The theoretical literature concerning financial crises is investigated under three generation models, namely first-generation models, second-generation models and third-generation models. First-generation models and second-generation models are also known

as currency crisis models. However, the third-generation models emphasize the occurrence of both banking and currency crises, i.e. the importance of the financial sector and capital flows in currency crises. Thus, the term twin crises. The theoretical model of banking failures are examined under several models, such as 'Random Withdrawal Models', 'Asymmetric Information Models', 'Adverse Shocks/Credit Channel Models' and 'Moral Hazard Models'. Following the theoretical model of Gonzalez-Hermosillo (1996), the linkage between systemic crisis (third-generation model) and individual bank failure is highlighted in the literature. The last section of this chapter looks at empirical literature in an attempt to identify determinants of banking sector fragility and an appropriate economic modelling framework. A brief overview of the literature suggests that the fragility of the banking sector is both micro and macro in nature and the most appropriate estimation technique appears to be the logit model and survival analysis.

Chapter 4 discusses data, model and associated econometric methodology applied to the banking sector fragility in North Cyprus. The purpose of this thesis is to empirically investigate the micro and the macro determinants of bank fragility in the North Cyprus economy over the period of 1984-2002. From this purpose, using the pool time series cross-section analysis the thesis combines observations across banks and observations over time. Basically, the panel data set contains key financial ratios of commercial banks that reveal micro conditions of banks, as well as aggregate data that reveal the macro environment and contagion currency crises from Turkey, which is calculated by Market Pressure Index. In order to have a consistency between both micro and macro data and to prevent the results been spurious, this chapter also tests the stationarity property by applying the Dickey-Fuller Unit Root Test. Additionally, in order to prevent volatility and large jumps in macro data to affect the integration level of the series, the existence of a structural break is tested according to the principles of Zivot Andrews (1992). Furthermore, this chapter describes in detail the econometric model, a logit model and a discrete time logistic survival analysis, which is employed in the empirical analysis. Use of these approaches should assist to estimating determinants of the likelihood and the timing of bank failure/problems in North Cyprus. The fifth and the sixth chapters report the empirical results from the econometric analysis.

Chapter 5 is the first stage of the empirical investigation that links individual banking problems to microeconomic variables that are expressed as functions of financial ratios

obtained from bank balance sheets and income statements. The microeconomic variables are mainly in the context of CAMELS criteria, which reflects the financial condition of banks in North Cyprus. The empirical results of microeconomic data obtained by the use of both univariate and multivariate analyses are reported. Univariate analysis attempts to examine the correlation matrix, significant mean values and panel unit root tests (stationarity property) for each micro data and Kaplan-Meier Product Limit. The results of panel unit root test reveals that all macro data are stationary at level. The multivariate analysis attempts to identify bank-specific determinants of bank failure in North Cyprus by estimating two types of empirical methodology; a multivariate logit model and a logistic survival analysis. In the first model a multivariate logit analysis is utilized to estimate the probability of bank failure, and in the second model a discrete time logistic model (survival analysis) is used to estimate the determinants of bank survival time. After identification of the bank-specific variables with the logit model and the survival analysis, in the next chapter the approach will proceed by combining these identified bank-level factors with the macro-environment.

Chapter 6 covers the second stage of the empirical investigation, which argued that the wider financial and economic environment and external shocks from Turkey exacerbated the internal troubles of the financial institutions and triggered the banking sector distress in North Cyprus. The first section is the univariate analysis, which tests the correlation, the unit root and structural break for each macro data. The result of the unit root test indicates that some of the macro data are stationary and some are non-stationary in level. Hence, in order to transform non-stationary series into a stationary series the first difference of the data is taken. Moreover, the result of the structural break test (Zivot and Andrew Test) provides evidence about the existence of structural breaks the real exchange rate. In the analysis structural changes in the time series are detected by adding a dummy variable corresponding to a pre-determined break date. Then in the second section a multivariate logit model and a logistic survival analysis is examined. The logit model and logistic survival analysis links the probability of banking problems to a set of bank-specific factors (which are determined in Chapter Five) with macroeconomic characteristics, financial and structure variables and external shocks. Specifically, the contagion effect from Turkey will allow an examination of whether shocks from Turkey played any role in the escalation of the 2000-2002 banking distress in North Cyprus.

Finally, **Chapter 7** sets out the main conclusions from this empirical study. At the same time it highlights the limitations of the study and provides recommendations for further research.

Chapter 2:

Developments in the North Cyprus Economy and Banking System (1980-2005)

2.1 Introduction

This chapter explores the main developments in the North Cyprus economy and banking system since the 1980s. The North Cyprus economy experienced severe economic and financial problems between the years 2000-2002. In particular, the onset of the Turkish currency and banking crises during 2000 - 2001 appears to have had a negative impact on the North Cyprus banking sector and to have led to the contraction of the economy. In 1999, there were a total of 37 authorised commercial banks operating in North Cyprus. However, towards the end of 2002 ten of these banks were revoked from operation and three were taken over by other banks. Understanding what caused the recent banking system failure in Northern Cyprus is the key to preventing a recurrence.

The chapter is structured as follows: Following the introduction, section 2.2 provides general information about North Cyprus. Section 2.3 investigates associated macroeconomic developments in the Republic of Turkey, and particularly highlights its impact on economic developments in North Cyprus. Section 2.4 examines developments in the North Cyprus banking sector and a three-year economic rehabilitation programme, which was formulated in 2000 in an effort to gain public confidence in the banking system. In addition, this section discusses the structure of the banks in North Cyprus. Section 2.5 considers the origins of the problems in the North Cyprus banking sector. Finally, section 2.6 provides some concluding remarks.

2.2 Country Profile

2.2.1 History and Geography

Cyprus is the third largest island, after Sicily and Sardinia, in the North East of the Mediterranean Sea, which is situated at the cross-roads of Europe, Asia and Africa.[1] The island has played an important role in the history of the eastern Mediterranean, which goes back to the sixth millennium B.C., when human settlements existed during the Neolithic Age or New Stone Age. The first known settlers of the island were the Hellenic people (325-58 BC). The island was later ruled by the Romans (58 BC-330 AD), the Byzantines (330-1191 AD), the Lusignans (1192-1489) and the Venetians (1489-1571). [2]

In 1571 the Ottomans conquered the island and the Turkish occupation lasted until 1878, when the Turks ceded Cyprus to Britain. It remain to formally part of the Ottoman Empire until the British Empire annexed the island in 1914[3], and then in 1925 it became a crown colony. On April 1 1955, the Greek Cypriot guerrilla group EOKA (National Organization of Cypriot Fighters), an anti British campaign that desired union with Greece, began armed violence against British rule. British rule lasted until 1960, when Cyprus gained formal independence from the United Kingdom and accepted the government of the "Republic of Cyprus", under the Zurich-London Treaty.

The Zurich-London Agreement was signed in 1959 by guarantor states (Turkey, Greece and Great Britain). The independent 'Republic of Cyprus' was founded in 1960. Thereafter, Greece and Turkey had limited rights to intervene in internal affairs, and the constitutional framework of Cyprus recognized the equality of the Turkish and Greek Cypriots. The 1960 Cypriot constitution was based on the equal political status and participation between two communities. In other words, it provided a presidential government system, which meant that the Greek Cypriot President and the Turkish Cypriot Vice-President would be elected by their respective communities every five years. Moreover, each side had a right to veto over certain legislations and executive decisions headed by the Greek Cypriot President and the Turkish Cypriot Vice-President. However,

1 The island has an area of 9251 square kilometres. Turkish Cypriots occupy the north of the island with an area of 3352 square kilometres, almost 36 percent (3355/9251) of the island. Cyprus is located 40 miles from the south of Turkey and 600 miles from the south east of Greece *(http://www.cyprus.com/cyprus-general-info-geography.php)*.

2 Cyprus Brief History *(http://www.kypros.com/Cyprus/cyhistory.htm)*.

3 When the Ottoman Empire entered the First World War in 1914 on the side of Germany, Britain in consequence annexed the island.

shortly after the establishment of the "Republic of Cyprus" in 1960 serious differences arose between the two communities about the implementation of the constitution. In November 1963, President Archbishop Makarios (the Greek Cypriot leader) unilaterally advanced a series of constitutional amendments designed to eliminate the mechanism to protect the basic rights of Turkish Cypriots'. The main features of these proposals were:

> "i) to have the Greek-Cypriot President and the Turkish-Cypriot Vice-President elected by the Greek-Cypriot dominated House of Representatives as a whole (not by the Greek-Cypriot and Turkish- Cypriot members separately); ii) to remove the veto powers of the Turkish-Cypriots; iii) to reduce the Turkish-Cypriot component in the civil and military arms of government; iv) to abolish the separate community voting on fiscal, electoral, and some other matters; and v) to unify the municipalities."[4]

However, as a consequence of the Turkish Cypriots objecting to such an arbitrary amendment to the Constitution, the Turkish Cypriot people became the target of armed attacks in late December 1963. In 1963 the Turkish Cypriot ministers withdrew from the cabinet and their participation in the Central Government ceased.

The violence of 1963-1964 brought the UN peacekeeping forces into Cyprus, which aims to provide a basis for negotiation between the two communities. The period between the 1963 and 1974 was the worst decade in the history of island. For eleven years the Turkish Cypriot people, as one of the co-founder partners of the 1960 Republic of Cyprus, were ejected by force of arms from the state machinery in 1963 and subjected to ethnic cleansing by the regime under the Greek Cypriot leadership. In particular, the 'Akritas Plan', drawn up by Greek Cypriot leaders and Greek Army Offices in 1963, aimed to achieve the annexation of Cyprus with Greece. Until 1974, a coup aiming to unite Cyprus with Greece was led by a group of Greek Cypriots and the Greek officer Nicos Samson, who had threatened the lives of Turkish Cypriots.[5] In response to the violence of Greek Cypriots, Turkey used its rights from the London and Zurich agreements and intervened militarily to protect Turkish Cypriots on July 20th 1974[6]. After the event of 1974, UN peacekeeping forces maintained a buffer zone between the two sides. Although the Turkish military occupation has been condemned by the international bodies (as it is opposed to basic human rights) for many years, Turkey still refuses to withdraw its military force from the island.

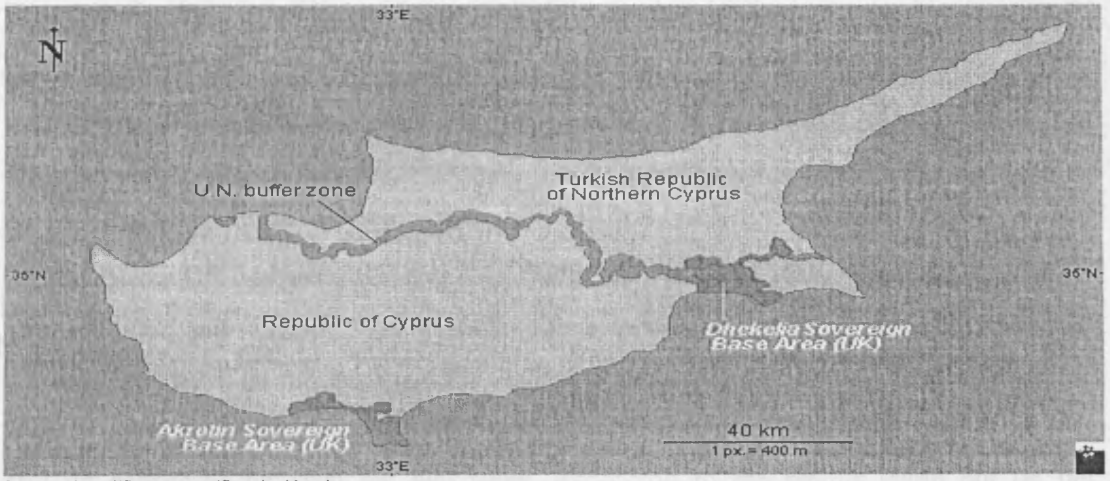
4 *(http://Cyprus History Breakdown of the 1960 Constitution.htm.)*

5 See Meyer (2000) for more information about the violence in Cyprus between the years 1955 and 1974.

6 See Bicak and Akifler (1998)

Since Turkish military intervention in the island in 1974[7], Cyprus has been territorially divided in two between the Turkish and the Greek communities. Eventually, Turkish Cypriots moved to the North and the Greek Cypriots moved to the South and the island was de facto partitioned[8] (see following Map of Cyprus).

Figure 2.1: Cyprus May



Source: http://flagspot.net/flags/cy(.html

Following the division, the Greek Cypriots in the southern part of the island have been under the control of the Republic of Cyprus, whilst, the Turkish Cypriots living in the northern part of the island and have been financially supported by the Republic of Turkey[9]. Since then, South Cyprus was accepted as the Government of the "Republic of Cyprus", which is known as the internationally-recognised Government of the whole island and occupies the country's seat at the UN. On 15 November 1983, the Turkish Cypriot community declared an independent state in the north that is known as the "Turkish Republic of Northern Cyprus" (TRNC) and is only recognized by the Republic of Turkey[10] (In this thesis, TRNC and North Cyprus are used interchangeably).

7 See Meyer (2000) for discussion on the interventions of 1974.

8 In February 1975, the "Turkish Federated State of Cyprus" was proclaimed in the North territory, formalising the de facto partition of the island.

9 Greek and Turkish Cypriots share similar customs but distinct identities based on religion and language. The main religion is Orthodox, followed by Islam and Maronite Christianity. There are three principal languages: Greek, Turkish and English. Greek is predominantly spoken in the South and Turkish in the North, and English has become the second language for both ethnic communities.

10 According to the 2003 statistics, the estimated population of the whole island was around 730,000, from whom 216,000 were Turkish living in the North (including Turkish settlers) (Noe and Watson (2005)).

2.2.2 Political Conditions

North Cyprus has a parliamentary democratic system. Rauf Denktas has been the political leader of the Turkish Cypriot community since the 1970s. A number of active political parties, both left- and right-wing are either in supported or opposed to the settlement of mainland Turks on the island and the politics of partition[11].

Before 1974, there was no movement of goods, people or services between the two sides on the island. However, on April 2003, Turkish Cypriot leader Mr. Denktas relaxed many restrictions. For the first time since 1974, the cross-border movement of people started to be free and efforts to reunite the island continued under the control of the United Nations. In November 2002, direct talks between the Presidents of both sides started under the support of the UN Secretary General, Mr. Annan. In February 2004, Greek President Mr. Papadopoulos and Turkish President Mr. Denktas accepted Mr. Annan's invitation to continue negotiations on the basis of "Annan's peace plans" for the resolution of the Cyprus issue. After a series of negotiations on a settlement of the Annan plan there was still no consensus between the two sides. According to the results taken out on the referendum on the 24th of April 2004, the majority of Turkish Cypriots (65%) voted to support the solution; however, the majority of Greek Cypriots (76%) voted to reject the agreement. As a consequence the 'Republic of Cyprus' joined the European Union on May 1, 2004 as a divided island[12].

2.2.3 Monetary Policy and Economic Plan

The official currency of North Cyprus is the Turkish Lira (TL). As North Cyprus does not have its own printed currency, it does not have the ability to develop an independent monetary policy[13]. Hence, the monetary policy of the Turkish Cypriots tends to be geared to the economy of Turkey, with little reference to the situation in North Cyprus. However, this does not mean that North Cyprus does not have a monetary policy. The Government uses its monetary authority to control the supply and availability of money with an attempt to influence the overall level of economic activity. The Central Bank of the TRNC was

11 For instance, two conservative status quo parties, the National Unity Party (UBP) and Democrat Party (DP), supported a resolutely separatist stance. The Communal Liberation Party (TKP) advocates closer relations with the Greek Cypriot community, and two pro-solution parties, the Republican Turkish Party (CTP) and the Peace and Democracy Movement (BDH), are in opposition to the Government's policy of restricted relations with the "Republic of Cyprus".

12 History of Cyprus: http://www.historyof nations nets/europe/Cyprus.html.

13 In fact, using TL as an official currency was planned as a short-term and temporary solution, for providing the required money into circulation for Turkish Cypriots13. However, the TL is still used as an official currency in North Cyprus

established in 1983,[14] and attempts to achieve economic stability by varying the quality of money in circulation, the cost of availability of credit, and the composition of the country's foreign aid taken from Turkey[15]. But, in the absence of a local currency, the central bank faces difficulties in building an efficient and stable economic structure. High inflation is a knock-on effect of this financial link with Turkey; hence, there is no price stability, which makes it difficult for the economy to establish an efficient macroeconomic policy[16]. In this sense, due to the unstable economic situation in Turkey, the North Cyprus economy has also suffered with the continuous deterioration of macroeconomic fundamentals (such as destabilizing, rapid devaluation and high inflation) for many years.

The economic development policy of the TRNC aims to achieve the highest possible rate of growth for economic stability, more equitably distribution of national income, and increases in the standards of living by improving the financial and social structure. In achieving its long-term economic objectives, TRNC has prepared 5-year plans and put them into action since 1977. The long-term aim of the development plans is to provide a stronger and self-sustained economy that is less dependent on Turkish aid.

2.2.4 Foreign Aid

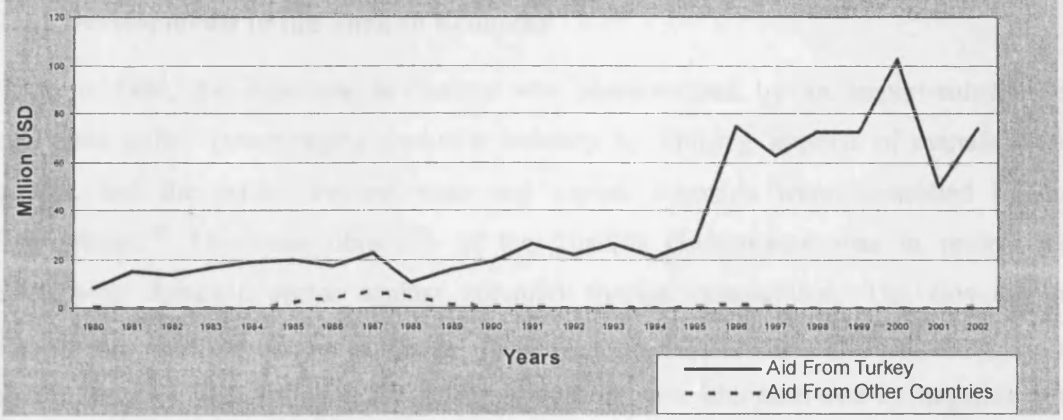
After the division of the island in 1974, the North Cyprus Government started to be persistently, economically and financially dependent on Turkey. Figure 2.2 shows the foreign aid that Turkey and other countries provided to North Cyprus between 1980 and 2002. It is possible to observe from the figure that Turkey has been providing persistent support to strengthen the economy of North Cyprus and to overcome the potential problems that Turkish Cypriots experienced.

14 The main duty of the Central Bank in North Cyprus is to implement money-credit policies and regulate and control the monetary and banking system with the development plans of the government.

15 Three instruments that the Central Bank of North Cyprus uses are reserve requirements, foreign aid taken from Turkey and credit conditions (the amount of money that financial institutions loan out). Reserve requirement is the percentage that depository institutions required to keep a deposit at the central bank in North Cyprus as a requirement of Banking Regulations. The Central Bank can change this percentage at any time, hence affecting the money supply and credit conditions.

16 See Ozdeser (2002).

Figure 2.2: Foreign Aid to North Cyprus



Source: State Planning Organization, 2002

Particularly, after the banking sector distress years of 1994 and 2000, Turkey' contribution to the Turkish Cypriot budget has increased (banking sector distress periods are discussed later in this chapter). This is because, as a consequence of the bank failure experienced during these periods, the needs to compensate depositors in failed banks increased. According to the annual report of the state planning organization, Turkey provided around 74 million US Dollar, 102 million US Dollar and 49 million US Dollar of economic and financial support, in terms of direct aid, loans and subsidies in years 2000, 2001 and 2002, respectively. Noe and Watson (2005) pointed out that annual transfers from Turkey have been estimated at 10-30 percent of the GDP – covering approximately 17 percent of GDP between 2000 and 2003.

Noe and Watson (2005) described the current economic situation of North Cyprus as:

> "relied substantially on the role of the public sector as a producer and employer; was dependent on Turkish aid; and through trade dependency and a common currency was linked to the then-troubled Turkish economy. This exposed it to a series of economic crises in Turkey – reflected in unstable growth, high inflation and sharp exchange rate fluctuations" (Noe and Watson (2005, 3)).

In this context, in order to better understand the economic developments in the North Cyprus economy, associated economic developments in Turkey must firstly be assessed.

2.3 Developments in the Turkish and North Cyprus Economy

2.3.1 Developments in the Turkish Economy

Prior to 1980, the economy in Turkey was characterized by an import-substitution economic policy (encouraging domestic industry by limiting imports of manufactured goods), and the prices, interest rates and capital accounts were controlled by the Government.[17] The main objective of the Turkish Government was to protect the developing domestic sector against potential foreign competition. The Government dominated exchange rates and interest rates on both deposit accounts and loans. As a consequence of high inflation the financial system were characterised by negative real interest rates, entry restrictions and a high tax burden on financial returns. However, the lack of foreign currency funds, accelerating inflation and problems in the balance of payment put the economy under heavy pressure towards the end of the1970s. Hence, in order to solve the problems of the economy, Turkey initiated the new economic stabilization and structural adjustment program in 1980[18]. With the implementation of new programme, development strategy changed from import substitution to an export oriented economic growth strategy. The stabilization program abolished price controls and emphasized the need for a free market mechanism in the determination of prices. Thereafter, the Turkish economy experienced fast economic and financial liberalization. After 1980 Turkish Financial Markets have been greatly liberalized. Firstly, the Turkish Economy eliminated the control on interest rates, and reduced the direct credit programme, and secondly, entry barriers into the banking system relaxed and the number of banks in operation in Turkey increased. Yilmaz (2003) states that the number of banks raised from 43 in 1980 to 66 in 1990 and to 81 in 2002.

Before 1980, fixed exchange rate was implemented, in which the value of TL was determined and adjusted by the Government according to the changing economic conditions. With the implementation in 1980 of the structural adjustment programme, TL was devalued against other currencies and a floating exchange rate system has been initiated. Starting from May 1981, the Central Bank of the Republic of Turkey

17 See Demir (2004) and Yilmaz (2003) for more information.

18 See OECD (1988), Aricanli and Rodrik (1990), Saracoglu (1996) and Demir (2004) for a more detail ed discussion of Turkey's financial liberalization.

commenced the floating exchange rate regime policy, in which exchange rates start to be run under daily adjustment[19].

Table 2.1 illustrates the economic environment during the onset of financial liberalization in Turkey and in North Cyprus over the period 1980-2002. In 1980, Turkey had a negative growth rate at an annual rate of 0.8%. The economy suffered from terrible inflation, and a high budget and trade deficit, which prevented stable economic development. In 1981, Turkey sustained a growth rate of 4.4%. This may suggest why the first year of the economic stabilization and structural adjustment programme was successful in terms of restructuring economic growth.

During the period 1982-1990, several developments had an effect on the Turkish economy. In 1982, as a result of a rising cost of funds, small banks experienced a liquidity crisis. In order to attack new customers, small banks offered high interest rates. Therefore, by the end of 1984, 6 banks failed in Turkey[20]. In 1985, with the aim of preventing further deposit withdrawal from the rest of the banking system, the Saving Deposit Insurance Fund (SDIF) founded independently in Turkey. The head of the SDIF (Turkey) was the Governor of the Central Bank, and all administrative decisions had to be approved by the central banks. Under the Banking Act of 1985, saving deposits were insured by the SDIF (Turkey), which increased the confidence of the public in the financial system (Bayir (2001)). In 1984, restrictions on the foreign exchange transactions were removed and the Turkish Government allowed the opening of foreign currency accounts in banks, which facilitated the international trade in goods and financial services. Additionally, the Banking Act of 1985 lead to the improvement of regulations and supervisions. For instance, the capital adequacy ratio, uniform accounting practices and independent auditing of banks (i.e. external auditors) were introduced and, in 1989, foreign exchange transactions and capital movements were fully freed. In February 1990, Turkey applied to the IMF for the full convertibility of the TL and then Turkish residents were allowed to carry foreign currency and open foreign exchange deposit accounts in any domestic banks. As a consequence, Turkey attracted a considerable amount of capital inflows and foreign exchange deposits in the Turkish banking system, which increased the foreign exchange reserves of the Central Bank (See Yilmaz (2003)).

19 Central Bank of Republic of Turkey (2002)

20 See Atiyas (1990) for more detailed analysis of the 1982 financial crises in Turkey.

Table 2.1: Major Economic Indicators in Turkey and North Cyprus

	1980	1981	1982-1989	1990	1991	1992	1993	1994	1995-1998	1999	2000	2001	2002
Real GDP growth rate (%)													
Turkey	-0.8	4.4	4.8	9.2	1.1	5.5	8.4	-5.0	6.1	-4.7	7.4	-7.5	7.8
North Cyprus	0.7	-7.1	6.7	6.4	-5.5	8.1	4.8	-3.7	4.1	7.5	0.1	-5.3	2.6
Inflation rate (%)													
Turkey	110	37	46	60	66	70	66	106	86	65	55	54	45
North Cyprus	93	43	48	69	46	63	61	215	77	55	53	77	25
Public Loan to GDP (%)													
Turkey	8.9	4	4.7	7.5	10.2	10.7	12.1	7.9	14.2	15.8	12.6	16.2	12.6
North Cyprus	14.6	12.1	9.4	7.1	13.7	114.7	24.1	30.3	108.8	204.5	178.5	132.4	121.5
Budget Deficit (Million US Dollar)													
Turkey	-2117	-1052	-2733	-4616	-7986	-6887	-12117	-5094	-13758	-24060	-22812	-28527	*
North Cyprus	-21	-18	-20	-32	-61	-50	-47	-29	-62	-114	-137	-146	-201
Trade Balance (Million US Dollar)													
Turkey	-5000	4231	-3509	-9343	-7454	-8157	-14083	-5164	-18929	-14084	-26727	-10064	-15101
North Cyprus	-50	-67	-128	-316	-249	-317	-309	-233	-306	-360	-375	-237	-246
Foreign Exchange Reserves (Million US Dollar)													
Turkey	1077	928	1842	6003	5098	6115	6227	7121	16708	23191	22313	18733	2 6884
North Cyprus	6	14	86	184	218	234	302	349	516	654	632	723	833
Exchange Rate (US Dollar)													
Turkey	76	111	794	2609	4172	6872	10985	29609	134960	418783	625218	1225590	1507230
North Cyprus	75	113	801	2619	4200	6896	11107	29916	136496	422313	626398	1177870	1550000
Nominal Interest Rate (%)													
Turkey	8	27	46	48	63	69	65	88	79	78	47	75	58
North Cyprus	12	15	32	55	62	66	68	94	93	74	37	58	63

Source: State Institute of Statistics in Turkey (SIS), International Financial Statistics, Central Bank of Republic of Turkey and North Cyprus, State Planning Organization, 2002

Note: * Stands for unavailability of the data in any published sources.

During the 1990s a number characteristics, such as high and variable inflation rates (averaging about 77%), altered the preference of residents from TL to foreign exchange, relatively high and volatile GDP growth, unsustainable public debt accumulation, increasing financial fragility and a lack of fiscal discipline (facing large fiscal deficit) increasing the crisis situation in Turkey. Particularly, in 1993, these fundamentals became uncontrollable. Political instability, rising inflation rates and accelerated currency substitution motivated the residents to open foreign currency with short maturity, causing an increase in the domestic interest rates. Another reason for Turkey's unstable situation was the inability of the Turkish Government to implement the necessary structural reforms and to restrain rising public sector borrowing requirements, which still cause problems. As shown in table 2.1, the ratio of public sector borrowing increased from 7.5% in 1990 to an average of 12.1% in 1993[21]. Moreover, in 1993 the Turkish economy recorded a widening of the budget and trade deficit with 12,117 million US Dollar and 14,083 million US Dollar respectively.

With particular regard to the macroeconomic indicators in Turkey, the period preceding the 1994 crisis indicated a continuous deterioration of macroeconomic fundamentals. In early 1994, the Turkish economy found itself in a very severe financial crisis that hit the economy in Turkey. According to Kibritcioglu *et al.* (1999), the reasons for the financial crisis were the imbalances in the macroeconomic variables, such as increasing public sector deficit (public deficit was financed by the domestic credits), which led to a growing external deficit. One US Dollar was equivalent to 15,000 TL, but jumped to 38,000 TL in April 1994 (Kibritcioglu *et al.* (1999)). During this year, there was a run from TL to foreign exchange. In order to defend the exchange rate, the Central Bank intervened in the foreign exchange market. As a result of this intervention, the Central Bank lost more than half of its reserves in April 1994. Moreover, the inflation rate reached a three-digit level (106%) and real output contracted by 5%. Overnight interest rate increased to 700% from the stable pre-crisis level of 70%.[22] Obviously, the economy was in need of urgent stabilization. Hence, in order to correct macro imbalances in the economy and re-establish the condition for sustainable growth, the IMF supported Stand-By Agreement was implemented on April 5th 1994. The core of the stabilization and adjustment programme was to reduce rates of inflation, to improve external balances, to preserve stabilization in

21 Towards the end of 1993, the Turkish government was trying to reduce the very high level of domestic debt by cutting interest rates on treasury bills (Celasun (1998)).

22 See Kibritcioglu *et al.* (1999)

the foreign exchange market and to reduce the public sector deficit. The new monetary programme prepared in line with the IMF Stand-by Agreement was put into effect in May. The pressure on the exchange rate started to reduce in May 1994, because of the appreciation of the exchange rate, and continued until August. The international reserves also started to increase after May (see Gumus (1995)).

Starting in 1994, subsequent reform packages were introduced to provide confidence in the banking sector. The Turkish Government changed its policy from a limited coverage case to a full coverage case. According to the Banking Law of 1985, coverage limits were not covering depositors of banks' major shareholder and managers, interbank deposits, and deposits at branches abroad. Immediately after the 1994 financial crisis, in May 1994, the Minister of Turkey changed the deposit insurance regulation, and implemented a full coverage for deposit accounts[23]. According to previous regulations, the maximum coverage for deposit insurance was 150 million TL or 4,000 US Dollar (Yilmaz (2003)). Since the 1994 economic crises, Turkey has been trying to maintain economic stability measures with assistance from the IMF. The economy had been growing steadily between 1995 and 1998. During this period the average real GDP growth rate increased to 6.1% and average inflation decreased to 86%. However, average budget deficit, trade deficit and high public sector deficit continued to increase.

In 1999, the Russian financial crisis of 1998 (Russia was Turkey's second most profitable trade partner after Germany)[24] and a major earthquake in August 1999, hit the Turkish economy. The GDP growth rate fell by 4.7% as a result. In addition, high public sector deficits continued in this period. According to Banking and Capital Markets (2001),

> " Over the last decade, the large public sector borrowing requirements, the chronic high inflation, the use of tax advantages in favour of government debt, and the deposit insurance that undermined market discipline, the prudential regulation and supervision, and the under capitalized state banks all contributed to the deterioration of the Turkish banking system. Furthermore, generous deposit insurance and a regulatory and supervisory environment triggered moral hazard and encouraged risk seeking. Connected lending, high exposure concentrations, large foreign exchange positions allowed banks to increase risk and lenient prudential regulations allowed these risks to remain hidden" (Banking and Capital Markets (2001, 32)).

23 Bayir (2001) and Yilmaz (2003)

24 See Bocutoglu *et al.* (2000), for more detail information on the effects of Russian Economic Crisis on Turkish Economy

With regard to this, once more the Turkish economy was in need of an urgent stabilization policy[25]. In December 1999, the Turkish Government launched a three-year IMF supported pegged exchange rate based stabilization program (fixed exchange rate regime) aimed to bring down inflation. Under the agreement, the economic stabilization program included a reduction in the budget deficit, economic structural reforms and currency stabilization[26]. The first nine months of the stabilization programme appeared to be successful and the economy gained public confidence[27]. Increased confidence in the Turkey economy, the improvement of the Russian economy and demand created by the earthquake recovery started to put the economy back on track in 2000 (GDP growth rate increased to 7.4%). The high budget and trade deficit and high public sector deficit were still continuing in this period.

After nine months from the start of the stabilization programme, there was a need for large IMF bailout in order to keep the economy in balance. A year after the start of the programme, a severe liquidity crisis hit the economy in November 2000.[28] After a few month of struggling it became clear that the programme was not effective, and in the face of massive attacks on the currency and rapid exit of capital the currency peg had to be abandoned in mid-February 2001, just 14 months after the start of the programme. It was replaced by a regime of free floating[29].

In fact, the 2001 crisis started with an outbreak of political tension. In February 2001, there was a public disagreement between Turkey's President and Prime Minister over whether or not to accept the IMF's recommended privatization plan. The contradictions between the President Necdet Sezer and the Prime Minister Bulent Ecevit became public and resulted in an immediate negative effect on the financial markets. Disagreement between the two leaders created great uncertainty and sent a signal of panic to investors. Most of the investor withdrew their TL holding and invested their money in a more stable currency. All those events prompted Turkey's most serious inflation problem to develop. Most of the Turkish banks in Turkey were exposed to net foreign exchange deficit, and

25 See also Akyuz and Boratav (2003)

26 See also Ozkan (2005).

27 Interest rates on Treasury bill were around 95 percent at the end of November 1999. However, a month after the adoption of the IMF base stabilization programme on 9 December, 1999 it dropped to around 38 percent by mid-February. For more detail, see Financial Times (12 June, 2000), for an article on the early success of the stabilization programme (See Ozkan (2005)).

28 See Ozkan (2005).

29 See Economic Survey of Turkey (2002).

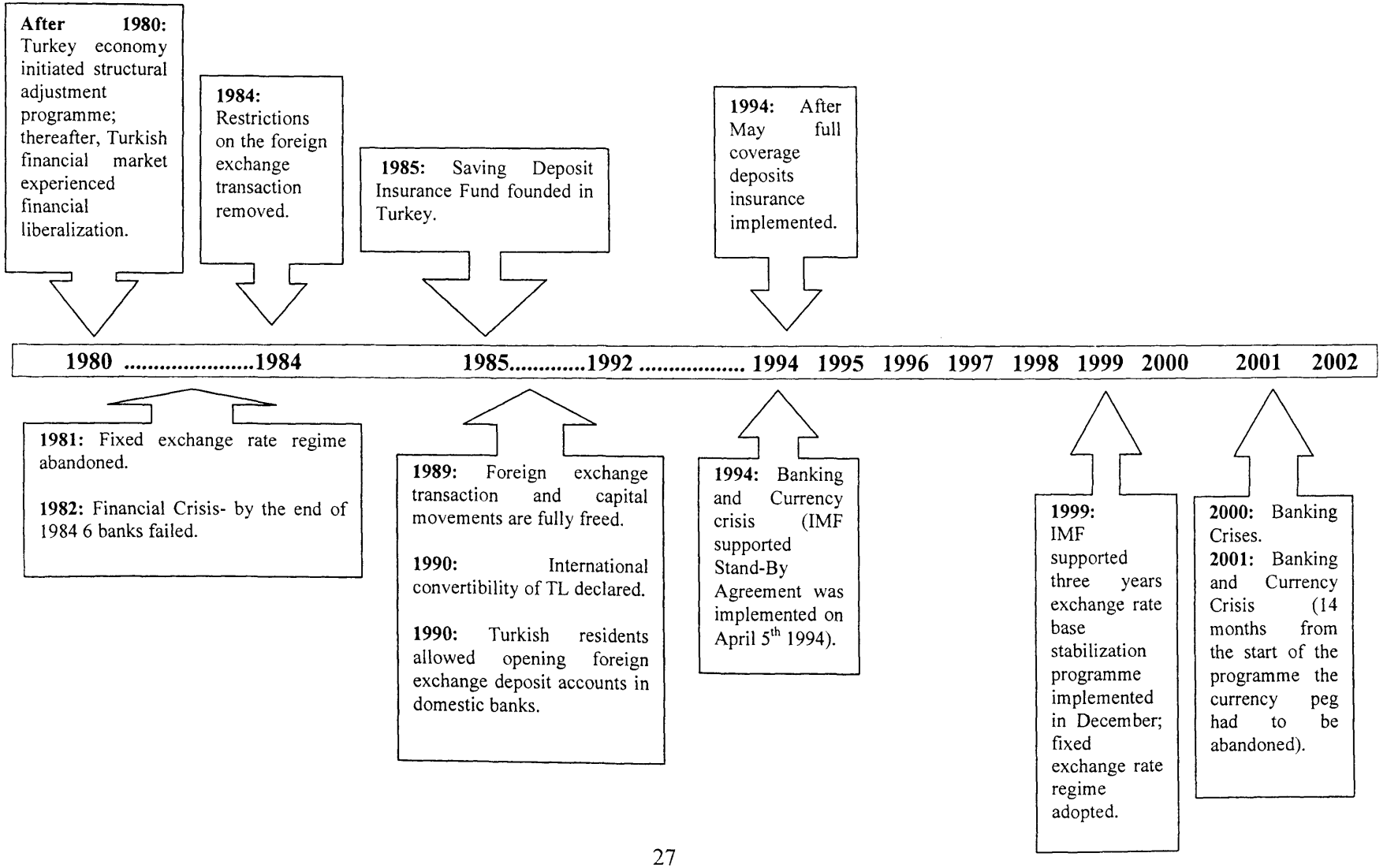
the Central Bank of Republic of Turkey responded by supplying money to some banks and taking over others.

The twin crisis (banking and currency crises) in 2000-2001 provided evidence that the macroeconomic stabilization programme also required adequate finance and reform of the fragile banking sector. A new program was implemented in May 2001, with a commitment to new funding in August 2001. The new programme attempts to address fundamental weaknesses in the economy. For this reason, key structural reforms paid important attention to public sector reforms, building health banks and liberalizing the market for the growth of the private sector. In particular, the programme aimed to tighten high fiscal costs for the banking sector, which was leading to growth of the budget deficit.

Finally, as illustrated in Table 2.1, after the implementation of the IMF programme, there had been some improvements in the Turkish economy. The inflation rate declined considerably and reached the target level. In 2002, inflation rate and the ratio of public loan to GDP decreased to the level of 45% and 12.6% respectively. Moreover, in 2001 there was an economic contraction in the economy (the GDP growth rate was around -7.5%) lower than it had been previously. However in 2002, economy sustained a GDP growth rate of 7.8%[30] (see Figure 2.3 for History of Turkish Banking after 1980).

30 See Central Bank of Republic of Turkey (2002)

Figure 2.3 History of Turkish Banking



2.3.2 Developments in the North Cyprus Economy

Following financial liberalization in Turkey, the North Cyprus economy also went through a step-by-step liberalization. After the 1980s the economy and the banking system started to be run under a liberal market structure.[31]

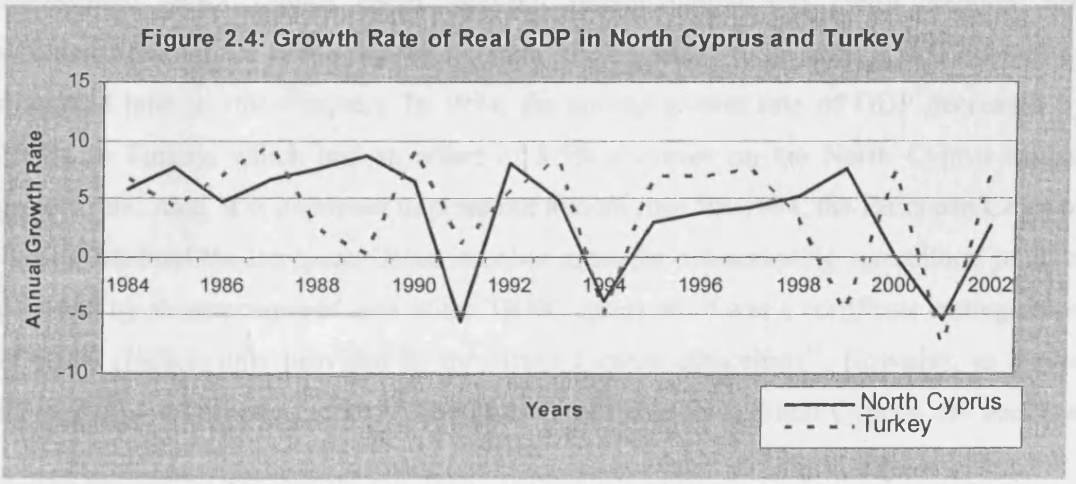
The following sections discuss the North Cyprus economy particularly focusing on the real GDP growth, inflation rates, interest rates, exchange rates, foreign trade, service sector and credit extended to the public sector. It is obvious from the graphs below that trends of the macro-economic variables for North Cyprus and Turkey are very similar, but values are not the same.

2.3.2.1 Real GDP Growth

Although the North Cyprus economy recorded high growth rates during some periods, this was not perpetual. Figure 2.4 depicts a detailed annual growth rate of real GDP in North Cyprus and Turkey.

North Cyprus experienced strong growth rates in excess of 6.8% between the years 1984 and 1990. However, in 1991, there was a contraction in the economy and the real growth rate fell by 5.5%. The main reason for this figure might be two important events that affected the whole economy: the collapse of the major foreign investor Asil Nadir at the end of 1990 and the Gulf War (Iraq invasion of Kuwait) in 1990-1991.

Figure 2.4: Growth Rate of Real GDP in North Cyprus and Turkey



Source: State Planning Organization, 2002.

31 For instance, liberalization of the foreign trade regime, removal of exchange rate control and liberalization of market interest rates to encourage private savings were some of the structural changes of the new economy.

Towards the end of 1990, a potentially serious problem for the North Cyprus economy was the collapse of the economic empire of Asil Nadir, the only major foreign investor in North Cyprus. Asil Nadir was the chairman of a large multinational company, Poly Peck International, who had taken advantage of the Government's "free economic zone policy" and invested heavily in industry, citrus production and tourism. Mr. Nadir was reported to have controlled up to one-third of the economic activities in the North, with investment in banking, clothing, tourism and fruit export and packaging, and around 8000 people were employed in Nadir's enterprises. However, late in 1990, Nadir's international empire suffered from financial difficulties, bankruptcy and liquidation, which had serious implications for the North Cyprus economy[32]. Subsequently, as a result of the adverse effects of the Gulf War on the economy during the first half of 1991, there was a contraction until 1991[33].

In 1992, North Cyprus sustained a growth rate of around 8.1%, which was proved to be quite successful in terms of restructuring economic growth. Nevertheless, in 1994 the North Cyprus economy again contracted by 3.77%. In 1994 two events might have had an impact on the output contraction in North Cyprus. The first was the currency crisis that Turkey experienced and the second was the embargo that was ruled out by the European Court of Justice concerning North Cyprus' agricultural products.

As a consequence of the 1994 currency crises in Turkey, the North Cyprus economy experienced economic contraction. In particular, failures of two privately-owned commercial banks slowed down financial intermediation and credit creation, and weakened confidence in the financial system (the banking sector distress in 1994 will be discussed later in this Chapter). In 1994, the annual growth rate of GDP decreased by 13.4% in Turkey, which had an effect of 8.5% decrease on the North Cyprus annual growth rate. Also, it is important to point out that on July 5th 1994, the European Court of Justice ruled out the European Union member states for not accepting agricultural product exported by an unrecognised area of the TRNC unless there was a certificate stating proof of origin (EUR1) only provided by the Greek Cypriot authorities[34]. However, as it was impossible for Turkish Cypriot to obtain this certificate from South Cyprus, the decision

32 See Cyprus: The State and Economic Development, (http://*www.country-data.com/cgi-bin/query/r-3545.html*).

33 Turkey was also hit by the 1991 Gulf War. As a consequence of the UN embargo on Iraq, oil exports through Ceyhan pipelines ended and resulted with the loss of pipeline fees. In addition, Turkey and North Cyprus lost from trade with Iraq.

34 See conference paper of Chaltabaeva (2003).

of the Court imposed an embargo on agricultural product, which was the major export activity of the North Cyprus economy[35].

The economic growth picked up in 1995, as is reflected in the rising real GDP that accelerated by 3.77% in 1994 to 3.02% in 1995, and to 7.5% in 1999. However, the annual growth rate dramatically dropped to the level of 0.1% in 2000 and to the level of negative 5.3% in 2001. This figure suggested that in 2001, once more the economic crisis in Turkey had a negative impact on the North Cyprus banking sector and led to contraction in the North Cyprus economy. In 2001, the growth rate decreased by 14.9% in Turkey, resulting in a 5.4% decrease in the growth rate of North Cyprus.

As a consequence of the banking and currency crisis in Turkey of 2000/2001, fragility in the North Cyprus banking sector increased and substantially damaged[36] the North Cyprus economy. During these years, the failure of 10 private commercial banks significantly impeded financial intermediation and credit creation; and undermined confidence in the financial system (the origin of the banking sector distress will be discussed later in this chapter). However, despite the sudden economic downturn of the banking distress period, in the following year the North Cyprus economy had made an amazingly quick recovery from a negative growth rate to a positive growth trend of 2.6% in 2002. The reasons for this might be the Government's timely and full reaction to the crisis and the positive response it received from the domestic sector, raising hopes of re-establishing confidence in the banking sector[37].

35 The share of agricultural products accounted for 77.5 percent of the total exports in 1977, but declined to 41.6 percent in 2002 (State Planning Organization).

36 Mishkin (1991, 1999) states that: "financial crises limit the ability of financial system to effectively channel funds to most effective investment opportunities, thereby retarding economic growth". In this regard, financial crises exacerbated decline in economic activities as a whole.

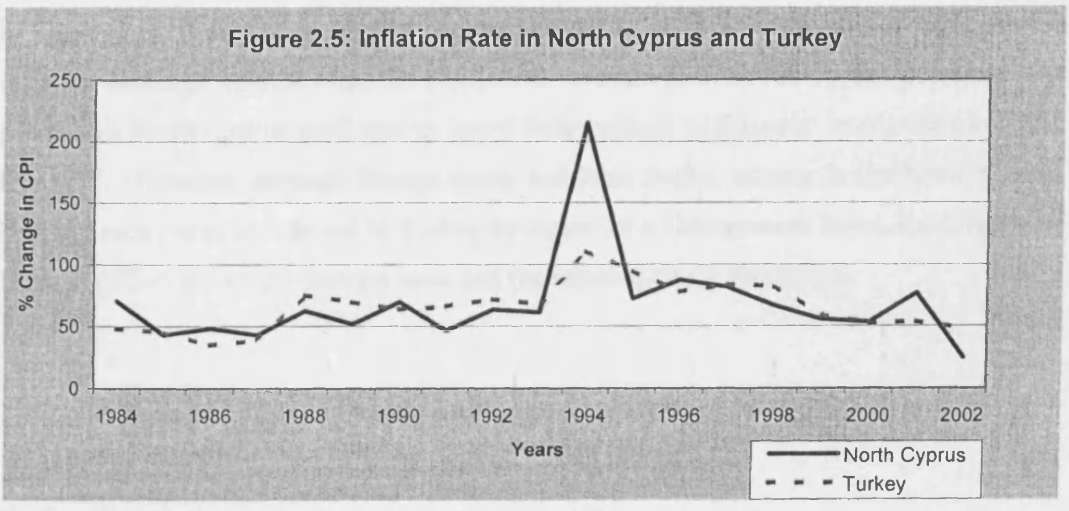
37 The three years of economic rehabilitation programmes implemented in North Cyprus will be discussed later in this chapter.

2.3.2.2 Inflation Rate

The inflation rate is measured as the Consumer Price Index. Figure 2.5 shows the annual inflation rate in North Cyprus and Turkey. Between 1984 and 2002, the average inflation rate was about 68% per year, which obviously indicates that the high rate of inflation had been prevailing in the North Cyprus. Subsequently, small increases and decreases continued between 1984 and 1993, where the average inflation rate was around 55.95%.

In early 1994, as a result of the devaluation of the Turkish Lira, the Turkey's inflation problems had an effect upon North Cyprus. During this year in Turkey the inflation rate increased from 66% to around 106%. However, in North Cyprus, the consequence of the 1994 Turkey currency crises was even worse, as the inflation rate increased abruptly and reached an unprecedented level of 215% in North Cyprus. In other words, the 40% increase in Turkey had a knock on effect on inflation rate in North Cyprus, which increased by 154%. The high inflation rate altered the preference of residents away from TL and towards foreign exchange, i.e. substitution of domestic currency with foreign currency.

Figure 2.5: Inflation Rate in North Cyprus and Turkey



Source: State Planning Organization and International Financial Statistics, 2002.

The inflation rate then fell from 72% in 1995 to 53.2% in 2000. It is important to recall that the IMF-supported pegged exchange rate based a three year anti-inflation program was implemented in Turkey in December 1999. The major goal of the economic stabilization programme was to deflate the economy; however, with the collapse of TL the currency peg had to be abandoned in mid February 2001. In Turkey the inflation rate

decreased considerably from 65% in 1999 to 45% in 2002, which suggests that the programme contributed positively to the decline in inflation[38]. As North Cyprus was hit with the similar macroeconomic shocks as a result of this effect on the Turkish economy, the failure of the stabilization programme had a dramatic effect in North Cyprus and the inflation rate increased from 53% in 2000 to about 77% in 2001. However, in 2002, as a consequence of the success of the anti-inflation stabilization programme in Turkey, the inflation rate in North Cyprus considerably declined to 25%.

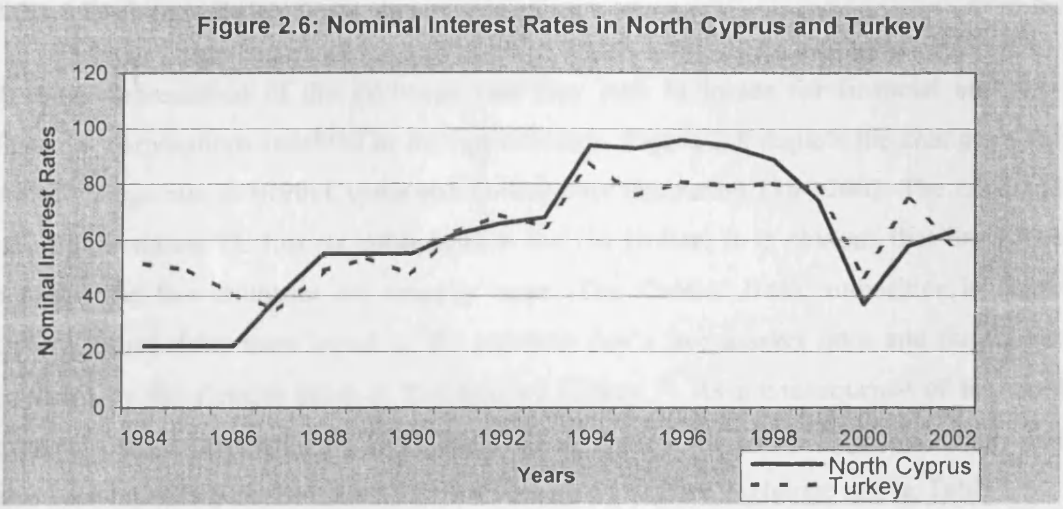
2.3.2.3 Interest Rates

High nominal interest rates are seen as a factor in explaining the banking crisis when they reflect a high and volatile inflation rate, which makes it difficult for banks to perform the maturity transformation of assets and liabilities. Figure 2.6 displays the nominal interest rates that have not accounted for inflation and Figure 2.7 demonstrates the real interest rate that is adjusted for inflation in both North Cyprus and Turkey[39]. It is possible to observe from both of the graphs that the trends of the interest rates for both countries are very similar. In particular, the nominal interest rates were at record level (around 80% and 90%) between 1994 and 1999 for both countries (see the values of nominal interest rates in Table 2.1). It is also important to emphasize that as a consequence of high chronic inflation and high interest rates the productive investment in North Cyprus decreased and peoples in North Cyprus preferred to invest their savings in financial institutions in North Cyprus[40]. Moreover, through foreign banks and local banks, money in the North Cyprus banking sector was transferred to Turkey by means of a Government Bond, Certificates of Deposit (CDs), overnight interest rates and the Istanbul Stock Exchange.

38 See The Economy and the Turkish Banking Sytem (2002).

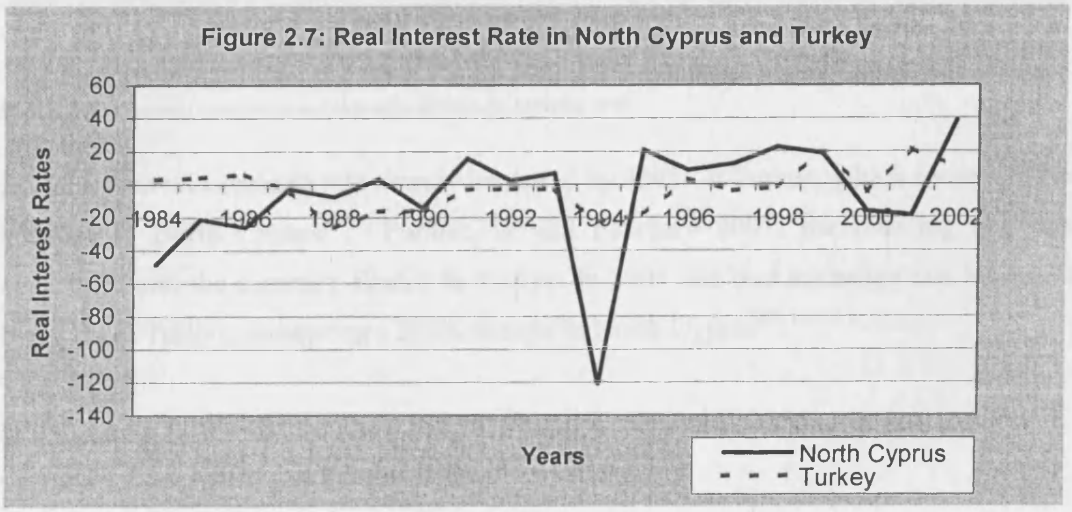
39 The real interest rate is the difference between the nominal interest rate and the inflation rate.

40 If the real interest rate is high it discourages investment and hence constrains economic growth.



Source: Central Bank of the TRNC and International Financial Statistics, 2002.

In 1984, the real interest rate was around negative 48.7% and between 1984 and 1991 it continued to be negative in North Cyprus. While the real interest rate was positive at around 16% between 1991 and 1993, it abruptly declined to around negative 121% in 1994. The main reason behind this is the dramatic increase in the inflation rate during the first financial crisis year of 1994. Subsequently, the real interest rate became negative 16.2% and negative 18.8% in the next financial crisis years of 2000 and 2001, respectively.

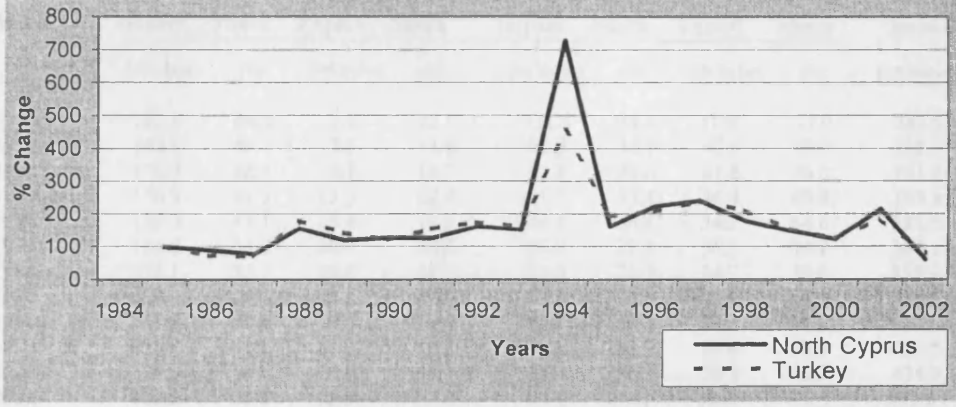


Source: Central Bank of the TRNC and International Financial Statistics, 2002.

2.3.2.4 Exchange Rates

A sharp depreciation of the exchange rate may lead to losses for financial and non-financial corporations indebted in foreign currency. Figure 2.8 depicts the change of the real exchange rate in North Cyprus and Turkey over the period 1984-2002. The exchange rate figure shows TL lost its value against the US Dollar. It is obvious that the trends between the two countries are roughly same. The Central Bank authorities in North Cyprus issued daily rates based on the previous day's free market rates and the figures provided by the Central Bank of Republic of Turkey. [41] As a consequence of the rapid exchange rate depreciation that has taken place in Turkey, the North Cyprus economy was also been hit with a similar shock (see the values of effective exchange rate in Table 2.1).

Figure 2.8: Real Exchange Rate in North Cyprus and Turkey



Source: State Planning Organization and International Financial Statistics, 2002.

In 1994, the real exchange rate sharply increased by 454% in Turkey, which cause a 727% increase in North Cyprus[42]. Further, in mid February 2001, the crawling peg was abandoned and the currency floated in Turkey. In 2001, the real exchange rate increased by 183% in Turkey, prompting a 213% change in North Cyprus[43].

41 Foreign exchange was traded freely, with no restriction on transaction. Foreign currency regulations, regulations for imports and exports are set by the Money and Foreign Exchange Legislation Act 1982. According to that law, fixing of foreign currency rates, possession and administration of foreign currency, export of foreign currency, purchase and sale of foreign currency, possession of foreign currency, credit, and security accumulation of foreign currency are under regulations to be issued by the Council of Minister.

42 During this year, the central bank heavily intervened in the foreign exchange market and as a result lost more than half of its international reserves (Ozatay (2000)).

43 From December 1999 to February 2001 a fixed exchange rate policy was implemented in North Cyprus.

2.3.2.5 Foreign Trade

The Economy of North Cyprus has limited resources; therefore, trade emerges as the major sector of economy. In particular, after 1987 as a consequence of the free–market economic system, the Government started to encourage investment in sectors such as trade, banking, transportation and tourism.

In accordance with the liberal economic policy, which was adopted by the Government, the country started to establish a trade relationship with more than 60 countries all over the world, in which Turkey and the EU Countries had been the largest trading partners.[44] The share of Turkey and EU countries can be seen in Table 2.2.

Table 2.2: Trade with Turkey and Other Countries

	Turkey				EU Countries				Total[45]	
Years	Import	Share	Export	Share	Import	Share	Export	Share	Import	Export
	(US Dollar)	(%)	(US Dollar)	(%)	(US Dollar)	(%)	(US Dollar)	(%)	(US Dollar)	(US Dollar)
1990	153.5	40.2	7.9	12.1	131.1	34.4	51.0	77.9	381.5	65.5
1991	143.0	47.5	7.3	13.9	92.9	30.9	42.0	80.0	301.1	52.5
1992	178.7	48.1	9.1	16.7	91.4	24.6	41.8	76.6	371.4	54.6
1993	150.9	41.5	12.5	22.9	121.7	33.4	36.4	66.8	363.9	54.5
1994	129.3	45.1	10.4	19.5	104.4	36.4	34.2	64.0	286.6	53.4
1995	194.8	53.2	20.2	30.0	102.0	27.9	36.5	54.2	366.1	67.3
1996	176.1	55.3	34.0	48.2	81.0	21.2	24.7	35.0	318.4	70.5
1997	202.0	56.6	27.1	47.0	87.5	24.5	23.9	41.4	356.6	57.7
1998	251.5	58.4	27.0	50.6	113.2	26.3	22.3	41.8	430.5	53.4
1999	256.4	62.1	27.9	53.2	99.8	24.2	20.4	38.9	412.7	52.4
2000	275.1	64.7	18.7	37.1	103.2	24.3	20.3	40.3	424.9	50.4
2001	173.5	63.8	12.8	37.0	63.1	23.2	12.2	35.3	272.0	34.6
2002	195.0	63.0	18.3	40.3	76.2	24.6	12.7	28.0	309.6	45.4

Source: State Planning Organization, 2002.
Note: US Dollar figures are in millions.

Agricultural products were one of the major exports for the North Cyprus economy. Until 1994, there were two major markets used by Turkish Cypriots for the exportation of agricultural products: Turkey and European Union Countries. However, as a consequence of the decision of the European Court of Justice, such exports to the European market drastically fell, damaging the economy of the TRNC (discussed earlier in this chapter). In 1994 the share of Foreign Trade with EU Countries was around 64%. However, after the decision of the European Court of Justice, this share considerably declined to 28% in

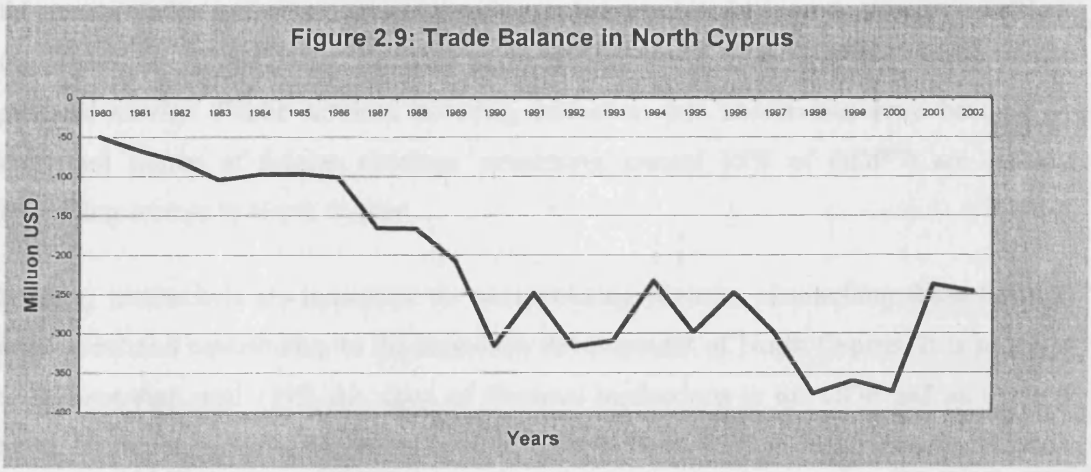
44 The goods that are exported from North Cyprus are agricultural products, industrial products, processed agricultural goods, such as citrus, potatoes, live animal, and minerals, readymade clothes, medicine, cigarettes, hides and leather, concentrated circus and alcoholic beverages. Goods that are imported from North Cyprus are food and lives animals, beverages and tobacco, mineral fuels, chemicals, manufactured goods classified mainly by materials, machinery and transport equipment etc.

45 Among these trading partners were EC Countries, Middle East Countries, United States of America, Japan and other numerous other countries in Africa and Asia.

2002. Currently, Turkey constitutes the highest market for North Cyprus export and import activities. However, it is possible to observe from Figure 2.9 that the trade gap had already widened before 1994. Ugur (2003) claimed that a poor development strategy was a major contributory factor.

Looking at the trade balance over the period of 1980-2002, Figure 2.9 shows that the amount of trade deficit in North Cyprus was remarkably high. It seems that a number of factors contributed to the poor performance of North Cyprus. Noe and Watson (2005) point out that "international non-recognition (Ayres, 2003), economic isolation, and limitation on direct trade with the EU since 1994 following a decision of the European Court of Justice on certification for product originating in North Cyprus" (Noe and Watson (2005, 3)).

Figure 2.9: Trade Balance in North Cyprus



Source: State Planning Organization, 2002.

2.3.2.6 Service Sector

As North Cyprus was a small economy with few natural resources, it has been unable to build up a manufacturing base. Instead, the development of the services sector has been strongly encouraged. Trade and tourism, transportation and communication, financial institutions, business and personal services and public services are the main sectors of economic development in North Cyprus. The service sector contributed 67.6% to GDP in 2002[46]. The share of the service sector to GDP is illustrated in Table 2.3.

46 State Planning Organization (2002).

Table 2.3: Sectoral Distribution of GDP (1977 Prices, %)

Sectors	1996	1997	1998	1999	2000	2001	2002
1. Agriculture	11.4	7.6	7.6	9.1	7.9	9.7	10.9
2. Industry	12.9	12.8	12.3	11.7	12.2	12.0	11.9
3. Construction	6.8	8.1	8.3	7.8	9.3	7.8	8.6
4. Trade and Tourism	16.3	16.5	17.3	17.3	16.4	14.6	15.7
4.1 Wholesale and Retails Trade	13.5	13.5	14.3	14.2	13.2	11.6	12.3
4.2 Hotels and Restaurants	2.8	3.0	3.0	3.1	3.2	3.0	3.4
5. Transportation and Communication	11.2	11.8	11.6	11.6	12.3	13.0	12.7
6. Financial Institution	**5.5**	**6.0**	**6.2**	**6.3**	**5.9**	**5.1**	**4.3**
7. Ownership of Dwelling	5.5	5.4	5.3	5.0	5.1	5.6	5.3
8. Business and Personal Services	6.8	8.2	8.1	8.7	7.8	9.4	8.9
9. Public Services	17.7	17.1	16.8	16.0	16.4	17.1	16.0
10. Import Duties	5.9	6.5	6.5	6.5	6.7	5.7	5.7

Source: State Planning Organization, 2002.

Trade and tourism includes wholesale and retail trade as well as hotels and restaurants[47]; the transportation and communication sector includes public highways, airways, maritime transportation services, mail services and radio and television services, business and personal service. Public services including education (six universities have become an important source of foreign earnings, generating around 15% of GDP[48]) are quickly improving sectors in North Cyprus.

Banking institutions are important for accumulating savings, channelling them through investment and contributing to the economic development of North Cyprus. It is possible to observe that until 1999, the share of financial institutions in the GDP had an upward trend. However, its share decreased from 6.3% in 1999 to 4.3% in 2002. The main reason for this decrease is the failure of 10 banks between 2000 and 2002, which impeded financial intermediation and undermined confidence in the financial system.

2.3.2.7 Credit Extended to the Public Sector

It is also important to recall that one of the most important characteristics of the North Cyprus banking sector is its strong relationship with the Government. Since the public sector borrowing requirements were compensated by domestic credits, large amount of money that were collected in the Central Bank of the TRNC, and used for financing the public sector deficits. Obviously, the public sector borrowing requirements were one of

47 "The North Cyprus received in 2003 470 thousand tourists (mainly from Turkey), or 2.3 million arrivals in the South" (Noe and Watson (2005, 3)).

48 Noe and Watson (2005).

the main obstacles to the functioning of the North Cyprus financial market, which crowds out other demands for financing and weakens relationships with the real sector.

Table 2.4: Credit Extended to the Public Sector

	1985	1990	1992	1994	1995	1998	1999	2000	2001	2002
Public Credits[a]	81.47	12.96	339.01	72.32	159.86	248.95	392.38	300.24	208.5	186.10
Total Credits[a]	113.94	156.79	473.60	234.46	422.45	605.29	844.90	594.62	397.01	376.15
Public Credit /Total (%)	71.5	8.3	71.6	30.9	37.8	41.13	46.44	50.5	52.5	49.5

Source: Central Bank of TRNC, 2002.

Note: a denote millions US Dollar.

Table 2.4 displays the public sector credit in the North Cyprus banking sector. In 1985, the amount of total credit used by the public sector was around 81.47 million US Dollar, and continued to increase until 1999. In 1999, this value increased to its highest amount of 392.37 million US Dollar. After the banking sector distress in 2000, the Government took legal precautions and decreased the public sector borrowing requirements. Prior to this, the North Cyprus Government was not able to implement the required fiscal reforms to restrain rising public sector borrowing requirements. As a consequence of the legal precautions taken in 2000 in the Economic Rehabilitation Programme, the amount of credit that was used by the public sector decreased by 300.24 million US Dollar, to an amount of 186.10 million US Dollar in 2002 (the economic rehabilitation programme (2000-2002) is discussed later in this chapter). The next section discusses developments in the North Cyprus Banking Sector.

2.4 Developments in the North Cyprus Banking Sector

2.4.1 Banking Sector Distress

The Turkish banking activities in Cyprus first started in 1901 under the name Islam Iddihar Sandigi, which was later, changed to Turkish Bank Ltd. The Turkish Bank Ltd. was the first commercial bank established by the Turkish Cypriots[49] and was subject to the control and regulations embodied by the Banking Act of 1976. In 1978, the second domestic commercial bank was established by Turkish Cypriots, and named the Cyprus Credit Bank Ltd. Turkiye Is Bankasi A.S., one of the biggest banks in Turkey, opened its

49 Currently this bank has independent branches in Turkey, namely, Turkish Bank A.S., and in U.K., namely Turkish Bank U.K. Ltd.

first branch in Cyprus in 1955. Later, another two foreign banks, namely TC Ziraat Bankasi A.S. and Turkiye Halk Bankasi A.S., started to operate in North Cyprus in 1974 and 1978 respectively[50]. Following liberalization policies adopted in 1980, the banking system started to be run under a liberal market structure. Thereafter, the role of the private banks was increased and led the expansion of investment in the economy. Subsequently commercial banks, namely Cyprus Vakiflar Bank Ltd. (1982), Cyprus Commercial Bank Ltd. (1982), Industrial Bank of Cyprus Ltd. (1982), Asbank Ltd. (1986) and Akdeniz Guarantee Bank Ltd. (1989) were established in North Cyprus. Commercial banks that were authorized by the Central Bank of the Turkish Republic of Northern Cyprus to establish a business between 1984 and 2002 are listed in Appendix A.2.1.

Table 2.5 displays the number of banks operating in North Cyprus from 1980 until 2002. Due to relaxation of entry the number of banks operating in North Cyprus increased rapidly from 7 in 1980 to 37 (consisting of 2 public banks, 29 private banks and 6 foreign banks) by the end of 1999. In 2002, there were 25 local banks and 30 off-shore banks operated in North Cyprus[51]. In general, offshore banks operating in the North Cyprus are owned and operating by their banking corporations in Turkey[52]. Before the banking crisis there were a total of 54 off-shore banks operating in North Cyprus. However, this number decreased to 32 in 2001[53] (Zorlu (2004)). Also, on March 27th 2001 the bank licence of 12 out of 32 off-shore banks was cancelled by the Ministry of Economy and Finance in North Cyprus (Central Bank of the TRNC (2002)). Moreover, the majority of the share of most of the domestic banks, such as Turkish Bank Ltd. (60% belongs to Turkish Bank A.S.), Yurtbank Ltd. (the majority of the share belongs to Yurtbank A.S.) and Sekerbank Ltd. (89.80% belongs to Sekerbank A.S.) also belongs to banks operating in Turkey. [54] In this regard, the banking sector in North Cyprus is highly dependent on Turkey, and therefore it is possible to expect a contagion effect from Turkey.

As point out earlier in this chapter, the North Cyprus economy experienced two banking sector distress periods. As a consequence of the financial distress experienced in Turkey

50 HSBC Bank A.S. started operations in North Cyprus in 2002.

51 Safakli (2003).

52 Offshore banking law states that, "foreign real persons or corporate bodies intending to established a bank shall be a resident of, carring out on business in Turkey, OECD countries, or countries having diplomatic relationship with TRNC, and holding the control of a bank directly (at least 51 percent of the shares) or indirectly" (Zorlu (2004)).

53 The reason for this decrease might be the changing offshore banking law. The minimum capital requirement for offshore banks increased to 2 million US Dollar on establishment of bank or opening of a branch.

54 In the case that the bank does not refund their money, depositors of offshore banks in North Cyprus need to take up the legal procedure applied in North Cyprus (*http://www.milliyet.com/2000/01/24/english/eco02.html*)

in 1994 and 2000, banks in North Cyprus were also affected. The first took place in 1994 and the second banking sector distress in North Cyprus took place between 2000 and 2002. Due to the liquidity crisis in 1994 two banks (Everest Bank and Mediterranean Guarantee Bank) were placed under the control of the TRNC Ministry of Finance. Later, these banks had to be bailed out by the Government. The Everest Bank was taken over by a private owner and the Mediterranean Guarantee Bank restarted its operation under the Government and Shareholders Project. According to the project 41.8 % of the bank shares were owned by the Government, and the rest of the shares were taken over by a private owner. Currently, 92% of the shares of the Mediterranean Guarantee Bank are held by the state and only 8 % of the banks shares are held by private owners (Guney (2004)).

Table 2.5: Number of Banks Operating in North Cyprus (1980-2002)

	Total Banks Beginning of the Year				Problem Banks		Total Banks End of Year
Year	**Public**	**Private**	**Foreign**	**TOTAL**	**SDIF**	**Closed**	**TOTAL**
1980	0	4	3	7	0	0	7
1982	1	7	3	11	0	0	11
1986	1	8	3	12	0	0	12
1989	1	9	3	13	0	0	13
1990	1	10	3	14	0	0	14
1992	1	13	3	17	0	0	17
1993	1	17	3	21	0	0	21
1994	1	18	3	22[1]	0	0	22
1995	2	17	3	22	0	0	22
1996	2	22	3	27	0	1[2]	26
1997	2	28	3	33	0	1[3]	32
1998	2	29	3	34	0	0	34
1999	2	30	5	37	0	0	37
2000	2	30	5	37	5[4]	0	32
2001	2	25	4	31	4	0	27
2002	2	21	4	27	1	1[5]	25
Total Number of Banks Operating in North Cyprus in 2002							***25***

Source: Central Bank of TRNC, 2002.

Notes: (1) Two banks, namely Everest Bank and Mediterranean Bank, bailed out by government in 1994.
(2) Cyprus Investment Bank Ltd. is closed because of fraud.
(3) Home and Overseas Bank Ltd. were closed because of fraud.
(4) These five banks formally closed in 2001.
(5) Hamzabank was taken over by Sekerbank.

By the end of 1999, there were a total of 37 authorised banks operating in North Cyprus. However, towards the end of 2002 ten of these banks were revoked from operation and three were taken over by other banks. In fact, the banking crisis in North Cyprus started with the failure of Yurtbank A.S. in Turkey in December 1999. The majority of the share

for both Yurtbank A.S. (bank located in Turkey) and Kibris Yurtbank Ltd. (located in North Cyprus), belong to the Balkaner group in Turkey. The failures of Yurtbank A.S in Turkey triggered panic in North Cyprus, and depositors ran to withdraw funds from Kibris Yurtbank. However, as many deposits were transferred to subsidiary bank in Turkey, due to the lack of sufficient liquidity, its activities were stopped by the Council of Ministers on the 27th December 1999 (Oney and Suphi (2001)). The bank run then spilled over to other banks. By the end of January 2000, another four banks were placed under the control of Saving Deposit Insurance Fund (SDIF) in North Cyprus[55] (discussed in the next section). In 2000, five banks were transferred to the SDIF (North Cyprus); namely, Cyprus Credit Bank, Cyprus Liberal Bank, Everest Bank, Kibris Yurtbank and Cyprus Finance Bank, were later closed in 2001.

Criminal investigations have started against the management of failed banks, where the total deposits of the five troubled banks were reported to be 112 trillion TL. The bankruptcy of these five banks initiated a serious banking crisis in North Cyprus (Central Bank of the TRNC (2002)). Another four banks, namely Cyprus Commercial Bank Ltd, Yasa Bank, Tilmo Bank and Asia Banks were transferred to the SDIF (North Cyprus) in 2001, and Cyprus Industrial Bank Ltd was put under SDIF-Cyprus in 2002. Furthermore, Finba was taken over by Artam Bank Ltd in 2000 and Med Bank and Hamza Bank were taken over by Seker Bank in 2001 and 2002 respectively. Safakli (2003) states that during the failure of 10 banks economic loss in North Cyprus was around 200 trillion TL, which was almost 50% of the total GNP. In addition, one of the foreign banks (Turkiye Emlak Bank A.S.) was taken over by TC Ziraat Bankasi A.S. in 2001 in Turkey and the banking activity of the Turkiye Emlak Bankasi A.S. was revoked in North Cyprus. Hence, in 2002 only 25 banks remained.

55 See Safakli (2003).

2.4.2 Economic Rehabilitation Programme (2000-2002)

Following the banking sector distress that the North Cyprus economy experienced between the years 2000 and 2002, a three year economic rehabilitation programme was formulated and executed by the Central Bank of the TRNC on the 4th of October 2000, in an effort to gain public confidence in the banking system. The aim of the programme was to slowly upgrade the financial system to an international standard, in which the modification of the regulatory structure advanced broadly on the schedule. The proposed new banking law in 2000 replaced the banking Act of 1976 and the Establishment law of 1987[56]. The new banking law was based on the banking Law of Turkey, and was particularly considered to be an improvement on the 11/1976 Banking Law implemented in 1976[57]. This new act sought to provide stricter prudential controls and a mechanism of tighter regulatory control of banks. In this regard, the economic rehabilitation programme led to major improvement of the banks' regulation and supervision. Some of the implementation of the economic rehabilitation programme is discussed below.

Firstly, a full coverage deposit insurance fund was implemented in 2000. From 1994 to 2000, an explicit limited coverage scheme covering the domestic bank deposit only amounted £7000[58]. However, in 2000, in order to prevent the adverse effects of a bank run from spilling over from a few banks to the whole financial system, the Government issued an urgent state guarantee covering all bank deposits in 2000. In the case of bank failure, insurance scheme are placed to ensure that any investment in the banking system is secure. The purpose of this was to increase confidence in the banking sector and to prevent the banking system from bank runs and financial panic.

In addition, in 2000 the Saving Deposit Insurance Fund founded in North Cyprus aimed to compensate the depositors of insolvent banks. The treasury was authorized to liquidate or to rehabilitate unhealthy banks. The head of the SDIF (North Cyprus) was the Governor of the Central Bank, and all administrative decisions should have been approved by the central banks. The names of banks transferred to the SDIF (North Cyprus) are listed in table 2.6. As is illustrated in the table, before 2000 the TRNC Economy and Finance

56 Changes included: tightening the prudential requirements on connected lending, a stricter definition of a "fit and proper" person for decision-makers of these institutions, new accounting guidelines concerning loans and non-performing loans and increasing the minimum capital requirements, etc.

57 See Safakli (2003).

58 In the 1994 banking sector distress, the Government had also announced an implicit deposit insurance, i.e. discretionary protection provided by the government in the case of failure.

Ministry was responsible for regulating banks in North Cyprus. However, later in 2001 this responsibility was given to the Central Bank of North Cyprus.

Table 2.6: Banks Under Saving Deposit Insurance Fund

Bank Name	Date	Decided By
1. Kibris Yurtbank Ltd.	21.03.2000	Council of Minister
2. Kibris Finance Bank Ltd.	21.03.2000	Council of Minister
3. Everest Bank Ltd.	21.03.2000	Council of Minister
4. Cyprus Liberal Bank Ltd.	21.03.2000	Council of Minister
5. Cyprus Credit Bank Ltd.	09.10.2000	Council of Minister
6. Asya Bank Ltd.	21.12.2001	Central Bank of North Cyprus
7. Yasa Bank Ltd.	21.12.2001	Central Bank of North Cyprus
8. Cyprus Commercial Bank Ltd	21.12.2001	Central Bank of North Cyprus
9. Tilmo Bank Ltd.	21.12.2001	Central Bank of North Cyprus
10. Industrial Bank of Kibris Ltd.	31.03.2002	Central Bank of North Cyprus

Source: Central Bank of TRNC, 2002.

The third amendment was on the minimum capital requirement[59]. One of the major problems with the 11/1976 Banking Law was that the Government allowed for the creation of a new bank with minimum capital requirements of 50 billion TL (120,000 US Dollar)[60]. However, just after the banking sector distress in 2000, under the Law of 14/2000 and 39/2001, this value increased to 2 million US Dollar and 4 years was given to existing banks to raise their capital and reserves to the required level[61].

Moreover, in order to reduce credit risks in the banking sector, under the Law of 14/2000 and 39/2001 some limitations was put on "credit and investments". Before 2000, maximum lending limits were determined according to bank deposits. However, after 2000, under the new rule, credit limits were not permitted to exceed 15% of its own capital and 60% of a bank's capital. Moreover, in order to assist the banking sector in their credit decisions and to encourage internal control and risk measurement within the banking sector, a 'Risk Centre' was set up under the Law of 41/2001 (Central Bank of the TRNC (2002)).

Furthermore, a new set of accounting policies was announced in 2001. External audits were required to include examinations of the loan portfolio and market risks, as well as of internal control and risk management systems.

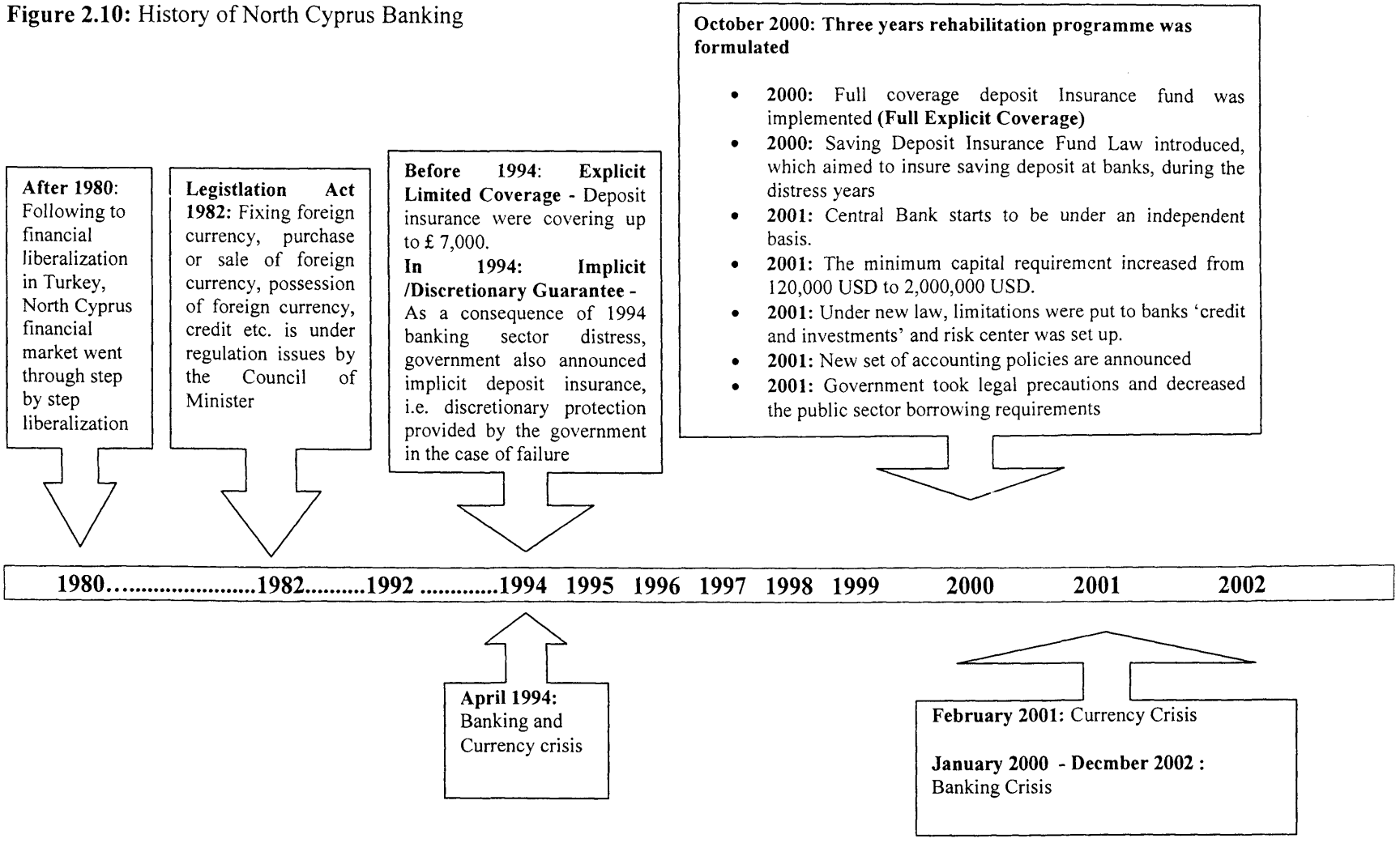
59 The main effect of the new banking law proposal was expected to be on the number of the banks. The number of banks is not expected to increase quite easily in the near future.

60 US value is calculated on the exchange rate of 30th of June 1999

61 See Safakli (2003).

Finally, after 2001 another important development brought with the rehabilitation programme was that the Central Bank of the TRNC started to be run independently. Subsequently, the Central Bank of TRNC implemented limitations on public credits. The North Cyprus economy had substantial fiscal deficits that have been financed by the Central Bank of TRNC Under the New Banking Act the Government took legal precautions and decreased the public sector borrowing requirements. Under Article 34 of the 41/2001 Law the Central Bank of the TRNC: "the balance of advance account can not exceed the 5% of the general budget of the current year". However, the ratio exceeded the legal limit about 9 times, and by 44% in 2001. According to the temporary Article 3 of the 41/2001 law of the TRNC the Central Bank stated that, "advances and credits to the treasury [were] stopped until this ration [reverted] to the legal limits" (Central Bank of the TRNC (2002)). Prior to amendment in the Banking Law the North Cyprus Government (Council of Minister) was not able to implement the required fiscal reforms to restrain rising public sector borrowing requirements (see Figure 2.10: History of North Cyprus Banking).

Figure 2.10: History of North Cyprus Banking



2.4.3 Structure of the Banking Sector

Despite the political difficulties caused by a lack of recognition, the North Cyprus banking sector has experienced a rapid change and a reasonably high-growth trend. This growth is partly due to an increase in the number of commercial banks. However, the macroeconomic environment in 2000-2002 prompted reversal in the growth of the financial sector.

In general, banks operating in North Cyprus can be classified under four groups: private banks, state banks, cooperative banks and foreign banks. The main duties of these banks are to provide traditional banking services, such as deposit-taking and lending to the private and public sector. Table 2.7 displays the amount of total assets in four categories of banks operating in North Cyprus in 2002.

Table 2.7: Group of banks operate in North Cyprus

Sector	Number of Banks	Total Assets	
		Million US Dollar	Share (%)
State-owned Commercial Banks	2	190.54	12.03
Cooperative Banks	2	420.57	26.55
Private Commercial Banks	17	415.42	26.25
Foreign Commercial Banks	4	557.32	35.17
TOTAL	***25***	***1583.85***	***100.00***

Source: Central Bank of TRNC, 2002.

In 2002, four foreign commercial banks (located in Turkey) held the largest portion of total assets with 35.17%. This value shows the importance of Turkey banks in North Cyprus banking sector, the second largest share held by two Cooperative Banks (26.55%). The third largest share of the total assets (26.25%) was held by seventeen privately-owned Commercial Banks. The two state-owned commercial banks held 12.03% of the banking sector, representing the leading role of public banks in the sector.

Table 2.8 displays the values and growth rate of total assets, total loans, total deposits and shareholders equity for the period of 1985-2002. In particular, during the period 1991-1999 these values showed a high growth trend, with an average annual increase of 29.88, 55.13, 32.09 and 6.65 percent respectively for total assets, total loans, total deposits and shareholder equity. It can be noted from the table that towards the end of 2001 there was an important contraction on these values, due to the failure of nine banks. However, in

2002 as a result of the three years economic rehabilitation programme that the economy undertook on the 4th of October 2000, there had been some positive improvements in the North Cyprus banking sector. The programme prompted rescue by the Central Bank, averting a massive loss of confidence and a bank run. More specifically, it sought to resolve banks taken over by the SDIF (North Cyprus) strengthen the structure of the Central Bank, public banks and private banks.

Table 2.8: Banks Balance Sheet Values

	Assets		Liabilities	Capital
Years	**Total Assets**	**Total Loans**	**Deposits**	**Shareholders Equity**
	Million US Dollar	Million US Dollar	Million US Dollar	Million US Dollar
1985	200.36	113.94	71.29	14.44
1990	426.03	156.79	233.72	37.15
1991	414.79	123.12	258.31	47.04
1994	696.09	234.46	423.88	50.81
1999	1571.65	844.90	889.05	59.38
2000	1421.88	594.62	865.33	77.82
2001	1203.98	397.01	823.84	59.23
2002	1583.85	376.15	1162.35	103.02
1985-1990	45.13 %	7.2 %	64.10 %	31.45 %
1991-1999	29.88 %	55.13 %	32.09 %	6.65 %
2000-2001	-11.70 %	-26.18 %	-4.67 %	-0.12 %
2002	31.55 %	-11.32 %	41.09 %	73.92 %

Source: Central Bank of TRNC, 2002.

2.4.3.1 Total Assets

The assets of commercial banks are mainly liquid assets (consisting of cash, values, dues from banks, securities, reserve requirements and other liquid assets), loans, permanent assets, and other assets. During the period 1985-2002, total assets in the North Cyprus banking sector increased from 200.36 million US Dollar to 1583.85 million US Dollar. As a consequence of the failure of nine banks between 2000 and 2001 there had been a contraction in total asset values (downed by negative 11.70%). However, in 2002, the asset growth rate increased to 31.55%.

Table 2.9 shows the ranking of the top five domestic banks and four foreign banks in North Cyprus. With average assets of nearly 171.44 million US Dollar at the end of 2002, the Turkish Bank was the largest domestic bank, holding 10.82% of the whole banking sector assets. It was followed by Cyprus Vakiflar Bank, Mediterranean Bank, Cyprus

Economy Bank and Asbank (see Appendix A.2.2 for the rankings of all banks in North Cyprus).

Table 2.9: Largest Banks[62] in Asset Size and Share

Bank Name	Total Asset (Million US Dollar)	Share (%)
Five Largest Domestic Banks		
1. Turkish Bank Ltd. (Private Bank)	171.44	10.82
2. Cyprus Vakiflar Bank Ltd. (Public Bank)	96.59	6.11
3. Mediterranean Guarantee Bank Ltd. (Public Bank)	93.95	5.93
4. Cyprus Economy Bank Ltd. (Private Bank)	47.39	2.99
5. Asbank Ltd. (Private Bank)	46.26	2.92
Four Foreign Banks		
1. TC. Ziraat Bankasi A.S.	272.91	17.23
2. Turkish Is Bank A.S.	231.93	14.64
3. HSBC Bank A.S	27.65	1.75
4. Turkish Halk Bank A.S.	24.58	1.55

Source: Central Bank of TRNC, 2002.

Particularly, it is important to emphasize that two foreign banks, namely T.C. Ziraat Bankasi A.S. and Turkish Is Bank A.S. (the two largest banks in Turkey), held the largest share of total bank assets (around 31.87%) in the North Cyprus banking sector in 2002. This figure shows the importance of the foreign banks (mainly based in Turkey) on the North Cyprus financial system.

2.4.3.2 Total Loans

Loans are the largest component of commercial banks' total asset values. Significant decreases were observed in the growth rate of loans, particularly, during the banking distress period of 2000-2002 (see Table 2.8). This decrease might have occurred for three reasons. Firstly, depending on the banking distress period, banks in North Cyprus prefer to be liquidised instead of providing credit to their customers. The second reason might be the changing regulation on credit between 2000 and 2001. That is, under new law, after 2000 shareholders' equity and deposits were determining the level of credit (as discussed earlier in this section). Another reason for the contraction might be worsened credit performance, which might be due to increasing exchange and interest rates. With regard to

62 Cyprus Turkish Cooperative Central Bank Ltd, which is composed of a number of cooperative banks, is not included in this ranking.

the non-performing loan, banks' credit performances appear to be have worsened significantly in 2001.

Table 2.10 illustrates non-performing debt that North Cyprus banking institutions (public banks, private banks and foreign banks) were burdened with during the banking distress year of 2001 and 2002. The figure demonstrates that in particular, private banks accumulated a large amount of non-performing loans in 2001 and 2002. The non-performing loan declined from 82,988,739 US Dollar in 2001 to 60,109,292 US Dollar in 2002 (see TRNC Central Bank (2002)).

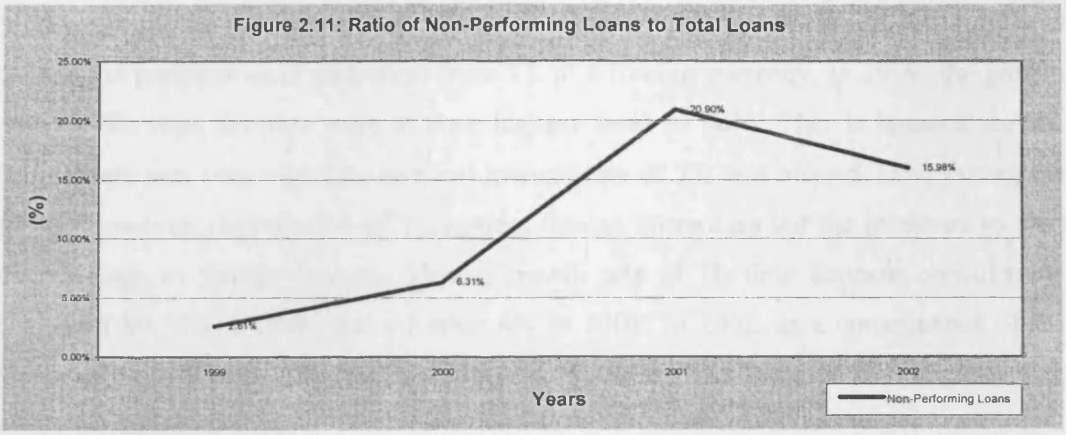
Table 2.10: Non-performing loans (US Dollar)

	2001	2002
Public Banks	11,624,821	11,605,002
Private Banks	70, 364,088	45, 726,362
Foreign Banks	999,830	2, 777,928
Total	***82,987,739***	***60,109,292***

Source: Central Bank of TRNC, 2002.

Figure 2.11 shows the ratio of non-performing loan to total loans. Non-performing loans jumped right after the banks were taken into the SDIF (North Cyprus). During the year 1999-2000, the ratio of non-performing loan to total loan increased considerably from 2.61% to 6.31%. This might be due to the fact that loans in foreign a currency transformed the foreign exchange risk into credit risk. The deterioration of the balance sheets of bank as a result of devaluation and economic downturn resulted in an increased in the non-performing loans. Moreover, before 2000 there was a connected lending problem. That is, loans were illegally transferred to the bank owners, to managers, to the banks' relatives and to related businesses without showing any collateral, exacerbating the amount of non-performing loans during 2000-2002 (Oney and Suphi (2001)). In 2001, this ratio increased to its highest level of 20.90%. The main reason for this high increase might be modification of the regulatory structure on the examination of internal control and risk management system. Due to poor regulations, before 2001 most of the banks were hidden their non-performing loans within the value of total real loans, i.e. insolvent banks were hiding their non-performing loans by making them evergreen. The reason for this behaviour was to reflect a healthy balance sheet, i.e. to indicate high profit performance. As a result of this wrong classification less provisions were taken for non-performing

loans. After 2001 the Central Bank become more efficient in controlling the bank credit activities and therefore banks became more cautious in their credit policy, as is indicated by the low ratio of non-performing loans to total loans.



Source: Central Bank of TRNC, 2002.

2.4.3.3 Total Deposits

Deposits have been the main source of funds that show the development of the commercial banks. Economic uncertainty and a high inflation environment in North Cyprus led customers to hold foreign exchange accounts or high interest rate TL accounts at the banks. It is possible to observe from Table 2.11 that during the depreciation of TL in 1994, TL deposits decreased by 32% and foreign exchange deposits increased by 34%. Similarly, in 2001, as a consequence of the depreciation of TL, the growth rate of both TL deposits and foreign exchange deposits decreased by 34% and 28% respectively. Probably, the full coverage deposit insurance fund and SDIF (that aim of compensating depositors from the risk of bank liquidation) in 2001, increased confidence in the banking sector, hence growth rate of both deposits accounts increased considerably.

Table 2.11: The Composition of Turkish Lira Deposits (%)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TL Deposits	20	-32	15	8	18	4	45	27	-34	54
Foreign Exchange Deposits	32	34	15	26	15	-1	23	15	-28	15

Source: State Planning Organization, 2002.

A high inflation environment, economic uncertainties, high interest rates and high exchange rates also encouraged people to prefer short-term time deposits (particularly, fixed term deposits for one month). Table 2.12 illustrates that in 1994 both demand deposits and time deposits decreased by 20% and 35% respectively. The reason for this decrease might be the depreciation of the TL against other currencies, which may have change the preferences of customers from TL to a foreign currency. In 1999, the growth rates of TL time deposits were at their highest level of 46%. This is because the TL interest rate was very high (the nominal interest rate of TL was around 73%) during the 1990s. However, depreciation of TL against foreign currencies led the investors to shift their savings to foreign deposits. Hence, growth rate of TL time deposits considerably decreased by 20% in 2000 and a further 4% in 2001. In 2002, as a consequence of the increase in confidence with the TL the investors preferred to invest in TL time deposits, which increased by 40%.

Table 2.12: Maturity Structure of Turkish Lira Deposits (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Demand Deposits	-3	-30	20	22	-20	-3	11	21	-35	64	8	4	23
Time Deposits[63]	43	8	6	20	-35	21	7	17	14	46	-20	4	40

Source: Central Bank of TRNC, 2002.

2.4.3.4 Shareholders Equity

An adequate level of bank capital can ensure that bank shareholders have sufficient amounts of their own funds at stake to encourage prudent management of the bank's risk. Before 2000 the capital adequacy standards were not rigorously implemented in North Cyprus. As was pointed out earlier, the minimum capital requirement before the banking crisis was very low, which made it quite easy to open a bank in North Cyprus, and therefore a huge number of banks were established in North Cyprus. Shareholder equity showed a continual increase from 14.44 million US Dollar in 1985 to 77.82 million US Dollar in 2000, which was due to an increase in the number of banks. In 2001, as a consequence of the closure of 5 banks, shareholders equity decreased to 59.38 million US Dollar. In 2002, shareholder equity increased to 103.02 million US Dollar. The reason for

63 Time Deposits compose of one month, three months, six months and one year deposits

this increase might be the impact of changing regulations concerning minimum capital requirement.

2.5 Origin of the 2000-2002 Banking Sector Distress

Several factors have contributed to the emergence of the 2000-2002 financial sector distress in North Cyprus. First of all, as a result of liberalization in the Turkish economy in the course of the 1980s the North Cyprus economy also went through a step-by-step liberalization. In this respect, financial system experienced an intense structural transformation encompassing their economic and social foundation at an unprecedented pace. Following financial liberalization, the number of private banks in North Cyprus also increased, making it nearly impossible for the Central Bank of TRNC to control financial and banking activities in North Cyprus. In addition, the exchange rates were liberalized and credit ceiling and selective credit controls were removed from the North Cyprus financial system.

In connection with poor supervision/legislation of the North Cyprus Central Bank, there were a number of weaknesses in the banking system. The Central Bank of TRNC was inefficient in controlling the financial and banking activities of each bank and this resulted in poor credit assessment, poor internal risk management and risk controls within the banks. Another reason for the unstable situation in North Cyprus is the inability of Government to implement the necessary structural reforms, and to restrain rising public sector borrowing requirements. Since the public sector borrowing requirements were compensated by domestic credits, a large amount of money was collected in the banking sector, through TRNC Central Bank, and used to finance the public sector deficits. For this reason, the financial strength of the Central Bank of the TRNC reduced and the Central Bank itself experienced liquidity problems. In this regard the North Cyprus Banking sector had a weakening relationship with the real sector. In other words, investments were not at a required level, which was forming an important barrier in front of economic development in North Cyprus. Furthermore, excessive public deficit increased the dependence of foreign loans from Turkey, which was vital for financing the deficit.

Moreover, banking crises tend to arise from deteriorating economic fundamentals. The macroeconomic factors, such as the effects of the sharp real exchange rate depreciation,

high interest rates, high inflation and trade deficit have an important role in the deterioration of bank balance sheet assets.

Additionally, bank-specific factors, such as a lack of consideration for the adequate capitalization of the banking system, poor asset quality, low profitability and liquidity risk of banks are also connected to the banking failure in North Cyprus. Between 1980 and 2000, the minimum capital requirement was 50 billion TL. Again, as the minimum capital requirement before the banking crisis was very low, this made it quite easy to open a bank in North Cyprus and as a consequence, a huge number of banks were established in North Cyprus.

The asset quality of banks is also an important factor, mainly based on the quality of a banks credit evaluation. Credit risk primarily corresponds to non-performing loans. Connected lending also seems to be one of the reasons for the failure of banks in North Cyprus. That is, loans were illegally transferred to the bank owners, managers, bank's business partners relatives and to related businesses without showing any collateral (Oney and Suphi (2001)).

The profitability of banks is another important factor that indicates the health of banks in the financial system. The level of profitability implies that lending and other decisions are made prudently by banks. However, in order to prevent closure, insolvent banks are forced to fake their balance sheet problems to depositors by rolling over non-performing loans or increasing their deposit based. The incentive of insolvent banks were to reflect a healthier balance sheets by hiding the true values of their assets and deposits, led to an inaccurately determined market value in North Cyprus. In other words, although debts were not performing, banks covered up their bad debts for many years. [64]

An evaluation of the main characteristics of the North Cyprus banking sectors indicates that the banking sector in North Cyprus was exposed to greater market competition. In order to attract new customers, the newly established bank was offering very high level of deposit interest rate, which was increasing the unjustified competition between the banks. As a consequence, small banks suffered liquidation.

64 See Yilmaz (2003) for similar problem in Turkey

Lastly, as the Turkish Cypriot Economy is heavily subsidized by Turkey, the economic crisis that caused general uncertainty over the future of the Turkey also spilled over to the North Cyprus economy. Consistent with the financial crises experienced in Turkey in the years 1994, 2000 and 2001, North Cyprus economy was also exposed to the same financial disturbances.

2.6 Conclusion

An overview of the economy and the financial system indicate that for several years before the banking sector started showing a signs of weaknesses. First of all, it is vital to stress that North Cyprus is only recognized by Turkey, dependent on Turkish aid, using a common currency with Turkey and also through trade dependency linked to Turkish economy. In this context, it is possible to expect that macroeconomic developments in the Turkish economy might put stress on the North Cyprus economy and expose the island to a series of economic crises. Particularly, the onset of Turkey currency and banking crises during 1994 and 2000/2001 appear to have had a negative impact on North Cyprus banking sector and led to contraction of the economy. Due to unstable economic situation in Turkey, North Cyprus economy has also suffered with continuing deterioration of economic fundamentals, such as sharp real exchange rate depreciation, high interest rates and high inflation, which had an important role in the weakening of bank balance sheet assets.

Moreover, in connection with poor supervision/legislation of the Central Bank, there were a number of weaknesses in the banking system. The Central Bank was ineffective in controlling the banking activities of each bank and political inferences. Mainly, ease in granting permission to establish new bank, making it nearly impossible for the Central Bank to control banking activities in North Cyprus. Accordingly, banks in North Cyprus were highly expose to banking risks such as credit risk and capital risk (regulator were allowing banks to work under low capital requirement). The most positive aspect of the banking sector distress that was experienced in 2000-2002 was that a three year economic rehabilitation programme formulated and executed by the Central Bank, which slowly upgraded the banking system to international standards, and therefore led to major improvement in bank regulation and supervision.

Chapter 3:

Financial Crises: Theoretical and Empirical Literature Review

3.1 Introduction

The previous chapter provided an evaluation of the performance of the North Cyprus economy and banking sector, particularly between 1984 and 2002. The banking sector has played an important role in the economic development of North Cyprus. The increase in the number of failures of commercial banks in North Cyprus has increased attention on efforts to identify the reasons for bank failure. This chapter offers a review of the theoretical and empirical literature on financial crises and individual bank failures, and attempts to identify the best framework and modelling strategy for the early detection of banking sector fragility in the North Cyprus economy.

The rest of the Chapter is organized as follows: Following the introduction section, Section 3.2 provides information on economic and financial crises. Section 3.3 presents a review of the theoretical literature on the micro and macro origins of financial crises and bank failures. More specifically, section 3.3.1 examines the theoretical literature of financial crises, investigated under three generation models: first-generation models, second-generation models and third-generation models. Section 3.3.2 focuses on theoretical models of bank failures, such as random withdrawal models, asymmetric information models, adverse shocks/credit channel models and moral hazard models, while Section 3.3.3 examines the modern theoretical model of banking sector fragility, which basically combines the macro origins of financial crises (mainly third-generation models) with the micro origins of bank failure models. Section 3.4 reviews the empirical literature about financial crises and individual bank failures. Sections 3.4.1 and 3.4.2 provide a detailed investigation of empirical literature on systemic crises and individual bank failure, while Section 3.4.3 addresses the most relevant issue in the existing empirical literature as the linkage between individual bank failure and systemic crises.

Section 3.4.4 draws important attention to the most common statistical methods used in the literature and the different composite of leading indicator for banking sector fragility. Finally, Section 3.5 provides some concluding remarks.

3.2 Economic and Financial Crises

Many countries have experienced serious economic or financial crises, and such events have been examined by many theoretical and empirical researchers[1].

It is possible to distinguish a number of categories of financial crises. Monetarists, such as Friedman and Schwartz (1963), have noted that the role of money growth and its variability are the principal determinants of a financial crisis. The general perception that bank runs (banking panics) lead to banking crises is the main source of contraction in the money supply, which in turn disturbs the economic activities within a country. According to this view, as can be observed in the US, contraction in money supply may in turn lead to contraction in economic activity[2]. Other studies, for instance Kindleberger's (1978), claim that financial crises involve one or more of the following fundamentals, such as a "sharp decline in asset prices, failure of both large financial and non-financial institutions, deflation or disinflation, and disruption in the foreign exchange market" (see, Isik and Hassan (2003, 294)). On the other hand, in order to understand the cause of the financial crises Mishkin (1991) accepts an asymmetric information framework (discussed later in more detail). According to Mishkin, "there are five factors in the economic environment that can lead to substantial worsening of adverse selection and moral hazard problems; increase in interest rates; stock market declines; increases in uncertainty; bank panics; unanticipated decline in the price levels" (Isik and Hassan (2003, 294)). Radelet and Sachs (1998) identify five types of financial crises: inconsistent government macroeconomic policies (foreign debt or fiscal crises), financial panics (banking panics, i.e. bank-runs), the collapse of asset price bubbles (excess borrowing) and moral hazard crises.

IMF (1998) states that all types crises have often had common origins:

> "Unsustainable economic imbalances and misalignments in asset prices or exchange rates, often in a context of financial sector distortions and structural

1 See Berg *et al.* (1999) for more detailed literature on financial crises.

2 See Isik and Hassan (2003).

> rigidities. A crisis may be triggered by a sudden loss of confidence in the currency and banking system, prompted by as a sudden correction in asset prices, or by disruption to credit or external financing flows that expose underlying economic and financial weaknesses" (IMF (1998, 75)).

Indeed, these factors together determine the economy's vulnerability to crises. Based on this idea, crises can be considered as a consequence of financial and economic disturbances, when economies suffer with a high degree of vulnerability. Lien (2001), states that there are two types of economic or financial crises: banking crises and currency crises. Similarly, Langrin's work (2001) encompasses financial crises that focus specifically on banking, currency crises or twin crises. The causality between a banking and currency crisis can run in either direction, i.e. a bank crisis can lead to currency crisis, currency crisis can lead to bank crisis. In this sense, these two crises are sometimes known as 'twin crises'[3]. For instance, for occurrence of twin crisis, see Turkey in 1994, Venezuela, Argentina and Mexico in 1994, Bulgaria in 1996, and Asian countries in 1997[4].

The most commonly cited definition of a banking crises is,

> "when an actual or potential bank runs or failures induce banks to suspend the internal convertibility of their liabilities or which compel the government to intervene to prevent this by extending assistance on a large scale" (IMF IV (1998, 74)).[5]

On the other hand, currency crises are said to occur:

> "when the speculative attack on the exchange value of a currency results in a devaluation of the currency, or forces the authorities to defend the currency by expending large volume of international reserves or by sharply rising interest rates" (IMF IV (1998, 74))

Several studies point out the causality from currency crises to banking sector distress[6]. A currency collapse usually leads to financial crisis if there is a weakness in the banking and financial system. Allen and Gale (2000), for example, point out that "after the financial liberalization that occurred during the 1980s, currency and banking crises

3 See Glick and Hutchison (2001) also investigated the joint causality of bank and currency crisis.

4 See Sexena (2004).

5 Also see Sundararajan and Balino (1991); Caprio and Klingebiel (1996b, 1999); Eichengreen and Rose (1998); Lindergren, Garcia and Saal (1996); Dizoebek and Pazarbasioglu (1997); Demirguc-Kunt and Detragiache (1998) and Kaminsky and Reinhart (1999) for similar definitions.

6 For analysis of determinants of currency and banking crises, see Gavin and Hausman (1996), Kaminsky and Reinhart (1996), Sachs, Tornal and Velasco (1996), Goldenstein and Turnel (1996), Caprio and Klingebiel (1999) etc.

became intertwined. The usual sequence of events is that initial problems in the banking sector are followed by a currency crisis and this in turn exacerbates and deepens the banking crisis. Although banking crises typically precede currency crises, the common cause of both is usually a fall in asset values due to recession and a weak economy" (Allan and Gale (2000, 178)). Kaminsky and Reinhart (1995) illustrate that banking crises tend to precede currency crises. They also show that causality can run in either direction[7]. Rojas-Suarez and Weisbron (1995) and Obstfeld (1994) argue that currency crises may lead to banking sector distress if a government responds to the pressure on the exchange rate by sharply raising interest rates. Miller (1996), emphasize that a speculative attack on a currency crisis can lead to banking crises if deposited money is used to speculate in the foreign exchange market and banks are 'loaned up'. Velasco (1987) and Calvo (1995) believe that bank runs can cause speculative attacks on a currency as a result of increased liquidity in the banking system, which may be due to government bailout.

More specifically, an adverse shock of currency crises may either have a direct effect (by depreciation of the domestic currency or deterioration of a bank's balance sheet) or indirect effect (by causing the central bank to increase interest rates to defend the currency) [8]. For this reason, as the foreign assets and liabilities are on the commercial banks' balance sheets, there is a good theoretical reason to expect a connection between a currency and a banking crisis. From this point of view, it is clearly important to know and understand the theory behind financial crises in order to understand factors determining banking sector fragility. The following section presents a survey of the theoretical literature on financial crises.

7 Kaminsky and Reinhart (1996) investigate 76 currency crises and 26 banking crises and find that banking and currency crises are closely related in the aftermath of financial liberalization, with banking crises generally preceding currency crises.

8 See also Glick and Hutchison (2001) and Goldenstein and Turnover (1996).

3.3 Review of the Theoretical Literature on Financial Crises

Theoretical models of financial crises can be examined under crisis models (currency or banking crises) and bank failure models. The macro origin of financial crises mainly relies on three generation models, first-generation models, second-generation models and third-generation models[9]. According to the first-generation models weak economic fundamentals are more vulnerable to speculative attacks. Even though the second-generation models do not reject the role of weak fundamentals, this suggests that self-fulfilling expectations appear to be the main cause of crises. These two generation models are also known as currency crisis models. On the other hand, the third-generation models combine weaknesses in the economic fundamentals of early generation models with weaknesses in the banking sectors, to the analysis of financial crises. For this reason, the third-generation models are also known as twin crises, i.e. banking and currency crisis models[10]. The micro origin of financial crises may be categorized by different groups of bank failure models, such as random withdrawal models, asymmetric information models, adverse shock/credit channel models and moral hazard models. The modern theoretical model of bank fragility combines these micro principles of individual bank failure models with macro principles of third-generation models.

3.3.1 Theoretical Model of Crises

3.3.1.1 'First-Generation' Models

The theoretical basis for the analysis of crises was originally developed in Paul Krugman's 1979 article, 'A model of balance of payments crisis". This article put forward the first formal model for balance-of-payment crises,[11] based on the work of Salant and Henderson (1978).

The Krugman model (1979) pioneered the first-generation models, which stressed that the role of weak fundamentals in the government policy was as a triggering factor of currency crises. The model focused on imbalances in macroeconomic fundamentals, in

9 These three generations models are also known as speculative crises (or currency crises) models.

10 Kaminsky and Reinhart (1999) pointed out that a new term appears associated to the concept of currency crisis through a fragile financial sector that both currency and banking crises occurs.

11 The Central Bank financed the balance-of-payments deficit by expending reserves. As a consequence, reserves fell to a critical threshold, which increased the speculative attack and eliminated the authority's remaining foreign reserves. Once reserves are depleted, the exchange peg is abandoned and the currency depreciates.

particular the role of excessive public sector deficits. Krugman's model assumes that the government budget deficit is at the root of speculative attacks on pegged exchange rates.

Under the fixed exchange regime, if the exchange rate is overvalued then in order to maintain the officially determined nominal exchange rate a government must use its reserves to purchase their own currency in the foreign exchange market. To maintain the exchange rate at a fixed level a central bank must reduce international reserves up to their complete exhaustion. At this point the previously determined exchange rate cannot be defended and devaluation takes place. However, speculators will foresee the forthcoming devaluation from the development of the related macroeconomic variables and start selling domestic currency and buying foreign exchange in order to avoid losses when this event takes place[12]. Speculators' actions will therefore cause a speculative attack on the domestic currency, which will accelerate the depletion of international reserves and lead to an earlier devaluation.

Krugman's work was later extended and simplified by several authors. For instance, Flood and Garber's (1984) model cites inconsistent government policies as the cause of speculative attacks on a fixed exchange rate. Connolly and Taylor (1984) investigate a crawling peg exchange regime and stress the behaviour of the relative prices of traded goods before the collapse of the exchange rate regime. Their analysis shows that the real exchange rate appreciates and the current account deteriorates prior to collapse. Edwards' (1989) analysis also stresses the same pattern as Connolly and Taylor (1984). According Krugman and Rotemberg (1990) the deterioration in fundamental macroeconomic variables, such as excessive expansionary monetary policies and significant currency depreciation, a large balance of payments of current account deficits, high inflation, rising domestic interest rates and rapid credit expansion that explain currency crises.

As mentioned above the first-generation models suggest that if the fundamentals of a country are deteriorating, economic crises are unavoidable. In other words, a warning signal exists. Even though these first-generation models work well in explaining many past crises, such as the Brazilian crises in 1983, 1986 and 1989-1990 and the Peruvian crises in 1976 and 1987, and the Bolivian crisis from 1982 to 1985, the models fail to

12 See Babic and Zigman (2001) for more detail.

explain more recent events[13]. For instance, the crises in Europe (1992-1993) and Mexico (1994-1995) do not appear to reflect the first-generation models.[14] This failure leads to the development of second-generation models.

3.3.1.2 'Second-Generation' Models

After the European Exchange Rate Mechanism (ERM) (1992-1993) crisis and the Mexican crises (1994-1995), the second generations of currency crises model received considerable attention. There were no critical developments in the fundamental macroeconomic variables. However, self-fulfilling expectations and market panics about the currency shifted the expectation in the market in a rational direction.

Second-generation models are exemplified by Obstfeld (1986) [15]. Even though these models do not reject the role of fundamentals, it is claimed that financial crises are not always determined by weak fundamentals. In contrast, the 'Second-generation models' provide theoretical macroeconomic models with rational expectations, in which market expectations directly influence macroeconomic policy decisions[16]. Following the suggestions of Flood and Garber (1984), Obstfeld has provided examples of multiple equilibria and self-fulfilled speculative attacks in foreign exchange, which is a new perspective on causes of currency crisis. In these circumstances two equilibria exist: attack equilibrium and no-attack equilibrium. In the first equilibrium there is no attack in the foreign exchange market, no change in fundamentals and indefinite maintenance of the peg. In the second equilibrium a speculative attack is followed by a change in fundamentals and speculators expect that a change in the exchange rate can take place. In other words, perceived weaknesses in the economy seem to be the key factors that contribute to such an attack. The main conclusion of this model is that even in the absence of weakened economic fundamentals, a crisis can occur by self-fulfilling expectations. However, the second-generation models failed to explain the crises in South East Asia (1997-1998)[17]. The characteristic of the recent crises prompted a re-

13 Saxena (2004).

14 See Obstfeld (1996), Cole and Kehoe (1996), Goldfajn and Valdes (1997), Krugman (1998), Sachs, Tornell and Velasco (1996), Masson (1999), Abdul-Majid *et al.* (2000), Kaminsky (1999), Chang and Velasco (1999, 2000) and Saxena (2004).

15 Other studies are Obstfeld (1994,1996); Calvo (1995); Cole and Kehoe (1996); Calvo and Mendoza (1997); Cole and Kehoe (1996); Dornbusch, Goldfajn and Voldés (1995); Krugman (1996) and Sachs, Tornell and Velasco (1996).

16 See Charoenseang *et al.* (2002).

17 See Mariano, Shabbir and Gultekin (2001), Puri, Kuan and Maskooki (2002), Mishkin (1999), Ratti and Seo (2003), Kaminsky, Lizondo and Reinhart (1998) and Saxena (2004).

examination of theoretical models of crises, which leads to the development of the third-generation models.

3.3.1.3 'Third-Generation' Models–Twin Crises

This new framework combines first and second-generation models with financial fragility are relies on third-generation models. It accounts for the standard determinants of both banking crises and currency crises. Although first and second-generation models are widely used in the literature, the apparent soundness of macroeconomic policies was misleading in the Asian crises. During the crisis period for Asian inflation, government deficits and unemployment levels were low, there were continued capital inflows and credits were high. Hence, the crisis in Asia revealed the need for the development of a new framework that integrates the role imbalances in the financial sector into the early generation models (see for instance, Krugman (1998), Krugman (1999), Corsetti, Pesenti and Roubini (1998), Radalet and Sachs (1998) and Kaminsky and Reinhart (1999) for third-generation models). The theoretical framework of third-generation models includes moral hazards, asymmetric information, the contagion effect and weaknesses in the financial or corporate sectors (especially, in the banking sector), in addition to weak economic fundamentals and self-fulfilling expectations, as potential fundamental causes of crises.

As a consequence of the 1997-1998 financial crises in Asia, financial researchers have started to include both foreign exchange markets and banking to enhance the understanding of financial crises. As noted above, this framework considers new issues such as moral hazards[18] or asymmetric information problems that lead to an excessive risk taking associated with investment and international contagion effects[19] appearing through trade or financial linkage between countries.

Krugman (1998) and Corestti *et al.* (1998) explain the Asian crisis by reference to a moral hazard model (excess borrowing, i.e. excessive lending caused by implicit government guarantees). Calvo (1995) highlights hedging behaviour, by explaining the costly information and diversification opportunities. Froot, Scharfstein and Stein (1992) analyze the rational hedging and multiple equilibria resulting from imperfect information.

18 Moral hazard is a source of over investment, excessive external borrowing and current account deficit.

19 See Gerlach and Smets (1995) and Masson (1998).

Another line of thought that requires considerable attention is the possibility of a contagion effect (or spill-over effect). The contagion models link currency crises in one country to crises in other countries. For instance, during the ERM crises, the French franc, the Irish pound, and the Swedish krona experienced speculative pressure when the Italian lira, the pound sterling, and the Finnish markka were floated (see Eichengreen and Wyplosz (1993) for a review of the European Monetary System crises). Moreover, the depreciation of the Mexican peso in December 1994 led to speculative pressures in Argentina and Brazil, and also in Peru and Venezuela. Lastly, the crisis in Thailand in mid-1997 quickly spread to Indonesia, Malaysia, the Philippines, Korea, Hong-Kong, Singapore, Taiwan and provinces of China within the region (see IMF (1998)).

Masson (1999) argues that at the time of the Mexican tequila crisis in 1994-1995, macroeconomic fundamentals alone did not seem to explain speculative attacks on other Latin American Countries, nor the spread of crises from Thailand to other East Asian crises in 1997. In those countries trade and competitiveness linkages were not strong enough for a crisis in one country to worsen fundamentals in other countries, suggesting that fundamentals and trade channels do not seem sufficient to understand the spread of contagion. Hence, in order to measure the contagion in these countries Masson formulated a model with multiple equilibria. That is, once a bad equilibrium occurs (i.e. devaluation or default), then pessimism in the financial market seems to be self-fulfilling for extended periods of time. Hence, it may be reasonable to expect that a good equilibrium is not immediate. The case of Mexico and Thailand suggests that an attack followed by a substantial depreciation seems to reduce the confidence to financial or non-financial institutions that have a substantial foreign currency debt. Then, contagion occurs when a country shifts to a bad equilibrium as a result of a crisis in other emerging market economies[20].

The main insight of the 'third-generation models' is that a weak financial system, asymmetric information and the moral-hazard problem in banking lead to over-investment and international contagion effects which cause banking crises. In other words, in the third-generation models, in addition to weak economic fundamentals,

20 "In the model, though not providing a theory of jumps between equilibria, has something to say about vulnerability to contagion. Multiple equilibria, and hence attack triggered by crises elsewhere that go beyond the macroeconomic fundamentals which themselves are influenced by spillovers can occur only in certain ranges of the fundamentals. Vulnerability is greater when there is a large debt, when reserves are low and when the trade balance is in deficit" (Masson (1999, 595)).

weaknesses in the financial or corporate sectors seem to be potential fundamental causes of crises.

In order to better understand the theory of individual bank failure, the next section looks at the theoretical models of bank failure.

3.3.2 Theoretical Models of Bank Failure

3.3.2.1 'Random Withdrawal' Model

The Diamond and Dybvig's (1983) model of liquidity is an ideal example of the random withdrawal models. The model of Diamond and Dybvig reveals that like currency crises, bank runs can originate from fundamental weakness of several commercial banks or from self-fulfilling expectations[21]. In this sense, the random withdrawal model of Diamond and Dybvig (1983) is very similar to the second-generation models of Obstfeld (1986). Both of the theories allow the possibility of multiple equilibria. In these circumstances two equilibria exist: a good equilibrium and a bad equilibrium. The Obstfeld model bad equilibrium occurs when there is a self-fulfilled speculative attack in foreign exchange and in Diamond and Dybvig's model it happens when there is a bank run, and visa-versa for good equilibriums.

Specifically, bank-runs exist as sunspot phenomena in the Diamond and Dybvig model[22]. In other words, the fact that people believe that a bank-run will happen and that these beliefs are self-fulfilling is an essential feature of financial markets. The model allows the possibility of multiple-equilibria in which demand deposit contracts have two equilibriums: a 'good' equilibrium and a 'bad' equilibrium. Hence, in the model of financial intermediation these equilibriums depend on institutions' confidence in the solvency of banks. In the good equilibrium there is a deposit insurance against any liquidity problem. Therefore, depositors trust and maintain their funds. However, in the absence of such safety nets of deposit insurance or a lender of last resort, banks are vulnerable to runs and panics, which may lead to a bad equilibrium, and subsequently a bank run.

21 Chang and Velasco (1998) also develop a model of currency and banking crises also depends on Diamond and Dybvig (1983) model of bank run.

22 In the model agents' expectation about bank run is self-fulfilling regardless of the true financial condition of the bank. For this reason distinguishing between a good equilibrium and bad equilibrium (bank run equilibrium) is very difficult, which makes the optimal risk sharing equilibrium very fragile and dependant on depositors' confidence.

A run equilibrium can arise as a result of bad reports, the failure of some financial institutions or any other factors that may affect the self-fulfilling expectations of the bank's failure to respond to depositors' demands for currency. Banks are usually uncertain about whether they will demand liquidity in order to pay for customers before and after the fulfillment of their long-term investment. Also, equilibrium can be influenced by adverse economic shocks that may influence financial conditions (i.e. the market value of banks' assets and liabilities). Therefore, any adverse shocks may result in the panicked withdrawal of deposits, based on the belief that other depositors will behave in the same way, making the bank illiquid. Spill-over may result in a run on even healthy banks. In this context, a bank's assets will be liquidated at a significant loss, and as a result the bank's potential liabilities will exceed the its asset value.

In the model a bank run equilibrium and optimal risk sharing (good equilibrium) depend on the depositors' commonly observed random variable in the economy. It is obvious that under exogenous-imposed uncertainty (bad earning reports, or a commonly-observed run at another bank) and the loss of confidence, and parallel to this a bad equilibrium (bank run equilibrium), is a very probable event in this model. For instance, if investors anticipate a speculative run, then banks need to liquidate their investments. Unfortunately, most of these are long-term investments; therefore, it is extremely costly for them to liquidate. As a result, banks become insolvent, which validates the initial expectation of a run. Eventually, this run will spread to the entire banking sector, and lead to a substantial loss of international reserves, and hence a currency crisis. This liquidity-driven crisis is in the banking sector and therefore reflects the interaction between expectations and outcomes, which point to the second-generation models crisis.

Nonetheless, the above model of Diamond and Dybvig has been extensively criticised as bank failures which occur as a result of a lack of confidence in the fractional reserve and banking system provide liquidity insurance have important weaknesses:

The first argument on the issue was that the collateral or capital adequacy does not have any role in the model. The collateral or capital adequacy assures that depositor's claim can be met. Indeed, if shareholders have sufficient capital, then this increases depositors' confidence and may prevent the occurrence of a bank run. Nevertheless, Diamond and Dybvig's model made no distinction between depositors and shareholders.

The second argument is that Diamond and Dybvig's model fails to distinguish between panics and information-based bank runs. This argument is related to the quality of a bank's assets. If banks are faced with a high level of non-performing loans, then they have an incentive to roll over bad loans instead of understanding these loans or providing for loan losses. This often leads to the deterioration of the loan portfolio. This is particularly bad information about banks' portfolio investments and could trigger a bank run. Jacklin and Bhattachharya (1988) state that private information about the ratio of loans to assets is the source of bank runs for depositors. Hence, under an uncertain economy, a run can be a systemic event that depends upon news about asset quality. A number of other studies have also noted that non-performing loans appear to be the main reason that banks experience distress. For instance, Chari and Jagannathan (1988), Gorton (1985), Calomiris and Khan (1991) and Calomiris and Gorton (1991) have suggested that if any kind of news leads depositors to view bank portfolios in a riskier way might trigger a bank run.

Finally, it is important to note another criticism of Diamond and Dybvig's model: it ignores the fact that runs are systematic events. Studies by Friedman and Schwartz (1963), Bernanke (1983) and Gorton (1988) note that bank failure tends to be associated with high deposit ratio, output contraction, and explosive demand for bank liabilities. More specifically, Gorton (1988) pointed out that panics are systematic and predictable, and event connected to the business cycle[23]. In fact, the financial sector responds endogenously to movements in the business cycle. For instance, bank runs result from changes to the bases of prior information, such as the liabilities of failed firms that are taken as a proxy of recession, and determine the risk of depositors. These weaknesses suggest that Diamond and Dybvig's (1983) model, suggesting that bank runs are sunspot equilibrium, do not provide a theory of bank failure.

In contrast to random withdrawal models, in which bank runs arise from the sunspot phenomena, in the symmetric information models a bank run arises as a result of the asymmetric information of informed and uninformed depositors concerning the health of a bank.

23 See also Taylor and O'Connell (1985) on the business cycle approach, who investigated the vulnerability of the financial sector over the business cycle.

3.3.2.2 'Asymmetric Information' Model

In the Asymmetric Information Model, the fact that depositors cannot distinguish between a solvent and an insolvent bank is the main source of bank failure. Chari and Jagannathan (1988) and Jacklin and Bhattacharya (1988) examine a situation where runs are attributable to information asymmetry, which exists between banks and depositors. Spiegel (2005) also demonstrates a model of intervention by international financial institutions under asymmetric information. Spiegel states that, "[International Financial Institution] is unable to distinguish between runs due to fundamentals and those which are the results of pure sunspot".

A bank is insolvent if the market value of its liabilities exceeds the market value of its assets. In order to prevent closure, insolvent banks can be forced to fake their balance sheet problems to depositors by rolling over non-performing loans or increasing their deposit base[24]. The incentives for insolvent banks to hide the true values of their assets or deposits lead to an inaccurately determined market value. If uninformed depositors observe that informed depositors at their bank withdraw their money then they may conclude that their bank may be forced to liquidate. As a result of this asymmetric information problem, informed depositors panic and demand their deposits, which increases the banks' vulnerability to runs.

Moreover, an adverse public signal, such as an economic downturn, may give wrong information to the depositors and may lead them to withdraw their deposits from banks believed by them to be insolvent. This can be considered as an asymmetric information problem. This may continue in the banking sector until the regulators distinguish between solvent and insolvent banks.

3.3.2.3 'Adverse Shock/Credit Channel' Models

Adverse economic shocks affecting banks can take a number of forms. For instance, unanticipated changes in the level of the interest rates, the inflation rate, the exchange rate, and in the level of the country's terms of trade, etc. These shocks may lead

24 See Caprio and Klingbiel (1996).

depositors to withdraw their funds from banks;[25] hence, a less capitalized banking system is created, which is more vulnerable to banking sector problems.

High inflation may increase economic uncertainty, which in turn results in a higher level of failure in the economy. A decline in asset prices may lead to a deterioration of bank balance sheets. If banks do not price this volatility correctly, this will affect their financial health and culminate in bank runs (see Evans *et al.* (2000)). Moreover, increased inflation will result in a decreased real interest rate[26], and saving will tend to fall and borrowing will tend to increase. If potential borrowing is accompanied by a reduction in the quality of the creditor, this may increase the probability of loss within a bank[27].

Moreover, shocks such as cyclical output downturns, terms of trade deterioration and declines in asset prices such as equity and real estate are also associated with banking sector problems (see for instance, Gorton (1988), Caprio and Klingebiel (1996), Lindgren, Garcia and Saal (1996)).

Another important shock is the interest rate risk[28], and exchange rate risks are likely to be the major sources of systemic banking sector problems. In general, all banks within a country are likely to experience interest rate risk and exchange rate risks because of the typical function (maturity transformation) of the banking system. A high interest rate on lending and high exchange rate depreciation[29] may result in a high amount of non-performing loans, which may affect bank profitability negatively and ultimately deteriorate bank balance sheets. Moreover, banks may be exposed to foreign exchange risk when they borrow foreign currency and lend domestic currency. In this case unexpected depreciation of the domestic currency may jeopardize bank profitability[30].

Goldfajn and Valdes (1995) focus on the role of illiquidity in the financial system. In the model, financial intermediaries supply liquid assets to foreigners that are unable to commit long-term investments. However, when, for exogenous reasons, foreign investors

25 See for instance, Bernanke *et al.* (1992), and Gertler (1992).

26 The reason is that inflation has a depressing effect on real interest rate (real interest rate is equal to nominal interest rate minus inflation).

27 See Bell and Pain (2000).

28 Increase in interest rates may be due to factors such as increase in the rate of inflation, the need to defend the exchange rate against a speculative attack, an increase in international interest rate or removal of interest rate controls as a result of financial liberalization (see Galbis (1993), Velasco (1987)).

29 Foreign currency loans were the source of banking problems in Chile in 1981 (Akerlof and Romer (1993)), in Mexico in 1995 and in Nordic countries during the 1990s (Mishkin (1996)).

30 See Demirguc-Kunt and Detragiache (1998a).

decide to withdraw their deposits, financial intermediaries who are unable to liquidate their asset face the risk of failure (see Eichengreen *et al.* (1998)). This suggests that a bank can produce a self-fulfilling banking crisis, and in turn run on currency can increase self-fulfilling exchange rate crises.

Meanwhile, studies by Gorton (1988) and Calomiris and Gorton (1991) attempt to test these two competing theories of bank runs or bank panics. They try to determine whether the patterns of bank run were more consistent with the sunspot phenomena (random withdrawal model) or the information based theories (asymmetric information model). Their results suggest that random shocks have no effect on bank runs, but bad economic news and bank vulnerability to that news causes bank runs.

3.3.2.4 'Moral Hazard' Models

To avoid the possibility of an adverse effect of bank runs and systemic crises, governments sometimes provide 'safety nets' (such as explicit or implicit deposit insurance) for a bank's protection. A moral hazard occurs when these protections negatively change the behaviour of depositors, bank owners, managers and supervisors, so that banks face less pressure to avoid excessive risk taking.

There are different arguments regarding the effect of explicit and implicit deposit insurance scheme. Diamond and Dybvig (1983) suggest that the implementation of explicit or implicit deposit insurance schemes can help to prevent a self-fulfilling bank run, which helps to reduce the probability of banking crises. However, according to many studies, although the existence of explicit or implicit banking system 'safety nets' prevent banking crises from turning into banking panics, these safety nets can also contribute to more severe banking crises[31]. The presence of 'safety nets' can give rise to serious moral hazards and adverse selection problems. For instance, Yilmaz (2003) states that "the presence of 'safety net' can encourage banks to take excessive risks and permit bank shareholders to shift some of the risk in their balance sheets to the provider of deposit insurance to the extend that bank fail to compensate its costs of resolving banking crises" (Yilmaz (2003, 45)). Also, Karenken and Wallace (1978) point out that the presence of an explicit or implicit deposit insurance scheme increases incentives for managers to take risky portfolios, which leads to a moral hazard problem.

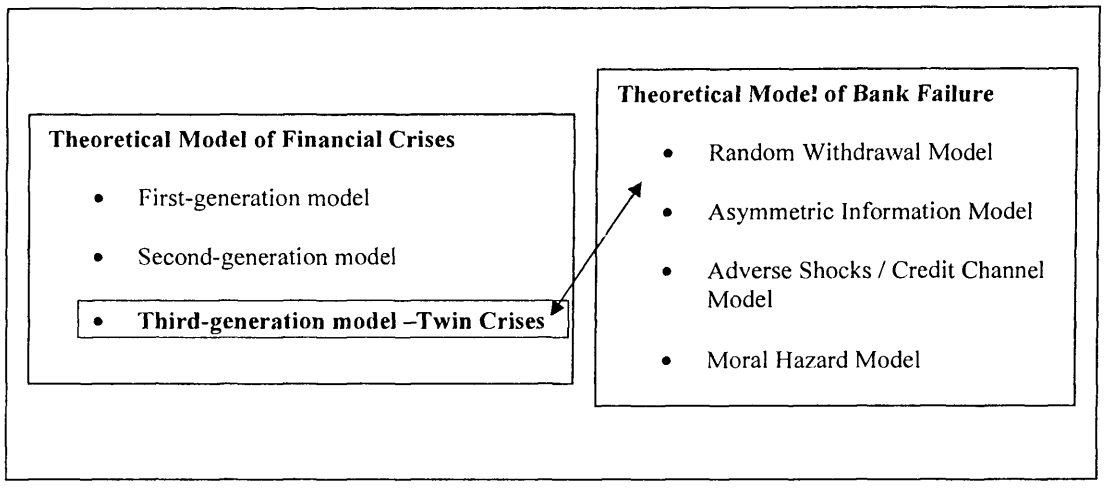
31 See Sleet and Smith (2000)

According to Masson (1999), "The micro theories need to be placed in a macroeconomic context, otherwise it's difficult to understand the severity of crises affecting the real economies in Latin America and in East Asia in recent years" (Masson (1999, 595)). In this sense, in order to better understand the severity of banking sector distress, the next section looks at approaches that combine both micro and macro models.

3.3.3 Combining Systemic Banking Crises ('Third-Generation' Models) and Bank Failure Models

The modern theoretical model of bank fragility combines individual bank failure with systemic banking crises. As is discussed earlier, the fundamental base explanation of financial crises utilises first and second-generation models of currency crises, to identify a set of fundamentals. However, the financial fragility-based explanation relies on the third-generation models to identify useful indicators for systemic banking crises. Hence, the aggregate that examines determinants of systemic banking crises (and even currency crises) relies on the third-generation models. The theoretical models, such as random withdrawal model, asymmetric information model, adverse shocks/credit channel model and moral hazard models, on the other hand, examine determinants of individual bank failure. The linkage between bank failure model and banking crises (i.e. third-generation models) are illustrated in Figure 3.1.

Figure 3.1: Theoretical Models of Bank Failure and Systemic Banking Crises



Even though it is highly convincing that banking sector distress is brought about by changes in micro factors and the macro environment, there are only a few studies that analyse the contribution of both microeconomic and macroeconomic factors. Gonzalez-Hermosillo (1996) provides the first attempt to offer a theoretical literature to link individual bank failure and systemic banking crises, for the purpose of identifying banking sector fragility.

The model of Gonzalez-Hermosillo addresses a number of factors that determine the degree of fragility of individual banks. The simple model assumes that when externalities are not concerned the probability that individual banks will fail depends on micro factors, such as deposit flows during a given period, net asset income and the level of capital required to minimize the cost of insolvency. Subsequently, the basic framework of Gonzalez-Hermosillo (1996), suggests that when externalities are concerned, then above three variables are generalized to explore the fundamental sources of risks: liquidity risk, credit risk and market risk. In the model, the liquidity risk of banks can increase if depositors demand their deposits and if banks do not have enough liquid assets, and this demand may lead to bank failure. Credit risk occurs if borrowers are not willing to pay their loans or if banks take extreme credit risks. In particular, credit risk reflects poor credit control by bank managers. The market risk encompasses economic and financial weaknesses, such as increases in interest rates, increases in inflation rates, stock market prices, changes in the money supply, and a sharp contraction in the level of liquidity of the financial system, which may affect the entire banking sector. The model of Gonzalez-Hermosillo also addresses the role of an implicit/explicit deposit insurance fund as a factor that affects the behaviour of depositors. In addition, the model is extended by considering the role of asymmetric information. That is, as depositors have less information about the health of different banks, this increases panic about deposit runs. Lastly, Gonzalez-Hermosillo argue that currency crises could lead to banking crises.

Based on these theoretical models, the following section reviews the empirical literature and identifies determinants of bank fragility and an appropriate modelling framework.

3.4 Review of the Empirical Literature

Empirical literature on banking sector distress can manifest itself in two ways: systemic crisis and individual bank failure. The first strand of the empirical literature, which is also known as the 'macro approach', uses macroeconomic variables in an attempt to predict systemic crises (currency crises and banking crises) are relies on three generation models of financial crises. The second stand of literature is also known as the 'micro approach', and attempts to predict individual bank failure, and uses of bank-specific indicators (usually financial ratios that are in the context of CAMEL rating). The recent empirical studies attempt to empirically investigate the connection between systemic banking crises and individual bank failure. Empirical studies on bank failure and systemic crises are summarized in Appendix B.3.1.

3.4.1 Systemic Crises

3.4.1.2 Currency Crises and Contagion

The empirical studies on currency crises are a particularly useful variety of different macroeconomic variables to account for the standard determinants of currency crises, mainly dictated by three generation models.[32] The empirical investigation of Frankel and Rose (1996), Sachs, Tornell and Velasco (1996), Kaminsky, Lizando and Reinhart (1998) and Eichengreen and Rose (1998), for instance, systematically predict the likelihood of currency crises. These studies use fundamental-based explanations to identify of a set of potential fundamentals. Most commonly-used currency indicators are international reserves, imports, exports, terms of trade, real exchange rate, differentials between foreign and domestic real interest rates on deposits, the money multiplier of M2, the ratio of domestic credit to GDP, the real interest rates on deposits; the ratio of lending to deposit rates, the stock of commercial bank deposits, the ratio of broad money to gross international reserves and the index of output and index of equity prices.

Frankel and Rose (1996) analyse the currency crashes on a panel of annual data for 105 developing countries from the period of 1971 to 1992, and utilizes two different methodologies, namely the event study approach and the probit model. In the model a crisis indicator is defined as one if there is a currency crisis, and zero otherwise. They

32 See Glick and Rose (1999).

define the currency crash as a normal depreciation of at least 25% in the bilateral exchange rate that also exceeds the previous year's depreciation level and is at least at least 10% higher than the previous year. The results of the first model suggest that several economic variables behave differently in crisis and non-crisis periods. However, only current account deficits and fiscal deficits behave differently between these periods. The results of the second model show that low levels of foreign direct investment, low international reserves, high domestic credit growth, high foreign interest rates and the overvaluation of real exchange rates are significant and increase the probability of currency crashes, which provide an early warning of a currency crisis. Similar to the result of the first model, the second model also finds that current account and fiscal deficits are insignificant in the probability of a currency crash.

Sachs, Tornell and Velasco (1996) used a probit model to analyse currency crises, particularly focusing on the 1995 Mexican 'techquila' crisis. Using a sample of 20 emerging countries they try to find the country that is most vulnerable to currency crises. Their results show that countries with weak fundamentals, such as low international reserve relative to broad money, fragile banking systems (lending boom) and an overvalued real exchange rate are more vulnerable to currency crises. Moreover, government consumption and current account deficits appear to increase currency crises in a country with weak fundamentals and weak reserves. Also after Mexican crises the contagion effect appeared to be worst in emerging countries characterized by weak underlying fundamentals.

Kaminsky, Lizando and Reinhart (1998) use the signal approach and to measure exposure to currency by means of indicators system (proposed a list of 103 macroeconomic variables). The currency crisis signals that seem most efficient are exports, the deviation of real exchange rate from trend, the ratio of M2 to international reserves, output and international reserves.

Eichengreen and Rose (1998) investigate 39 crisis cases in developing countries for the period 1975-1992. They utilize statistical tests for differences in behaviour of the relevant macroeconomic and structural variables between crisis and non-crisis cases. The results reveal that higher world interest rates and slower world growth strongly increases the probability of a crisis in emerging markets. Furthermore, they find little evidence of a connection between the crisis and exchange rate regime. However, in Eichengreen's

subsequent paper, Eichengreen (2000), re-evaluates the Eichengreen and Rose (1998) model by adding five additional years of data. Eichengreen's result show that the role of external factors appears to be weaker[33].

Currency crisis tends to pass 'contagiously' from one country to another. Empirical evidence on the ERM crisis in 1992-1993, Mexican crisis in 1994-1995 and Asian crisis in 1997 suggest that contagion effects play an important role[34]. The focus on contagion in the context of currency crises extends earlier works on indicators of currency crisis by looking at factors that expose a country to contagion effects and increase the risk that a crisis in one country may spill over to others. Usually, a currency crisis can be simply identified as substantial exchange rate depreciation. However, central banks or government can use a contractionary monetary policy and sell their foreign exchange reserves to defend a currency. [35] Alternatively, authorities may adopt a new policy and raise interest rates. Thus, there is a need for another criterion for identifying a currency crisis that captures different indications of speculative attacks. For this reason, in order to identify currency crises, studies must construct a market pressure index (index of speculative pressure), which takes into account not only exchange rate changes, but also movements in international reserves or interest rates that absorb pressure and thus moderate the exchange rate pressure. [36]

There are different types of explanation for contagion in currency crises. Earlier Studies on contagion effects focus on financial linkages as an important channel transmission of exchange market pressure from one country to another. These studies focus on macroeconomic or financial influences. For instance, Eichengreen, Rose and Wyplosz (1995) proposed the first systematic evidence of the existence of contagious currency crises. It follows that in 1996 Eichengreen, Rose and Wyplosz (1996) estimated a binary probit model and investigated the contagious nature of currency crises for a panel of quarterly data for 20 industrial countries for the period of 1959-1993. The variables that they employed were inflation, growth rate of GDP, ratio of government deficit to GDP,

33 See Eichengreen and Arteta (2000).

34 For instance, Calvo (1996) has argued that it is difficult to find fundamentals to account for the 'tequila effect' in Mexico; rather the tequila effects seem to reflect investor pessimism. Investors believe that other emerging market economies might experience similar difficulties and provoke a downturn in capital flows, and run on other currencies even though fundamentals were unchanged. On the other hand, Sachs, Tornel and Velasco (1996a) argue that shifts in expectations generated by the Mexican crises affected only countries with weak fundamentals. These countries are vulnerable to self-fulfilling investors' pessimism, or contagion, where countries with strong fundamentals experienced only very short lived downturns in capital inflows (see IMF (1998)).

35 See Eichengreen, Rose and Wyplosz (1996).

36 See Chapter Four for more information on the methodology of Eichengreen, Rose and Wyplosz (1995), who seek to analyse currency crises systematically by constructing an exchange rate pressure for a measure of speculative attacks.

ratio of current account to GNP and growth in real domestic credit. After controlling economic and political fundamentals within a country, they suggest that crises elsewhere in the world statistically increase the probability of speculative attacks. The results reveal that the contagion effect is statistically significant, i.e. the incidences of speculative attacks increase the probability of a domestic currency crisis. The approach would better distinguish contagion if it also measured currency crises by trade between neighbouring countries.

Cerra *et al.* (2000) investigate the contagion effect of the recent currency crisis from the neighbouring countries of in Indonesia by using probit models. In the study the causes of the exchange rate crisis are investigated under three categories: the domestic variables (private claim to GDP, domestic claim to GDP, foreign liabilities to GDP, foreign assets to M1, interest rate spread, trade balance, terms of trade and confidence in political system and policies), external shocks common to Asian countries and contagion effects from Thailand and Korea. The results suggest that domestic financial conditions and contagion effects from neighbouring countries contributed to the crisis in Indonesia.

Another line of investigation on contagion takes into consideration the common bank lender effect (liquidity effects)[37]. Caramazza, Ricci and Salgado (2004), for instance, investigated financial linkage through common bank lenders for 41 emerging market economies. Using a panel multivariate probit regression they find that financial linkages played an important role in the spread of the Mexican, Asian and Russian crises[38]. Their study defines a common bank lender for each crisis as the country that lent the most to a ground zero country in each of the major crises[39]. The result show that once domestic fundamentals (slow GDP growth, interest rates, current account balance, fiscal balances, M2 growth), external fundamentals (real exchange rate appreciation and external current account deficit) and trade linkage (the combination of the appreciation of real exchange rate and decline of export market growth induced by crises in other countries) are controlled, financial linkage play an important role in explaining the spread of crises in Mexico, Asia and Russia. Moreover, countries experiencing crises (Mexico, Asian counties and Russia) rely on the common bank lender, unlike non-crises countries.

37 Kaminsky and Reinhart (2000) also argue that studies on contagion largely ignore the linkage to the financial sector. To examine the issue of contagion they analyse how fundamental-based contagion arises due to both trade and financial sector links (i.e. a bank lending channel and liquidity channel). Their findings show that financial sector links through common bank lenders are an important channel of fundamental-based contagion.

38 To test the financial linkage they used exchange market pressure, like Eichengreen *et al.* (1996).

39 In the study, the common lenders to Mexico, Asia and Russia are the United States, Japan and Germany, respectively.

Similarly, Rijckeghem and Weder (2001) use a probit model and empirically investigate the spill over for Mexican, Thai and Russian crises through bank lending, as opposed to trade linkages and country characteristics, which increase contagion effect. These variables are drawn from a set of variables used to explain the incidence of currency crises, the ratio of broad money to foreign exchange reserves, the percentage of change in credit to the private sector, the percentage change in the real effective exchange rate, the current account balance as a percentage of GDP and the ratio of short-term debt to reserves. Their results reveal that after controlling all of the macroeconomic fundamentals and trade linkages, common lender effects (bank lending channel) in these countries raises the contagion effect. [40]

Abdul-Majid *et al.* (2000) investigates the determinants of the currency crises and the contagion effect in four countries, namely Malaysia, Thailand, Indonesia and Philippines, by using a probit model. The study tries to link the fundamental macroeconomic variables, namely the ratio of M2 to reserves, domestic inflation, trade balance, real exchange rate, domestic credit and banks' claims to the private sector, and currency crises. Abdul-Majid *et al.* assumed that the contagion variable for a country takes the value of unity when there is a crisis and visa-versa when the contagion variable takes the value of zero. In the study lagged economic fundamentals are used, which suggest that economic fundamentals deteriorated some time before the currency crisis occurred. The study provides a simple test of the ability of the explanatory variables in order to predict future crises. The results show that currency crises could be contagious. In particular, in these four Asian countries reserve inadequacy, deteriorating trade balance, increase of bank claims on private sector and real exchange rates increase the probability of speculative attack on a currency crisis.

40 To examine bank channels they focus on size, and the volatility of bank credits as well as amounts of losses by banks.

3.4.1.2 Banking Crisis

The systemic banking crises are very similar to the third-generation models, which combine weaknesses in the economic fundamentals of early generation models with weaknesses in the banking sectors. Demirguc-Kunt and Detragiache (1997) provide the first article that defines systemic banking crises. Demirguc-Kunt and Detragiache identify a banking sector crisis as a situation in which one of the following four conditions holds: [41]

- Ratio of non-performing assets to total assets is greater that 2% of GDP
- Cost of the rescue operation was at least 2% of GDP
- Banking sector problems resulted in a large scale nationalization of banks
- Extensive bank runs took place or emergency measure such as deposit freezes, prolonged bank holidays, or deposit guarantees were enacted by governments in response to the crises

Alternatively, Caprio and Klingebiel (1999), in order to define banking crises, use loan losses and the erosion of bank capital.

The widespread banking failures in crises have increased the attention in the determinants of systemic banking crises. Several recent research papers, such as Demirguc-Kunt and Detragiache (1998a, 1998b, 2000), Hutchison and McDill (1999), Hutchison (2002); Eichengreen and Arteta (2000), Eichengreen and Rose (1998), Hardy and Pazarbasioglu (1998), Domac and Martinez-Peria (2003), Kaminsky (1999), Kaminsky and Reinhart (1999), Edison (2000) and Munoz (2000) identify the key macroeconomic and institutional factors preceding the episode of banking sector distress in a systematic way.

Demirguc-Kunt and Detragiache (1998a) investigate the determinants of banking crises by using a sample of developed and developing countries. In order to estimate the probability of a crisis, they utilize a multivariate logit model for the period of 1980-1994 and use a set of macroeconomic variables (such as GDP growth rate, change in terms of trade, rate of change of the exchange rate, real interest rate, inflation rate and ratio of central government budget surplus to GDP), financial variables (such as ratio of M2 to

41 Systemic banking crises can be defined in different ways. Demirguc-Kunt and Detragiache (1998a), for instance, define them as events that effect the functioning of the whole banking, financial and economic system. Gonzalez-Hermosillo *et al.* (1996), however, define them as situations in which externalities result in costs to unrelated parties. Therefore, it embodies a contagion effect

foreign exchange reserves, ratio of domestic credit to private sector to GDP, ratio of bank liquid reserve to bank asset and growth rate of real domestic credit) and structural characteristics (such as dummy for the presence of the explicit deposit insurance scheme and index of the quality of law enforcement). They argue that crises do not appear from self-fulfilling expectations as suggested by Diamond and Dybvig (1983). In general, results reckoned that systemic banking crises tend to emerge when the macroeconomic environment is weak[42]. According to Demirguc-Kunt and Detragiache, weak macroeconomic variables, in particular low GDP growth, high real interest rates and high inflation, significantly increase the probability of systemic banking problems. Also, there seems to be little evidence that adverse terms of trade shocks, rapid credit growth, large banking sector credit to private sector and liquidity increase the probability of banking crises. In particular, credit growth is significant if lagged by two periods. However, the size of fiscal deficit and the rate of depreciation of the exchange rate seem to have no effect. Another finding is that the presence of explicit deposit insurance and weak 'law and order' seems significantly associated with the probability of crisis, suggesting that moral hazard has a major role. Finally, as predicted by the theory, external vulnerability (which is measured by the ratio of broad money to foreign exchange reserves) significantly increases the probability of failure. In other words, they find evidence that vulnerability to balance of payment crises has also played a role.

Demirguc-Kunt and Detragiache (1998b) extended their earlier (1998a) analysis with an attempt to fill the gaps in their previous work by adding the role of financial liberalization in addition to the variables mentioned above. They construct a financial liberalization dummy variable for a large number of developed and developing countries between 1980 and 1995. The results reveal that financial liberalization increases the likelihood of a banking crisis. Moreover, their results reveal that as in earlier studies the banking crises tend to be associated with low GDP growth, adverse terms of trade change, high real interest rates, high inflation, past credit growth and the ratio vulnerability of a speculative attack against a currency crisis. However, other variables appear to be insignificant.

In the subsequent paper, Demirguc-Kunt and Detragiache (2000) continue to use a multivariate logit model and to develop a model of the determinants of the systemic banking crises for large panel of countries. In particular, in 2000, they developed an early

42 The countries that did not experience systematic banking crises serve as controls

warning system that issues signals concerning the probability of a banking crisis that can be used for monitoring banking sector fragility. The variables that they used were growth rate of GDP, changes in terms of trade, exchange rate depreciation, real interest rates, inflation, ratio of fiscal surplus to GDP, ratio of M2 to foreign exchange reserves, ratio of bank liquid reserves to bank assets, GDP per capita and growth rate of credit that lagged for two periods. Results reveal that in 1993, high past credit growth, high real interest rates and high inflation were the factors causing high probability of a banking crisis in Mexico. Moreover, negative growth shocks and an increase in the ratio of M2 to foreign exchange reserves (which shows the vulnerability of capital out flow) significantly raised the probability of a crisis. However, ratio of fiscal surplus to GDP and terms of trade change appears to be insignificant.

Hutchison and McDill (1999) employed a Multivariate Probit Model[43] to analyse banking sector distress in Japan during the period 1975 to 1997. The date of the episode of banking sector distress is identified by Demirguc-Kunt and Detragiache (1998a). In the model macroeconomic variables (such as real GDP growth, real credit growth, nominal and real interest rate, inflation, changes in the index of stock price budget position of general government, ratio of broad money to foreign exchange reserves and exchange rate depreciation) and institutional characteristics (such as explicit deposit insurance, financial liberalization, moral hazard and degree of Central Bank independence) are employed. The results reveal that during the period preceding the banking crisis, only two macroeconomic variables, namely real growth rate of GDP and changes in stock prices, were indicating the emergence of a banking crisis. Moreover, all of the institutional variables appear to be important indicators that increase the probability of banking distress, while real credit growth is only significant for one specification. More interesting, however, was the fact that at the onset of the banking crisis, Japan was in a strong position. In particular, macroeconomic developments were similar with countries that did not experience any financial problems.

Another empirical study by Hutchison (2002) emphasizes banking sector distress in eighteen Western European countries for the period 1975-1997. Hutchison estimates a multivariate probit model that links the probability of banking sector distress to a set of

43 Following Eichengreeen and Rose (1998), probit equation employed with one year lagged explanatory variables.

macroeconomic variables (such as inflation, GDP growth and exchange rate pressure[44]) and institutional characteristics (such as liberalization of deposit interest rate, weaknesses in law and regulations, etc). Hutchison also found that during periods of financial liberalization (domestic interest rate deregulation), weaknesses in law and regulations, declines in output growth, severe exchange rate instability and high inflation increase, there was a higher likelihood of banking sector problems. In general, results suggest that the model predicts a low probability of banking sector distress in European Union countries.

Eichengreen and Arteta (2000) determine the causes of banking crises in emerging markets. Eichengreen and Arteta used the same methodology as Hutchison and McDill (1999). In the study macroeconomic and financial variables are used (namely external debt relative to GDP, the current account relative to GDP, the government budget surplus relative to GNP, real exchange rate overvaluation, the ratio of M2 to reserves, ratio of bank liabilities to reserves, the rate of domestic credit growth, a weighted average of interest rates in the advanced industrial countries, deposit insurance, domestic interest rate liberalization, exchange rate regime etc.). The results reveal that rapid domestic credit booms, a large bank liability to reserves, ratio of M2 to reserves and deposit rate decontrol are strongly associated with banking crises. However, the relationships between exchange-rate regimes and banking crises seem to be less significant. Other evidence shows that deposit insurance reduces crisis risk by solving the depositor-run problem rather than encouraging crises by weakening market discipline.

Hardly and Pazarbasioglu (1998) evaluate the episode of banking distress by using three groups of variables; real sector variables (such as GDP growth rate, growth rate of consumption and growth rate of investments), aggregate financial variables (such as deposit liabilities, credit to the private sector, growth rate of credit and foreign gross liabilities) and potential shocks (such as inflation, real interest rates, real exchange rates, real growth rate in imports and terms of trade). In order to identify the role of these macroeconomic and aggregate financial indicators they estimated a multi-nominal logit model. The study analysed 38 countries between 1980 and 1997. The results suggest that banking crises are associated with a fall in real GDP growth, boom-bust cycles in inflation, domestic credit expansion, rising real interest rates and a sharp decline in the

44 Following Glick and Hutchison (2001) is constructed from large changes in an index defined as weighted average of monthly real exchange rate changes and monthly reserve losses.

real exchange rate and an adverse trade shocks. Another result reveals that macroeconomic variables were poor in predicting Asian crises in 1997. However, aggregate financial variables such as credit growth and rising foreign liabilities were important indicators in the Asian crisis. Hardy and Pazarbasioglu pointed out that Asian countries should have paid more attention to financial variables than macroeconomic variables.

Another empirical study by Domac and Martinez Peria (2003) measures the relationship between banking crises and exchange rate regimes[45] in developed and developing countries between 1980 and 1997. The study attempts to examine whether the choice of exchange rate regime affects the likelihood, cost and duration of banking crises by using three types of empirical models with three groups of variables, such as domestic-macroeconomic (real GDP growth, real interest rates, inflation, GDP per capital), external conditions (terms of trade change, real exchange rate change etc.) and financial variables (ratio of broad money to foreign exchange reserves, growth rate of real domestic credit, ratio of credit to GDP, ratio of cash held by banks to total bank assets, ratio of government surplus to GDP, financial liberalization dummy for real interest rates, for real credit growth and for credit extended to the private sector, the exchange rate regime, etc.) used in their studies are lagged by one period. Logit analysis is employed to estimate the probability of a banking crisis and cox and weibull's hazard function is used to estimate the duration of banking crises. The authors define the systemic crises period in the same way as a period that meets one of the four criteria of Demirguc-Kunt and Detragiache (1998a). The results indicate that fixed exchange rate regimes reduce the probability of a banking crisis, especially in developing countries[46]. The findings also confirm that there is an adverse effect from excessive credit growth, high M2 to reserve ratios and high inflation on financial stability.

Kaminsky (1999) evaluates the leading indicators of 102 banking and currency crises in 20 countries between 1970 and 1995 by using the noise-to-signal approach. Leading indicators are classified under 6 heading: over-borrowing cycles (M2 multiplier, domestic credit/GDP, domestic and external financial liberalization), bank runs (bank deposits),

45 Chang and Velasco (1998), Eichengreen and Hausmann (1999), Eichengreen and Rose (1998) and Velasco and Cespedes (1999) also discussed the theory behind exchange rate regime and financial stability

46 On the other hand, Eichengreen and Rose (1998) and Eichengreen and Arteta (2000) conclude that the exchange rate regime does not have a significant impact on the probability of a banking crisis

monetary policy (excess M1 balances), current account problems (exports, imports, terms of trade and real exchange rate), capital account problems (reserves, M2/reserves, real interest rate differential, world real interest rate, foreign debt, capital flight, and short term foreign debt) and growth slow down (output, domestic real interest rate, lending / deposit rate ratio and stock prices). The empirical findings indicate that in general no crisis occurs following a unique shock. Instead, crises develop in the midst of multiple economic problems. Another finding shows that, in contrast to the view that the Asian crisis couldn't have been anticipated, the results show clear signs of distress eight months before the currency crashes.

After the Mexican crisis, Kaminsky and Reinhart (1999) developed an early warning system model to analyze the link between the currency and banking crisis. The study focuses on the links between the banking crisis and exchange rate crisis for the period 1970-1995, and is based on a total of 20 countries. Variables such as output and stock prices, financial sector variables (broad money multiplier, domestic credit to GDP ratio, real deposit interest rates, bank lending rate spread, broad money official reserves ratio) and external sector variables (exports, imports, terms of trade, real exchange rate, changes in net foreign assets and interest rate differentials) are used as predictors of a banking crisis. The results show that banking crises are often preceded by financial liberalization. The best indicators for banking crises appear to be the real exchange rate, real broad money multiplier, stock market prices, output and real interest rates. On average, the earliest signals provided by the best predictors are between 6-18 months before a banking crisis occurs.

Edison (2000) analyses and extends the early warning system developed by Kaminsky and Reinhart (1999) that is based on the signal approach between the period 1970 and 1998. The variables are divided into four groups, namely, current account indicators (deviation of real exchange rate from the trend, value of imports and exports), capital account indicators (foreign exchange reserves, the ratio of M2 to foreign exchange reserves and the domestic foreign real interest rate differential on deposits), real sector indicators (industrial production and index of equity prices) and lastly, financial indicators (M2 multiplier, the ratio of domestic credit to nominal GDP, the real interest rate on deposits, the ratio of lending to deposit interest rates, excess real M1 balances, and commercial bank deposits). The results show that it is difficult to predict the nature

and exact time of a crisis. Even though some variables provided early indications, these were false indicators. In particular, appreciation of real exchange rate, high ratio of short-term debt to reserves, high ratio of M2 to reserves, loss of foreign exchange reserves and a sharp decrease in equity prices seem to be an important indicators of vulnerability. Results reveal that the more changeable the exchange rate, interest rate and inflation, the higher are the risks to financial institutions. Edison concluded that in the early warning system, it might be useful to estimate the probability of a crisis by using a probit model. Furthermore, additional variables, such as the volatility of interest rates, changes in the inflation rate, and variables that capture contagion could be included in the study.

Munoz (2000) investigates the effect of banking crises on bank credit to the private sector between 1970 and 1998, for a panel of developed, developing and transition countries. In the first part, factors that are leading to a likelihood of banking crisis are traditional variables, such as changes in terms of trade, exchange rate, fiscal surplus/deficit over GDP, real interest rate and variables that are identified from the third-generation models, such as interest controls, currency crises, stock market prices, private credit over GDP, the presence of a deposit insurance scheme and the M2 over reserves. In the second part, the author tries to determine the bank credit to the private sector in a crisis environment. The variables that are used in this part are loan interest rate, total deposits, credit to the public sector, central bank credit to the private sector, output, expected inflation, open market operations, reserve requirements, interest rate spread, expected investment and three time variables. The study estimates an endogenous switching model. The logic behind this is that a banking crisis is endogenous with respect to bank credit to the private sector. The model also attempts to investigate the probability that a banking crisis will occur. The basic model is divided into a discrete and a continuous part that will characterize bank credit supply to the private sector. The results reveal that the variables coming from the third-generation models appear to be more significant than the other variables. Also, the presence of currency crises, inflation and lag of credit to the private sector seems to be an important indicator. Decline in stock market, real interest rates and lower inflation indexes are positively related and GDP growth is negatively related with the occurrence of a banking crisis. In the study they give support to third-generation models. Similar to Kaminsky and Reinhart (1999), Monoz's results show that banking and currency crises are not unidirectional. A banking crisis tends to come before a currency crisis and the collapse of a currency tends to deepen the banking crisis. Similar

to the results of the Demirguc-Kunt and Detragiache (1998), Munoz found that the level of exchange rates and the terms of trade changes are insignificant.

3.4.2 Individual Bank Failure

Bank failures can be identified as ex-ante and ex-post indicators. Ex-ante measures of bank failure are associated with the volume of non-performing loans or problem loans[47]. These studies state that banking sector weaknesses emerge as a result of the deterioration of the asset quality. However, data concerning on non-performing loans is not always available, reliable or timely in the balance sheet. Ex-post measures of bank failure, on the other hand, are related to actual insolvencies, such as forced closure, mergers, or government intervention in the operations of financial institutions,[48] or when the net worth of banks becomes negative[49].

Balance sheet indicators have long been used to predict the failure of individual banks in the US, an economy with a less volatile macro environment. Sinkey (1975), Meyer and Pifer (1970), Martin (1977) and Ohlson (1980) are the earliest studies employing the financial and accounting information as a ratio analysis that is mainly included in the context of CAMEL criteria[50]. The financial ratios used in the CAMEL model include different categories of risks such as capital adequacy, asset quality, management quality, earning and liquidity. Their results show that the financial and accounting information is an efficient way of showing the characteristics of failed financial institutions and non-failed financial institutions that help to discriminate between failed and surviving banks.

Most widely used bank-specific indicators are financial ratios[51] that are designed to measure CAMEL's five categories of information. CAMEL is a composite of five separate performance components, namely capital adequacy (C), asset quality (A), management efficiency (M), earnings (E) and liquidity (L), which basically emphasize

47 For instance, Langrin (2001) defined bank fragility as when the ratio of non-performing loans to total loans exceeds 10 percent or 20 percent fragility threshold values

48 These types of failure are also known as official failures They occur when bank regulators officially recognize that an institution no longer continues its operations and in order to remain open it is either closed or receives assistance from the Central Bank (or is merged or acquired by another bank)

49 These types of failure are also known as economic failure This occurs when the market values of banks' assets are below the market value of their liabilities

50 Altman (1968) was the first study to use the multivariate discriminant analysis technique to balance sheet information for predicting the failure of firms in the manufacturing sector He concluded that the model accurately predicts bankruptcy two years prior to business failure Out of 22 financial ratios five were found to have a good predictive power

51 Financial ratios are mainly constructed from bank balance sheets and income statements that financial institutions report regularly

the potential risk inherent within financial institutions[52]. In general, researchers expect that failed banks have inadequate capital, poor asset quality (possibly from lack of diversification or from high provision for bad loans), less efficient management and low profitability.

Capital adequacy is one of the key indicators of financial stability. An adequate level of bank capital makes sure that shareholders have sufficient funds to cover any unexpected losses. In other words, capital adequacy is a measure of capital that can absorb losses and reduce risk. The role of capital as a buffer against loan losses can prevent the failure of a bank when customers' are unable to repay loans and it also provides protection to depositors, which increases confidence in the financial institutions[53].

Asset quality is one of the main risks that banks face. As loans have the highest default rates, an increasing number of non-performing loans shows a deterioration of asset quality. With worsening loan quality, non-performing loans (bad debts) are written off from the books, which reduces the value of banks. Severe deterioration in asset quality may affect the profitability and the capital of the bank and may also trigger bank failure.

The management quality of a bank can be measured by operating efficiency, which constitutes cost of management and productivity of employees. Some studies measure the performance of management quality based on the performance of the 4 other criteria of CAMEL, namely; capital adequacy, asset quality, earning and liquidity[54].

Earning is the most important performance measurement of banks. In particular, this measurement shows how good the bank is at increasing its income (through banks loans and investments) ahead of rising expenses (such as interest on deposits, money market borrowings, the payments on salaries, etc.).

Liquidity risk is the risk that depositors will withdraw large amounts of their deposits and banks will be unable to have enough liquid assets to cover these withdrawals. In other words, it measures an institution's ability to meet unanticipated funds that are claimed by depositors. In fact, there is a liquidity mismatch between bank assets (loans) and bank

52 Some banks are small and some banks are big. For this reason, most recent studies also utilise the Size Effect (S), which result in the use of an extended acronym CAMELS

53 See also Estrella, Park and Peristiani (2000) on capital ratios as a predictor of bank failure

54 See Barr and Siems (1994) and Wheelock and Wilson (1995)

liabilities (customer deposits) that makes banks vulnerable to the threat of depositors withdrawing their money (see methodology chapter for more discussion).

Although the CAMEL approach appear to be appropriate for identifying weaknesses specific to individual banks, in order to measure systemic fragility it is more appropriate to include banking system variables to the CAMEL criteria. For instance, Rojas-Suarez (1998) states that bank level indicators that are in the context of the CAMEL rating system are not good signals of bank strength in emerging markets, particularly in Latin America. She argues that other variables such as the spread between lending and deposit rates, growth rate of credit and growth rate of interbank debt, which measures systemic fragility, should also be considered.

Empirical works on bank failure prediction using financial ratios attempt to predict either the probability of bank failure or the timing of bank failure. The following discussion focuses on the empirical literature to determine the probability and the timing of bank failure.

3.4.2.1 Probability of Bank Failure

In the late 1980s and early 1990s a large number of bank failures occurred in the United States (US) as a result of regional economic difficulties. Studies investigating bank failures in the US include those by Martin (1977), Avery and Hanweck (1984), Espahbodi (1991), Thomson (1991, 1992), Kolari *et al.* (2002), Persons (1999), Canbas *et al.* (2004) and Rahman *et al.* (2004)[55]. Martin (1977) is the first author to use the logit model to evaluate commercial bank failures[56], and he assessed 5700 US banks (58 failed) between 1970 and 1976. In the research he used a combination of 25 financial ratios[57], classified under 4 groups, namely capital adequacy (ratio of capital to total assets, ratio of gross capital to risky assets), asset risk (ratio of loan to total assets, ratio of gross charge-offs to net operating income, ratio of commercial loans to total loans, etc.), liquidity (ratio of liquid assets to total assets) and earnings (ratio of net income to total assets,

55 In the UK, Logan (2001) estimates a logit model and for analysing the UK's banking crisis in the early 1990s. The objective is to identify leading microeconomic indicators for bank failure. Results indicate that the most important leading indicators pointing to the future failure in the short-run are low profitability, low loan growth, and illiquidity (low short-term assets relative to liabilities), as are a high dependence on net interest income and low leverage. Moreover, in the long run, rapid loan growth at the peak of the previous boom are seem to be the best indicators of failure. On the other hand, size, age, deposit concentration and exposure to property dummies appear to be insignificant.

56 Later, Ohlson (1980) predicted the probability of corporate failure for 2,163 firms (105 bankrupt firm) using the logit model.

57 Similarly, Barth *et al.* (1985) and Benston (1985), employing US data, reported various financial ratios as significant variables in explaining bank failure

etc.). His results show that the ratio of net income to total assets and gross charge-offs/net operating income, gross capital to risky assets, and ratio of liquid assets to total assets is significant. However, the ratio of commercial loans to total loans and ratio of loans to total assets appear to be insignificant and wrong sign coefficient.

Later, using the logit model, Avery and Hanweck (1984) investigated US bank failure for 1290 banks (100 banks failed) during the period 1979-1983. The results indicate that earning after taxes on assets, the ratio of capital to assets and loans to assets and banks' percentages of industrial and commercial loans are statistically significant variables in explaining bank failure. However, size appears to be insignificant.

Espahbodi (1991) adopted both logit and discriminant analysis for 37 failed banks and 33 surviving banks in the US in 1983. Espahbodi defined bank distress or failure as a situation in which banks were closed because of financial difficulties or required assistance from the Central Bank. The variables employed in the study are classified as excess credit (ratio of total loans to total assets) or liquidity risk (ratio of liquid assets to total assets), poor loan quality (reserves for loan losses to total loans) and efficiency, such as excessive expenses relative to revenue (ratio of total operating expense to total operating income), profitability (ratio of operating income to total assets) and capital adequacy (ratio of total loans to total equity capital). The results reveal that the ratio of loan revenue to total income, interest income on US Treasury Securities to total operating income and interest paid on deposits to total operating income were significant. On the other hand, measures of liquidity, capital adequacy, efficiency (total operating expense to total operating income), loan quality (reserve for possible loan losses to total loans), and loan volume (ratio of total loans to total assets) were found to be insignificant in explaining bank failure.

Thomson (1991) employed a logit model for US banks over the period of 1983-1988, assessing 2506 banks (770 banks failed). In this model, bank failure was a function of CAMEL criteria (such as ratio of capital to total assets, loan to total assets, net income to total assets and the natural logarithm of the total assets). In addition, four other factors are used to measure the effect of economic conditions. These are unemployment rates, growth in personal income, business failure rates and a measure of economic diversification. Results show that the ratio of loans to total assets, the ratio of net income to total assets and size are among some of the factors that are statistically significant and

related to the likelihood of failure up to 30 months before the failure of banks. Moreover, economic factors appear to have an effect upon the likelihood of bank failure.

Kolari *et al.* (2002) investigated large US commercial bank failure for the period 1989-1992. He focuses on large banks that have more than 250 million US Dollar in total assets and estimated two years before failure. Due to the small sample size he employed a stepwise logit procedure. Some of the variables employed in the analysis are the logarithm of total assets, ratio of net interest income to total assets, ratio of net income to total assets, ratio of total equity capital to total assets, and ratio of loans to total assets. The mean values of these variables are statistically significant for distinguishing failed banks from non-failed banks. One year prior to failure, using a stepwise logit procedure by entering 4 variables into a model, results appear to be statistically significant. Two years prior to failure, 14 variables were entered into a model and only 7 variables appeared to be significant. However, significant variables were not clarified.

In Thailand, Persons (1999) employed a multivariate logit model and predicted potential failure of 41 financial institutions (26 banks failed) between 1993 and 1996. The variables that Persons used ratio of equity capital to total loans, ratio of loan to total assets, ratio of non performing loan to total loans, ratio of operating expense to total assets, ratio of net income to total assets, ratio of total loans to total deposits and ratio of liquid assets to total borrowing and deposits, and lastly, logarithm of total assets. The results reveal that earning (ratio of net income to total assets), liquidity (ratio of total loans to total deposits) and size (natural logarithm of total assets) variables have a negative impact and management quality (ratio of operating expense to total assets) has a positive impact on the probability of failure.

In Turkey, Canbas *et al.* (2004) investigated the bank failure of 40 commercial banks (23 failed) during the period 1997-2003. Canbas *et al.* utilized financial ratios (such as the ratio of interest income to interest expense, ratio of liquid assets to deposits, ratio of liquid assets to total assets, ratio of net income to average total assets, ratio of non-performing loan to total loans, provision for loan losses to total total assets, ratio of total loans to total assets etc.) and estimated three statistical methods, namely logit, probit and discriminant analysis. Inconsistent with the findings of other studies, Canbas *et al.* claims that CAMEL criteria do not represent the specific financial characteristics of Turkish commercial banks. This might be due to the fact that the economy of Turkey is

influenced by a highly volatile macro environment that may have an effect on individual banks' financial statements. For this reason, as North Cyprus is also affected by a similar macro environment, research considers both bank-specific factors and the macro environment.

In Asia, Rahman *et al.* (2004) utilised the logit model and investigated the banking sector distress between 1995 and 1997. More specifically, countries such as Indonesia, South Korea and Thailand are used as a function of financial ratios, such as capital adequacy (ratio of total capital to total assets), asset quality (ratio of loan loss provision to total loans and ratio of loans to total assets), management (loan management: ratio of interest income to interest expense; management efficiency: ratio of interest expense to total loans; operating efficiency: ratio of total operating expense to operating income), earning (return on assets, return on equity and ratio of interest income to total income, ratio of profit before taxation to total income), liquidity (ratio of liquid assets to deposit plus money market funds, ratio of liquid assets to total assets), in the context of the CAMEL rating system. The total number of banks employed in Indonesia, South Korea and Thailand are 30, 29 and 17 respectively. Results show that capital adequacy (ratio of total equity capital to total assets), loan management (ratio of interest income to interest expense) and operating efficiency (ratio of total operating expense to total net income before tax) are found to be significant in all three countries.

Until now a number of different methodologies and techniques (such as logit, probit, discriminant analysis and linear regression etc.) have predicted the determinants of the probability of bank failure for commercial banks. One criticism of the above approach is the failure to estimate the determinants on the probable time to bank failure. The following discussion mainly focuses on an alternative statistical technique, namely survival analysis, for an early detection of the time to bank failure.

3.4.2.2 Time to Bank Failure

Although extensive literature exists on explaining the probability of bank failure, much less attention has been given to predicting the timing of bank failure. To the best of the author's knowledge Lane, Looney and Wansley (1986), Whalen (1991), Cole and Gunther (1995), Henebry (1996), Laviola *et al.* (1999), Wheelock and Wilson (1995, 2000) and Molina (2002) are the only published empirical studies that offer model to predict the time to failure. In their models they apply Cox Proportional Hazard (CPH) model (1972) to predictions of time to bank failure.

Lane, Looney and Wansley (1986) apply the CPH model to the prediction of bank failure for 464 banks (130 banks failed) in the US during the period 1979-1983. Lane *et al.* classified 21 financial ratios under the 5 categories of the CAMEL rating and applied a stepwise procedure for combining the backward and forward elimination technique both one year and two years prior to bank failure (some of the variables employed were the ratio of total capital to total assets, ratio of total loans to total capital, ratio of commercial loans to total loans, ratio of loans to total assets, ratio of total operating expenses to total operating income, ratio of operating income to total assets, ratio of net income to total assets, ratio of net income to total capital, ratio of loan to deposits, ratio of liquid assets to total assets and ratio of interest in deposits to total deposits). Results reveal that a proportional hazard model is an effective early warning tool that identifies financial distress prior to the actual failure date. In particular, the ratio of commercial loans to total loans, the ratio of loans to deposits, the ratio of total equity capital to total assets and of operating expenses to operating income significantly determines the one-year ahead of time to failure.

Consistent with Lane, Looney and Wansley (1986), and Whalen (1991) use the CPH Model to estimate the time to failure in the US between 1987 and 1990. The main difference between Lane *et al.* and Whalen is their sample selection and time period. Whalen utilised a larger sample of 1500 randomly selected banks. Moreover, Whalen employed the local economic condition variable. Some of the variables that Whalen used are the ratio of total loan to total assets, ratio of commercial loans to total assets, ratio of net income to average total assets, ratio of operating expenses to average total assets, ratio of primary capital to average total assets, ratio of total non-performing loans to average total assets and ratio of total non-performing loans to total loans. Similar to Lane

et al. (1986), Whalen suggests that the CPH model provides an effective early warning for banks time to failure. In particular, variables such as the ratio of total loans to total assets, the ratio of net income to average total assets and the ratio of capital to average total assets are significant.

Another study, by Cole and Gunther (1995), investigated the time to failure utilising a different statistical technique. Using quarterly US data during the period 1985-1992, Cole and Gunther suggest that the factors influencing the probability of bank failure may be different from those explaining the time to failure. Cole and Gunther separate the determinants of bank failure from the survival time of failing banks in the US using a split-population survival model (log-logistic distribution), logit survival model and CPH model. Some of the variables that they used are the ratio of equity capital to total assets, ratio of non-performing loans to total assets, ratio of commercial loan to total assets, ratio of insider loan to total assets, ratio of salaries and employee benefits to total assets, ratio of net income to average total assets, ratio of large certificate of deposits to total assets (proxy for liquidity) and a logarithm of the total assets. Findings suggest that when the logit survival model is utilized, capital (ratio of total equity capital to total assets), leverage (ratio of loans to total assets), troubled assets (ratio of non-performing loans to total loans) and net income (ratio of net income to total assets), liquidity (ratio of certificate of deposits to total assets) and asset size are important in explaining the time to bank failure.

Henebry (1997) utilised a CPH model for bank failure prediction in the US during the period of 1985-1988. Variables are categories of CAMEL criteria such as, the ratio of total capital to average total assets, ratio of non-performing loan to total loan, ratio of commercial and industrial loans to total assets, ratio of operating expense to average total assets, ratio of net income to total assets and ratio of total loan to total assets. The results show that from the selected accounting ratios; the ratio of primary capital to total assets, non-performing loans to total loans and total loans to total assets were significant in predicting time to bank failure.

Wheelock and Wilson (2000) also employed a proportional hazard model in the US during the period 1984-1993, using variables (such as ratio of total capital to total assets, ratio of commercial loans to total assets, ratio of non-performing loan to total assets, ratio of net income to total assets, ratio of liquid assets to total assets and logarithm of banks

total assets), which are in the context of CAMELS criteria. The results indicate that lower capitalization (the ratio of bank equity to assets), lower asset quality (the ratio of loans to total assets and the ratio of non-performing loans), lower earning, lower liquidity and smaller size also result in a high probability of failure.

In Venezuela, Molina (2002) utilized a CPH model with time varying covariates for 36 commercial banks (17 failed) and attempted to determine the time to failure for the 1994-1995 banking crisis. The variables that Molina used are in the context of CAMEL criteria (ratio of total capital to total assets, ratio of operating expense to financial income, ratio of net income to total assets, ratio of liquid assets to total liabilities, ratio of financial expense of deposits to average deposits, other assets to total assets[58] and the logarithm of total assets). The results reveal that banks with a higher return on investment in government bonds, higher return in assets, more financial expense and less operational expenses are less likely to fail. Also, there is some evidence that banks with higher capitalization are less likely to fail. Molina argues that during the Venezuelan banking crisis problem banks cut their operating costs and in order to increase more depositors they increased interest rates and indicated falsely high accounting earnings.

Recently, studies on the prediction of individual bank failure suggest that both microeconomic factors and a volatile economic environment may influence bank fragility. Therefore, the following section examines studies on banking sector fragility that combine individual bank failure with the macro-environment.

3.4.3 Banking Sector Fragility[59]

The banking sector fragility base explanation combines large disruptions in the banking sector as a whole (systemic banking crises) with problems of a small magnitude (individual bank failure). See for instance, Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996), Gonzalez-Hermosillo (1999), Heffernan (1996), Borovikova (2000), Langrin (2001) and Yilmaz (2003).

Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996) empirically investigated bank fragility in Mexico, by utilizing the logit model and log-logistic specification to quarterly

58 Other assets are proxy as an account that banks use to hide bad assets.

59 Throughout the thesis, the term 'Banking Sector Fragility' refers to the model that combines individual bank failure and systemic banking crises.

data for the period 1991-1995. The aim of the paper was to uncover the variables that determine the probability of bank failure and the factors that affect the time to failure (or survival). In the empirical analysis they used a two-step procedure. In the first step, they estimated the one-step-ahead probability of failure and factors that influenced the probability of bank failure were determined. In the second step, they conducted a survival analysis for determining the duration of failure. The banking sector fragility is expressed as the function of bank-specific factors, macroeconomic condition and contagion effects (contagion effects measured by the ratio of loans in the banking system as a whole to the region's GDP). The bank-specific factors used in the analysis are very similar to the criteria that are used in the CAMEL rating system. These variables are capital to asset ratios, non-performed loans to total loans, consumer loans, profit margins, public deposits to total loans, interbank deposits to total loans, operating expenses to total assets, liquid assets to total assets and bank assets to total banking sector assets. Banking sector variables include total banking sector loans to GDP, banking sector fragility and risky banking sector loans. Finally, macroeconomic variables that are employed in the study are exchange rate depreciation, real interest rates, economic activity and unexpected inflation. In their analysis bank-specific variables (non-performing loans to total loans) and contagion effects explain the likelihood of failure, whereas macroeconomic variables largely determine the timing of failure. More specifically, bank-specific variables (ratio of non-performing loans to total loans and size variables), banking sector variables (banking sector risky loans), adverse macroeconomic shocks (nominal exchange rates and real interest rates) and contagion effects shorten the survival time of banks. Gonzalez-Hermosillo *et al.* argue that in the Mexican case even though negative macroeconomic shocks increased the fragility of the banking sector, rapid growth in bank lending was the main reason that the banking sector was increasingly destabilised by these shocks.

Similar to the previous studies, a later study of Gonzalez-Hermosillo (1999) evaluates the contribution of both macroeconomic and microeconomic factors in five recent banking crises in the American Southwest (1986-1992), North East (1991-1992), California (1992-1993), Mexico (1994-1995) and Columbia (1982-1987). The study estimates logit model and survival analysis (weibull hazard). The choice of variables is consistent with the theoretical framework of Gonzalez-Hermosillo (1996), in which bank distress is a function of market risk, credit risk and liquidity risk. Bank-specific indicators, such as the

ratio of the non-performing loans to total loans, ratio of non-performing loans to total assets, ratio of total equity capital to total assets, ratio of net income to average assets, ratio of salaries on premises and mixed assets to average assets and the logarithm of total assets, are built on different measures of risk. The market risk includes vulnerability to foreign exchange fluctuations and sector dependence of common prices or stock prices. The credit risk includes the ratio of high loans to assets and weak internal credit controls, and the liquidity risk includes large deposits, liquid assets and average interest rates paid on deposits. The results reveal that a high ratio of non-performing loans to total assets and a low ratio of capital to total assets increase the probability of failure. Other findings also show that contagion (measured by the ratio of the loans in the banking system overall to the region's GDP) is present but its effect is small.

Langrin (2001) constructed a panel data and examined the banking sector distress during 1996/1997 in Jamaica. Langrin used survival analysis (weibull distribution) and logit models and estimated the determinants of probability of bank failure and survival time until failure. Bank-specific variables (such as the ratio of total capital to total assets, ratio of total loans to total capital, ratio of total deposits to total loans, ratio of liquid assets to total assets, ratio of non-performing loans to total loans, ratio of net income to total assets, ratio of net interest income as a percentage of total assets, logarithm of the total assets and ratio of fixed assets to total assets), structural variables (a dummy variable is given for domestic banks and for financial liberalization) and macroeconomic and financial variables (such as the ratio of total credit extended to private sector to GDP, inflation rate, stock exchange index, nominal exchange rate and ratio of broad money to foreign exchange reserves). Results show that asset size, capital to asset ratio and troubled assets determine both probability and time to bank intervention. In addition to the above variables, the ratio of loans to capital, net income, domestic banks and financial liberalization explain time to failure. Moreover, the ratio of private credit to GDP and nominal exchange rates determine failure when the threshold of non-performing loans determines bank failure.

Heffernan (1996) used the logit model and combined for panel data in Australia, Finland, France, Norway, Sweden and the US over the period 1989-1992. In addition to microeconomic variables, Heffernan considered the effects of macroeconomic variables. The bank-specific variables considered were the ratio of net income to total assets, ratio

of net interest income to total assets, ratio of net income to total capital, ratio of total equity capital to total assets, ratio of liquid assets to deposits, ratio of loan loss reserve to total loans and logarithms of total assets. The macroeconomic variables are real interest rates, nominal and real effective exchange rates, inflation rates and real GDP growth. Results show that macroeconomic indicators are important determinants of bank failure. In particular, nominal interest rates, exchange rates and inflation rates were found to be the best performing macro indicators. Evidence also shows that asset size is an important determinant of bank failure, and profitability (ratio of net income to total assets) was found to be the best performing micro indicator. Also, capital adequacy appeared to be significant when other profitability ratios were employed.

Borovikova (2000) applied the split-population and analysed the determinants of bank failure and survival time in Belarusian banks between 1992 and 1999. In a similar manner to Cole and Gunther (1995), Gonzalez-Hermosillo, Pazarbasioglu and Billing (1996) and Borovikova used the logit model and log-logistic specification. The microeconomic variables used were the logarithm of total assets, ratio of net income to total operating income, ratio of average assets to equity capital, ratio of consumer loans to average assets, ratio of non-performing loans to total assets and profit margins. The macroeconomic variables used were real GDP growth rates, inflation rates, exchange rate depreciation, and discount rates. Results show that profitability, asset size, quality of assets (ratio of loans to total assets) and GDP growth rates are important indicators that explain the probability of failure. On the other hand, profitability, interest rates and exchange rates are the indicators that seem to reduce the survival times of banks in Belarus.

Yilmaz (2003) analysed 36 privately-owned commercial bank and investigated the probability of bank failure in Turkey between 1988 and 2000. Firstly, Yilmaz utilised the probit model and analysed the determinants of bank failure and then he investigated whether the presence of full coverage deposit insurance after 1994 worsened the financial positions of banks. The explanatory variables that Yilmaz used are categorised as bank-specific variables (the ratio of liquid assets to deposits, ratio of loans to total assets, non-performing loans, ratio of capital equity to total assets and logarithms of total assets); macroeconomic variables (real interest rates, exchange rate depreciation, real GDP growth); external variables (the ratio of capital account to GNP) and institutional

variables (deposit insurance schemes). Results show that the ratio of total loans to total assets, ratio of capital equity to total assets, ratio of deposit insurance, real interest rates and real GDP growth are important factors that significantly determine the probability of failure. Moreover, the findings reveal that the presence of full coverage deposit insurance after 1994 led to the deterioration of financial ratios, which increased bank fragility through moral hazards and adverse selection[60].

3.4.4 Summary of the Statistical Methods and Leading Indicators

3.4.4.1 Methodology

Discriminant analysis, linear probability[61], logit and probit methods, signal approach and survival analysis are the most common techniques applied in the study of bank failure. Traditionally, the linear form of multiple discriminant (LMDA) analysis was used for predicting bank failure. However, LMDA has strong assumptions, later researchers have preferred to use a maximum likelihood estimation technique such as logit and probit.

Espahbodi (1991) emphasises two problems of LMDA as:

> "i) assumes that the independent variables are multivariately normally distributed with the groups having equal variance-covariance matrices are not equal, the linear form of multiple discriminant analysis is not appropriate (quadratic form should be used). ii) the ability of screen out insignificant variables, because significance tests or individual coefficients are not appropriate when the normality assumption is not meet" (Espahbodi (1991, 55)).

Moreover, the signal approach is a bivariate approach, and therefore it evaluates the predictive powers of individual indicators. Hence, an optimal threshold for each indicator is separately calculated. In this regard, the correlation between variables is taken into account and may negatively affect the optimal thresholds when constructing a composite leading indicator. Another important issue is that these models do not allow for the

60 Bayir (2001) also investigated the impact of full-coverage deposit insurance policy for 35 privately-owned commercial banks in Turkey over the period 1991-1998. Bayir found that after controlling the bank specific and macroeconomic factors the full coverage deposit insurance was associated with the bank failures. This implies that the presence of deposit insurance policy (after 1994) deteriorated the financial position of banks in Turkey.

61 Meyer and Pifer (1970) used OLS linear regression, where the dependent variable is a dummy that takes the value of 1 if the bank failed and 0 when the bank did not fail. The fitted values of this dummy variable were interpreted as estimated probabilities of bank failure. Stuhr and Van Wicklen (1974) and Sinkey (1975) extended and applied its model to commercial banks. However, as the Linear Probability Model faces a problem in dealing with a prediction of probabilities that are greater than 1 or less than 0, this model is not recommended. The usual way of avoiding this problem is to hypothesize that the probability is S-Shaped model and the explanatory variables are a function of the probability that an event has occurred. There are several non-linear mathematical functions that can represent an S-Shaped (Sigmoid) curve, such as logit and probit model.

application of statistical evaluation methods (such as significant tests etc.) as in non-parametric models[62].

The logit and probit models are the most recent econometric models, which employ regression techniques to estimate the relationship between potential indicators and identify discrete outcomes such as a bank failure or banking crisis[63]. Since bank failure is a binary event it takes the value of one when an event occurs and zero when an event does not occur. Therefore, these models are also known as Qualitative Response Models[64]. The probit and the logit models are indeed very similar in form[65]. The main difference between the two models is that in the probit model the probability function is based on the cumulative normal distribution and in the logit model[66] is it is based on the cumulative logistic distribution. As the normality assumption is generally not met, a statistical test based on the estimated coefficients are not relevant. Therefore, the cumulative logistic distribution, which is very similar in form to cumulative normal distribution, is more applicable. The logit model is therefore used in this research (Chapter Four presents a more details on the logit model).

Following the first logit application to bank failure by Martin (1977), several relevant studies have appeared. For instance, Avery and Hanweck (1984), Espahdobi (1991) and Thomson (1992) and Martin (1977) argued that the linear discriminant function is a special case of the logit model, and Espahdobi (1991) uses both logit and discriminant models. Espahdobi (1991) favours the logit model over probit, as the normality assumption of the probit model is not normally meet. Thus, Espahdobi preferred to use the logit model, which is based on the cumulative logistic probability function. However, the logit model is not beyond criticism. Even though this type of model can be used to explain the likelihood of bank failure[67], it does not give any indication of the time to bank

62 See Feridun (2004)

63 Ohlson (1980) utilised the logit and probit model to estimate the probability of bankruptcy.

64 See Martin (1977), Avery and Hanweck (1984), Barth *et al.* (1985), Benston (1985), Thompson (1992), Demirguc-Kunt and Detragiache (1997,2000), Gajewski (1988), Hardy and Pazarbasioglu (1998) and Gonzalez-Hermosillo (1999) for more recent Qualitative Response Models literature

65 The logit and probit model are two non-linear mathematical functions that can represent an S-Shaped (Sigmoid) curve

66 In the logit model, the errors are assumed to have a standard logistic distribution with zero mean and Π2/3 variance.

67 Kane (1986,1989),Gajewski (1988), Demirgunc-Kunt (1989,1991), Thomson (1992) etc.

failure. Therefore, some recent studies have also used a subsequent use of survival analysis or duration models[68].

It seems that existing literature on survival time analysis used uses a continuous time parametric, such as such as CPH model, exponential, Weibul, log-logistic and logit survival models to predict time until bank failure. However, as the time units in these studies are large, such as months or years, these authors are being criticised for not using a discrete time model.[69] It is therefore more appropriate to use discrete time methods, such as logit or complementary log-log, for estimating time to failure.

3.4.4.2 Leading Indicators

This section identifies several indicators that are useful for determining banking sector distress. More specifically, two approaches have been considered to predict banking vulnerability to crises. These are the 'macro approach' that examines systemic banking crises and 'micro approach' which examines bank-specific data. Recent studies on banking sector fragility combine these two phenomena. Empirical studies on the potential early warning indicators of bank failure, systemic banking crises and banking sector fragility are displayed below in Tables 3.1, 3.2, 3.3 and 3.4.

The first type is the 'macro approach'[70], which relies on macroeconomic factors, financial factors, institutional factors and external shocks as key explanatory variables of banking crises. Table 3.1 illustrates the indicators of a systemic banking crisis. The macroeconomic determinants of bank failure are investigated by Demirguc-Kunt and Detragiache (1998a, 1998b), Hutchison and McDill (1999), Hutchison (2002), Eichengreen and Arteta (2000), Hardy and Pazarbasioglu (1998) and Domac and Mertinez-Peria (2003). In general, the macroeconomic perspective and focus on variables such as low GDP growth, real interest rate, inflation, ratio of budget deficit to GDP (budget position), ratio of external debt to GNP (external debt), the index of stock prices (stock), ratio of current account to GDP (current account balance), losses of foreign

68 See Lane, Looney and Wansley (1986), Whalen (1991), Wheelock and Wilson (1994), Cole and Gunther (1995), Gonzalez-Hermosillo (1996), Gonzalez-Hermosillo, Pazarbasioglu and Billings (1997) and Gonzalez-Hermosillo (1999) for the application of duration models for bank distress.

69 See Jenkins (2004)

70 See Calvo (1996), Gavin and Hausmann (1996), Mishkin (1996), Sachs, Tornell andVelasco (1996), Caprio and Klingebiel (1996b), Honohan (1997), Hardy and Pazarbasioglu (1998), Demirguc-Kunt and Detragiache (1998, 2000), Kaminsky and Reinhart (1999), Eichengreen and Arteta (2000), Sunderarajan *et al.* (2002)

exchange reserves and capital outflow (M2/reserves)[71], liquidity in the banking sector (liquidity)[72], growth rate of real domestic credit (credit growth rate), credit lagged for two years (credit growth rate (-2), credit expansion to the private sector (private credit), bank liabilities relative to reserves (bank liabilities/reserves), total banking sector loans to GDP, the ratio of riskiest loans to total capital (banking sector risky loans), banking sector non-performing loans to total loans (banking sector fragility), bank deposits relative to GDP, foreign liabilities to GDP, deposit insurance (insurance), financial liberalization (through interest rate, growth rate of credit and credit extended to the private sector), law and order, degree of central bank independence (CD independence), change of exchange rate regime, domestic banks, growth rate of import, adverse terms of trade shocks, real exchange rate, exchange rate depreciation (change in exchange rate), and exchange rate pressure from another country (contagion effect) and ratio of capital account to GDP are widely used in the literature as causes of systemic banking crises.

In the tables, highlighted variables represent the significant variables[73]. The result of Demirguc-Kunt *et al.* (1998a), for instance, reveals that GDP growth rate, real interest rate, inflation, ratio of M2 to foreign exchange reserve, liquidity, past credit growth, credit extended to the private sector, deposit insurance, financial liberalization, 'law and order' and terms of trade are significant determinant of systemic banking crises. However, Demirguc-Kunt *et al.* (1998 b) found that GDP growth, real interest rates, inflation, the ratio of M2 to reserves, past credit growth, liberalization (domestic interest rates deregulation) and terms of trade shocks are statistically significant variables. The result of Hutchison and McDill (1999) reveal that GDP growth rate, changes in the index of stock prices, deposit insurance, liberalization (domestic interest rates deregulation) and Central Bank independence are statistically significant variables.

71 The vulnerability to capital outflows is measured by ratio of broad money to foreign exchange reserves. A decrease in this ratio leads to a decrease in probability of crises.

72 Ratio of bank liquid reserves to bank assets.

73 In the table 'X' represents the variables used by the studies.

Table 3.1: Indicators of Systemic Banking Crises

Explanatory Variables *	Demirguc-Kunt *et al.* (1998 a, b)[1]	Hutchison *et al.* (1999)	Hutchison (2002)	Eichengreen *et al.* (2000)	Hardy *et al.* (1998)	Domac *et al.* (2003)
Macroeconomic Characteristics (M)						
GDP Growth Rate	[X]	X	X		X	X
Real Interest Rate	[X]	X		X[2]	X	X
Inflation	[X]	X	X		X	X
High Inflation Dummy		X				
Budget Position	X	X		X		X
External Debt				X		
Stock Price		X				
Current Account				X		
Financial Variables (F)						
M2/Reserves	[X]	X		X		X
Liquidity	X					X
Credit Growth Rate		X		X		X
Credit Growth Rate (-2)	[X]				X	
Private Credit	X				X	
Bank Liabilities/Reserves				X		
Bank Deposits/GDP					X	
Foreign Liabilities/GDP					X	
Financial Structure (FS)						
Deposit Insurance	X	X		X		
Liberalization (Interest Rates)	[X][3]	X	X	X		X
Liberalization (Credit Growth)						X
Liberalization (Private Credit)						X
Law and Order	X		X			
CB Independence		X				
Exchange Rate Regime				X		X
External Shocks (E)						
Terms of Trade	[X]				X	X
Growth Rate of Import					X	
Real Exchange Rate				X	X	X
Change in Exchange Rate	X	X				
MPI			X			

Notes. * Highlighted variable in Tables 3.1, 3.2, 3.3 and 3.4 represent the significant variables that determine the probability of bank failure

(1) [X] represents the variables that are significant in 1998 b.

(2) Interest rate is proxied as a weighted average of interest rates in the advanced industrial countries.

(3) Demirguc-Kunt *et al.* employed this variable in 1998b.

(4) Results of Demirguc-Kunt *et al.* (2000) reveal that negative growth shocks, high real interest rate, high inflation, past credit growth and high ratio of M2/Reserves are significantly increase the probability of failure.

The second type is the 'micro approach' that estimates two different methods for individual bank failure: logit model and survival analysis. The logit model is used to estimate the probability of bank failure and the survival analysis is used to estimate the time to bank failure. Table 3.2 displays the findings of the logit model investigated by Martin (1977), Avery and Hanweck (1984), Espahbodi (1991), Thompsom (1991), Kolari *et al.* (2002), Persons (1999), Canbas *et al.* (2004) and Rahman *et al.* (2004). Another line of investigation using survival analysis is investigated by Lane *et al.* (1986), Whalen (1991), Cole and Gunther (1995), Henebry (1997), Wheelock and Wison (1995) and Molina (2002)[74] are illustrated in table 3.3. These studies are in the main estimates of CPH model for predicting the time to failure.

Tables 3.2 and 3.3 display the indicators of individual bank failure. The presented variables are organised in six categories; namely capital adequacy, asset quality, Management Efficiency, Earning, Liquidity and Size.

As can be observed from the tables in each category the variables are not the same for each study. The most commonly used variables are the ratio of total capital to total assets (capital/asset), ratio of loan to equity capital (loan/capital), proxy for capital adequacy, ratio of loan to total assets (loan/asset), ratio of non-performing loan to total loans (non-performing loans/loans), ratio of non-performing loans to total assets (non-performing loans/assets), ratio of loan to total loans (loan) and ratio of total government bonds to total assets (government bond/asset), proxy for asset quality, ratio of operating expense to total assets (operating expense/asset), ratio of total operating expense to operating income (operating efficiency) and ratio of interest expense to total deposits (interest expense/deposit), ratio of interest income to interest expense (loan management) and ratio of interest expense to total loans (management efficiency), proxy for management, ratio of net income to total assets (net income/asset), ratio of net income to total operating income (profit margin), ratio of net interest income to total assets (interest income/asset), ratio of net income to total equity capital (net income/capital), proxy for earning, ratio of liquid assets to total assets (liquid/asset), ratio of liquid assets to deposits (liquid/deposit), ratio of liquid assets to total liabilities (liquid/liabilities), ratio of deposits to total loans (deposit/loan), ratio of loans to deposits (loan/deposit), proxy for liquidity, and lastly the

74 See also Laviola *et al.* (1999).

ratio of bank asset to total banking sector assets (asset (1)) and the natural logarithm of total assets (asset (2)), proxy for size.

Recent studies, such as that conducted by Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996) Langrin (2001), Heffernan (1996), Borovikova (2000) and Yilmaz (2003), investigate the linkage between micro and macro approaches in their studies. Table 3.4 presents indicators of banking sector fragility that combine both micro and macro approaches.

Table 3.2: Indicators of Individual Bank Failure - Probability of Bank Failure

Explanatory Variables	Martin (1977)	Avary *et al.* (1984)	Espahbodi (1991)	Thompson (1991)	Kolari *et al.* (2002)	Persons (1999)	Canbas *et al.* (2004)	Rahman *et al.* (2004)
Microeconomic Variables (CAMELS)								
Capital Adequacy								
Capital/Asset	X	X		X	X			X
Loan/Capital			X			X[1]		
Asset Quality								
Loan/Asset	X	X	X	X	X	X	X	X
Non-Performing Loan/Loan			X			X	X	X
Loan	X	X						
Management Efficiency								
Operating Expense/Asset						X		
Operating Efficiency			X					X
Loan Management							X	X
Management Efficiency								X
Earning								
Net Income/Asset	X	X	X[2]	X	X	X	X	X
Net Income/Capital								X
Interest Income/Asset					X			
Liquidity								
Liquid/Asset	X		X				X	X
Liquid/Deposit						X	X	X
Loan/Deposit						X		
Size								
Asset 2		X[3]		X	X	X		

Notes:
(1) Proxied as ratio of total capital to total loans.
(2) Proxied as ratio of operating income to total asset.
(3) Proxied as natural logarithm of total bank assets minus loan loss reserves

Table 3.3: Indicators of Individual Bank Failure - Time to Bank Failure

Explanatory Variables	Lane *et al.* (1986)	Whalen (1991)	Cole and Gunther (1995)	Henebry (1997)	Wheelock and Wilson (2000)	Molina (2002)
Microeconomic Variables (CAMELS)						
Capital Adequacy (C)						
Capital/Asset	X	X	X	X	X	X
Loan/Capital	X					
Asset Quality (A)						
Loan/Asset	X	X	X	X	X	
Non-Performing Loans/Loan		X		X		
Non-Performing Loans/Asset		X	X		X	
Loan	X					
Government Bonds /Asset						X
Management Efficiency (M)						
Operating Expense/Assets		X	X	X		
Interest Expense/Deposit	X					X
Operating Efficiency	X					X
Earning (E)						
Net Income/Assets	X	X	X	X	X	X
Net Income/Capital	X					
Operating Income/Asset	X					
Liquidity (L)						
Liquid/Asset	X		X		X	
Liquid/Liabilities						X
Loan/Deposits	X					
Size (S)						
Asset 2			X		X	X

Table 3.4: Indicators of Banking Sector Fragility

Explanatory Variables	Gonzalez-Hermosillo *et al.*[1] (1996)	Langrin [2] (2001)	Heffernan (1996)	Borovikova[3] (2000)	Yilmaz (2003)
Microeconomic Variables (CAMELS)					
Capital Adequacy (C)					
Capital/Asset	X	X	X	X	X
Loan/Capital		X			
Asset Quality (A)					
Loan/Asset	X			X	X
Non-Performing Loans/Loan	X	X	X		X
Non-Performing Loans/Asset				X	
Management Efficiency (M)					
Operating Expense/Assets	X			X	
Earning (E)					
Net Income/Asset		X	X		
Interest Income/Asset		X	X		
Net Income/ Capital			X		
Profit Margin	X			X	
Liquidity (L)					
Liquid/Asset	X	X			
Liquid/Deposit			X		X
Deposit/Loan	X	X			
Size (S)					
Asset (1)	X				
Asset (2)		X	X	X	X
Macroeconomic Variables (M)					
GDP Growth Rate	X		X	X	X
Real Interest Rate	X		X	X	X
Inflation	X	X	X	X	X
Stock		X			
Financial Variables (F)					
M2/Reserves		X			
Private Credit		X			
Banking Sector Loans to GDP	X				
Banking Sector Risky Loans	X				
Banking Sector Fragility	X				
Financial Structure (FS)					
Deposit Insurance					X
Liberalization (Private Credit)		X			
Domestic Banks		X			
External Variables (E)					
Real Exchange Rate			X		
Change in Exchange Rates	X	X	X	X	X
Capital Account / GNP					X

Notes:

(1) Significant variables that determine the survival time to failure are ratio of non-performing loans to total loans, size variable, banking sector risky loans, share of total banking loans to GDP, nominal exchange rates and real interest rates

(2) Significant variables that determine survival time to failure are asset size, capital adequacy, troubled assets, net income, financial liberalization and domestic banks.

(3) Significant variables that determine survival time to failure are profitability, interest rates and exchange rates.

3.5 Conclusions

This chapter provides insights from the financial crises experienced by developed and developing countries. The discussion of the theoretical and empirical literature on bank failures and/or banking crises ascertains that the origin of bank failure is brought about by changes in both micro factors and macro environment. Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996), Heffernan (1996), Gonzalez-Hermosillo (1999), Borovikova (2000), Langrin (2001) and Yilmaz (2003) are some of the analysts who systematically examined the concurrent contribution of these changes.

Section 3.4.4 summarizes the statistical methods and leading indicators that are employed in the earlier individual bank failure and/or systemic banking crisis literature. Empirical evidence reveals that the logit model and survival analysis are the most commonly employed methodologies applied to banking crises and/or individual bank failure. Basically, the logit model is used to estimate the probability of bank failure and the survival model is used to estimate the time to bank failure. To the best of the authors' knowledge, Cole and Gunther's (1995) is the only study that utilizes the logit survival model to estimate the time to bank failure. As the time units in this research are large (annual data) this thesis will also employ a discrete time logistic model to predict the determinants of time to bank failure.

Moreover, the available evidence seems to point to the fact that indicators of bank fragility are based on bank-specific factors (financial ratios that are in the context of CAMELS criteria), macroeconomic characteristics (such as interest rates, real exchange rates and inflation rates and government budget position), financial variables (such as ratio of broad money to foreign exchange reserves, liquidity, growth rate of real credit, credit extended to private sector, credit extended to the public sector), institutional variables (financial liberalization, regulatory and supervisory changes, deposit insurance) and external shocks (the deterioration of the terms of trade, exchange rate depreciation). (Tables 3.1, 3.2, 3.3 and 3.4 illustrate the variables utilized in the literature and highlight the significant variables).

Chapter 4:

Data, Model of Bank Fragility and Associated Empirical Methodology

---

4.1 Introduction

The purpose of this chapter is to discuss the data, models of bank fragility and associated econometric methodology applied to the study of banking sector fragility in North Cyprus over the period 1984-2002. The previous chapter highlighted to the importance of understanding the causes and linkages between micro and macro factors in modelling banking sector fragility and pointed to the most relevant estimation techniques for the early identification of bank failure. The most appropriate model of bank fragility was found be the theoretical framework initially developed by Gonzalez-Hermosillo (1996), which combines the internal conditions of individual banks with weaknesses of the economy that are common to the whole banking sector, and the most appropriate estimation technique appears to be the logit model and survival analysis. Since the objective of this study is to identify variables, which exacerbate bank fragility in North Cyprus, use of these methodologies should help to estimate determinants of the likelihood and the timing of bank failure in the country.

This chapter is organized as follows: Section 4.2 examines the model of bank fragility utilized in the thesis. Section 4.2 outlines the data and the explanatory variables used in the empirical applications. Basically, the data set contains key financial ratios of commercial banks, aggregate data that reveal the macro environment and the effect of contagion currency crises from Turkey. The impact of contagion currency crises from Turkey is a measure of the degree of speculative pressure on the exchange rate, which is constructed as an index of exchange market pressure. Section 4.4 proposes a panel technique for combining observations across banks and observations over time. In order to have a consistency between both micro and macro data and to prevent the results from being spurious, this section also tests the stationarity property of applying the Dickey-Fuller Unit Root Test. Additionally, in order to prevent volatility and large jumps in

macro data to affect the integration level of the series the existence of structural breaks is tested according to Zivot Andrews (1992). Section 4.5 describes the econometric methodology, namely the logit model and discrete-time logistic survival analysis, which is employed in the empirical analysis. Section 4.6 provides some concluding remarks.

4.2 The Model of Bank Fragility

The model of bank fragility that is developed in this thesis is based on (in part) the model initially developed by Gonzalez-Hermosillo (1996). Gonzalez-Hermosillo suggests a theoretical framework that considers the degree of fragility of individual banks and the banking system. Before examining the model and the factors that determine individual bank failure, it is desirable to technically define individual bank's balance sheets and to identify the sources of risks.

By looking at the structure of a bank's balance sheet, it could be argued that bank problems are either associated with the deterioration of the bank asset quality, which either refers to the asset side of the bank's balance sheet (i.e. an increase in non-performing loans) or is associated with bank runs, which reflects the liability of bank balance sheets (i.e. depositors rush to claim their funds) or on both sides. In particular, following adverse macroeconomic shocks these characteristics make the banking industry vulnerable to collapse[1] (see Appendix C.4.1 for a sample balance sheet from a North Cyprus bank). With reference to bank balance sheets, a simplified balance sheet can be considered as follows:

Figure 4.1: Bank's Balance Sheet

ASSETS	**LIABILITIES**
Assets	***Liabilities***
Reserves (R)	Deposits (D)
Risky Earning Assets (A)	***Capital***
	Capitals (C)

1 See Gonzalez-Hermosillo (1996) and Hutchison and McDill (1999).

On the asset side, the bank's balance sheet includes reserves (R) (bank reserves are assumed to be in the form of currency and no interest is being paid on them) and risky earning assets (A) (including loans and other types of investments). On the liability side, the bank balance sheet includes deposits (D) (taken from individuals and from other banks or institutions and representing the largest share in the liability structure) and capital (C) (or shareholders' equity, which is the total value of assets of a bank, less liabilities). If the value of banks' assets is less than the values of liabilities then banks are said to be insolvent[2]. In this thesis, official insolvency is utilized, which defines failure as when capital is judged inadequate by the regulators and the institution has to close, transfer to SDIF or is taken over by another bank[3].

Most of the theories on banking failure focus particularly on the explicit characteristics of bank balance sheets; such as a maturity mismatch, random withdrawal, asymmetric information, currency transformation and moral hazards which expose financial institutions expose to collapse following adverse shocks[4].

Firstly, banks are basically illiquid in their role of transforming short-term demand deposits (liquid claims) into long-term loans (illiquid claims). In other words, there is a maturity mismatch between assets and liabilities, which is due to the fact that banks liabilities are mainly short-term deposits and their assets are short and long-term loans to consumers[5]. In this sense, as a consequence of loss of confidence in the banking sector, depositors rush to claim their funds, in which perceived risks on the banks liabilities side increase liquidity risk. Hence, the existence of random and independent deposit withdrawals enable banks to issue liabilities payable on demand while holding earning assets (loans) and an estimated cash reserve at an amount sufficient to respond to demand for deposits[6]. Secondly, the asymmetric information problem is also the source of bank failure. In this model, asymmetric information exists between banks and depositors, and depositors cannot distinguish between solvent and insolvent banks[7]. In this context, an

2 See Demirguc-Kunt (1989), Demirguc-Kunt and Detragiache (1998), Gonzalez-Hermosillo (1996) and Hutchison and McDill (1999).
3 Other studies that utilized official insolvency are Martin (1977), Avery and Hanwech (1984), Lane *et al.* (1986), Espahbodi (1991), Thompson (1991), Whalen (1991), Cole and Gunther (1995), Wheelock and Wilson (1995), Henebry (1997), Persons (1999), Langrin (2001), Molina (2002), Kolari *et al.* (2002), Yilmaz (2003), Canbas *et al.* (2004) and Rahmen *et al.* (2004).
4 See Hutchison and McDill (1999).
5 See Demirguc-Kunt and Detragiache (1998).
6 See Diamond and Dybvig (1983) on random withdrawal model.
7 See Chari and Jagannathan (1988) and Jaclin and Bhattacharya (1988).

adverse public signal, such as an economic downturn, may also give wrong information to the depositors and may lead them to withdraw their deposits from banks believed by them to be insolvent, this can be considered as an asymmetric information problem. Moreover, on the asset side of balance sheet several factors can affect both a bank's loan portfolio and security investment. Adverse changes in the bank's external economic environment can deteriorate the quality of assets by increasing the share of non-performing loans in the economy (i.e. an increase the riskiness of the bank portfolio) and may jeopardise the bank's profitability[8]. In particular, all banks within a country are likely to experience exchange rate risks because of the typical function (currency transformation) of the banking system[9]. In other words, when banks borrow foreign currency and lend domestic currency, this exposes them to foreign exchange risks. In this case, an unexpected depreciation of the domestic currency may affect bank profitability negatively and ultimately deteriorate the bank's balance sheet.

Furthermore, the institutional characteristics (such as a weak regulatory and supervisory policy, government guarantees such as existence of explicit or implicit deposit insurance, financial liberalization, etc.) are also highlighted in the literature that has increased moral hazards by giving an incentive for bank managers to take on excessive risks. Hence, this was an impact on the profitability of banks[10].

Recent studies on bank fragility put the macro theories in a micro context; otherwise it is difficult to understand the severity of crises affecting financial institutions. Gonzalez-Hermosillo (1996) pointed out that banks are faced with a decision of investing their deposits and capitals in a portfolio consisting of reserves and risky earning assets, which are exposed to credit risks[11] (default risk) and market risks[12]. As a result of increased

8 Adverse macro shocks can be either of domestic origin (such as deepening recession, high inflation, high real interest rates, high budget deficit etc.) or external (external balance or high exchange rate depreciation, terms of trade change, contagion effect from other countries etc.).
9 See Akerlof and Romer (1993), Drees and Pazarbasioglu (1995) and Mishkin (1996).
10 The existence of government guarantees is highlighted in the literature and prompts two arguments. On the one hand, with full coverage deposit insurance, depositors can distinguish between solvent and insolvent banks during a bank run, which eliminates the incentives of depositors to run on a bank. On the other hand, existence of full coverage deposit insurance also increases moral hazard by giving an incentive for bank managers to take on excessive risk in lending operations (i.e. risk of adverse selection); hence, there is increased instability in the banking sector (see Yilmaz (2003) for survey in Turkey). Also, the weak supervisory and regulatory policy also increases incentive for financial institutions to continue their operations with low capital ratios and allowing the managers to avoid full responsibility for mistakes in monitoring and evaluating risks. Hence, there is an incentive to moral hazard and adverse selection, ultimately impacting on the profitability of banks.
11 Risk that borrowers are unwilling to pay their loan commitments to the banks.

market and credit risk on bank portfolios, depositors may perceive risks to their deposits and may rush to withdraw their funds, which increases liquidity risks and leads to fragility in the banking sector.

Gonzalez-Hermosillo (1996) defined bank fragility as a function of bank-specific factors that are common to individual banks and macro factors that are common to all banking sectors. According to Gonzalez-Hermosillo, the "degree of soundness/fragility must be a forward-looking measure based on the probability that it can withstand unforeseen destabilizing shocks" (Gonzalez-Hermosillo (1996, 2)). From this perspective, in this thesis it is argued that the macro environment and potential contagion currency crises from Turkey may exacerbate the internal troubles of many of the financial institutions in North Cyprus. Therefore, the model showing the fragility of bank i may be expressed as a function of:

$$F_i = \mathbf{f_i} \text{ (Micro, Macro, Contagion)} \qquad (4.1)$$

Where,

Micro is bank-specific risk in the context of CAMELS criteria.

Macro is the risk of a macro-environment, which represents weaknesses in the economy and financial system.

Contagion is the contagion effect from Turkey.

In this framework, the attempt is to link the individual banks' fragilities and the overall banking sector[13]. Hence, it is assumed that basically the bank fragility in North Cyprus depends on a micro approach (bank-specific risks), macro-environment and potential contagion effect from Turkey (see Figure 4.2 for schematic illustration of sources of risk in North Cyprus).

Several approaches have been developed to predict future bank failure. The approach followed in this thesis is termed ex-post empirical, in which a group of actual failures is identified from a real record of bank failures. Limitation of data is the main reason that the

12 Risk that value of portfolio may change as a result of adverse changes in the bank's external economic environment.

13 See also Gonzalez-Hermosillo (1999), Langrin (2001), Heffernan (1996), Brovikova (2000) and Yilmaz (2003) for other studies that combine micro factors and a macro environment.

study identifies the event as the date of the occurrence of a bank failure. The events include forced closure or government intervention in the operation of financial institutions. The characteristics of banks that failed one year prior to failure are compared with a group of banks that did not fail.

The evidence from previous empirical studies, such as Martin (1977), Avery and Hanweck (1984), Lane *et al.* (1986), Thompson (1991), Espahbodi (1991), Gonzalez-Hermosillo (1996), Heffernan (1996), Gonzalez-Hermosillo (1999), Canbas *et al.* (2004) and Yilmaz (2003) etc. reveal that a one-step ahead-probability of failure is an effective approach for predicting bank failure. Following those studies, the bank intervention decision of regulators is set as a discrete variable that takes the value of one for bank intervention by regulators and zero otherwise. Intervention encompasses banks that were forced to close or banks that are able to continue in business through "rescue" operations, such as actual acquisitions or mergers. These are also included in the failure (or problem) prediction model. The intervention date was obtained from the publication of the Central Bank of the TRNC.

4.3 The Data and The Variables

4.3.1 The Data

In 1999 there were a total of 37 banks operating in North Cyprus. However, only 2 of these banks were of public origin and the remaining 35 were financed by the private sector. This sample excludes corporate banks and foreign banks in order to sustain the homogeneity of the banks in the sample. The original sample for this research consists of 7 failed banks, 3 taken-over banks and 13 non-failed banks. From the 14 discarded banks 6 were foreign, 2 were cooperative and the rest were small banks without complete data. To analyse the North Cyprus banking sector distress, 23 banks out of 37 in the total system were used. The failure rate between 1999 and 2002 was 32.4%. The failure rate in the selected sample was 39%, i.e. virtually the same as the rate in the universal population.

Table 4.1 shows a list of the banks assessed in this research. In the table commercial banks are split into two broad groups: surviving banks (constituting non-failed public and private banks) and failed banks, which are either transferred to the Saving Deposit

Insurance Fund (SDIF), closed or taken-over by other banks. The samples of failed banks between 2000 and 2002 were divided into three different failure date. In the first wave of failure, in 2000, 5 banks were first transferred to the SDIF and then closed and in the second wave of failure, in 2001[14], another 5 banks were transferred to the SDIF. The last group of failed banks contain 3 banks that ceased to exist were either merged or acquired by another bank. These are Finba Financial Bank, which was taken over by Artam Bank, and Med Bank and Hamza Bank, both taken over by Seker Bank Ltd in 2001 and 2002, respectively.

Table 4.1: List of Sample of Failed Banks and Non-Failed Banks

Surviving Banks (Non-Failed Banks)

Public Banks
1. Cyprus Vakiflar Bank Ltd
2. Mediterranean Guarantee Bank Ltd.

Private Banks
1. Turkish Bank Ltd.
2. Asbank Ltd.
3. Cyprus Economy Bank Ltd.
4. Rumeli Bank Ltd.
5. Kibris Altinbas Bank Ltd.
6. Denizbank Ltd.
7. Near East Bank Ltd.
8. Yesilada Bank Ltd.
9. Universal Bank Ltd.
10. Kibris Continental Bank Ltd.
11. Viyabank Ltd.

Failed Banks	Closure Year	Problem / Failed
1. Cyprus Credit Bank Ltd	2000	Closed
2. Liberal Bank Ltd	2000	Closed
3. Everest Bank Ltd	2000	Closed
4. Cyprus Yurtbank Ltd*	2000	Closed
5. Cyprus Finance Bank Ltd	2000	Closed
6. Cyprus Commercial Bank Ltd	2001	Transfer to the SDIF
7. Industrial Bank Ltd	2002	Transfer to the SDIF
8. Finba Financial Bank Ltd	2001	Renamed as Artam Bank Ltd.
9. Med Bank	2001	Renamed as Seker Bank Ltd.
10. Hamza Bank Ltd	2002	Taken-over by Seker

Source: Central Bank of the Turkish Republic of Northern Cyprus (2002)
Note: * Formerly Tunca Bank Ltd, established in 1994, and taken-over by Kibris Yurtbank Ltd. in 1999.

An important point to be stressed about the model is the fact that the North Cyprus banking sector is a small industry. Therefore, the number of observations included in the

14 Our sample includes only 2 of these failed banks.

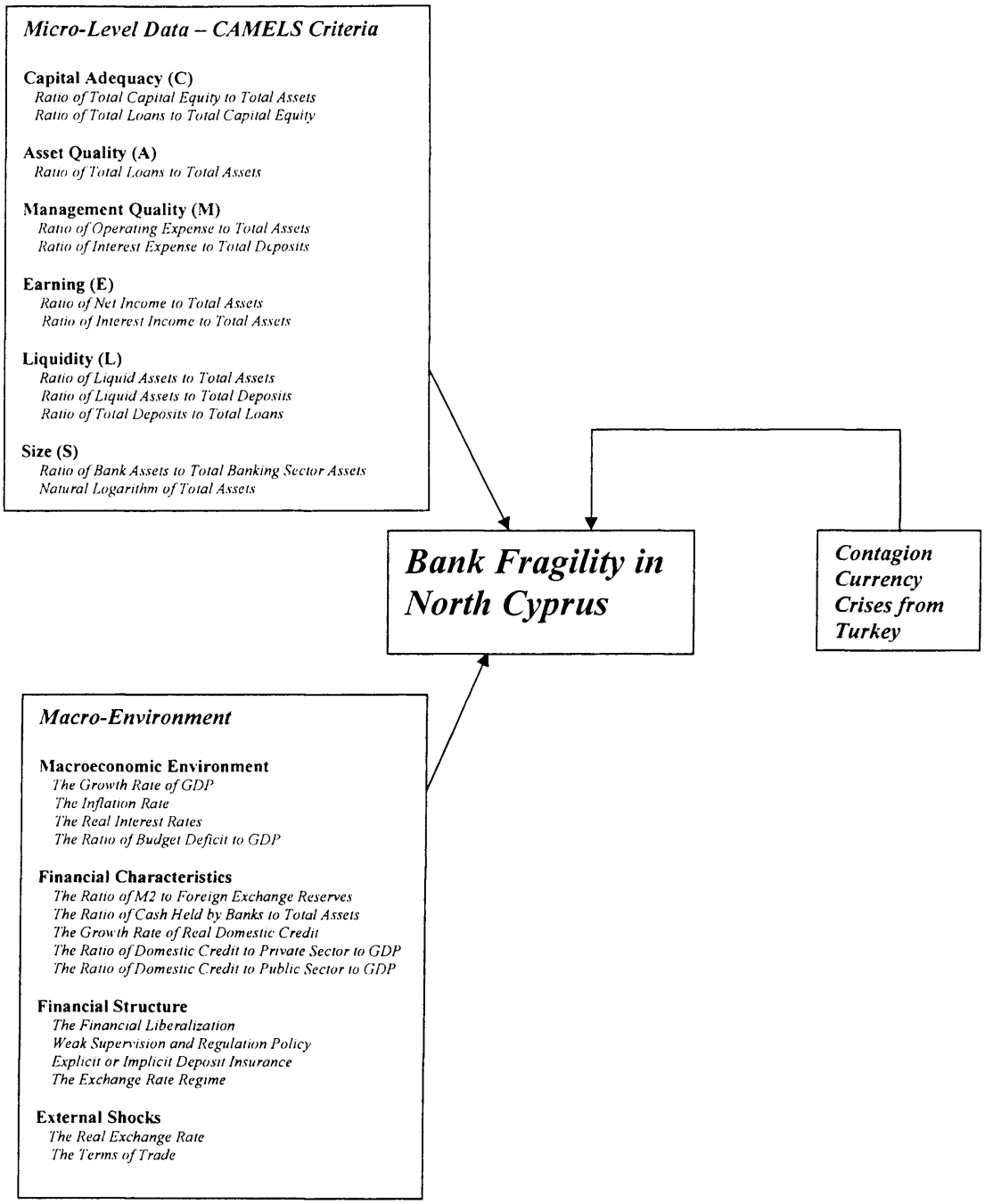
model is considerably small. For this reason, it is useful to use the pooled cross-section time-series data set, which allows using panel data regression procedures to consider both individual bank's effects and time effects. The results of the works of Gonzalez-Hermosillo *et al.* (1996), Heffernan (1996), Persons (1999), Brovikova (2000), Langrin (2001), Molina (2002), Yilmaz (2003), Canbas *et al.* (2004) and Rahman *et al.* (2004) provide evidence that the existence of a small number of observations can work well in bank failure estimations.

4.3.2 The Variables

4.3.2.1 Bank-Specific Variables

In the micro approach, CAMELS rating system is employed to evaluate individual banks' overall financial statuses. Specifically, CAMELS is a measure of six separate performance measurement, as noted in Chapter Three, that help to monitor banking conditions. In North Cyprus, the key financial ratios that are in the context of CAMELS criteria are: capital adequacy, which is proxy by the ratio of total capital equity to total assets and the ratio of total loans to total capital equity; asset quality which is proxy by the ratio of total loans to total assets; management quality which is proxy by the ratio of operating expense to total assets and the ratio of interest expense to total deposits; earning which is proxy by the ratio of net income to total assets and the ratio of interest income to total assets; liquidity which is proxy by the ratio of liquid assets to total assets, the ratio of liquid assets to total deposits and the ratio of total deposits to total loans, and lastly size, which is proxy by the ratio of bank assets to total banking sector assets and the natural logarithm of total assets (for more detailed discussions on measurement components of CAMELS see Chapter Five).

Figure 4.2: Sources of Risk in North Cyprus Banking Sector



4.3.2.2 Macro Environment

The variables that are used to measure the macro environment are divided into four groups, namely macroeconomic environment, financial characteristics, financial structure and external shocks. The variables capturing the macroeconomic environment include the growth of real GDP, the inflation rate and the real interest rate, as well as the ratio of budget deficit to GDP. The second group of variables capturing characteristics of the financial sector is the ratio of M2 to foreign exchange reserve, liquidity (ratio of cash held by banks to total bank assets), the growth rate of domestic credit lagged one year, ratio of public credit to GDP lagged one year, and the ratio of private credit to GDP lagged by one year. To capture structural variables dummy variables are used for financial liberalization, weak supervision and regulatory policy, explicit or implicit deposit insurance and the real exchange rate regime. Lastly, in order to capture external conditions, two variables are included: the change in the terms of trade and the depreciation of the exchange rate (relative to the US Dollar).

Moreover, there are some aspects of contagion that seem hard to explain on the basis of macroeconomic fundamentals. In other words, the official currency in North Cyprus is Turkish Lira (TL). Hence, the economy and the banking sector in North Cyprus is directly affected by money related-problems which arise in Turkey. This suggests that it may be useful to formulate models that explain the impacts of contagion currency crisis, possibly triggered by a crisis in Turkey. From this perspective, the thesis also analyzes the role of contagion effects on the spread of currency crises from Turkey.

4.3.2.3 Analyzing the Contagion Effect from Turkey

The contagion effect that is the concern of this thesis is an increase in the probability of speculative attacks on the Turkish Lira. Currency crises are identified as extreme values of the speculative pressure index. Following Eichengreen, Rose and Wyplosz (1995, 1996), a measure of speculative pressure on currency crises (exchange rate pressure index) is constructed as a weighted average of changes in the exchange rate, changes in the international reserve and changes in the interest rate.

To examine currency crises in Turkey, an index of the weighted average of changes in the exchange rates, foreign exchange reserves and interest rates are calculated. Then, the

Market Pressure Index (index of exchange rate pressure on Turkish Lira) is calculated as follows:

$$MPI_{i,t} = (\alpha\%\Delta e_{i,t}) + (\beta\Delta i_{i,t}) - (\gamma\%\Delta r_{i,t}) \quad (4.2)$$

(see Eichengreen, Rose and Wyplosz (1996))

Where,

e denotes the nominal exchange rate vis-à-vis the USA. [15]

$i_{i\,t}$ denotes short-term interest rates.

r is foreign exchange reserves.

α, β, γ are weights.

A higher index is reflected in higher values of these three variables; therefore, this indicates greater pressure on the exchange market depending on the nature of the intervention of the respective Central Bank. That is, speculative pressures are either accommodated by a loss of reserves or can be prevented by the monetary authorities through an increase in interest rates. See, for instance, Eichengreen, Rose and Wyplosz (1996)[16].

As with Eichengreen, Rose and Wyplosz (1996), a crisis episode is defined as a month in which MPI exceeds its overall mean of the index by 1.5 times the pooled standard deviation of the calculated index.

The crisis is defined in the following index:

$$\begin{aligned} &\text{Crises (T)} = 1 \qquad \text{If MPI (T)} > \mu_{\text{MPI (T)}} + 1.5 * \sigma_{\text{MPI(T)}} \\ &\text{Crisis (T)} = 0 \qquad \text{Otherwise} \end{aligned} \quad (4.3)$$

Where T is the country of Turkey, μ is the sample means and σ is the standard deviation of MPI. This model allows the calculation of speculative attacks (Index of Exchange Pressure) for Turkey. The next step in the study is to form crisis dummy in the logit

15 Local currency divided by foreign currency.

16 See also Sach, Tornel and Velasco (1996), Frankel and Rose (1996), Kaminsky, Lizando and Reinhart (1998), Gaston and Sahay (2000), Cerra *et al.* (2000) and Cramazza *et al.* (2004) for similar construction of exchange rate pressure.

model, which will allow the estimation of the likelihood of speculative attacks in Turkey to have any influence on bank failure in the North Cyprus.

This thesis uses a logit model and logistic survival model in a panel data framework. The one-step ahead probability of failure is estimated as a function of a set of micro and macro variables. From this perspective, before running the estimation techniques the panel considers potentially combining time-series and cross section data. Using pooled time series cross-section data (panel data) it is convenient to measure the sensitivity of bank-specific data, macro data and contagion effects over time for each bank.

4.4 Combining Micro and Macro Data

4.4.1 The Pooled Time-Series Cross-Section Data

Pooled time series cross-section analysis is probably the most suitable way to examine simultaneously the sensitivity to time as well as banks[17]. This pooled time-series for several cross-section data sets are characterized by having repeated observations over time for the same financial institutions, which allows the researchers to consider both individual banks' effects and time effects. Due to the fact that there is a limited amount of individual observation in the cross section data, this approach is very useful.

Bank-level data and macro data over time have very rarely been pooled in research to determine banking fragility. In this thesis the standard regression model of bank fragility is pooled as follows:

$$Y_{it}^* = \beta_1 + \Sigma_{k=1,2,3\ldots k}\, \beta_2\, Micro_{kit} + u_{i\,t} \qquad (4.4)$$

$$Y_{it}^* = \beta_1 + \Sigma_{k=1,2,3\ldots k}\, \beta_2\, Micro_{kit} + \Sigma_{k=1,2,3\ldots k}\, \beta_3\, Macro_{kit} + u_{i\,t} \qquad (4.5)$$

$$Y_{it}^* = \beta_1 + \Sigma_{k=1,2,3\ldots k}\, \beta_2\, Micro_{kit} + \Sigma_{k=1,2,3k}\, \beta_3\, Macro_{kit} + \Sigma_{k=1,2,3k}\, \beta_4\, Contagion_{kit} + u_{it} \qquad (4.6)$$

Where,

i=1,2,3,.....N , represents a cross-sectional unit.

t=1,2,3,.....T , represents annual time-series (i.e. a time effect).

17 In cross sectional data observations are across banks at one point in time and time-series data observations are over time.

k=1,2,3,.....K , represents a specific potential explanatory variables (these variables are summarized in Figure 4.2).

Y^*_{it} represent the binary dependent variable for unit i and time t (see logit model in Section 4.5.1 for more detailed information on Y^*_{it})

u_{it} is the disturbance term.

β_1 refers to constant intercept.

$\beta_{2,3,4}$ refers to the slope parameters.

The data set consisting of observations made from a sample of 23 commercial banks (number of banks i) over the period of 1984-2002 (over t time period) in North Cyprus. Specifically, the first empirical chapter (Chapter Five) pools the regression of the estimated logit and logistic survival analysis and considers only micro perspective, which examines data on specific banks, and is written as (4.4). Whereas, in the second empirical chapter (Chapter Six), in addition to micro data that are identified in Chapter Five, equations also consider macro data and the contagion effect from Turkey, written as (4.5) and (4.6) respectively.

Before combining time series for several cross-section data sets, the stationary property of the explanatory variables was also tested for both micro and macro data. In fact, it is possible to run logit regression, even if the time series do not satisfy the stationary assumptions. However, these results could be spurious.

4.4.2 The Unit Root Test and The Structural Break

To examine the presence of the unit roots, the Dickey-Fuller (1979) test is conducted. The unit root test is utilized to test the stationarity property of data, i.e. whether a series is stationary or non-stationary. With respect to the series, it is also observed that there is a potential break. Any kind of structural break may cause bias to the results of the ADF test. Hence, a structural break tested of Zivot-Andrews (1992) is employed to see whether sudden changes in data capture any structural breaks. The Zivot Andrew (1992) approach treats the break date as endogenously determined.

Macroeconomic time series data is typically non-stationary (unit root), which can be regarded as a potentially major problem for econometric studies. Hence, the stationarity

properties for all of the macro variables are tested over the period of 1984-2002 by using the Dickey Fuller test (1979).

4.4.2.1 Unit Root Test for Time Series

The Dickey-Fuller (1979) has received the most attention in applied econometrics literature. Using the t-test method of Dickey Fuller, all variables are tested one by one. The Dickey and Fuller test (1979) for the order of integration of X_t is based on the following estimation:

$$\Delta X_t = \gamma X_{t-1} + e_t \quad \text{(for level)} \tag{4.7}$$

The interest is to test the negativity of γ in the OLS regression[18]. In the above time series regression if $\gamma = 0$ then X_t series is said to have a unit root (i.e. it is non-stationary). Alternatively, $\gamma < 0$ implies that the series is stationary.

The hypothesis in the unit root tests is considered as follows:

H_0: X_t is non-stationary (i.e. unit root or difference stationary).
H_1: X_t is stationary (i.e. trend stationary).

The null hypothesis is integrated of order one, I(1), against the alternative that is integrated of order zero, I(0). The null hypothesis rejected against alternative implies that X_t is stationary. Box and Jenkins (1970) argue that a non-stationary series can be transformed into a stationary by differencing of the series until stationarity achieved is a solution to this problem[19]. Therefore, in order to transform non-stationary macroeconomic data to stationary, we took the first difference.

Then, the DF equation is written as;

$$\Delta\Delta X_t = \gamma \Delta X_{t-1} + e_t \qquad \text{(for first difference)} \tag{4.8}$$

In the same way rejection of the null hypothesis in favour of an alternative implies that the series is stationary, in the first difference.

18 This is a one-sided test, therefore the sign is expected to be negative or significantly different from zero.
19 However, Sargan (1964) and Davidson *et al.* (1978) have criticized this idea as differenced variables only for benefit of long-run relationship.

Furthermore, the macroeconomic shocks that are observed from figures in Chapter Two suggest volatility and large jumps in macro data. In this sense, if structural break are not considered, the analysis of the future behaviour of economic variables can bias the results obtained from the Dickey-Fuller test. Hence, test statistics for structural breaks by Zivot-Andrew (1992) test is applied to all of the macro variables over the period 1984 to 2002.

4.4.2.2 The Structural Break Test

It has been argued that the existence of structural changes (breaks) in a time can easily affect the integration level of the series and makes the Dickey Fuller test unreliable. It can also affect all the parameters of the model. For this reason, this issue is important for both univariate and multivariate analysis. Perron (1989) provided evidence that a structural break in the mean of a stationary variable is likely to bias the Dickey-Fuller test towards the non-rejection of the null of a unit root in the hypothesis. Perron (1990) argued that ignoring the existence of structural breaks can lead to inadequate model specification, poor forecasts and spurious unit root results. Banerjee *et al.* (1993), Perron and Vogelsang (1992), Zivot and Andrews (1992) and Perron (1997) have developed tests that account for structural breaks in order to avoid bias in favour of a unit-root hypothesis.

In this research the influence of a potential break in the time series is tested according to Zivot Andrews (1992). In the Zivot Andrews (1992) approach, "the null hypothesis is that the series under study has a unit root without a structural break and it is tested against the alternative hypothesis of a trend stationary with a one-time break in the intercept and slope of the trend function at an unknown a point in time" (see Fethi (2003, 251)).

Then the hypothesis in the structural break test is considered as follows:

H_0: X_t is non-stationary without structural break.
H_1: X_t is stationary with a structural break.

In the analysis of Zivot and Andrew test the time of the structural break is determined endogenously as the value that minimizes the Dickey-Fuller t-statistic. That is, the break years are the years corresponding to the minimum t-statistics; the null-hypothesis of unit root without a break can be rejected.

Further, in order to have a consistency between macro and micro data and to prevent the results from being spurious, a panel unit root test is applied to all of the microeconomic variables (bank-specific variables) over the period 1984-2002.

4.4.2.3 Unit Root Test for Panel Data

A panel unit root test is carried out to test the level of integration of panel data series based on the article of Im *et al.* (2003). Im *et al.* presents standardized t-bar test statistics based on the (augmented) Dickey-Fuller statistics averaged across the groups. In this model the test is based on the mean of (augmented) Dickey-Fuller (1979) statistics computed for each group (each bank) in the panel, which is referred to as a t-bar test.

The test statistics are proposed as follows

$$Z_i = \frac{\sqrt{N[t-bar_{NT} - E(t_T|\beta_i = 0)}}{\sqrt{Var(t_T|\beta_i = 0)}} \tag{4.9}$$

Where,

$t\text{-bar}_{NT}$ is the average of the standard individual ADF unit root t-statistics, such that $t\text{-bar}_{NT} = 1/N \Sigma_{i1..N} t_{it}$.

$E(t_T | \beta_i = 0)$ is the common mean value of t_{it} for i=1,2,.....N, obtained from $\beta_i = 0$ (tabulated in Im *et al.*(2003) in Table 3, page 19).

$Var(t_T | \beta_i = 0)$ is the common variance value of t_{it} for i=1,2,...N, obtained from $\beta_i = 0$ (tabulated in Im *et al.*(2003) in Table 3, page 19).

There are two basic estimation techniques adopted in the thesis: a logit model and survival analysis. The next section focuses on these methodologies. The logit model is utilized to estimate the probability of bank failure and discrete-time survival analysis (or time-to-event analysis) is utilized to estimate the time that a bank is at risk of failure[20]. Specifically, the model of discrete-time survival analysis framework is fit using standard logistic regression.

20 See also Lane *et al.* (1986), Whalen (1991), Wheelock and Wilson (1995), Cole and Gunther (1995), Gonzalez-Hermosillo *et al.* (1996), Henebry (1997) and Molina (2002) for studies on time to bank failure.

4.5 The Econometric Methodology

4.5.1 The Logit Model

The logit model is the most commonly employed methodology applied in the banking sector, especially in detecting potential failure risks[21]. The results obtained in this model allow us to identify the determinants of the likelihood of bank failure in North Cyprus.

In the context of the logit model, the binary dependent variable Y_{it} takes the value of 1 if a bank fails (transferred to SDIF, closed or taken over by another bank) during the year, and 0 otherwise.

In practice, Y_{it}^* is the latent variable, which is not observable by the researcher and assumed to depend on k explanatory variables, ranging from - ∞ to ∞. The latent variable is linked to the observable Y_i variable by a measurement equation.

The latent variable Y_{it}^* is linked to the observable categorical variable as follows:

$$Y_{it} = \begin{cases} 1 & \text{If individual banks fail} \quad \text{If } Y_{it}^* > 0 \\ 0 & \text{otherwise} \quad \text{If } Y_{it}^* \leq 0 \end{cases} \tag{4.10}$$

(see Madalla (2001, 322))

The latent variable link to the explanatory variables as follows:

$$Y_{it}^* = \beta_0 + \sum_{j=1}^{k} \beta_j X_{itj} + u_{it} \tag{4.11}$$

Where,

Y_{it}^* : Represents latent variable, and its scale can not be determined.

21 See Martin (1977), Avery and Hanweck (1984), Thomson (1991), Espahbodi (1991), Heffernan (1996), Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996), Demirguc-Kunt and Detragiache (1998a, b, 2000), Hardy and Pazarbasioglu (1998), Persons (1999), Gonzalez-Hermosillo (1999), Domac & Mertinez Peria (2000), Borovikova (2000), Langrin (2001), Kolari *et al.* (2002), Rahman *et al.* (2004), Canbas *et al.* (2004) for studies that employed logit model in banking sector.

u_{it} : is a composite error term.

β_j : coefficient of j th independent variable, and measures the effects on the odds of failure of a unit change in the corresponding independent variables.

X_{itj}: is a vector of k number of explanatory variables in period t for bank i. (the explanatory variables employed in the analysis are mentioned earlier).

The above equation implies that the larger values of Y_{it}^* are observed as $Y_{it}=1$ (i.e. failed banks), while those with smaller values of Y_{it}^* are observed as $Y_{it}=0$ (i.e. non-failed banks).

In the logit model, the log-odds ratio[22] is a linear function of the explanatory variables[23] (see Appendix C.4.2 for the derivation of the model). The estimated multivariate logit model links the likelihood of banking problems to a set of variables.

$$\text{Log}\left(\frac{P_i}{1-P_i}\right) = \beta_O + \sum_{j=1}^{k} \beta_j X_{itj} \qquad (4.12)$$

Where,

P_i : represents the probability that bank i will fail.

$1-P_i$: represents the probability that bank i will not fail.

The logit regression results are obtained with the use of STATA 8 Software[24]. At a particular time t a bank is experiencing failure when the dummy variable is Y_{it} takes on a value of 1, and visa-versa when it takes the value of 0. The probability that a bank failure will occur in North Cyprus, Prob ($Y_{it}=1$), is hypothesized to be a function of a vector of k number of explanatory variables in period t for bank i, X_{itj}, and the parameter vector β. Furthermore, if the sign of β is greater than 0 ($\beta>0$) in the model, then an increase in X_{itj}

22 There are two steps for the logit transformation. Firstly, the probability is transformed into the odds (odds denotes the likelihood of the occurrence of an event to the likelihood of the non-occurrence of an event) and the then the log of odds gives the logit. The logistic transformation ensures that there is no possibility of getting predictions of the probabilities less than 0 or greater than 1.

23 See also Aldrich and Nelson (1984), Madalla (1983, 1988, 2001), Greene (1990, 1993, 2000), Liao (1994), Menard (1995), Long (1997), Pampel (2000), Powers and Xie (2000) and Jaccard (2001).

24 The random effect logit model results in STATA software also give an additional panel level variance, which is the log of the standard deviation. The standard deviation is also given together with rho. The rho gives the proportion of the total variance contributed by the panel level variance. If the value of the rho is zero, this indicates that the panel-level variance is unimportant. Then, it can be concluded that the panel estimator is not different from the pooled estimator (STATA (2003)).

increases the probability of bank failure, and if the sign of β is less than 0 ($\beta_t < 0$) then an increase in X_{itj} reduces the probability of bank failure.

4.5.2 The Survival Analysis Model

Survival models attempt to explain the duration of a particular event. Graphical methods are useful for displaying data on duration and for preliminary analysis of survival that may suggest the survival patterns of the banks. For this reason, as a first step of survival analysis the study presents the Kaplan-Meier Product-Limit Estimator (1958), an estimate of the distribution of bank failure duration. This method is especially useful for estimation and graphical survival curves. The Kaplan-Meier survival estimates evaluate the curve of the time points at which an event occurs. The cumulative survival probability estimates the proportion of all cases that are still alive at a particular point in time. The formula of the survivals function for the Kaplan-Meier Method (Product-Limit Estimator) is presented in Appendix C.4.3. The formula implies that the measure for banks to survive to the first observed time (t), is simply 1 minus the proportion of the number of banks observed to fail by that time to the number of banks at risk of failure. In this thesis, the next step of survival analysis concerns method that deals with events measured or occurring in discrete-time survival analysis for analysing the length of time until the occurrence of event[25]. In discrete–time methods for modelling the time to an event the functional form can either be a logistic model or complementary log-log model. The methodology employed in this thesis is a logistic survival model that uses a latent variable modelling framework. The results obtained in this methodology permit us to verify the determinants of time to bank failure. The results of both the Kaplan-Meier method and discrete-time logistic survival analysis are obtained by processing a computer software package (STATA 8).

The presentation of a discrete time method begins by examining the discrete event history data. Then, after describing the foundation of discrete-time intervals, the thesis presents the underlying statistical model of survival analysis implemented by standard logistic regression.

25 See also Singer and Willett (1993), Masyn (2003) and Jenkins (2004) for more information on discrete time survival analysis.

4.5.2.1 Recording Discrete Event History Data

A distinctive feature of the survival data is that some observations are censored. The simplest situation of censoring data is depicted in Figure 4.3. The figure presents a sample of bank data that describes the lifetime of failed and non-failed banks in North Cyprus. The horizontal axis represents time, and the vertical axis represents the 23 selected banks. The sample consists of 13 censored banks (i.e. survival time is not known exactly) and ten uncensored banks. Censored banks are those that have not yet experienced the event during the observation period and uncensored banks are those that experienced the event during the observation period. X indicates that events occurred, i.e. a bank became bankrupt or was taken over by another bank at that point in time. The values at time X are observed, and hence those failure times are uncensored. For instance, Turk Bank Ltd, Asbank Ltd., Economy Bank Ltd., Rumeli Bank Ltd., Deniz Bank Ltd., Altinbas Bank Ltd., Near East Bank Ltd., Yesilada Bank Ltd., Universal Bank Ltd., Continental Bank Ltd., Viya Bank Ltd., Vakif Bank Ltd. and Mediterrenean Bank Ltd. have censored failure times[26]. Other banks, such as Industry Bank Ltd., Commercial Bank Ltd., Credit Bank Ltd., Liberal Bank Ltd., Everest Bank Ltd., Yurt Bank Ltd., Finans Bank Ltd., FinBa Ltd., Med Bank Ltd. and Hamza Bank Ltd. have uncensored failure times.

In the model, it is assumed that every individual bank in the sample survives until it experiences the event of failure or is censored by the end of data collection. For each bank, therefore, the chronology of the occurrence of the event can be expressed using a dummy variable Y_{ij}, is written as follows:

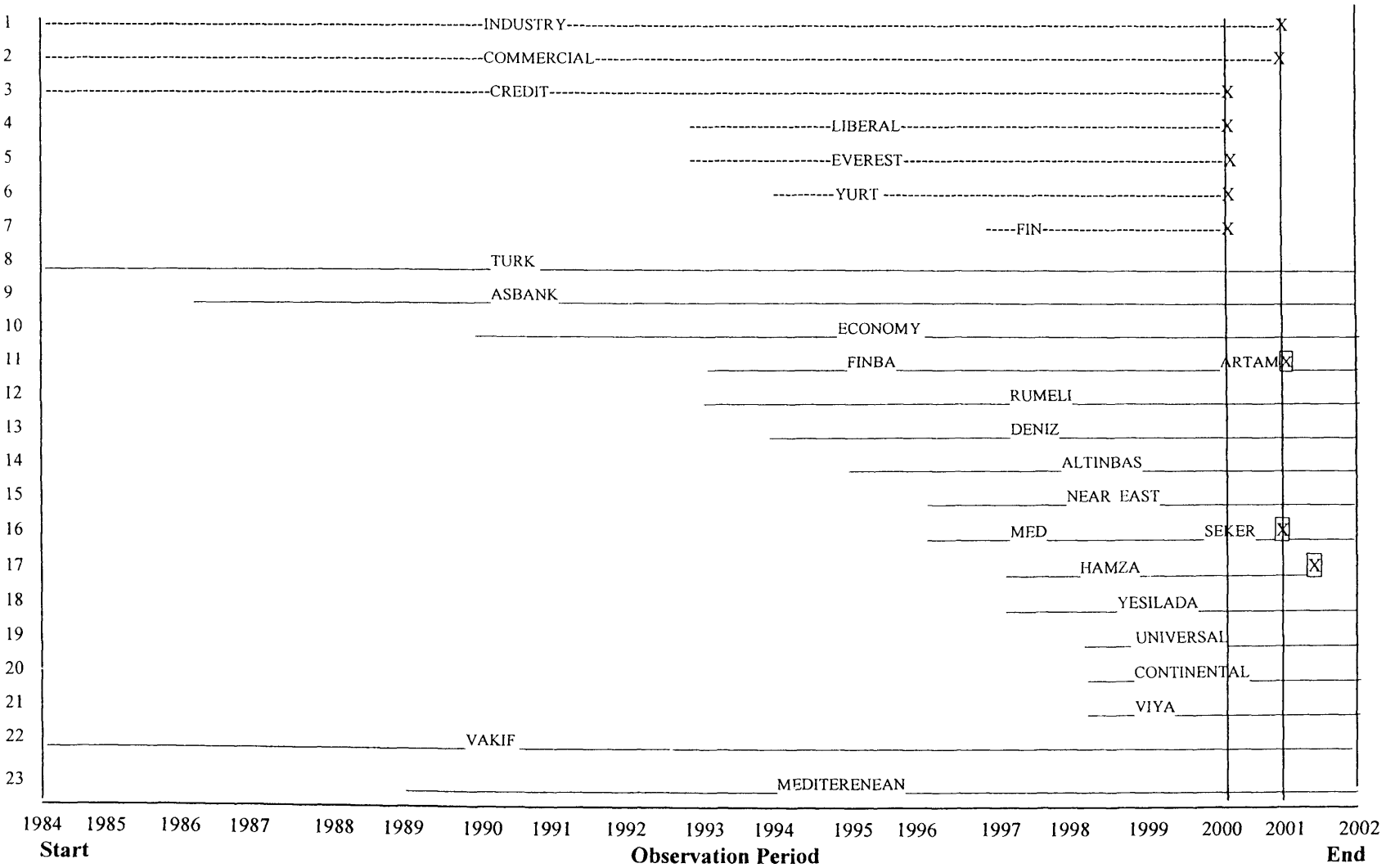
$$Y_{ij} = \begin{cases} 1 & \text{If individual bank i experienced the event in period j} \\ 0 & \text{If individual bank i did not experience the event in period j} \end{cases} \qquad (4.13)$$

If Y_{ij} takes on the value of one in every time period, indicating that individual bank i experienced the event of interest at any time during data collection, i.e. data is uncensored. On the other hand, if Y_{ij} take on the value of zero in every time period, indicating that individual bank i never experienced failure at any time during data collection was ultimately censored.

26 The study deals with right censored observations. Right-censoring occurs when banks in the sample has not experienced the event of failure at the end of the observation period.

Figure 4.3: Survival Time Data

Number of Banks



Note: _____ Denotes censored banks
..... Denotes uncensored Banks

X Represents bankruptcy at point in time
[X] Represents taken over at point in time

In addition to describing each bank by a chain of y values, it is also useful to separately record whether each bank ended by the target event or by censoring. This information is stored in a censoring indicator, c_i.

The values of a censoring indicator, c_i, are defined as:

$$c_i = \begin{cases} 1 : \text{If bank i is censored} & \Rightarrow \quad Y_{ij}=1 \text{ for } j=T_i, \quad Y_{ij}=0 \text{ otherwise} \\ 0 : \text{If bank i is not censored}^{27} & \Rightarrow \quad Y_{ij}=0 \text{ for all j.} \end{cases} \tag{4.14}$$

Let T denote the discrete time interval of the event where T is indexed by using positive integers {1,2,3...J} and Y_{ij} represents the dependent variable, i.e. if a bank's spell ends in year j. Each bank's spell is observed from year one through to the end of the j^{th} year, at which bank i's spell is either complete (c_i = 1), or right censored (c_i = 0) (see Singer and Willett (1993) and Jenkins (2004))

4.5.2.2 Discrete-Time Intervals

The scale of an event can be classified as either continuous or discrete. If the time units are large, such as months, years or decades, it is more appropriate to use discrete time methods[28]. For this reason, as we have an annual data set, the research deals with events measured or occurring in discrete-time or group-time intervals. In these studies, spell lengths are observed in intervals and indexed by using positive integers, such as 1,2,3...etc., and the observations are summarized discretely rather than continuously.

In the research the yearly time data is divided into a number of contiguous disjoint intervals where the interval boundaries are the dates $t_0 = 0, t_1, t_2,...,t_k$.

The time intervals are written as;

$$[0=t_0, t_1), (t_1, t_2], (t_2, t_3],..,(t_{j-1}, t_j=\infty] \tag{4.15}$$

(See Jenkins (2004, 17))

The above time interval assumes that interval $[0, t_1)$ begins at the instant after the date marking the beginning an end of interval t_1. This implies that an event which occur any

27 i.e. observed to have event.
28 See Jenkins (2004).

time until the last day of year one is classified as having happened during the first time interval, and an event occur any time after t_1 up to an including t_2 (the last day of year two) is classified as having happened during the second time internal $(t_1, t_2]$, and the last interval is defined as $(t_{j-1}, t_j]$, which is referred as the j^{th} interval (see Singer and Willett (1993)).

4.5.2.3 Discrete-Time Hazard Function– Logistic Model

The discrete time hazard function h_j is defined as the conditional probability that a randomly selected banks will experience the event during interval j, given no earlier occurrence (see Singer and Willett (1993) and Jenkins (2004)).

$$h_j = Pr\,(T=j \mid T \geq j) \tag{4.16}$$

Where,
T denotes the discrete time interval of the event, which is indexed by using positive integers {1,2,3...J}.

The response variable for a discrete time model is a binary indicator of occurrence of the event $Y_{ij}(t)$. The hazard function is then written as,

$$h_j(t) = Pr\,(Y_j(t) = 1 \mid Y_j(t-1) = 0) \tag{4.17}$$

As Singer and Willett note, "Cox (1972) proposed that, because the h_{ij} are probabilities, they can be reparameterized so that they have a logistic dependence on the predictors and the time periods" (1993, 166). In this thesis, the discrete time model that is utilized for modelling time to event the functional form for h_j is a logistic model.

The discrete time logistic model is then written as,

$$\text{Logit}\,(h_j(t)) = \log\left[\frac{h_j(t)}{1-h_j(t)}\right] = \alpha(t) + \beta X_j(t) \tag{4.18}$$

(see Singer and Willett (1993))

Where,
$X_j(t)$ is time varying covariates
$\alpha(t)$ logit of baseline hazard function (function of time)

Specifically, the equation (4.18) assumes that the predictors are linearly connected to the logistic transformation of hazard.

4.6 Conclusion

This chapter introduced the methodological approach that will be used to estimate bank fragility in North Cyprus. Similar to Gonzalez-Hermosillo et al. (1996), linkages between micro and macro factors are used in modelling banking sector fragility in North Cyprus. (See Table 4.2 for detail on micro and macro data). In order to have a consistency between both micro and macro data, and to prevent results being spurious, first the stationarity property of data is tested by using Dickey-Fuller (1979) test. Second, in order to prevent volatility and large jumps in macro data, the existence of structural break is tested according to Zivot-Andrew (1992). Moreover, following Eichengreen, Rose and Wyplosz (1995, 1996), Market Pressure Index (a measure of speculative pressure on Turkish Lira) is constructed as a weighted average of changes in the exchange rate, changes in the interest rates and changes in the international reserves. Basically, two econometric methodologies, namely a logit model and a discrete-time logistic survival analysis, are used. Logit model is used to estimate the determinants of the likelihood of bank failure, and a discrete-time logistic survival model, is used to estimate the determinants of time to bank failure.

In this sense, using logit model and logistic survival analysis, the thesis advocates a two-stage procedure. In the first stage, in Chapter Five, micro level analysis identifies the determinants of bank failure using bank-specific factors (financial ratios), and in the second stage, the analysis proceeds by combining the factors that are identified in micro analysis with the macro-environment. More specifically, Chapter Six links the likelihood of individual bank problems to a set of bank-specific factors and macro factors, namely macroeconomic characteristics, financial and structural factors and external conditions. Moreover, the Market Pressure Index constructed for Turkey aims to capture the effect of contagion currency crises, which will also help to examine whether external shocks from Turkey play any role in the escalation of 2000-2002 banking distress in North Cyprus. Chapters Five and Six report the empirical results of the logit model and logistic survival analysis.

Chapter 5:

Bank Failure in North Cyprus: An Empirical Examination of Bank-Specific Variables

5.1 Introduction

This chapter is the first stage of the empirical investigation, which links the likelihood of individual banking problems to a set of bank-specific factors in North Cyprus. The attempt is to develop a model of bank failure using financial information obtained from bank balance sheets and income statements. In particular, financial ratios are used to determine the important factors that can significantly explain the changes in the internal conditions of banks. The linkage between bank-specific factors (financial ratios) and bank failure is estimated using two types of empirical models. In the first model a multivariate logit analysis is utilized to estimate the probability of bank failure, and in the second model a discrete time logistic survival model is used to estimate the determinants of the time to bank failure (i.e. bank survival time). After identifying the bank-specific variables to the logit model and the survival analysis, in the next chapter the approach will proceed by combining these bank-level factors with various macro variables that may have exacerbated the internal troubles of the financial institutions.

This chapter is organized as follows: Section 5.2 defines the micro variables (financial ratios that are mainly in the context of CAMELS criteria) employed in the empirical analysis and discusses their expected effect on bank failure. Section 5.3 reports and assesses the empirical results from both a univariate and multivariate perspective. The univariate analysis in Section 5.3.1 tests the correlation between the explanatory variables and the mean values of explanatory variables (i.e. whether variables for failed banks are significantly different from non-failed banks), and looks at the stationary properties of the data. In the same section the survival ratio is also calculated using a procedure called the Kaplan-Meier Product Limit. The multivariate analysis in Section 5.3.2 employs two analyses, the logit analysis and the survival analysis (discrete time logistic model). First, a logit model is employed that permits the main bank-specific determinants of the

likelihood of bank failure, and then a logistic survival model is used to examine the determinants of the time to bank failure in North Cyprus. Finally, Section 5.4 summarizes the main results and contains some brief concluding remarks along with suggestions for how the results might be improved.

5.2 Explanatory Variables (CAMELS Categories)

The micro approach typically uses financial ratios that are in the context of CAMELS criteria and evaluates bank default probability. The weaknesses of banks can be apparent over time from a number of financial ratios that reflect capital inadequacy (C), excessive credit, poor loan quality or poor fund diversification (A), management inefficiency (M), lower income (E), liquidity risk (L) and small asset size (S) as reported by banks. It is theoretically and empirically proved by other studies that each of the above categories has an affect on the probability of bank failure[1]. Hence, the study employs a set of explanatory variables that capture those weaknesses in the North Cyprus banking sector.

The bank-specific variables are drawn from various financial ratios, identified in Chapter Three (see for instance, Tables 3.2, 3.3 and 3.4 for summaries of indicators employed by earlier empirical studies). Based on previous empirical analysis, a number of financial ratios appearing to provide a suitable basis for predicting bank failure in North Cyprus is tabulated in Table 5.1. The same table also displays a description of the selected data and expected effects on both the probability of bank failure and time until failure. In North Cyprus the key financial ratios that are designed to reflect CAMELS components are discussed below.

5.2.1 Capital Adequacy (C)

The first variable is the indicator of capital adequacy, defined as the ratio of total capital equity to total assets (Capital/Asset) and the ratio of total loans to total equity (Loan/Capital).

This ratio of total capital equity to total assets is expected to be negatively related to the probability of failure and positively related to the survival time. The higher this ratio indicates that there is sufficient capital to absorb unexpected shocks (such as unexpected

1 See Chapter Three for detailed information.

customers' defaults on loans), hence the lower the probability that bank will fails and longer survival time[2]. Martin (1977), Avary *et al.* (1984), Heffernan (1996), Langrin (2001), Yilmaz (2003) and Rahman *et al.* (2004) argue that this ratio significantly determines the probability of bank failure, and Lane *et al.* (1986), Whalen (1991), Cole and Gunther (1995), Henebry (1997), Wheelock and Wilson (2000), Langrin (2001) and Molina (2002) find that this ratio significantly determines the time to bank failure.

The second variable of the capital adequacy is the ratio of total loans to total equity capital. The capital equity of a bank can decline as a result of continuous losses. As loans are the riskiest assets, any increase of the value of non-performing loans may lead to a decline in bank capital. Hence, it is expected that an increase in the ratio of total loans to a total equity capital increases the probability of bank failure and shortens the survival time. Lagrin (2001) found that this ratio significantly determined the time to bank failure in Jamaica.

5.2.2 Asset Quality (A)

The quality of assets usually deteriorates because of non-performing loans. To measure the quality of assets the ratio of the total loans to total assets (Loan/Asset) is utilized. Again, growth in bank's riskiest assets may concern banks underestimates of non-performing loans. Hence, a higher leverage may reflect poorer asset quality, and an increase in this ratio is expected to increase the probability of failure and to shorten survival time[3]. Avary *et al.* (1984), Thompson (1991), Borovikova (2000) and Yilmaz (2003) found that this ratio is an important determinant of the likelihood of bank failure. Other studies, such as Whalen (1991), Cole and Gunther (1995), Henebry (1997) and Wheelock and Wilson (2000) found that this ratio significantly determine survival time[4].

2 This ratio is also employed by Altman (1977), Ohlson (1980), Rojas-Suarez (1998), Judijanto and Khmaladze (2003).
3 See also Ohlson (1980), Hooks (1995) and Hwang and Lee (1997).
4 A well functioning financial system is important to efficiently identifying and allocate funds to the most productive and innovative activities. This highlights the importance of leverage (loans) in the banking sector. If banks operate under a good credit and risk management system, an increase in the ratio of total loan to total asset may decrease the probability of failure and increase the survival time.

Table 5.1: Definitions and Expected Signs of the Micro (Bank-Specific) Variables

Variables	Definition	Expected Sign	
		Failure	Survival Time
Capital Adequacy			
Capital/Asset	Total capital as a percentage of total assets	-	+
Loan/Capital	Total loans as a percentage of total capital	+	-
Asset Quality			
Loan/Asset	Total loan as a percentage of total assets	+	-
Management Quality			
Operating Expense/Asset	Operating expense as a percentage of total assets	+	-
Interest Expense/Deposit	Deposit interest expense as a percentage of total deposits	+	-
Earning			
Net Income/Asset	Net income as a percentage of total assets	-	+
Interest Income/Asset	Net-interest income as a percentage of total assets	-	+
Liquidity			
Liquid/Asset	Liquid assets as a percentage of total assets	-/+	-/+
Liquid/Deposit	Liquid assets as a percentage of total deposits	-/+	-/+
Deposit/Loan	Total deposits as a percentage of total loans	-/+	-/+
Asset Size			
Asset Size (1)	Total assets as a percentage of total banking sector assets	-	+
Asset Size (2)	Logarithm of total assets	-	+

5.2.3 Management Quality (M)

As management is a qualitative issue, such as the ability for risk taking, it is usually difficult to measure the quality of management. The ratio of operating expense to total assets (Operating Expense/Asset) and the ratio of interest expense to total deposits

(Interest Expense/Deposit) are used as a measure of the quality of management[5]. Higher costs expected to be positively related with the probability of bank failure and negatively related with survival time. Persons (1999) found that ratio of operating expense to total assets is a significant variable that determines the probability of bank failure, and Molina (2002) argues that the ratio of interest expense to total deposits is a significant variable that determines time to bank failure.

5.2.4 Earning Ability (E)

The ratio of net income to total assets (Net Income/Assets), which is also known as the 'return on assets', and the ratio of net interest income to total assets (Interest Income/Asset) is utilized to measure the earning ability, i.e. the profitability, of banks.[6] It is expected that higher profitability ratios will be negatively related to the probability of failure and positively related to survival time. This implies that the higher these ratios are the lower the probability that the bank will fail and the longer survival time. The results of Martin (1977), Avary *et al.* (1984), Thompson (1991), Persons (1991) and Heffernan (1996) reveal that returns to assets significantly determine the likelihood of bank failure; and Whalen (1991), Cole and Gunther (1995), Wheelock and Wilson (2000), Langrin (2001) and Molina (2002) reveal that a return to asset is an important determinant of time to bank failure.

5.2.5 Liquidity (L)

Higher liquidity may impact on the failure of a bank for two reasons. On the one hand, a high ratio of liquidity may send a positive signal to the depositors that the bank is liquid; hence, higher is the depositors' confidence. However, a lower value of this ratio may signal that a bank is not in a good situation, which may increase the incentive for runs. On the other hand, higher liquidity may also imply the inefficient utilization of resources (i.e. weak financial investment activities), therefore may be associated with a high probability of failure. Liquidity ratios are expected to be both positively and negatively related to the likelihood of failure and to the survival time.

---

5 Molina (2002) states that: "the proxy for aggressive competition through interest rates measures the relative deposits financial expenses, to account for the competition in attracting new customers deposit during the crisis" (Molina (2002, 39)).

6 Ohlson (1980), Tam and Kiang (1992), Barr and Siems (1994), Hwang and Lee (1997) also measured the ability of earning by taking return on asset as an indicator for earning ability.

To measure the overall liquidity risk three ratios are used: the ratio of liquid assets to total assets (Liquid/Assets), the ratio of liquid assets to total deposits (Liquid/Deposits) and the ratio of total deposits to total loans (Deposit/Loan).

A higher ratio of liquid assets (cash and government securities) to total assets implies a greater capacity to discharge liabilities, and is therefore associated with a lower probability of failure and higher survival time. Alternatively, higher liquidity may also imply non-marketability of loans, and therefore may also be related to higher probability of failure and shorter survival time. The second variable that represents liquidity is the ratio of liquid assets to total deposits. A bank with more liquidity can be in a better position to face unexpected deposit runs. Liquidity risk here is the risk that depositors will withdraw a large amount of their deposits and a bank will be unable to have enough liquid assets to cover these withdrawals. When the volume of liquid assets is large enough it allows banks to meet unexpected demand from creditors[7]. The last variable that stands for liquidity risk is the ratio of total deposits to total loans that measure the deposit runs. When information becomes available to the public on the condition of banks, a transfer of funds from fragile banks to more healthy banks may indicate this ratio. Cole and Gunther (1995) and Wheelock and Wilson (2000) found that liquidity (ratio of liquid assets to total assets) is an important determinant of time to bank failure.

5.2.6 Asset Size (S)

The last variable is meant to serve as a proxy for the size of the bank and is measured as the ratio of bank assets to total banking sector asset value (Asset (1)) and natural logarithm of total assets (Asset (2)). Size variable is expected to have a negative influence on the probability of failure and a positive influence on the survival time. That is, as the size of the banks increase it is less likely that they will fail and longer the survival time. Larger banks have the advantage of better access to additional financing, dealing with liquidity problems and diversifying risk. This is probably due to the fact that larger banks benefit from a 'too large to fail' policy and are believed to be more likely to survive than smaller banks. Thompson (1991), Heffernan (1996), Persons (1999), Langrin (2001) and Borovikova (2000) argue that size is an important determinant of bank failure; and Cole

7 Tam and Kiang (1992) used the ratio of liquid assets to total borrowing and deposits to proxy for liquidity.

and Gunther (1995), Gonzalez-Hermosillo *et al.* (1996), Wheelock and Wilson (2000), Langrin (2001) argue that size is a significant determinant of the time to bank failure.

5.3 The Empirical Results

5.3.1 The Univariate Analysis

The logit model tends to select variables based on the strength of the statistical relationship characterized in univariate tests. From this perspective, the cited variables in the univariate analysis are most likely to be prominent in the logit models. This section analysis the correlation between the explanatory variables, the means differences for failed and non-failed banks and the stationary property of data. Further, as a preliminary analysis of survival analysis, a Kaplan Meier Product Limit is estimated.

5.3.1.1 The Correlation Matrix

The potential for multicollinearity arises if there is dependence among variables. For this reason stepwise, forward and backward procedures are used, and appropriate variables are dropped from or added to the model one at a time based on the contribution of variables to the overall fit of the model. The correlation of explanatory variables such as the inclusion of highly correlated variables in a model could result in bias in a significant level of the parameters. For this reason, knowledge of the correlation is useful for the development of the model as some ratios might have a higher correlation between each other. Table 5.2 reports the correlations between bank-specific variables. The table indicates that, in general, the correlation between each variable is quite low, with the only exception being Capital/Asset and Loan/Capital (-0.47), Net Income/Asset and Operating Expense/Asset (-0.73), Liquid/Deposits and Capital/Asset (0.64) and Interest Income/Asset and Net Income/Asset (0.53). Hence, from the above highly correlated variables, only one of the variables should enter into the logistic model.

Table 5.2: Correlation Matrix of the Micro Data (Financial Ratios)

	Capital/ Asset	Loan /Capital	Loan /Asset	Oper Exp /Asset	Intexp /Deposit	Net Income /Asset	Intest Income /Asset	Liquid /Asset	Liquid /Deposit	Deposit /Loan	Asset Size (1)	Asset Size (2)
Capital/Asset	1.00											
Loan/Capital	-0.47	1.00										
Loan/Assets	-0.20	0.24	1.00									
Operating Exp/Asset	-0.41	0.22	0.24	1.00								
Interest Exp/Deposit	0.03	0.14	0.05	-0.36	1.00							
Net Income/Asset	0.36	-0.33	-0.05	-0.73	0.06	1.00						
Interest Income/Asset	0.31	-0.25	-0.05	-0.39	0.14	0.53	1.00					
Liquid/Asset	0.25	-0.32	-0.39	-0.27	-0.11	0.27	0.12	1.00				
Liquid/Deposit	0.64	-0.21	-0.15	-0.44	0.43	0.28	0.36	0.44	1.00			
Deposit/Loan	0.26	-0.17	-0.13	-0.20	-0.13	0.08	0.02	0.43	0.21	1.00		
Asset Size (1)	-0.20	-0.06	-0.14	0.09	-0.08	-0.03	-0.10	0.33	-0.06	0.02	1.00	
Asset Size (2)	-0.39	0.27	0.35	0.21	0.09	-0.18	-0.12	-0.28	-0.14	-0.07	-0.07	1.00

5.3.1.2 Mean-Difference for Each Financial Ratio

Table 5.3 displays the sample means of the financial ratios by differentiating failed banks from surviving banks over the entire sample period. It is possible to observe from the table that in a number of cases some of the variables are significantly different. Denoted by asterisks are the variables that have significant t-statistics (at 5% significance level) for mean differences between failed and non-failed banks in all samples. Altogether 6 out of 12 variables in the table are found to have significantly different means in the original sample sets. The variables that are significantly different for failed and non-failed banks are the ratios in the context of capital adequacy, asset quality and liquidity.

The mean value of the capital adequacy is significantly different for failed banks and non-failed banks. Higher value of the ratio of capital equity to assets for non-failed banks indicates that non-failed banks have more sufficient capital than failed banks, which represents a support to absorb adverse shocks. Furthermore, the ratio of loans to total capital is higher for failed banks that it is for non-failed banks. This implies that on average failed banks show extremely high leverage compared to non-failed banks. The mean value of the asset quality is also significantly different for failed and non-failed banks. The implies that the mean value of the leverage for failed banks appears to be higher than for non-failed banks, which may suggest that intervening banks may have a poorer asset quality (which may lead to high non-performing loans) than non-intervened banks. Lastly, the mean value of the liquidity is significantly different for failed and non-failed banks. The liquidity ratios are higher for non-failed banks, which indicate than non-failed banks have enough liquid to cover large withdrawals, whereas failed banks did not.

5.3.1.3 The Panel Unit Root Test

This section tests the stationary properties of the data and decides whether a trend stationary process or a difference stationary process best reflects the bank specific indicators. The standard Augmented Dickey-Fuller (ADF) test is used in the series. The result of the panel unit root test in which the t-bar test statistic is based on the Dickey-Fuller statistics, averaged across the groups, indicates that all of the micro data (financial ratios) are stationary in level. A clearer view of these findings is presented in Table 5.4. (for more detail see Chapter Four).

Table 5.3: Means Difference for Each Financial Ratio

	Failed Banks		Non-Failed Banks		Difference Significant
Variables	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**(t-Stat)**
Capital Adequacy					
Capital/Asset	0.13	0.14	0.20	0.22	2.65**
Loan/Capital	8.66	7.86	6.68	9.20	-1.67**
Asset Quality					
Loan/Asset	0.56	0.21	0.36	0.21	-4.47**
Management					
Operating Expense/Asset	0.21	0.14	0.14	0.08	0.36
Interest Expense/Deposit	0.24	0.14	0.23	0.39	-0.23
Earning					
Net Income/Asset	0.01	0.05	0.01	0.04	-0.54
Interest Income/Asset	0.07	0.08	0.08	0.11	1.01
Liquidity					
Liquid/Asset	0.38	0.21	0.44	0.23	1.87**
Liquid/Deposit	0.50	0.36	1.17	2.67	2.35**
Deposit/Loan	2.39	3.20	4.47	13.76	1.66**
Size					
Asset Size (1)	0.05	0.07	0.06	0.14	0.93
Asset Size (2)	0.06	0.01	0.06	0.01	0.92

Note: The last column shows the t-statistic for the differences in means at 5% significance level.

Table 5.4: The Panel Unit Root Test Results for Bank-Specific Data

	LEVEL		
p^8=1	Constant	Trend	Stationary
Capital Adequacy			
Capital/Asset	-21.1987**	-4.7369**	Lever
Loan/Capital	0.3313	-14.679**	Level
Asset Quality			
Loan/Asset	-5.2875**	7.1688**	Level
Management Efficiency			
Operating Expense/Asset	-18.0356**	-4.6579**	Level
Interest Expense/Deposit	-18.1895**	-4.3332**	Level
Earning			
Net Income/Asset	-72.6262**	-3.5585**	Level
Interest Income/Asset	-50.2654**	-5.7591**	Level
Liquidity			
Liquid/Assets	-2.42481**	7.1688**	Level
Liquid/Deposit	-13.6233**	7.1688**	Level
Deposit/Loan	-3.5341**	7.1688**	Level
Size			
Asset Size (1)	-3.6694**	-6.6199**	Level
Asset Size (2)	-2.1865**	-3.6402**	Level

Notes:
(1) The critical values of the t-bar$_{NT}$ statistics at 5% significance level are -1.97 and -2.61 (N=15 and T=25) for constant without trend model and constant with trend model, respectively. (Tabulated in Im *et al.* (2002, 17-18)).
(2) ** Denotes rejection of the null of non-stationary at the 5% level of significance.

8 p is the lag length.

5.3.1.4 The Kaplan-Meier Product-Limit

For the purpose of survival analysis, first the Kaplan-Meier Method (1958) was used to estimate the distribution of bank failure duration in North Cyprus over the period 1984-2002. The Kaplan Meier (Product-Limit Estimator) is suitable for univariate survival analysis. This method is especially useful for estimation and graphical survival curves. The Kaplan-Meier method is most suitable in this case as smaller data set is available with precisely measured event times. Results of the estimates of the survival function are tabulated in Table 5.5. In the model, estimates of the standard error of cumulative survival are also computed. The estimated survival probabilities are calculated using a product limit formula obtained from STATA 8 software (see Chapter Four for more detail).

Table 5.5: Kaplan Meier Product-Limit Survival Estimates

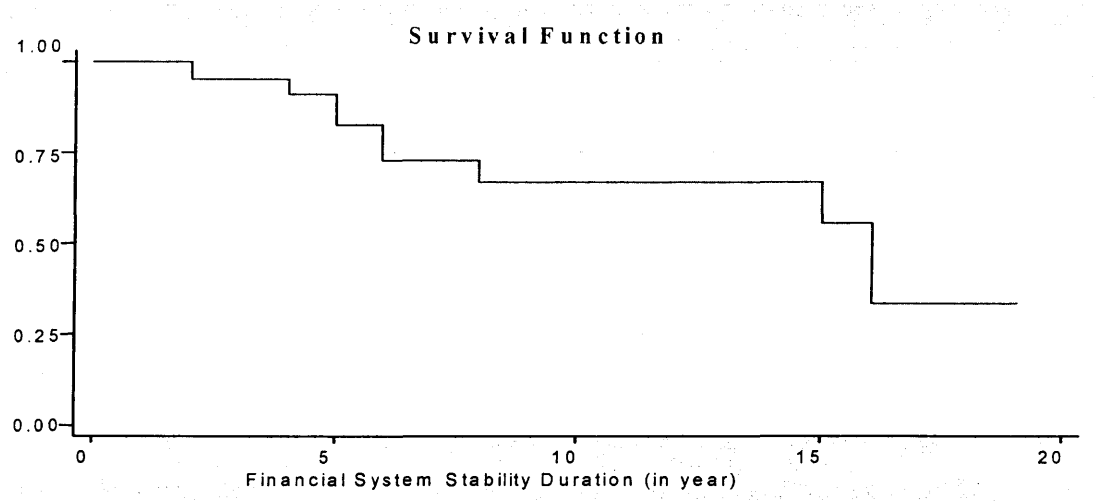
Years	Banks in Total	Total Fails	Net Lost	Survivor Function	Std. Error	(95% Conf. Int.)	
2	23	1	0	0.9565	0.0425	0.7293	0.9938
4	22	1	0	0.9130	0.0588	0.6949	0.9775
5	21	2	2	0.8261	0.0790	0.6006	0.9309
6	17	2	2	0.7289	0.0950	0.4919	0.8685
7	13	0	1	0.7289	0.0950	0.4919	0.8685
8	12	1	1	0.6682	0.1047	0.4215	0.8284
9	10	0	1	0.6682	0.1047	0.4215	0.8284
10	9	0	1	0.6682	0.1047	0.4215	0.8284
13	8	0	1	0.6682	0.1047	0.4215	0.8284
14	7	0	1	0.6682	0.1047	0.4215	0.8284
15	6	1	0	0.5568	0.1340	0.2697	0.7698
16	5	2	0	0.3341	0.1461	0.0911	0.6055
17	3	0	1	0.3341	0.1461	0.0911	0.6055
19	2	0	2	0.3341	0.1461	0.0911	0.6055

In Table 5.5, the second column (Banks in Total) shows the total number of banks at risk of failure at the time shown in the first column. The third column (Total Fails) shows the banks that actually failed at each time. The fourth column (Net Lost) illustrates the number of banks censored, and therefore no longer entering the risk sets. The crucial column is the fifth, labelled survival function, which gives the KM estimates. At 16 years, for example, the KM estimate is 0.33. In other words, the estimated probability that a bank will survive for 16 years or more is 0.33. The failure function can be derived as 1

minus the KM estimate, which is the estimated probability of bank failure prior to the specified time. Furthermore, the table shows the estimates of the standard error of the KM estimate[9] together with estimates of the confidence intervals. For instance, the table indicates that 33% of the sample remained alive after t=16, with a 95 percent confidence interval of 0.091 and 0.605. The estimated standard errors can be used to construct confidence intervals around the KM estimates.

The results of the Kaplan Meier estimator show a common pattern of bank survival and risk of failure. Figures 5.1 and 5.2 illustrate the estimated survival and hazard functions of each duration for bank failure, along with the 95 percent confidence band, respectively. A quick look at the figures reveals that the survival function is decreasing in the time. In figure 5.1, at each failure time, the curve steps down to a lower value. This first appears to have a lower slope until the seventh year, and then remain constant. Then, after fifteenth year the slope tends to decrease slightly. It stops at the highest censoring time (19).

Figure 5.1: Plot of the Survival Function

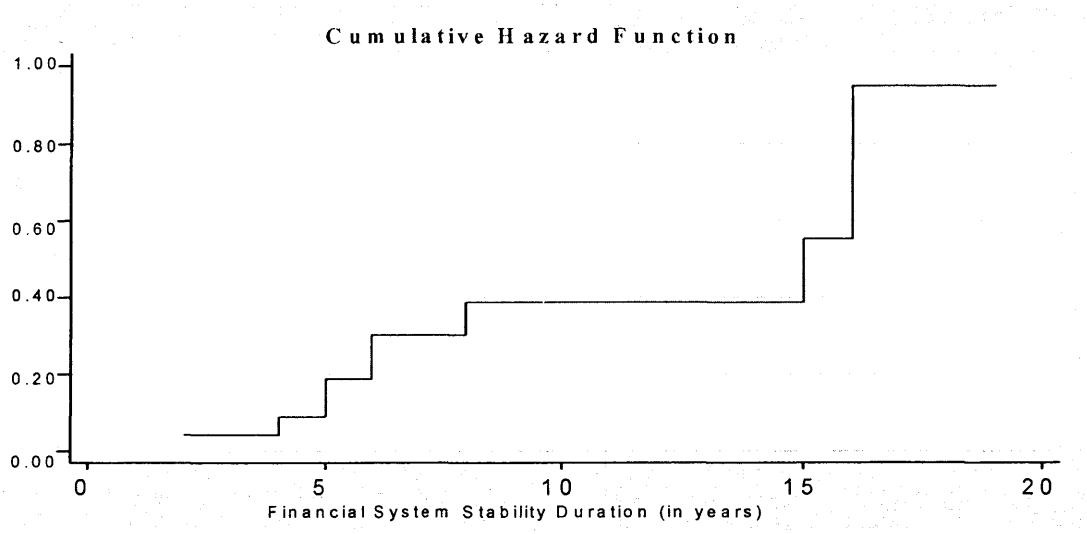


In line with decreasing survival, the hazard (the probability that a bank slips into failure at time t, given that it has been stable until the preceding period) first appears to have an upward slope, and then remains constant. The results from estimation of the hazard function (Kaplan Meier Product Limit Estimator) provide evidence that the probability of failure tends to increase slightly until the seventh year, and then the hazard function is

9 The standard error of the KM estimates can be obtained by Greenwood's formula (Collet 1994, 23).

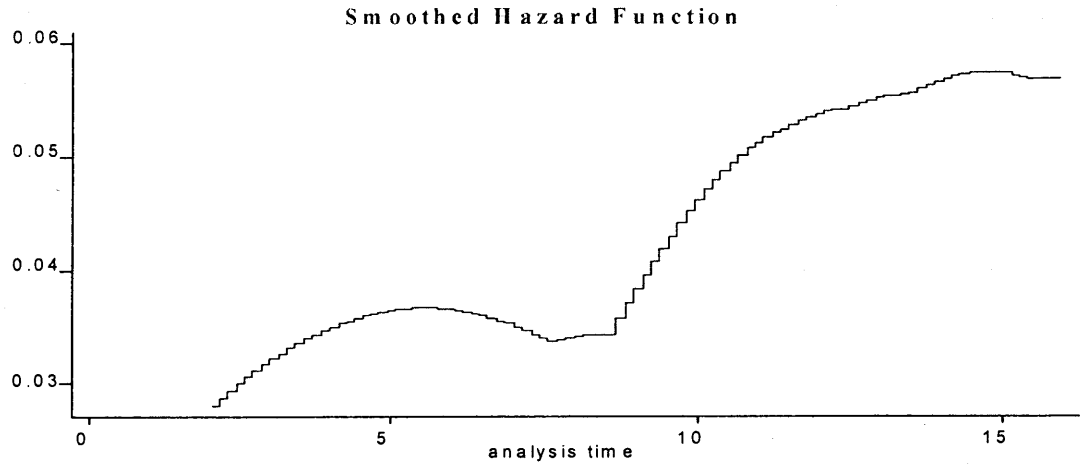
stable. As is illustrated in the table, after 15 years in the Market the risk of failure appears to increase significantly.

Figure 5.2: Plot of the Cumulative Hazard Function



In order to see the step nature of the hazard function, the smoothing method is estimated (see Figure 5.3). The graph of Smooth Hazard Function clearly illustrates that after banks reach their seventh year in the market, most will face a very high risk of sudden failure. It is important to recall that between 1984 and 2002, the banking sector in North Cyprus was exposed to greater competition. The number of private banks expanded rapidly in response to financial market liberalization. In particular, the number of newly established banks increased after 1990 (i.e. after the seventh year in the market). Since the 1990s the role of private banks has increased substantially and led to the expansion of investment in the North Cyprus economy. As noted earlier, as a consequence of an uncontrolled increase in the number of banks, the Central Bank is faced with difficulties in monitoring and controlling the situation of an increasing number of banks heightening risks in the financial system. From the seventh year until the fourteenth year the hazard function was stable. However, after the fifteenth year in the market (i.e. after 1998) increased risk of failure in the financial system led to a crisis situation.

Figure 5.3: Plot of the Smoothed Hazard Function



The Kaplan-Meier approach ignores the variables that the survival function may depend upon. For this reason, in order to deal with the issue of variables that determine the survival times of banks, it is required to run a discrete time logistic survival analysis. Detailed findings for the discrete time logistic survival analysis are presented in section 5.3.2.2.

5.3.2 The Multivariate Analysis

5.3.2.1 The Logit Analysis

Based on the univariate tests, this section provides the results of the multivariate logit regression for the model of bank failure in North Cyprus. All of the variables are stationary in level and the variable selection depends on the fact that there is no high-correlation variable in the models, which ensures the accuracy of the estimated parameters and the significance levels of each variable.

The logit model estimated here assumes random effects[10]. By the likelihood ratio test the restriction $\rho=0$ could not be rejected (see Chapter Four for more detail on the random

10 Even though the random effects model will be biased if the assumption of zero correlation between regressors and the error term is violated, there are important methodological and practical obstacles in using a fixed-effects logit model that uses panel data (Greene, 2000). The reason is that we have a small sample size and for about half of the panels all of the outcomes are either zero or one. The fixed effect logit model drops all of those panels, while the random effect model does not. When the random effect is run the sample size is 223 for the random effect model, but only 101 for the fixed effects model; therefore, it is not possible to use the Hausman Test.

effects logit model). This is taken as evidence of the consistency property of the pooled logit model. The sample was pooled across banks and several regressions were run. However, from the regression only five specifications were worth reporting, based on the significance of the coefficients as measured by t-ratios[11].

Overall, results suggest that bank-specific variables are important determinants of the likelihood of failure. Table 5.6 presents the empirical findings for the estimated multivariate logit models for five alternative specifications, which contains the results of one-year-ahead probability for the direct intervention with banks. The results are obtained from STATA 8 Software. The negative sign coefficient suggests a lower probability of bank failure and vise-versa for the positive sign coefficient. Further, the signs of the estimated coefficients are consistent with the expectations in all cases.

In this thesis, assessment of the quality of model specification is based on three criteria: Pseudo R^2, Model Chi-Square and Akaike's Information Criterion (AIC). Due to sampling limitations (the small sample size) and the need to preserve a degree of freedom, variables are added to or dropped from each model based on their contribution to the overall fit of the model, which is measured by pseudo R^2. Pseudo R^2 is used as a measure of accuracy of the fit, lying between zero and one. Pseudo-R^2 in this model ranges from 19.05% to 42.95%, indicating a moderate degree of explanatory power for the equation. A chi-square likelihood ratio test of the significance of the overall model indicates that all of the specification models are highly significant (Prob > Chi-square: 0.000). The AIC[12] compares the model with different degrees of freedom and eliminates the model specification when irrelevant explanatory variables are added into the regression. A model with a lower value of the AIC is judged to be preferable. A close inspection of table 5.5 indicates that the last specification (fifth specification) has the highest Pseudo R^2 (42.95), lowest chi-square (12.51), and lowest Akaike's Information Criterion (AIC) (31.663). These findings suggest that the final specification is more robust when predicting future bank failure in North Cyprus.

11 A total of 850 regressions were estimated. A forward and backward stepwise procedure was used to permit different financial ratios from the same category to be tested.

12 The use of AIC criterion introduces a statistic that gives a measure of the precision of the estimate and a measure of the parameterisation of the model. According to this criteria a model with the lowest AIC is chosen. The AIC is computed as minus the log likelihood plus the number of estimated parameters of explanatory variables. Then, as is obvious from the model, as the number of variables increases it is less advantageous to the value of the AIC (see Fijisoki and Satoh (1997)).

Table 5.6: Logit Analysis and Determinants of Bank Intervention

Variables	(1)	(2)	(3)	(4)	(5)
Capital Adequacy					
Capital/Asset	_	-0.043*	-0.085*	-0.055*	-0.048*
		(0.025)	(0.044)	(0.030)	(0.025)
Loan/Capital	0.001	_	_	_	_
	(0.001)				
Asset Quality					
Loan/Asset	0.012 ***	0.015***	0.014**	0.023**	0.018***
	(0.004)	(0.005)	(0.006)	(0.010)	(0.006)
Management Efficiency					
Operating Expense/Asset	_	0.97	_	_	_
		(0.625)			
Interest Expense/Deposit	_	_	_	0.027**	_
				(0.013)	
Earning					
Net Income/Asset	_	_	-0.136*	-0.181**	-0.202***
			(0.070)	(0.081)	(0.070)
Interest Income/Asset	-0.065*	_	_	_	_
	(0.036)				
Liquidity					
Liquid/Asset	_	_	0.030	_	_
			(0.031)		
Liquid/Deposit	-0.010	_	_	_	_
	(0.015)				
Deposit/Loan	_	-0.033**	_	-0.049**	-0.038***
		(0.015)		(0.023)	(0.015)
Size					
Asset Size (1)	_	-0.74**	-0.684**	-1.027**	-0.836**
		(0.305)	(0.295)	(0.5201)	(0.347)
Asset Size (2)	-0.611*	_	_	_	_
	(0.358)				
Constant	0.882	0.43	-2.767**	0.062	0.133
	(2.311)	(1.07)	(1.370)	(0.954)	(0.999)
Model Statistics:					
Wald Chi2	38.23***	38.11***	13.44**	18.83***	12.51**
Pseudo R^2	0.1905	0.3903	0.3756	0.3889	0.4295
Log pseudo-lik	-31.40	-28.43	-29.18	-26.601	-26.663
AIC	36.40	33.43	34.18	32.601	31.663

Notes:
(1) ***, **, * indicates significance at the 1, 5 and 10 percent level, respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-5 is the bank probability of intervention model.

The first explanatory variable that is employed in the analysis is the capital adequacy. The ratio of the total capital equity to total assets is widely reported by other studies as a proxy for capital adequacy. Any measure of this ratio should have a negative sign coefficient, which suggests that if this variable increases, the capacity to absorb losses will also increase; hence, the probability of bank failure declines. The results reveal that the coefficient of this variable is correctly signed and it is significant at 10% significance level for specifications (2), (3), (4) and (5). This result is consistent with Martin (1977), Avary *et al.* (1984), Heffernan (1996) and Yilmaz (2003). On the other hand, the evidence of Langrin (2001) in the Jamaican banking sector and Rahman *et al.* (2004) in Asian banks (in Indonesia, South Korea and Thailand) demonstrates that an increase in this ratio significantly increases the probability of failure. The results appear to be contrary to the expectations in the literature. Langrin (2001) explains this as a moral hazard problem that may be the consequence of the joining of large banks with financial conglomerates.

In the specification (1), instead of the ratio of the total equity capital to total assets, the ratio of the loans to total capital is employed as the proxy of capital adequacy. As noted in the literature, this ratio is correctly signed (positively related with the probability of failure); however, it seems to have no significant power. This implies that the level of capital does not seem to have been affected by the deterioration in quality of bank loan portfolios. This result is consistent with Espahbodi (1991), Persons (1999) and Langrin (2001).

The second variable measures the asset quality and it is generally associated with the leverage volume. The credit risk (portfolio risk) seems to be positively related to the probability of failure. A higher ratio may reflect poor loan quality and higher probability of failure. The reason for taking this variable is that loans are believed to be more risky than securities and cash assets that banks hold. As is illustrated in the table, for specifications (1), (2) and (5) the results indicate significance at 1%, and for specification (3) and (4) the results indicate significance at 5%. These results agree with those obtained by Avary *et al.* (1984), Thompson (1991) and Borovikova (2000). Contrary to other empirical findings which suggest that the higher the ratio of loans to total assets the more likely a bank is to fail, Yilmaz (2003) found evidence that this ratio is negatively related to the probability of failure in Turkey. He argues that "moving away from extending

credit to the private sector and financing high yield government bonds does not protect banks from failing in Turkey" (Yilmaz (2003, 104)).

The ratio of operating expense to total assets is used as a measure for quality of management. Higher costs show lower management quality; therefore, this ratio is expected to be positively related to the probability of bank failure. For specification (2) this ratio appears to be correctly signed but statistically insignificant. This result is consistent with Gonzalez-Hermosillo *et al.* (1996) and Borovikova (2000).

Furthermore, the ratio of interest expense to total deposits represents an aggressive competition through interest rates and it accounts for the competition in attracting new customer deposits during bank distress periods. As expected, the findings show that this ratio is positive and statistically significant at 5%. This suggests that an increase in interest expense increases the probability of failure in North Cyprus.

The fourth ratio of net income to total assets measures the earnings. This ratio is negatively related to bank failure, which means that by holding all other variables constant, an increase in the ratio of net income to total assets can be expected to decrease the probability of failure. This variable is correctly signed and statistically significant for specifications (3), (4), (5) at 10%, 5% and 1% significance levels respectively. Martin (1977), Avary *et al.* (1984), Thompson (1991), Heffernan (1996) and Persons (1999) also concluded that the ratio of net income to total assets is negatively related to the probability of failure. Some studies also undertake the ratio of net interest income to total assets as a measure of profitability. Specification (1) illustrates that this ratio is correctly signed and statistically significant at 10 % significance level.

A fifth type of risk is the liquidity risk, which arises because a bank issues short-term liquid liabilities to fund longer-term loans that are less liquid. The ratio of total deposits to total loans appears to be significant for specifications (2), (4) and (5) at 5% significance level. This variable is negatively related to the probability of failure. This suggests that higher liquidity indicates a high capacity to fulfill liabilities, and it is therefore associated with a lower probability of failure.

Finally, two measures of bank size were tested. These were the logarithm of total asset and the ratio of total assets of banks to total banking sector assets. These ratios have a

negative sign of the coefficients, which means that larger banks experienced a lower probability of intervention when compared to smaller banks. This result is consistent with the expectation in the literature. In general, the influence of a "too big to fail" policy is cited as the reason to expect larger banks with a lower probability of intervention. With respect to the significance level of the estimated coefficients, the ratio of total assets to total banking sector assets is appears to be statistically significant at a 5% significance level for specification (2), (3), (4) and (5). Another measure of size variable (natural logarithm of total assets), illustrated in specification (1), appears to be correctly signed and statistically significant at a 10% significance level. This result is also confirmed by Thompson (1991), Heffernan (1996), Persons (1999), Borovikova (2000) and Langrin (2001).

5.3.2.2 The Survival Analysis - Discrete-Time Logistic Model

The aim of this section is to analyse the survival patterns for domestic banks in North Cyprus over the period 1984-2002. The greatest advantage of the survival model in financial distress application is its ability to provide information regarding the expected time to failure. A number of studies on survival analysis predict the time to bank failure using a continuous time methods. For instance, Lane *et al.* (1986), Whalen (1991), Henebry (1997), Wheelock and Wilson (1995) and Molina (2002) used a cox proportional hazards (CPH) model, Gonzalez-Hermosillo *et al.* (1996) and Borovikova (2000) used a log-logistic model and Langrin (2001) used a Weibull model to predict the time to bank failure. However, these studies suffer from potentially severe shortcomings. In particular, the time units are large in those studies, such as months, quarters or years, and therefore it is more appropriate to use discrete time methods[13].

For this reason, to study the determinants of the duration of bank failure a discrete time logistic model is utilized in the present study. To the best of the author's knowledge Cole and Gunther (1995)[14] is the only study that utilises the logit survival model to predict the determinants of survival time of FDIC-insured commercial banks. Table 5.7 presents the empirical results from the estimation of the determinants of the survival time until failure, for a one-period ahead bank intervention. The findings reveal that specifications (1) and

13 Jenkins (2004).

14 In addition to the standard logistic model, Cole and Gunther (1995) employed split-population log-logistic distribution and a CPH model. The author argues that the results obtained from the standard logistic regression model and split-population model are very similar.

(2) appear to be the best models to explain the bank-specific determinants of time to bank failure.

Overall, results suggest that bank-specific variables are important determinants of the time to failure. Again, the quality of the model specification is assessed based on three criteria: Pseudo R^2, Model Chi-Square and Akaike's Information Criterion (AIC).

The selected variables are added to or dropped from each model depending upon their contribution to the overall fit of the model, which is measured by pseudo R^2. The Pseudo R^2 in the model ranges from 44.43% to 53.60%. A chi-square likelihood ratio test of the significance of the overall model indicates that all of the specification models are highly significant (Prob > Chi-square: 0.000). The AIC compares models with different degrees of freedom and eliminates the model specification when irrelevant explanatory variables are added into the regression. Also, a close inspection of table 5.7 indicates that the second specification has the highest Pseudo R^2 (53.60%) and lowest value of Akaike's Information Criterion (AIC) (24.94), judged to be preferable for predicting future time to failure in North Cyprus.

The key result from the bank intervention equation concerns banks that have a higher capital to assets ratio, which are expected to survive longer. However, in specification (2) this ratio is insignificant, which suggests that capitalization is not associated with the time to failure in North Cyprus. The findings of Borovikova (2000) and Gonzalez-Hermosillo *et al.* (1996) also show that there is no relationship between the ratio of capital to assets and time to bank failure. Another variable that measures capitalization is the ratio of loans to total capital, which is also insignificant. Lane *et al.* (1986) also find that this variable is not associated with bank failure in the USA.

The findings reveal that the ratio of loans to assets is negative and significant at a 1% significance level, which is consistently significant for all specifications. The negative coefficient suggests that credit risk reduces the expected survival time until intervention. These findings are also confirmed by Whalen (1991), Cole and Gunther (1995), Henebry (1997) and Wheelock and Wilson (2000).

Table 5.7: The Logit Method and Determinants of Time to Failure

Variables	(1)	(2)
Capital Adequacy		
Capital/Asset	_	0.097
		(0.06)
Loan/Capital	0.001	_
	(0.001)	
Asset Quality		
Loan/Asset	-0.026***	-0.036***
	(0.007)	(0.012)
Earning		
Net Income/Asset	0.082	0.116
	(0.075)	(0.092)
Liquidity		
Liquid/Asset	_	0.060**
		(0.029)
Deposit/Loan	0.001	_
	(0.001)	
Size		
Asset Size (1)	0.039	0.028
	(0.139)	(0.414)
Time		
Time	-0.029**	-0.043**
	(0.012)	(0.021)
Constant	-3.776	_
	(0.706)	
Model Satatistics:		
Log-likelihood	22.68	-18.94
LR Chi 2	36.27***	43.76***
Pseudo-R^2	44.43	53.60
AIC	27.68	24.94

Notes:
(1) ***, **, * indicates significance of the hazard ratio at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logistic survival model.
(3) Specification from 1-2 is the bank survival time until intervention model.

It is expected that the higher the profitability ratio is (ratio of net income to total assets), the longer the survival time. This is because high profitability enables banks to increase capital and to improve economic capability. However, in North Cyprus profitability appears to have no impact on survival time. Lane *et al.* (1986) and Henebry (1997) also found no relationship with profitability and time to failure. This result in the North Cyprus banking sector seems to suggest that net income figures on balance sheets may not reflect the correct figures. As discussed in an earlier chapter, in order to reflect healthier balance

sheets, insolvent banks were hiding the extent of their difficulties by providing less provision for non-performing loans (see Chapter Two for more detail).

A high volume of liquid assets allow a bank to meet unexpected deposit withdraws, which may suggest a longer survival time until intervention. The results in this study reveal that the ratio of the liquid to total assets is a positive sign coefficient and statistically significant at the 5% level. This result is in line with the statistics of Cole and Gunther (1995) and Wheelock and Wilson (2000).

Lastly, the findings indicate that the size variable has no influence on survival time. Borovikova (2000) and Molina (2002) also found no evidence that size has an impact upon survival time.

5.4 Conclusions

This chapter uses a micro approach to explain the likelihood and timing of bank failure. In particular, a model structure is explored by questioning the direct connections between financial ratios and the particular outcomes of bank distress.

According to the findings of the multivariate logit model, capital adequacy (ratio of total equity capital to total assets), asset quality (ratio of loans to total assets), management quality (ratio of deposit financial expense to total deposits), profitability (ratio of net income to total assets and ratio of net interest income to total assets), liquidity (ratio of total deposits to total loans) and the size variable (natural logarithm of total assets and ratio of total sectoral assets to total bank assets) are significant variables that determine the likelihood of bank failure in North Cyprus.

With regard to the survival analysis, in the first case the graphical estimation of the Kaplan Meier Method was used for the distribution of bank failure duration. Results suggest that until 1990 the risk of failure was low. However, as a consequence of an increase in the number of banks, the risk of failure in the banking system has increased. Hence, when the studied banks reached fifteenth year in the market (i.e. after 1998), most of them faced a very high risk of sudden failure. Then, in the second case, a multivariate discrete time logistic model was employed to find the underlying determinants of the duration of bank failure. The findings suggest that variables, namely asset quality (ratio of

loans to total assets) and liquidity (ratio of liquid asset to total assets) are two important factors that determine the time to failure in the North Cyprus banking sector.

In general, the empirical findings in this chapter suggest that bank-specific variables play a significant role in explaining the probability and the time to bank failure. Unlike Canbas *et al.* (2004), who claim that CAMEL criteria do not represent the specific financial characteristics of the Turkish commercial banks, the results in this thesis emphasise that CAMELS components are significant in forecasting bank distress in North Cyprus.

However, as the North Cyprus economy is influenced by a highly volatile macro environment dependence on a set of bank-specific variables as a sole explanation might be misleading. This raised the question of whether these microeconomic factors are sufficient to explain a bank's financial situation or failure results from factors in the wider financial and economic environment. In an attempt to improve the model of bank failure, the next empirical chapter also examines the influence of macro factors.

This chapter has been useful for determining the best micro models of the probability of bank failure (specification 5) and the best micro model of time to bank failure (specification 2) that are taken as the basis for Chapter Six. The identified five variables that are reported in the fifth specification of the logit model are categorized as capital adequacy (the total equity capital as a percentage of total assets), asset quality (the loan as a percentage of total assets), earning (the net income as a percentage of total assets), liquidity (the total deposits as a percentage of total loans) and asset size (1) (the total assets as a percentage of total sectoral assets). Another five variables reported in the second specification of the survival analysis are categorized as capital adequacy, asset quality, earning, liquidity (liquid assets as a percentage of total assets) and asset size (1). In the next empirical chapter, in addition to bank-specific variables that are determined in this chapter, the impact of macroeconomic characteristics, financial and structural variables, external shocks and contagion effect from Turkey are also assessed in the model of bank failure.

Chapter 6:

Banking Sector Fragility in North Cyprus: An Empirical Examination of the Role of Micro and Macro Factors

---

6.1 Introduction

The previous empirical chapter is the starting point of the analysis that links the likelihood of individual banking problems to a set of bank-specific factors. In this chapter, in addition to those microeconomic determinants, an empirical model is developed that also links banking sector distress to macroeconomic characteristics, financial and structural factors and external conditions. In addition to the above factors, the Market Pressure Index (discussed in Chapter Four) aims to capture the contagion effect from Turkey, which will help to examine whether external shocks from Turkey played any role in the escalation of the 2000-2002 banking distress in North Cyprus.

An overview of several observable characteristics of the economy indicate that for several years before the banking sector distress, economic fundamentals in North Cyprus started showing signs of weaknesses (see Chapter Two for more detailed information). The discussion on the macroeconomic variables in line with the theory and literature review (see leading indicators in Chapter Three) suggests that macroeconomic factors such as lower GDP growth, high real interest rates and high inflation, the Government's budget, weaknesses in the financial system such as liquidity, growth rate of real domestic credit, increase in credit extended to the private and public sectors, structural characteristics such as financial liberalization, weak regulatory and supervisory frameworks and explicit or implicit deposit insurance schemes, and external exogenous disturbances such as the depreciation of the real exchange rate, deterioration in the terms of trade and contagion effects from Turkey can be considered important indicators that may be associated with the onset of banking sector distress in North Cyprus.

The remainder of the chapter is organised as follows: Section 6.2 describes in detail the macro data employed in the empirical analysis and discusses their expected effects on

banking fragility. Section 6.3 examines the empirical results obtained by use of univariate and multivatiate statistical techniques. Section 6.3.1 presents the results of the unit-root test and correlation analysis for the variables employed in the analysis. Section 6.3.2 reports findings of the multivariate logit model and logistic survival analysis and also provides a detailed discussion of the main determinants of the probability of failure and time until failure in the North Cyprus banking sector. Section 6.4 presents the findings of the predicted values of bank failure obtained from both Chapters Five and Six. The same section discusses the predictions for risky banks in North Cyprus. Finally, Section 6.5 is the conclusion.

6.2 Explanatory Variables

A number of macro factors are considered by theory as good indicators of banking fragility. In addition to the selected microeconomic (bank-specific) variables that are identified and discussed in the previous chapter (namely capital adequacy, asset quality, earning, liquidity and asset size), and five sets of macro variables, namely macroeconomic variables, financial and structural variables, external conditions, as well as potential contagion effect from Turkey are also included in the model[1]. Descriptions and expected signs of macro variables are illustrated in Table 6.1. [2] For more detailed information on explanatory variables employed in earlier studies see Tables 3.1, 3.2, 3.3 and 3.4 in Chapter Three.

6.2.1 Macroeconomic Environment

To capture macroeconomic characteristics the real GDP growth, the inflation rate, the real interest rates and the ratio of budget balance to GDP are considered. It is expected that low GDP growth, high inflation, high real interest rate and high budget deficit will increase the probability of bank failure and reduce the expected survival time of a bank.

1 See Gonzalez-Hermosillo *et al.* (1996), Heffernan (1996), Gonzalez-Hermosillo (1999), Brovikova (2000), Langrin (2001) and Yilmaz (2003) for other empirical studies that combined micro and macro data in the bank failure model.

2 The model attempts to control the influence of current and lagged financial and macroeconomic variables. In the study some of the time varying macro variables, such as the growth rate of real domestic credit, the ratio of private credit to GDP and the ratio of public credit to GDP, the ratio of M2 to foreign exchange reserves and the real interest are expected to have a lagged effect. Hence, in order to minimize the simultaneity problem, these variables are lagged for one whole year (See also Domac and Peria (2003) and Demirguc-Kunt and Detragiache (2000)).

6.2.1.1 The Growth Rate of GDP

Economic analysts argue that banking crises are commonly preceded by a significant contraction in real GDP growth. An increase in real GDP growth rate is negatively related to the probability of failure and positively related to the survival time. Other researchers, such as Hardy and Pazarbasioglu (1998), Huchison and McDill (1999), Demirguc-Kunt and Detragiache (1998, 2000), Brovikova (2000), Hutchison (2002) and Yilmaz (2003) found that GDP growth is an important determinant of banking sector distress. In line with existing literature, the growth rate of the GDP is taken as an indicator of the banking sector problems in North Cyprus.

Table 6.1: Definition and Expected Signs of Macro Variables

Variable Name	Definition	Expected Sign	
		Failure	Survival Time
Bank-Specific Variables:			
Capital/Asset	Total capital as a percentage of total assets	-	+
Loan/Asset	Total loans as a percentage of total assets	+	-
Net Income/Asset	Net income as a percentage of total assets	-	+
Deposit/Loan	Total deposit as a percentage of total loans	- / +	- / +
Liquid/Asset	Total liquid assets as a percentage of total assets	- / +	- / +
Asset Size (1)	Total sectoral asset as a percentage of total assets	-	+
Macroeconomic Variables:			
GDP	The growth rate of real GDP	-	+
Inflation (INF)	The inflation rate	+	-
Real Interest Rate (RIR)	The real interest rates	+	-
Budget Deficit	The ratio of Budget Deficit to GDP	+	-
Financial Variables:			
M2/Reserves	The ratio of M2 to foreign exchange reserves	+	-
Liquidity	The ratio of cash held by banks to total bank assets	-	+
Credit Growth	The growth of real domestic credit	±	-
Private Credit	The ratio of Private domestic credit to GDP	+	-
Public Credit	The ratio of the Public Credit to GDP	+	-
Financial Structure[1]:			
Liberalization	Financial Liberalization	+	-
Deposit Insurance	Deposit Insurance	- / +	- / +
Weak Regulation	Weaknesses in Regulation and Supervision	+	-
Exchange Rate Regime	Dummy for Pegged Exchange Regime	- / +	- / +
External Conditions:			
Real Exchange Rate (RER)	The real exchange rate	+	-
Terms of Trade (TT)	The Terms of Trade Change[2]	-	+
Market Pressure	The Market Pressure Index in Turkey	+	-

Notes

(1) Dummy variable used for existence of explicit or implicit deposit insurance, financial liberalization and weakness in regulation and supervision

(2) Change in the price of export over import

6.2.1.2 The Inflation Rate

High inflation tends to be associated with an increased probability of banking sector distress and decreases the banks' survival times. It has long been recognised that sudden changes in inflation can have a negative impact on interest rates and deterioration of bank capital (expansion in non-performing loans) and collateral values[3], and also weaken bank balance sheets. In particular, in a period of high inflation it is difficult to predict real profits and banks find it more difficult to assess credit quality. Heffernan (1996), Demirguc-Kunt *et al.* (1998, 2000), Hardy *et al.* (1998), Domac and Martinez-Peria (2003) and Hutchison (2002) found that inflation rate significantly determines banking crises.[4]

6.2.1.3 The Real Interest Rates

An increase in real interest rates is likely to raise the probability of banking sector distress. Bernante and Gertler (1995) state that an unanticipated rise in interest rates can lead to substantial harm to the balance sheets of firms due to the fact that decreases in their cash flows result from the higher interest payments of firms. Real interest rates would signal an impending liquidity problem in the financial system that would indicate deterioration in commercial bank loan portfolios and is also potentially to result in a slowdown in the rate of economic growth. In such an environment banks are faced with increasing financial and credit risks. Hence, in such a circumstances it is expected that an increase in interest rates would serve to increase the probability of failure and decrease survival time. The results of Heffernan (1996), Hardy and Pazarbasioglu (1998), Demirguc-Kunt *et al.* (1998, 2000) and Yilmaz (2003) indicate that real interest rate significantly determines the probability of banking crises. Moreover, the results of Gonzalez-Hermosillo *et al.* (1996) and Borovkova (2000) show that interest rate is an important determinant of time to bank failure.

3 Banks can hedge against inflation pressure by lending rate indexation, and investing in assets such as foreign exchange.

4 Glick and Rose (1999), Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001), Mendis (2001) and Glick and Hutchison (2001) are also employed this variable.

6.2.1.4 The Ratio of Budget Deficit to GDP

The ratio of the budget balance of the Government to GDP captures the financing needs of the central Government. An increase in the ratio of the budget deficit to GDP is expected to increase the probability of bank failure and decrease survival time. In other words, if the Government is in a strong financial position, it is more likely that it can quickly take precautions to recapitalize problem banks and avoid a crisis situation. It is expected that an increase in the ratio of budget deficit to GDP increases the probability of failure and shortens the survival time.

6.2.2 Financial Characteristics

In terms of financial characteristics, the ratio of M2 to foreign exchange reserves, the ratio of cash held by banks to bank assets, the growth of real domestic credit, the ratio of the public credit to GDP and the ratio of private domestic credit to GDP are considered as important candidate variables that may have an effect on the North Cyprus banking sector distress.

6.2.2.1 The ratio of M2 to Foreign Exchange Reserves

A number of studies argue that a government usually loses substantial reserves prior to a currency crisis. The ratio of broad money to foreign exchange reserves captures the risks that banks face associated with currency crises[5]. A sharp increase in the ratio of money supply and a low level of reserves are capable of triggering a currency crisis. Thus, it is expected that the ratio of M2 to foreign exchange reserves is positively related to the likelihood of a bank failure and negatively related to bank survival time. Langrin (2001) argues that the extent of bank run will depend on the actual amount of liquid monetary assets that depositors can potentially withdraw from the banking system. It is expected that this ratio increases the likelihood of failure and decreases the survival time. Demirguc-Kunt *et al.* (1998), Eichengreen *et al.* (2000) and Domac *et al.* (2003) found that the ratio of M2/reserves is a significant variable that determines the probability of banking crises[6].

5 The variables of the ratio of M2 to foreign exchange reserves are lagged one year, because a number of studies suggest that the money supply takes 9 or 18 months to take effect. For example, King and Plosser (1989) found the impact of unanticipated money to peak with a lag of 3 or 4 quarters.

6 See also Edward (1989) and Bordo, Eichengren, Klingebiel and Martinez-Peria (2001).

6.2.2.2 The Ratio of Cash Held by Banks to Total Assets

In order to examine a bank's liquidity, the ratio of cash held by the bank to total banking sector assets is employed. This ratio mainly reflects the ability of banks to deal with potential runs on their deposits (i.e. the ability to provide liquidity support to banks) and is expected to be negatively related to the probability of failure and positively related to survival time. The results of Demirguc-Kunt *et al.* (1998a) reveal that liquidity significantly decreases the probability of failure.

6.2.2.3 The Growth of Real Domestic Credit

Most of the studies found that the rapid growth of domestic credit to the real sector makes the banking sector increasingly vulnerable to destabilizing shocks, and thus increases the probability of failure and shortens the survival time. Hardy and Pazarbasioglu (1998), Hutchison and McDill (1999), Eichengreen and Arteta (2000) and Damac *et al.* (2003) have argued that banking crises are associated with the growth rate of the real domestic credit (i.e. lending booms)[7]. Similarly, Demirguc-Kunt *et al.* (1998 and 2000) found that growth rate of credit in the past increased the probability of crises. As is widely acknowledged, an increase in the amount of domestic credit leads to financial vulnerability by contributing to an endogenous decline in the quality of bank assets.

6.2.2.4 The Ratio Domestic Credit to Private Sector to GDP

An increase in credit extended to the private sector reflects a rise in the risky credit, particularly following financial liberalization. For this reason an increase in the private credit is expected to be positively related to the probability of failure and negatively related to survival time. The findings of Demirguc-Kunt *et al.* (1998a) show that this ratio is an important determinant of banking crises[8].

6.2.2.5 The Ratio of Domestic Credit to Public to GDP

An increase in public credit to the Central Bank of TRNC is expected to increase the probability of failure and decrease the survival time. Erdogan Kucuk (2002) noted that unlimited credit to the public sector might trigger banking sector distress in North

7 See also Gavin and Hausman (1996).

8 Munoz (2000) also found that a lag of credit to the private sector is an important indicator of banking crises.

Cyprus.[9] The North Cyprus Government has substantial fiscal deficits that are financed by the Central Bank. This suggests that the Government had limited reserves to rescue the banks in North Cyprus during the period of bank distress. Burnside, Eichenbaum and Rebelo (1998) reveal that there is a relationship between a boom in the credit to the Government sector and banking crises.

6.2.3 Financial Structure

In general, financial weaknesses in the banking sector arise during rapid financial liberalization, weak supervision and regulatory policies and greater market competition, when banks are taking high risks on both the asset and liability sides of balance sheets[10]. To capture structural factors, dummy variables are used for financial liberalization, weak supervision and regulatory policy, explicit/implicit deposit insurance and the real exchange rate regime in Turkey.

6.2.3.1 The Financial Liberalization

Weaknesses in the financial sector often arise as a result of rapid financial liberalization. It is expected that financial liberalization is moral hazard associated. Hence, it increases the probability of banking sector distress and decreases the survival time.[11]

In the existing literature, a number of studies of banking crises proxy the financial liberalization by the removal of interest rate controls, exchange rate controls, the growth rate of credit or an increase in credit extended to the private sector.[12] To capture this effect financial liberalization is defined as giving a value of one during policy change to financial liberalization, and zero otherwise.

Following the studies of Demirguc-Kunt *et al.* (1998b) and Hutchison *et al.* (1999), Eichengreen *et al.* (2000) and Hutchison (2002), it appears that financial liberalization period is proxy by the removal of interest rate controls. These authors state that financial liberalization significantly increases the fragility of the financial system.[13] Moreover, the

9 Central Bank of TRNC (2002).

10 See Hutchison and McDill (1999).

11 Domac *et al.* (2003) argue that high real interest rates increase the likelihood of banking sector distress as a result of adverse selection problem. To capture this effect of real interest rate, a dummy variable is used for financial liberalization.

12 Demirguc-Kunt and Detragiache (1998) point out that "removal of interest rate ceilings or reduction to barriers to entry reduces banks franchise values thus exacerbate moral hazard problems" (Demirguc-Kunt and Detragiache (1998, 22)).

13 See also Sundararjan and Balino (1991), Drees and Pazarbasioglu (1995), Caprio and Klingebiel (1996) and Lindergreen, Garcia and Saal (1996).

results of Langrin (2001) indicate that financial liberalization is an important determinant of the time to bank failure.

6.2.3.2 Explicit/Implicit Deposit Insurance

The model also considers the factors of the role of explicit and implicit deposit insurance in affecting the behaviour of depositors. The deposit insurance policy can have both positive and negative effects on the probability of banking sector distress. On the one hand, the presence of explicit or implicit deposit insurance serves as a 'safety net' and prevents the incentive of depositors to run on a bank. On the other hand, the presence of this safety net can raise credit risk by weakening market discipline and encouraging excessive risk taking, consequently increasing instability in the banking sector[14]. Hence, though moral hazard and adverse selection the presence of deposit insurance can worsen the positions of banks[15]. Demirguc-Kunt *et al.* (1998), Hutchison *et al.* (1999) and Eichengreen *et al.* (2000) and Yilmaz (2003) found that deposit insurance is an important factor that has an effect on the probability of banking crises.

Between 1984 and 2002, three different deposit insurance policies was implemented in North Cyprus. Before 1994, the explicit limited coverage scheme was covering up to £7000. As a consequence of the 1994 banking distress year, in addition, the Government announced implicit deposit insurance or implicit discretionary guarantee, i.e. discretionary protection provided by the Government in case of failure. In 1994, two banks experienced financial difficulties. Under discretionary coverage, depositors expected that either the Government would protect the banks from insolvency or compensate them for their losses in the event of bank failure. Between 1994 and 2000 the decision of government to implement the implicit discretionary guarantee increased the moral hazard. From this perspective, the implicit deposit insurance policy of the Government was expected to increase the likelihood of failure and shorten the survival time.

On the contrary, during the banking distress of 2000-2002, to prevent the adverse effects of a bank-run from spilling over from a few banks to the whole financial system, the Government provided a full coverage deposit insurance scheme (full explicit coverage was providing full coverage for all deposits). The idea of this explicit deposit insurance

14 Benston *et al.* (1986), Kane (1986), Kaufman (1994) and Demirguc-Kunt and Detragiache (2002) argue that deposit insurance increases financial stability.

15 Yilmaz (2003) pointed out that moral hazard occurs when "protection negatively changes the behaviour of depositors, shareholders and managers so that they engage in practices that run counter to bank soundness, hence banks face less pressure to avoid excessive risk taking" (see Yilmaz (2003, 46)).

policy was to increase confidence in the banking sector and prevent the banking system from bank runs and financial panics. During these periods the Government provided full protection to insolvent banks and compensated their losses. From this point of view, it is expected that explicit deposit insurance decreased the probability of failure and increased the survival time.

6.2.3.3 Weak Supervision and Regulation Policy

An inadequate supervision and regulation, in particular, generates a serious moral hazard problem for bank managers and shareholders, so that banks face less pressure to avoid excessive risk-taking. Thus, weak supervision and regulation is expected to increase the probability of bank failure and shorten the survival time. The empirical results of Demirguc-Kunt *et al.* (1998a) and Hutchison (2002) conclude that inadequate regulation and lack of supervision at the time of liberalization leads to banking sector distress[16].

6.2.3.4 The Exchange Rate Regime

This study also considered the link between the exchange rate regime and banking crises. The exchange rate regime can have both positive and negative effects on the probability of banking crises. On the one hand, fixed exchange rate increase the vulnerability of the banking system to external shocks[17]. Hence, the abandonment of a fixed exchange rate may result in unexpected exchange rate depreciation and may directly have a negative effect on the banking sector.

Yilmaz (2003) states that the risk of failure is high because "banks have sizeable un-hedge foreign liabilities and/or there is a maturity mismatch between bank assets and liabilities, or indirect when large depreciation creates deterioration in banks balance sheets of bank borrowers" (Yilmaz (2003, 23)). On the other hand, as a fixed exchange rate has no prospect of being changed, it increases the moral hazard problem for customers who are willing to borrow in foreign currency.[18] In other words, by providing implicit guarantees for investors that borrow in a foreign currency, a fixed exchange rate regime may decrease the probability of crisis.

16 Caprio and Klingebiel (1996) also state that inadequate regulation and lack of supervision at the time of liberalization lead to a banking problems.

17 See First Generation Models.

18 See Domac *et al.* (2003).

The results of Domac and Martinez-Peria (2003) show that exchange rate regime is an important determinant of banking sector distress. For this purpose, dummy variables are introduced to capture the declared exchange rate regime. As discussed in the earlier chapter, the currency peg had to be abandoned in mid-February 2001 in Turkey, just 14 months after the start of the programme, and replaced by a regime of free floating. The information on exchange rate regime is extracted from the Economic Survey of Turkey, 2002.

6.2.4 External Conditions

To capture the external conditions that North Cyprus faces, two variables are included: the real exchange rate and the change in terms of trade.

6.2.4.1 The Real Exchange Rate

Foreign shocks such as high real exchange rate are likely to increase the probability of crises by leaving bank customers unable to pay their debts. An increase in the real exchange rate is also expected to decrease survival time. In principle, "volatility in real exchange rate can cause difficulty for banks either directly - when banks have sizeable un-hedged foreign liabilities or when a currency or maturity mismatches between bank liabilities and assets, or indirectly - when exchange rate volatility creates deterioration in balance sheet of bank borrowers" (See Goldstein and Turner (1996, 10). Heffernan (1996) and Hardy *et al.* (1998) suggest that depreciation in terms of real exchange rates is an important factor that increases the vulnerability of the financial system. Moreover, the results of Gonzalez-Hermosillo *et al.* (1996) and Borovkova (2000) show that exchange rate is an important determinant of the time to bank failure.

6.2.4.2 The Terms of Trade

There is a fair amount of evidence suggesting that some crises are proceeded by negative trade shocks (Edward (1989)). According to Yilmaz (2003), large terms of trade shocks reduce export prices, and the ability of exporters to pay their debts may result in the deterioration of bank balance sheets, which threatens the solvency of domestic banks. Deterioration in the terms of trade is expected to increase the likelihood of bank failure, since it negatively affects the ability of borrowers to pay their loans. Moreover, terms of

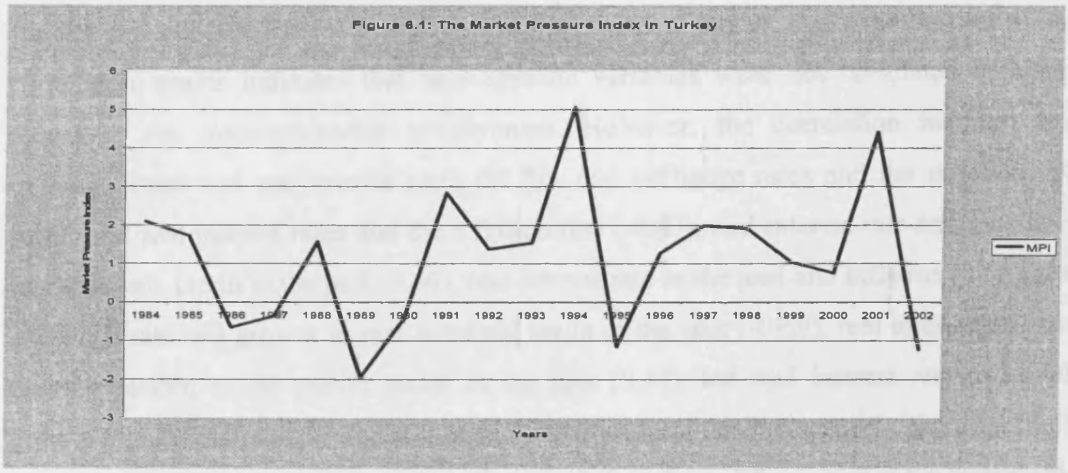
trade shocks are expected to shorten survival time. The results of Demirguc-Kunt *et al.* (1998) and Hardy *et al.* (1998) show that terms of trade are a significant variable that determines banking crises.

6.2.5 Contagion Effect

Lastly, in order to capture the contagion effect from Turkey, the market pressure index (MPI) (exchange rate pressure) is constructed for Turkey.

6.2.5.1 The Market Pressure Index in Turkey

The contagion effect that is considered in this thesis is thought of as whether the increase in the probability of bank failure depends on the existence of a speculative attack in Turkey. The financial and macroeconomic conditions for North Cyprus and Turkey are broadly similar. Therefore, there is a reason to suspect that the same underlying problems exist between the two countries. Figure 6.1 presents the market pressure index of Turkey. The results of Hutchison (2002) indicate that the market pressure index is an important factor that determines banking crises.



The existence of contagious currency crises is constructed as an index of exchange market pressure, which is a weighted average of changes in interest rates, international reserves and the nominal exchange rate. Following the approach of Eichengreen, Wyplosz and Rose (1996) for contagious currency crises, an index of money market pressure is proposed by identifying crises in Turkey (see Chapter Four for more detail on how to construct a MPI). High values of this indicator point to significant tensions in the Money

Market, which could be the result of runs, or large losses of deposits at a bank. It is expected that the crises in Turkey led to a loss of confidence in the North Cyprus financial system. Hence, it is expected that speculative pressure in Turkey increases the probability of bank failure in North Cyrus and decreases the survival time. In the Turkey crisis years are identified as 1994 and 2001. [19]

6.3 The Empirical Results

6.3.1 The Univariate Analysis

6.3.1.1 Correlation Matrix

Due to small sample size and the need to preserve degrees of freedom, in a similar manner to the previous chapter a stepwise selection technique was developed for selecting the appropriate macro variables. Including highly correlated macro variables in a model could result in significant bias to the level of the parameters. For this reason, in order to prevent the collinearity problem, the models formed in this research do not include correlated variables in the same model. Table 6.2 tabulates the correlation matrix for bank specific variables and key macro factors in the North Cyprus economy. Explaining the correlation between variables and taking into account practical aspects help in making a decision concerning what variables should be dropped from a model. An examination of the correlation results indicates that bank-specific variables were not correlated with any aspect of the macroeconomic environment. However, the correlation between real exchange rates and real interest rates (-0.79), real exchange rates and the inflation rate (0.97) and real interest rates and the inflation rate (-0.82), real interest rate and growth in real domestic credit in the past (0.69), real interest rate in the past and inflation (0.65), real exchange rate and growth in real domestic credit in the past (-0.69), real interest rate and credit extended to the public sector in the past (0.57) and real interest rate and GDP growth (0.50), and the correlation among credit variables (such as growth in credit, credit extended to the private sector and credit extended to the public sector) were remarkably high. Therefore, in order to prevent these highly correlated variables from causing multicollinearity problems, one variable needed to be dropped from the logistic model.

19 Other studies, such as Lindgren, Garcia, and Saal (1996), Demirguc-Kunt and Detragiache (1998), and Glick and Hutcison (2001) also identified the crisis years (of increasing market pressure) as 1991 and 1994 for Turkey.

Table 6.2: Correlation Matrix of the Micro and Macro Data

	Capital /Asset	Loan/ Asset	Net Income/ Asset	Deposit /Loan	Liquid/ Asset	Asset Size (1)	RER	RIR	RIR (-1)	INF	TT	GDP	Cr. Grow	Cr. Grow (-1)	Pri. Cr.	Pri Cr. (-1)	Pub. Cr	Pub. Cr (-1)	M2/ Reserve (-1)	Liquidity	Budget Deficit	Market Pressure
Capital /Asset	1.00																					
Loan/Asset	-0.20	1.00																				
Net Inc./Asset	0.36	-0.05	1.00																			
Deposit/Loan	0.26	-0.13	0.08	1.00																		
Liquid/Asset	0.25	-0.39	0.27	0.43	1.00																	
Asset Size (2)	-0.20	-0.14	-0.03	0.02	0.33	1.00																
RER	0.05	-0.16	-0.08	0.13	0.08	0.05	1.00															
RIR	-0.10	0.21	0.10	-0.16	-0.09	-0.02	-0.79	1.00														
RIR (-1)	-0.06	0.09	-0.05	0.03	-0.01	-0.05	0.61	-0.15	1.00													
INF	0.05	-0.11	-0.09	0.14	0.07	0.03	0.97	-0.82	0.65	1.00												
TT	0.12	0.02	-0.01	0.05	-0.03	-0.18	0.16	-0.28	-0.04	0.20	1.00											
GDP	-0.11	-0.04	0.10	-0.10	0.08	0.12	-0.35	0.50	0.13	-0.31	-0.43	1.00										
Credit Growth	-0.02	-0.03	-0.06	0.06	-0.04	0.01	0.26	-0.29	0.01	0.25	-0.13	0.00	1.00									
Credit Growth (-1)	-0.10	0.03	0.08	-0.19	-0.02	0.05	-0.69	0.69	-0.28	-0.27	-0.14	0.38	-0.61	1.00								
Private Credit	0.05	-0.10	-0.05	0.12	0.02	0.02	0.40	-0.36	0.03	0.38	-0.25	0.01	0.49	-0.46	1.00							
Private Credit(-1)	-0.10	0.05	0.05	-0.05	0.04	0.07	-0.38	0.24	-0.34	-0.37	0.05	0.22	-0.35	0.49	-0.47	1.00						
Public Credit	-0.04	-0.11	0.03	-0.02	-0.02	-0.01	0.10	0.01	0.03	0.04	-0.22	0.26	0.85	-0.36	0.32	-0.32	1.00					
Public Credit(-1)	-0.21	0.06	0.03	-0.15	-0.04	0.02	-0.44	0.57	0.09	-0.44	-0.25	0.42	-0.55	0.85	-0.46	0.32	-0.28	1.00				
M2/Reserve(-1)	0.01	0.06	0.02	-0.07	-0.01	0.02	0.13	0.16	0.36	0.08	0.01	-0.23	-0.48	0.15	-0.37	0.05	-0.36	0.25	1.00			
Liquidity	-0.12	-0.14	-0.00	-0.03	0.05	0.05	0.08	0.04	0.11	0.06	-0.22	0.31	0.57	-0.06	0.22	-0.24	0.61	0.08	-0.31	1.00		
Budget Deficit	0.01	0.45	-0.10	0.03	-0.19	-0.15	-0.25	0.22	-0.06	-0.17	0.37	-0.31	-0.05	0.01	-0.09	0.02	-0.34	-0.14	0.03	-0.21	1.00	
Market Pressure	0.07	-0.01	-0.08	-0.09	-0.17	-0.13	0.69	-0.60	0.37	0.70	0.15	-0.26	0.17	-0.57	0.38	-0.35	0.08	-0.40	0.34	0.00	-0.10	1.00

Note:
(-1) represent 1 year lagged variable.

6.3.1.2 The Unit Root and the Structural-Break Tests

The first empirical chapter tested the stationarity for bank-specific data. The results reveal that microeconomic data is stationary at level. Since much macroeconomic time series data is typically non-stationary, this can be regarded as a potentially major problem for econometric studies. In fact, it is possible to run logit regression, even if the time series do not satisfy the stationary assumption. However, these results could be spurious. Hence, before we run the logit model we must test the stationarity for all of the macro variables. The stationarity and occurrence of the structural break for the macroeconomic variables are estimated for the years between 1984 and 2002. The results of the Augmented Dickey Fuller (ADF) tests with and without linear trend for the macro data in level and in first differences are reported in Table 6.3.

By testing both the unit root hypothesis and the stationary hypothesis in level, we can distinguish a series that appears to be stationary from one that appears to be unit root. The results reveal that the hypothesis[20] of unit root null is rejected for GDP growth rate, real interest rates, budget deficit, liquidity and market pressure at the 5% significance level. In other words, these variables are stationary I(0) in level.

However, the data series of inflation, M2/reserves, credit growth rate, pubic credit, private credit, terms of trade, real exchange rate and change in exchange rate are appear to be non-stationary in level I(1). Hence, in order to transform a non-stationary series into a stationary series we must test the first difference[21]. The first difference of the non-stationary series make sure that series of Inflation, M2/reserves, credit growth rate, pubic credit, private credit, terms of trade, real exchange rate and change in exchange rate are stationary I(0) at first difference.

20 Our null and alternative hypothesis is given as; Ho : Data is non- stationary and H1 : Data is stationary.

21 See Box and Jenkins (1970).

Table 6.3: The Unit Root Test Results for Macro Data (Augmented Dickey-Fuller Test)

	LEVEL		FIRST DIFFERENCE		
$p^{22}=1$	**Constant**	**Trend**	**Constant**	**Trend**	**Stationary**
Macroeconomic Characteristics:					
GDP Growth Rate	-3.682**	-4.021**	-5.682**	-5.771**	Level
Inflation	-3.717**	-1.982	-7.163**	-3.991**	First-Difference
Real Interest Rates	-4.493**	-3.205**	-6.836**	-3.898**	Level
Budget Deficit	20.212**	5.024**	-4.948**	3.612**	Level
Financial Variables:					
M2/Reserves	-4.318**	-2.223	-5.333**	-4.732**	First-Difference
Liquidity	-4.272**	-3.207**	-6.635**	-4.653**	Level
Credit Growth Rate	-5.254**	-2.283	-9.299**	-6.022**	First-Difference
Public Credit	-2.321	-2.461	-5.842**	-3.296**	First-Difference
Private Credit	-3.196**	-1.835	-6.256**	-4.308**	First-Difference
External Conditions:					
Terms of Trade	-1.378	-2.310	-4.365**	-4.348**	First-Difference
Real Exchange Rates	-3.353**	-1.594	-6.990**	-4.534**	First-Difference
Exchange Rate	-3.721**	-2.270	-7.039**	-5.103**	First-Difference
Market Pressure	-4.867**	-4.103***	-6.579**	-6.006**	Level

Notes: (1) The critical values of the Dickey-Fuller statistics at 1%, 5% and 10% significance level are –3.436, –2 86 and –2.568 for constant without trend model and –3.97, -3.116 and –3.13 for constant with trend model, respectively.
(2) ** Denotes rejection of the null of non-stationary at the 5% level of significance

The adverse macroeconomic and external shocks (observed from figures in Chapter Two) suggest volatility and large jumps in macro data. Structural changes can affect all the parameters of the model. For this reason, a test is employed to see whether sudden changes in our data capture any structural breaks. The results presented in Table 6.4 report the minimum t-statistics and their corresponding break times, which is determined endogenously by Zivot and Andrews (1992).[23]

22 p is the lag length.

23 Our null and alternative hypothesis is given as, H0: there is no structural break, and H1: there is a structural break.

Table 6.4: The Unit Root Tests based on Zivot and Andrews[24] (1992)

DEPENDENT VARIABLE	Min T-Statistics	1%	Estimated Break
Macroeconomic Characteristics:			
GDP	-2.69517 at 1997:01	Accept H_0	No Structural-Break
Inflation	-2.18857 at 1994:01	Accept H_0	No Structural-Break
Real Interest Rates	-4.56073 at 1994:01	Accept H_0	No Structural-Break
Budget Deficit	-3.29923 at 1998:01	Accept H_0	No Structural-Break
Financial Variables			
M2/Reserves	-2.66311 at 1994:01	Accept H_0	No Structural Break
Liquidity	-3.88489 at 1991:01	Accept H_0	No Structural Break
Credit Growth	-1.93988 at 2000:01	Accept H_0	No Structural-Break
Public Credit	-3.81896 at 1995:01	Accept H_0	No Structural-Break
Private Credit	-2.16775 at 1997:01	Accept H_0	No Structural-Break
External Conditions:			
Terms of Trade	-2.84421 at 1990:01	Accept H_0	No Structural Break
Real Exchange Rate	-7.28419 at 1994:01	Reject H_0	Structural Break
Exchange Rate	-2.33077 at 1993:01	Accept H_0	No structural Break

This table presents the main results of estimating the relevant equation estimated by Zivot-Andrews (1992) for values, which minimize the t-values for estimating regression over t-2 regression.

Notes:

(1) p=2, p indicates the lag length.
(2) The critical value at 1% significance level is –5.34.

If t-statistics are less than critical value, then the null hypothesis is rejected, which means that there is a structural break. Likewise, if t-statistics are greater than the critical value, then the null hypothesis is accepted, which means that there is no structural break.

The analysis of the future behaviour of economic variables can be biased if structural break are not considered. The results of the Zivot and Andrews test provide evidence about the existence of structural break for real exchange rate. According to test statistics, the estimated year for the breaks point appears to be 1994 for real exchange rate series, which is coincides with the devaluation of the TL during the Turkey currency crisis in 1994. For this reason, in estimation of real exchange rate, structural break should be taken into account. In the analysis structural changes in a time series are detected by adding a

24 The results allow for break in intercept only and including 2 Lags of difference.

dummy variable corresponding to a predetermined break date in the augmented test of Dickey and Fuller (1979). [25] The findings detect no evidence of structural break for other variables.

6.3.2 The Multivariate Analysis

6.3.2.1 The Logit Analysis

This section presents the results of the multivariate logit model, which estimates how a particular macro variable changes the probability of the occurrence of the event when all other micro variables are constant. In fact, macroeconomic disturbances of almost any sort can adversely affect bank balance sheets, and if large enough they threaten the solvency of large parts of the banking system. However, though it is generally believed that the underlying cause of the crises were microeconomic, there is no doubt that the macro-environment exacerbated the internal troubles of many of the financial institutions. To examine this issue first the bank-specific variables are assessed in the previous empirical chapter, and then a stepwise selection technique is developed to determine the impact of macroeconomic factors, financial factors, external conditions and the potential contagion effect on bank failure.

The results of the univariate analysis reveal that there is a high correlation among macro variables. For this reason, in an attempt to minimize the possible correlation and bias among relevant macro variables, it would be reasonable to run various combinations of variables in separate equations. For this purpose, 15 regression equations were found to be the best model to satisfy the statistical requirements. Further, all of the explanatory variables included in these models are stationary in level. From Table 6.5 to Table 6.8 reporting the result of the multivariate logit analysis for 15 alternative model specifications, standard errors are given in parentheses. Each column presents the results for a specific combination.

Specifically, Table 6.5 presents the microeconomic and financial variables as the explanatory variables, Table 6.6 shows the interaction of weaknesses in the financial structure with macroeconomic factors and financial factors and Table 6.7 includes additional external conditions. Lastly, Table 6.8 adds the MPI (market pressure index) of Turkey, which aimed at measuring to measure the contagion effect from Turkey.

25 See Perron (1989) for more information.

Table 6.5: Logit Analysis of Determinants of Bank Fragility (Macroeconomic and Financial Variables)

Variables	(1)	(2)	(3)	(4)
Bank-specific Variables				
Capital/Asset	-0.047**	-0.074***	-0.079**	-0.066***
	(0.022)	(0.027)	(0.033)	(0.025)
Loan/Asset	0.018***	0.021***	0.021***	0.020***
	(0.006)	(0.007)	(0.007)	(0.007)
Net Income/Asset	-0.173**	-0.161***	-0.179***	-0.196***
	(0.076)	(0.054)	(0.065)	(0.057)
Deposits/Loan	-0.052***	-0.044***	-0.047***	-0.051***
	(0.017)	(0.014)	(0.015)	(0.019)
Asset Size (1)	-0.782**	-1.220***	-1.195***	-1.165***
	(0.355)	(0.417)	(0.416)	(0.380)
Macroeconomic Variables:				
Real Interest Rates		-0.034***		
		(0.009)		
Real Interest Rates (lag1)	0.141***			
	(0.202)			
Inflation			0.062***	0.018***
			(0.018)	(0.006)
GDP	-0.505**			
	(0.202)			
Budget Deficit				0.001***
				(0.001)
Financial Variables:				
M2/Reserves (Lag1)			3.8***	
			(1.402)	
Credit Growth (Lag 1)			0.002	
			(0.002)	
Private Credit (Lag 1)	3.852**	2.535**		2.042***
	(1.802)	(1.099)		(0.735)
Constant	-0.415	-0.260	0.851	1.460
	(0.959)	(1.019)	(1.045)	(1.184)
Model Satatistics:				
Wald Chi2	33.87***	54.44***	62.27***	58.87***
Pseudo R^2	61.18	55.75	56.22	56.63
Log pseudo-lik	-17.92	-20.535	-20.216	-20.02
AIC	25.92	27.535	28.216	28.02

Notes: (1) ***, **, * indicates significance at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-15 is the bank probability of intervention model.

The number of observations in this chapter range from 218 to 223, depending on data availability. The quality of model specification is assessed based on the criteria of the Model Chi-square, Pseudo R^2 and AIC criteria.

In the model, the pseudo R^2 ranges from 52.93 to 63.17, implying that most of the variation of the dependent variable is explained by the model explanatory variables. The R^2 value suggests a relatively high degree of explanatory power for the model when micro and macro data are included together. Model (14) seems to have the highest pseudo R^2. A chi-square likelihood ratio test of the significance of the overall model indicates that all of the specification models are highly significant (Prob>Chi-square: 0.000). The AIC compares the model with different degrees of freedom and eliminates the model specification when irrelevant explanatory variables are added into the regression. A model with a lower value of the AIC is judged to be preferable. From the tables, Model 1 appears to have the lowest AIC.

With regard to bank-specific variables the results seem to be almost the same with the results of the previous empirical chapter. The findings suggest that after including macro factors into the model, bank-specific variables (namely capital inadequacy, low asset quality, low earning, low liquidity and small asset size) are still statistically significant.

As expected, the coefficient on the measure of capital adequacy is negative and statistically significant, indicating that the lower a bank's shareholders equity to total assets ratio, the higher the probability that the bank will fail in North Cyprus. The results suggest that the ability of banks to absorb the cost of domestic and external shocks was seriously limited due to being undercapitalized. At that time, regulations were allowing banks to work under low capital requirements, also contributing to the problem.[26] This result is consistent with Martin (1977), Avary *et al.* (1984), Heffernan (1996), Langrin (2001) and Yilmaz (2003).

Since loans are generally the most risky assets that banks hold, the findings on asset quality indicate that banks with high leverage are more likely to fail. For most of the specification this result is statistically significant at 1%. After the bank failures it was noted that some of the failed banks in North Cyprus were using their banks to channel funds into their own mostly unprofitable trading activities. The amount of connected

26 The minimum capital requirement was around 50 billion TL, which was equivalent to 120,000 US Dollar.

lending in the failed banks ranged from 50% to 90% of total loans[27], which increased the credit risk in those failed banks. The findings implies that as banks were operating under a poor credit and risk management, this may increase the possibility of poor quality lending and lead to a bank failure. This result is consistent with the previous findings of Avary *et al.* (1984), Thompson (1991) and Borovikova (2000).

The results on the profitability measures are negative and for most specifications it is statistically significant at 1% level, which means an increase in the ratio of net income to total assets decreases the probability of failure. These results agree with those obtained by Martin (1977), Avary *et al.* (1984), Thompson (1991), Heffernan (1996) and Persons (1999).

The findings on the liquidity risk (the ratio of deposits to total loans) are negative and for most specifications they are statistically significant at 1%, suggesting that a decrease in liquidity increases the probability of bank failure in North Cyprus. A decrease in this ratio indicates that banks are illiquid to face unexpected deposit runs[28]. Safakli (2003) states that a banking crisis in North Cyprus was triggered by the failure of Yurtbank A.S (located in Turkey) in December 1999. A major share of Kibris Yurtbank Ltd. in North Cyprus belonged to the owner of Yurtbank A.S. The failure of Yurtbank A.S in Turkey triggered a panic in North Cyprus, and depositors began to withdraw funds from Yurtbank Ltd.. The bank run quickly spilled over to other banks in North Cyprus. By the end of January 2000, four illiquid banks that failed to face unexpected deposit runs were put under the control of the Ministry of Finance. Gonzalez-Hermosillo (1999) and Langrin (2001) also found that this ratio was negatively related to the probability of failure, but their results were insignificant.

Finally, the measure of bank size (logarithm of total asset and the ratio of total assets of a bank to total banking sector assets) is negative and for most of the specification statistically significant at 99% confidence level. This suggests that larger banks experienced a lower probability of failure than smaller banks. The result suggests that large banks are perceived to be "too-big-to fail". Hence, the probability of failure is low.

27 See Safakli (2003).

28 A few years before the distress period, with the hope to attack new deposits banks that had a liquidity problem and offered high interest rates was a short-term solution to the situation of the problem bank. In the long run, failure to pay the deposits plus high interest rates for customers led to liquidity problem.

Macroeconomic Characteristics

The results show that the growth rate of the GDP is negative and statistically significant at 1% and 5% significance level. This suggest that a sharp fall in the real GDP growth, i.e. a reduction in economic activities, is associated with an increase in credit risk due to an increase in the probability of default on loans in North Cyprus. These findings are consistent with Hardy *et al.* (1998), Hutchison *et al.* (1999), Hutchison (2002), Demirguc-Kunt *et al.* (1998, 2000), Borovikova (2000) and Yilmaz (2003), who suggest that the slow growth of GDP tends to be associated with bank distress[29].

Consistent with previous findings, results indicate that the inflation rate is positive and statistically significant with 99% confidence level. This proves that a high inflation environment seems to make it hard for North Cyprus banks to evaluate the credit risk of companies and results in deterioration in the quality of borrowers. Other authors such as Hardy *et al.* (1998), Demirguc-Kunt *et al.* (1998, 2000), Domac *et al.* (2003) and Hutchison (2002) also indicate that high inflation is associated with the banking sector distress.

Likewise to the result of Heffernan (1996), the findings in this thesis suggest that at 1 % significance level real interest rate is negatively related to the probability of failure. Results appear to be contrary to the expectation in the literature. The findings of Yilmaz (2003) also reveal that real interest rate is negatively related to the probability of failure in Turkey. This may imply that as a consequence of increased interest rate, an increase in the amount of deposit may prevent the probability of bank failure. However, if banks fail to efficiently invest customer's funds, then at the end of a contract date it is highly probable that an illiquid bank will fail to pay the customers' deposits plus interest. In the relevant literature it is frequently argued that real interest rates have a lagged effect. Following the studies of Gonzalez-Hermosillo *et al.* (1996) and Hardy *et al.* (1998) in this model the real interest rates are also considered to have a lagged effect. The real interest rate is lagged by one-period, and as expected results seem to be positive and statistically significant at 1% level. The one period lagged suggests that the effect of real interest rates on bank balance sheet is not very quick. As expected, the findings support the view that an increase in the real interest rate in the past increased the probability of bank failure in North Cyprus.

29 See also Kaminsky and Reinhart (1999) and Eichengreen and Rose (1998).

These results are in agreement with those obtained by Hardy *et al.* (1998) and Demirguc-Kunt *et al.* (1998, 2000). This is probably due to the fact that an unanticipated increase in interest rates makes it difficult for firms or households to service their existing loans. As a result, this lead to an increase in banks' non-performing loans, which increases the probability of banking problems and insolvency.

The results also show that the ratio of the budget deficit to GDP is positive and statistically significant at 1% level. This suggests that the North Cyprus economy is not in a strong financial position, so during the crises periods it was more likely that the Government could not quickly take precautions to recapitalize problem banks and avoid problems. Demirguc-Kunt *et al.* (1998) also states that governments with high budget deficits are more likely to postpone measures to strengthen the health of the banking sector, allowing small problems to degenerate into systemic crises.

Financial Variables

Consistent with Demirguc-Kunt *et al.* (1998, 2000), Eichengreen *et al.* (2000) and Domac *et al.* (2003), the results reveal that the estimated coefficient of the ratio of M2 to foreign exchange reserves is positive and significant with 99% confidence level. This suggests that during the 2000-2001 currency crisis in Turkey, banks in North Cyprus faced runs associated with currency crises, increasing the likelihood of bank failure. Indeed, banks in North Cyprus were highly exposed to currency risk because there are large unhedged foreign liabilities and/or maturity mismatches between assets and liabilities. In other words, as bank liabilities were in a foreign currency, any devaluation within the country exposed these banks to a crucial mismatch and worsening balance sheet.

The liquidity ratio (the ratio of cash held by banks to total assets) is statistically insignificant. Domac *et al.* (2003) also found that this ratio has no effect on banking crises, while Demirguc-Kunt *et al.* (1998) found a weakened effect.

The findings of Eichengreen *et al.* (2000) and Domac *et al.* (2003) indicate that real credit growth increases the probability of failure. Moreover, the results of Hardy *et al.* (1998) and Demirguc-Kunt *et al.* (1998, 2000) indicate that a strong growth of bank credit in the past is associated with a high probability of banking failure. By contrast with the conclusion of a number of studies, the results in this study reveal that growth rate of past

domestic credit (lagged credit) does not affect the likelihood of banking sector distress in North Cyprus. These results are also confirmed by Caprio and Klingebiel (1996), who find little evidence between lending booms and banking sector distress.

According to Sachs, Tornell and Velasco (1996) an increase in bank lending may not be a bad sign as it shows that the economy is expanding. These authors argue that a growth of bank credit to the private sector may be a cause of concern as this may lead to a decline in the quality of credit. The findings in the study reveal that one-year lagged of this variable is positive and statistically significant at 1% level, which suggest that credit extended to the private sector in the past increased the probability of bank failure in North Cyprus. This implies that a lending boom can lead to a banking crisis, especially if banks do not have a good quality credit. This result is consistent with those obtained by Demirguc-Kunt *et al.* (1998a) in a sample of countries. Other researchers, such as Pill and Pradhan (1995) and Domac *et al.* (2003), argue that the ratio of the domestic credit to the private sector to GDP can be used to capture the extent of financial liberalization. In this regard it can also be concluded that an increased in financial liberalization increases the likelihood of bank failure in North Cyprus.

The findings suggest that one-year lagged of the credit that is extended to the public sector has a positive sign and results seem to be statistically significant at 5% level. The one period lagged implies that the effect of public credit on bank balance sheets is not very quick. This suggests that an increase in the ratio of credit to public sector to GDP in the past raised the likelihood of banking problems in North Cyprus. The North Cyprus Government had limited reserves, and therefore, in order to pay the salaries of the public workers, it was taking a large amount of domestic credit from the Centrai Bank of TRNC. This suggests that the vulnerability of the banking sector and the Government's inability to rescue financial institutions may have triggered the necessary conditions for a banking crisis in the year 2000-2001.

Table 6.6: Logit Analysis of Determinants of Bank Fragility (Structural Weaknesses)

Variables	(5)	(6)	(7)	(8)
Bank-Specific Variables:				
Capital/Asset	-0.066**	-0.082**	-0.031	-0.045**
	(0.028)	(0.033)	(0.019)	(0.0207)
Loan/Asset	0.020***	0.023**	0.017***	0.020***
	(0.006)	(0.009)	(0.006)	(0.007)
Net Income/Asset	-0.165**	-0.183***	-0.212***	-0.204**
	(0.071)	(0.070)	(0.081)	0.086
Deposit/Asset	-0.053***	-0.054***	-0.051***	-0.046***
	(0.017)	(0.015)	(0.018)	(0.018)
Asset Size (1)	-0.924***	-1.124**	-0.693**	-0.930***
	(0.356)	(0.447)	(0.312)	(0.346)
Structural Variables:				
Explicit Deposit Insurance	-1.761*			
	(1.065)			
Implicit Deposit Insurance				2.177*
				(1.230)
Weak Regulation		2.262**		
		(0.947)		
Liberalization			2.186***	
			(0.821)	
Macroeconmic Variables:				
Real Interest Rates (Lag1)	0.210***	0.144***	0.097***	
	(0.034)	(0.032)	(0.031)	
GDP	-0.660***	-0.393***		-0.480*
	(0.204)	(0.108)		(0.280)
Financial Variables:				
Private Credit (Lag 1)	4.023***		3.098***	3.062**
	(1.463)		(1.018)	(1.538)
Constant	-0.082	-0.453	-2.102	-0.894
	(1.297)	(0.973)	(1.021)	(1.111)
Model Statistics:				
Wald Chi2	89.97***	85.51***	22.23***	16.11***
Pseudo R^2	62.89	57.17	57.64	52.93
Log pseudo-lik	-17.134	-19.900	-19.557	-21.842
AIC	26.134	27.900	27.557	29.842

Notes: (1) ***, **, * indicates significance at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-15 is the bank probability of intervention model.

Financial Structure

The findings show that the removal of control on interest rate are positive and statistically significant at 1% level, suggesting that financial liberalization increased the probability of banking sector distress in North Cyprus. These results are also confirmed by Demirguc-Kunt and Detragiache (1998b) and Hutchison *et al.* (1999), Hutchison (2002) and Eichengreen *et al.* (2000), who conclude that financial liberalization is an underlying cause of a banking crisis. Demirguc-Kunt *et al.* (2000) stressed that if legal institutions and governance are not strong, financial liberalization increases problems in the banking sector.

As argued by Hutchison *et al.* (1999), under a newly competitive environment, weak supervisory and regulatory policies may induce the moral hazard incentives of banks to increase their risk position and allow them to avoid full responsibility for mistakes in monitoring and evaluating risks. The results reveal that weak supervision and regulatory policies increase the probability of bank distress in North Cyprus at 5% significance level. This result is also confirmed by Demirguc-Kunt *et al.* (1998a) and Hutchison (2002).

On the one hand, the findings of the Government implicit bailed out policies are statistically significant at 10% level, suggesting an increased fragility in the North Cyprus banking sector through moral hazard and adverse selection. This implies that after 1994 the implicit deposit insurance policy in North Cyprus offered incentives for moral hazard and adverse selection, which encouraged a remarkable increase in the lending of poor quality investments and led to deterioration in the financial ratios during the period of 1994- 2000. In North Cyprus this induced banks to take excessive risks and allowed bank shareholders to shift some of the risk in their balance sheets to the provider of deposit insurance. These results are consistent with the results of Demirguc-Kunt *et al.* (1998a) and Hutchison *et al.* (1999). The findings of Yilmaz (2003) and Bayir (2001) also reveal that the presence of full-coverage deposit insurance applied after 1994 increased the probability of bank failure in Turkey.

On the other hand, the evidence reveals that explicit deposit insurance is negative and statistically significant at 10% level. This implies that the presence of explicit deposit insurance during the years 2000-2002 increased confidence (and hence, bank stability) by reducing a self-fulfilling or information-driven depositors run during the distress period.

The findings support the view that depositors will no longer be concern about the solvency of their banks; therefore, they will not have any incentive to withdraw their funds from banks in North Cyprus. This result is consistent with Eichengreen *et al.* (2000). The result suggests that, after 2000, the presence of explicit deposit insurance in North Cyprus enabled small banks to compete with larger banks. Furthermore, deposit insurance helped domestic banks in their competition with foreign banks, which carry their home country coverage. However, as mentioned earlier, the main problem with explicit deposit insurance is that shareholders and managers have more incentives to take higher risks in their operations and investments as they are taking advantage of deposit insurance protection; hence, no market discipline will be imposed on banks. At this point, after sustaining confidence in the North Cyprus banking sector, it would be preferable to remove full coverage deposit insurance in order to prevent other bank failures in the future, which may arise from moral hazard.

The findings also illustrate that adopting a fixed exchange rate regime is positive and statistically significant at 5% level, suggesting that a fixed exchange rate regime increased the probability of failure in North Cyprus. This suggest that after the implementation of a three year exchange rate based implementation programme in December 1999 (pegged exchange rate was put into practice in Turkey and parallel to this in North Cyprus), banks and firms in North Cyprus dominated their borrowing in foreign currency without hedging foreign exchange rate risks. However, as a consequence of the unexpected depreciation of TL in February 2001 (14 months from the start of the programme the currency peg had to be abandoned), this increased the failure risk in banks and firms whose exchange rate was dominated by foreign currency. Eichengreen and Rose (1998) and Eichengreen *et al.* (2000) found little connection between exchange rate regime and the banking sector distress. The results of Domac *et al.* (2003), on the other hand, reveal that adopting a fixed exchange rate regime diminishes the probability of banking crises. They found evidence that a fixed exchange rate provides implicit guarantees for investors that borrow in a foreign currency.

Table 6.7: Logit Analysis of Determinants of Bank Intervention (External Shocks)

Variables	(9)	(10)	(11)
Bank-specific Variables:			
Capital/Asset	-0.088**	-0.067**	-0.070***
	(0.039)	(0.026)	(0.026)
Loan/Asset	0.023***	0.020***	0.021***
	(0.009)	(0.007)	(0.008)
Net Income/Asset	-0.194***	-0.192***	-0.172***
	(0.072)	(0.058)	(0.052)
Deposit/Loan	-0.056***	-0.051***	-0.046***
	(0.017)	(0.019)	(0.016)
Asset Size (1)	-1.176***	-1.190***	-1.207***
	(0.412)	(0.389)	(0.420)
Macroeconomic Variables:			
Inflation	0.042***		
	(0.009)		
Financial Variables:			
Liquidity			-0.002
			(0.002)
Public Credit (Lag 1)	4.129**		
	(1.714)		
Private Credit (Lag 1)		1.811***	2.416***
		(0.565)	(0.905)
External Conditions:			
Terms of Trade	-0.070***	-0.084**	
	(0.025)	(0.028)	
Real Exchange Rate		2.976***	3.665***
		(0.737)	(0.970)
Constant	0.969	0.705	0.322
	(1.036)	(1.059)	(0.931)
Model Satatistics:			
Wald Chi2	51.62***	64.58***	65.25***
Pseudo R^2	54.00	57.57	56.02
Log pseudo-lik	-21.237	-19.591	-20.305
AIC	29.237	27.591	28.305

Notes: (1) ***, **, * indicates significance at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-15 is the bank probability of intervention model.

External Conditions

As confirmed by Heffernan (1996) and Hardy *et al.* (1998), results in this study demonstrate that exchange rate depreciation is positive and statistically significant at 1% significance level. This implies that the real exchange rate is an important factor that increases the vulnerability of the financial system in North Cyprus.

Consistent with the results of Demirguc-Kunt *et al.* (1998) and Hardy *et al.* (1998) results in this study reveal that at 1% and 5% significant level, adverse trade shocks increase the probability of bank distress.[30] As stated in the previous chapter, on the 5th of July 1994 the European Court of Justice ruled that the European Union member states should not accept agricultural product exported by an unrecognised area of the TRNC. This imposed an embargo on agricultural products, which was the major export activity of the North Cyprus economy. The deterioration in the terms of trade negatively affected the ability of borrowers (especially the ability of traders to pay their debts) to repay loans, which resulted in the deterioration in bank balance sheets, thus threatening the solvency of domestic banks and increased the probability of banking sector problems in North Cyprus.

The Contagion Effect from Turkey

As the North Cyprus financial market is highly integrated with Turkey's capital market, it has been increasingly subject to the effects of changes in Turkey. The results confirm that a speculative attack in Turkey is statistically significant and increases the vulnerability of the North Cyprus banking sector, even after controlling the economic and financial fundamentals in the country concerned. In other words, the exchange pressure in Turkey in 1994 and 2001 put stress on banks that operate in North Cyprus and led to banking sector distress. This would appear to be the first systematic evidence of the existence of contagious currency crises in North Cyprus.

30 See also Gavin and Haussman (1996) and Kaminsky and Reinhart (1999).

Table 6.8: Logit Analysis of Determinants of Bank Intervention (Contagion Effect from Turkey)

Variables	(12)	(13)	(14)	(15)
Bank-Specific Variables:				
Capital/Asset	-0.054*	-0.062*	-0.064**	-0.064**
	(0.028)	(0.034)	(0.028)	(0.030)
Loan/Asset	0.017***	0.017**	0.019**	0.018***
	(0.006)	(0.007)	(0.006)	(0.007)
Net Income/Asset	-0.204***	-0.195***	-0.163**	-0.187***
	(0.060)	(0.071)	(0.072)	(0.063)
Deposit/Loan	-0.055**	-0.057**	-0.052***	-0.055***
	(0.023)	(0.024)	(0.017)	(0.022)
Asset Size (1)	-0.890***	-0.775**	-0.894**	-0.904***
	(0.324)	(0.311)	(0.366)	(0.338)
Macro Variables:				
Real Interest Rates (lag1)	0.120***	0.257***	0.167**	0.163***
	(0.028)	(0.073)	(0.075)	(0.031)
Financial Variables:				
Private Credit (Lag 1)	2.009***		3.449***	3.059***
	(0.649)		(1.084)	(0.907)
Public Credit (Lag 1)		4.912*		
		(2.555)		
Structural Variables:				
Fix exchange regime			3.392**	
			(1.447)	
External Conditions:				
Terms of Trade		-0.162*		
		(0.084)		
Contagion Effect:				
Market Pressure	0.848***	0.808*	0.642***	
	(0.382)	(0.374)	(0.413)	
Crises Dummy				4.476***
				(1.275)
Constant	-1.825	0.147	-5.703	-1.720
	(1.329)	(2.919)	(2.050)	(1.088)
Model Satatistics:				
Wald Chi2	95.24***	74.74***	65.74***	77.71***
Pseudo R^2	58.12	56.20	63.17	59.58
Log pseudo-lik	-19.337	-20.222	-17.006	-18.662
AIC	27.337	29.222	26.006	26.662

Notes: (1) ***, **, * indicates significance at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-15 is the bank probability of intervention model.

6.3.2.2 The Survival Analysis –Discrete-Time Logistic Model

This section furthers explores the effects of bank-specific variables, by including macro variables into the micro model of survival analysis. Using a multivariate discrete time logistic model, the model estimates the determinants of time until bank failure in North Cyprus over the period 1984-2002.

The estimation of survival analysis involves a two-stage procedure. First, in Chapter Five, the bank specific factors are identified. The results indicate that specification two has the highest R-Square (53.60) and lowest AIC (24.94) is the best model that actually helps to explain survival time of banks in North Cyprus. In this chapter, in addition to the identified bank-specific factors, macro factors are included in the model. The results of the second specification in Chapter Five indicate that the indicators of a bank's condition, such as asset quality (total loans as a percentage of total assets) and liquidity (total liquid assets as a percentage of total assets) are related significantly to the timing of bank failure. The findings of Cole and Gunther (1995) also reveal that these variables are significant determinants of bank failure when a logistic survival analysis is employed. However, in contrast to Cole and Gunther (1995), no evidence is found that capital adequacy and earning are important determinant of bank survival time. Also, consistent with the results of Cole and Gunther (1995), the findings reveal that the survival time of a bank is not related to bank asset size in North Cyprus.

The empirical findings of the survival analysis are reported in Table 6.9. In the table the standard logistic regression model estimates five alternative specifications. A chi-square likelihood ratio test for the significance of the overall model indicates that the discrete time logistic models are highly significant. ($p>0.000$). The R-values (Pseude R^2) of the model range from 53.67 to 66.38 for the one period ahead data, which are indicative of a good fit.

Table 6.9: The Logit Model and Determinants of Time to Bank Failure

Variables	(1)	(2)	(3)	(4)	(5)
Bank-specific Variables					
Capital/Asset	0.113	0.123	0.124	0.096	0.119
	(0.074)	(0.087)	(0.077)	(0.060)	(0.093)
Loan/Asset	-0.040***	-0.041***	-0.037***	-0.037***	-0.044***
	(0.014)	(0.014)	(0.013)	(0.012)	(0.015)
Net Income/Asset	0.147	0.077	0.057	0.132	0.030
	(0.075)	(0.131)	(0.096)	(0.105)	(0.157)
Liquid/Asset	0.067**	0.070**	0.052*	0.060*	0.074**
	(0.032)	(0.033)	(0.029)	(0.029)	(0.034)
Asset Size (1)	0.075	0.069	0.242	0.242	0.208
	(0.219)	(0.129)	(0.439)	(0.429)	(0.516)
Macroeconomic Variables:					
Real Interest Rates	–	0.018	0.017	–	–
		(0.020)	(0.013)		
Financial Variables:					
Private Credit	-2.349**	-2.029**	–	–	-3.165**
	(1.065)	(0.959)			(1.341)
Public Credit	–	–	-2.284		
			(2.301)		
Liquidity	–	–	–	- 0.001	–
				(0.005)	
External Conditions:					
Exchange Rate	–	–	–	0.006	–
				(0.015)	
Market Pressure	–	–	–	–	-1.134
					(0.731)
Time	-0.051**	-0.051**	-0.045***	-0.045***	-0.053***
	(0.022)	(0.022)	(0.021)	(0.021)	(0.025)
Constant	-6.195	-6.441	-4.412***	-5.043	-8.257***
	(2.130)	(2.096)	(1.824)	(2.159)	(2.766)
Model Satatistics:					
Wald Chi2	50.38***	51.29***	45.83***	43.57***	53.88***
Pseudo R^2	62.06	63.18	56.47	53.67	66.38
Log pseudo-lik	-15.398	-14.943	-17.669	-18.802	-13.644
AIC	22.398	22.943	25.669	26.802	21.644

Notes: (1) ***, **, * indicates significance at the 1, 5 and 10 percent level respectively.
(2) Standard errors are given in parentheses for the logit model.
(3) Specification from 1-5 is the bank probability of intervention model.

According to the estimation results at 1% significance, the higher the level of leverage (the ratio of total loan to total assets) the shorter the survival time. This results is also confirmed by Whalen (1991), Cole and Gunther (1995), Henebry (1997) and Wheelock and Wilson (2000). A well-functioning financial system is important for efficiently identifying and allocating loans to the most productive and innovative activities. The result implies that if banks operate under a bad credit and risk management system, increase in the ratio of total loan to total asset increases credit risk and shorten the survival time.

The results indicate that liquidity ratio (total liquid asset as a percentage of total assets) is positive and statistically significant at 5% and 10%. This suggests that the higher the liquidity, the longer the survival time. This result is also confirmed by Cole and Gunther (1995) and Wheelock and Wilson (2000).

To assess the importance of macro variables that vary over time, macroeconomic variables, financial variables, external conditions and contagion effect are also included in the survival model. However, in the North Cyprus banking sector, macroeconomic factors and external conditions appear to have no impact on the survival time. With regard to financial variables, only the credit extended to the private sector is negative and statistically significant at 5% level. The results suggest that credit risk (credit extended to private sector) reduce the expected survival time of a bank. As noted earlier in this chapter, the ratio of domestic credit to the private sector to GDP can be used to capture the extent of financial liberalization. From this perspective, it can also be concluded that an increase in financial liberalization decreased the survival time of bank failure in North Cyprus.

6.4 Predictions for Each Banks

With regard to the predictive power of the models, the results indicate that models estimated in Chapters Five and Six, did quite well in predicting the occurrence of banking failure between 1984 and 2002 in North Cyprus. Table 6.10 and 6.11 report the values of the predicted probability of banking failure and time to bank failure for one year and two years ahead of failure. [31] It is possible to observe from the tables that the predicted values indicating an increasing likelihood of banking problems for failed banks are quite robust.

Specifically, for all of the specification the predicted accuracy of the probability of failure for failed banks, namely Cyprus Credit Bank, Liberal Bank, Cyprus Commercial Bank, Industrial Bank and Hamza Bank are very high. Particularly, the combining micro and macro model 4 (logit model analysis) suggests that the Government had had enough reserves, it could have rescued the Cyprus Credit Bank, Cyprus Liberal Bank, Industrial Bank and Cyprus Commercial Bank.

The best model that explains the failure of Everest Bank and Kibris Yurtbank[32] is the combining micro and macro model 12 (logit model analysis), which takes into consideration the bank specific factors (such as low capital, high leverage, high interest expense, low income and low liquidity), the market pressure in Turkey, credit extended to the private sector and high real interest rates are the main factors underlying the high probability of failure. In 1998, Model 12 predicted 47% and 49% of failures for Everest Bank and Kibris Yurtbank, respectively.

The predictive probability of Cyprus Finance Bank best explains with combining micro and macro model 9 (logit model analysis). More specifically, in 1998, the bank specific factors, deterioration in the terms of trade, high inflation and high public credits were the main determinants of failure, predicting 44% of failure.

Further, Hamza Bank was taken over by Sekerbank and Finba Financial Bank was taken over by Artam Bank in 2001. The results indicate that most of the specification models predicted a high probability of failure for both banks. Particularly, the combining micro and macro model 1 (logit model analysis) appears to be the best model that explains 76%

31 From the results of logit model and survival analysis, banks that have a very low probability of failure are not presented in the table.

32 Tunca Bank is owned by Yurt Bank A.S, which is located in Turkey, get bankrupt parallel to the failure of YurtBank A.S in 2000 in Turkey.

and 74% of the probability of failure for these two banks respectively. Moreover, the results of the survival analysis reckoned that the predicted value of the survival time of the Hamza Bank was very high (99%).

In 2000, the risk for failure for Med Bank was low. Towards the end of 2000, Med Bank was taken over by Sekerbank. The best model for Med Bank appears to be combining micro and macro Model 1 (logit model analysis), in which the predictive probability of failure was 35%. The result support the view that, in 2000, the balance sheet position of Med Bank was less affected by adverse macroeconomic shocks when compared to other two taken over banks. In contrast, predicted probabilities of survival analysis models seem to be more powerful in explaining the time to failure.

Furthermore, for all of the specification the predicted accuracy of survival time are very high for Cyprus Credit Bank, Cyprus Liberal Bank, Cyprus Commercial Bank, Hamza Bank and Med Bank. The model implies that high leverage, low liquidity and high credits extended to the private sector are the main factors that determined the survival time these banks. Moreover, the best model that determines time to failure for Industrial Bank in 1998 is combining micro and macro models 5 (survival analysis), which predicts with 56%.

The model also predicts a high probability of failure for some of the surviving banks, such as Sekerbank, Yesilada Bank, Deniz Bank, Cyprus Economy Bank and Mediterenean Bank. Although this does not necessarily mean that these banks will fail in the near future, early detection of bank failure may prove preventative. For this reason, the above-mentioned banks should pay particular attention to the issues discussed below.

Table 6.10 Predicted Probabilities of Bank Failures in North Cyprus (Logit Model Analysis)

Bank Name	Years	Micro Models (%) (Chapter 5)					Combining Micro and Macro Models (%) (Chapter 6)														
Failed Banks:		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Cyprus Credit Bank Ltd.	1998	0,76	0,52	0,50	0,88	0,55	0,83	0,66	0,60	0,73	0,82	0,74	0,78	0,79	0,73	0,70	0,65	0,75	0,81	0,81	0,75
2. Cyprus Liberal Bank Ltd.	1998	0,49	0,50	0,46	0,75	0,47	0,68	0,73	0,69	0,77	0,74	0,67	0,60	0,70	0,79	0,77	0,66	0,70	0,73	0,73	0,70
3. Everest Bank Ltd.	1998	0,06	0,14	0,08	0,13	0,10	0,33	0,12	0,13	0,28	0,35	0,14	0,34	0,19	0,31	0,20	0,12	0,47	0,36	0,36	0,43
4. Kibris Yurtbank Ltd (TuncaBank Ltd.)	1998	0,06	0,15	0,10	0,19	0,14	0,37	0,25	0,23	0,41	0,41	0,22	0,34	0,28	0,45	0,34	0,21	0,49	0,42	0,42	0,46
5. Cyprus Finance Bank Ltd.	1998	0,07	0,21	0,19	0,26	0,14	0,26	0,29	0,13	0,40	0,33	0,19	0,23	0,25	0,44	0,36	0,21	0,39	0,33	0,33	0,36
6. Cyprus Commercial Bank Ltd.	1998	0,26	0,19	0,15	0,21	0,15	0,33	0,20	0,18	0,29	0,32	0,17	0,31	0,29	0,31	0,26	0,16	0,33	0,32	0,32	0,30
	1999	.	0,97	0,95	.	0,98	0,79	0,94	0,99	0,96	0,97	0,98	0,90	0,74	0,93	0,95	0,99	0,95	0,86	0,86	0,96
7. Industrial Bank Ltd.	1998	.	0,72	0,75	.	0,79	0,91	0,93	0,92	0,93	0,93	0,93	0,86	0,93	0,93	0,93	0,91	0,89	0,93	0,92	0,89
	1999	.	0,99	0,98	.	0,99	0,93	0,99	0,99	0,99	0,99	0,99	0,96	0,93	0,99	0,99	0,99	0,99	0,96	0,96	0,98
8. Hamza Bank Ltd (Sekerbank Ltd.)	1998	0,05	0,23	0,28	0,43	0,25	0,43	0,46	0,38	0,64	0,53	0,34	0,43	0,41	0,69	0,58	0,39	0,66	0,53	0,53	0,61
	1999	0,05	0,34	0,26	0,36	0,24	0,02	0,08	0,20	0,17	0,04	0,11	0,07	0,01	0,12	0,12	0,22	0,28	0,04	0,05	0,26
	2000	0,05	0,38	0,34	0,45	0,36	0,76	0,49	0,55	0,38	0,47	0,69	0,71	0,64	0,36	0,40	0,46	0,39	0,69	0,69	0,46
9. Med Bank Ltd (Sekerbank Ltd.)	2000	0,17	0,17	0,14	0,14	0,14	0,35	0,18	0,20	0,08	0,10	0,25	0,29	0,31	0,07	0,11	0,12	0,06	0,24	0,24	0,08
10. Finba Financial Bank Ltd (Artm Bank Ltd.)	2000	0,01	0,16	0,13	0,21	0,21	0,74	0,28	0,31	0,27	0,46	0,52	0,72	0,51	0,25	0,25	0,25	0,38	0,63	0,63	0,43
Non-Failed Banks:																					
1. Cyprus Economy Bank Ltd.	2002	0,18	0,08	0,23	0,18	0,08	0,01	0,13	0,01	0,01	0,00	0,00	0,00	0,00	0,01	0,06	0,01	0,06	0,00	0,00	0,00
2. Sekerbank Ltd.	2001	0,06	0,05	0,07	0,04	0,06	0,00	0,00	0,07	0,00	0,00	0,00	0,00	0,03	0,01	0,00	0,05	0,00	0,00	0,00	0,00
	2002	0,15	0,20	0,23	0,47	0,52	0,06	0,39	0,04	0,14	0,00	0,00	0,08	0,36	0,17	0,30	0,08	0,01	0,00	0,00	0,02
3. Mediterranean Bank Ltd.	1994	0,29	0,02	0,39	0,57	0,59	0,78	0,87	0,87	0,92	0,86	0,91	0,72	0,60	0,90	0,89	0,91	0,92	0,88	0,88	0,92
	2001	0,23	0,09	0,05	0,05	0,05	0,00	0,00	0,05	0,23	0,00	0,01	0,00	0,03	0,13	0,00	0,04	0,00	0,00	0,00	0,00
	2002	0,37	0,20	0,10	0,22	0,16	0,12	0,16	0,17	0,34	0,10	0,10	0,12	0,21	0,47	0,13	0,11	0,10	0,10	0,10	0,10
4. Yesilada Bank Ltd.	2000	0,05	0,15	0,24	0,32	0,37	0,67	0,35	0,43	0,30	0,58	0,55	0,59	0,35	0,28	0,29	0,35	0,36	0,57	0,57	0,39
	2001	0,03	0,24	0,03	0,27	0,21	0,00	0,26	0,01	0,06	0,04	0,00	0,18	0,01	0,03	0,25	0,00	0,00	0,00	0,00	0,00
	2002	0,00	0,30	0,25	0,24	0,29	0,05	0,23	0,02	0,09	0,00	0,00	0,06	0,20	0,10	0,18	0,04	0,01	0,00	0,00	0,02
5. Deniz Bank Ltd.	1999	0,14	0,32	0,16	0,30	0,23	0,02	0,06	0,15	0,12	0,02	0,07	0,06	0,01	0,08	0,09	0,15	0,17	0,02	0,03	0,15
	2001	0,39	0,00	0,53	0,21	0,09	0,0	0,00	0,03	0,00	0,00	0,00	0,00	0,03	0,00	0,00	0,02	0,00	0,00	0,00	0,00
	2002	0,07	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Source: Predicted Values for estimated logit model obtained from STATA Software.

Table 6.11: Predicted Probabilities of Bank Failures in North Cyprus (Logistic Survival Analysis)

Bank Name	Years	Micro Models (Chapter 5)		Combining Micro and Macro Models (Chapter 6)				
Failed Banks:		(1)	(2)	(1)	(2)	(3)	(4)	(5)
1. Cyprus Credit Bank Ltd	1998	0,50	0,62	0,61	0,63	0,49	0,55	0,73
2. Cyprus Liberal Bank Ltd	1998	0,85	0,98	0,98	0,98	0,97	0,97	0,99
3. Everest Bank Ltd	1998	0,27	0,37	0,03	0,05	0,25	0,24	0,30
4. Kibris Yurtbank Ltd (Tunca Bank Ltd)	1998	0,11	0,21	0,20	0,19	0,18	0,22	0,30
5. Cyprus Finance Bank Ltd	1998	0,16	0,40	0,41	0,38	0,39	0,46	0,57
6. Cyprus Commercial Bank Ltd.	1998	0,94	0,98	0,96	0,97	0,97	0,97	0,98
7. Industrial Bank Ltd	1998	0,45	0,38	0,39	0,39	0,43	0,44	0,56
	1998	0,05	0,17	0,21	0,17	0,17	0,28	0,26
	1999	0,07	0,27	0,19	0,23	0,27	0,37	0,13
8. Hamza Bank Ltd (Seker Bank Ltd in 2002)	2000	0,96	0,99	0,99	0,99	0,99	0,99	0,99
9. Med Bank Ltd (Seker Bank Ltd in 2001)	2000	0,54	0,41	0,79	0,83	0,62	0,36	0,82
10. Finba Financial Bank Ltd (Artam Bank Ltd in 2001)	2000	0,01	0,01	0,09	0,14	0,03	0,02	0,12
Non-Failed Banks:								
1. Cyprus Economy Bank Ltd	2002	0,28	0,35	0,39	0,39	0,51	0,38	0,16
	2001	0,03	0,00	0,00	0,00	0,01	0,01	0,00
2. Sekerbank Ltd	2002	0,02	0,02	0,02	0,00	0,01	0,04	0,00
3. Mediterranean Bank Ltd	2002	0,08	0,07	0,08	0,03	0,04	0,06	0,00
	2000	0,05	0,05	0,33	0,29	0,13	0,08	0,15
	2001	0,02	0,00	0,00	0,00	0,00	0,00	0,00
4. Yesilada Bank Ltd	2002	0,03	0,11	0,22	0,10	0,10	0,24	0,01
	1999	0,28	0,20	0,07	0,08	0,13	0,21	0,04
	2001	0,20	0,03	0,00	0,00	0,01	0,03	0,00
5. Deniz Bank	2002	0,03	0,00	0,00	0,00	0,00	0,00	0,00

Source: Predicted Values for estimated survival analysis obtained from STATA Software.

The result of the probability of failure for Economy Bank is low. However, the result of the survival analysis shows that high leverage and low liquidity increased the survival time of the Economy Bank in 2002. Combining micro and macro model 3 (survival analysis) appears to predict 51% of the time to failure.

The predicted probability of failure for Sekerbank was 52% micro model 5 (logit model analysis) in 2002. It is important to recall that Sekerbank had taken over Med Bank in 2001 and Hamza Bank in 2002. Low capital, high leverage, low profitability, low liquidity and small size were the main factors that increased the probability of failure for Sekerbank.

The predicted probability of failure for the Mediterranean Bank increased from 13% in 2001 to 47% in 2002 (see micro and macro model 9, logit model analysis). It is important to recall that Mediterranean Bank is a state-owned bank. In 2002 the main factors that increased the probability of failure for Mediterranean Bank were low capital, low leverage, low profitability, low liquidity, high inflation and high credit which extended to the public sector and deteriorated terms of trade. During the distress period of 2001-2002 resources for the Mediterranean Bank Ltd were largely used to finance the public deficit. The findings particularly imply that the credit extended to the public sector exaggerated the risk of failure in the Mediterranean Bank.

In 2000, combining micro and macro model 1 (logit model analysis) predicts 67% of bank failure for Yesilada Bank. Specifically, low capital, high leverage, low income, low liquidity, small asset size, high real interest rates, low GDP growth and high credit extended to the private sector are the main factors underlying the high probability of failure for Yesilada Bank.

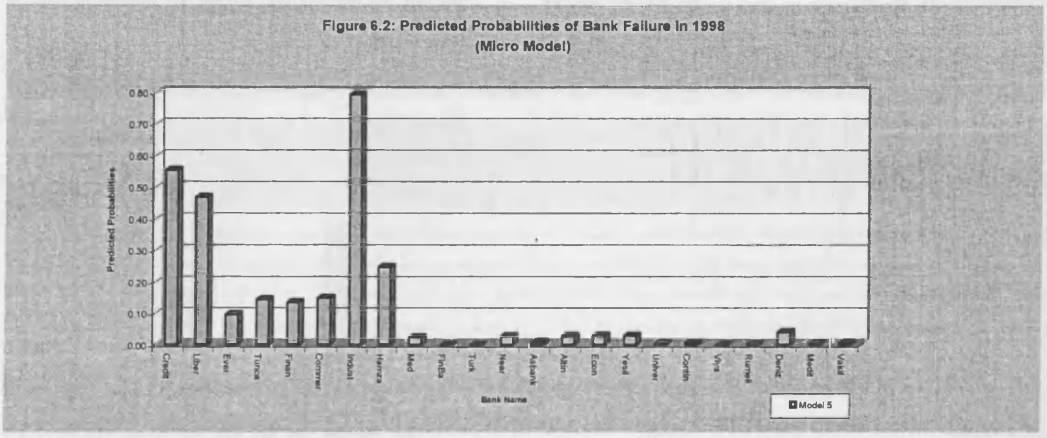
In 2001, micro model 3 (logit model analysis), i.e. low capital, high leverage, low income and small size appeared to increase the probability of failure for Deniz Bank. The predicted probability was around 53%. However, in 2002 the bank seemed to recover and the probability of failure decreased considerably.

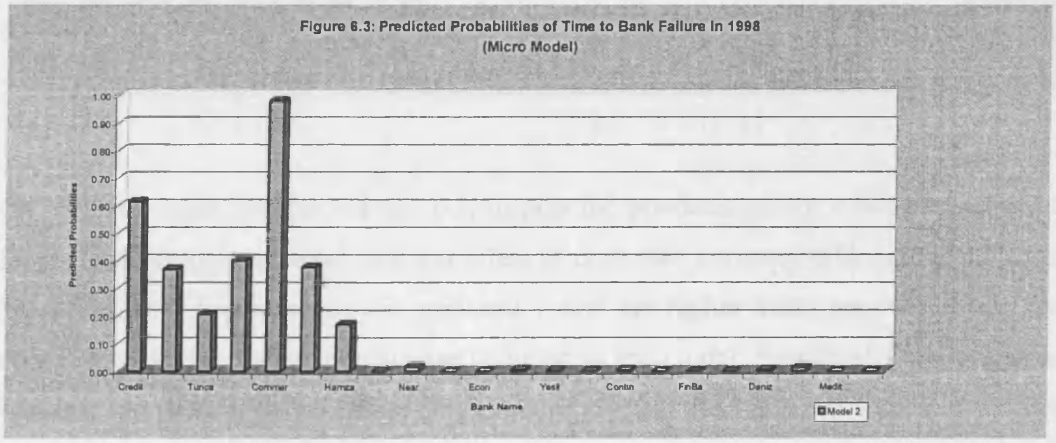
The expected probability of banking sector distress based on one period ahead probability of failure appears to be an accurate predictor of actual failures. The graphs of the models that had the highest success in 1998 (i.e. just before the distress period) are shown in

Figures 6.2, 6.3, 6.4 and 6.5. The vertical axis labels the predicted values for each bank from the model specification.

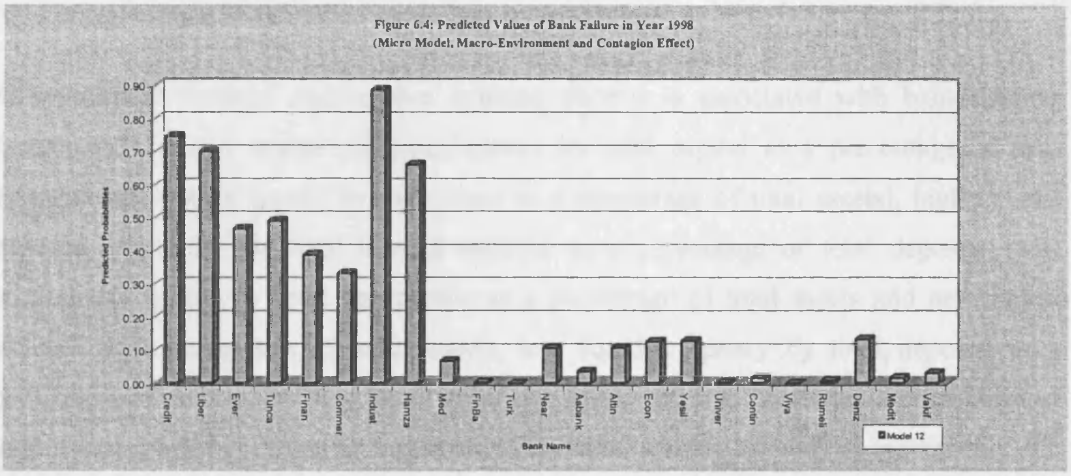
It is clear from the above figures that failed banks such as Credit (Cyprus Credit Bank), Liber (Cyprus Liberal Bank), Ever (Everest Bank), Tunca (Kibris Yurtbank formerly Tunca Bank), Finan (Cyprus Finance Bank), Commer (Cyprus Commercial Bank), Indust (Industrial Bank) and Hamza (Hamza Bank) had a higher probability of failure in 1998 than surviving banks.

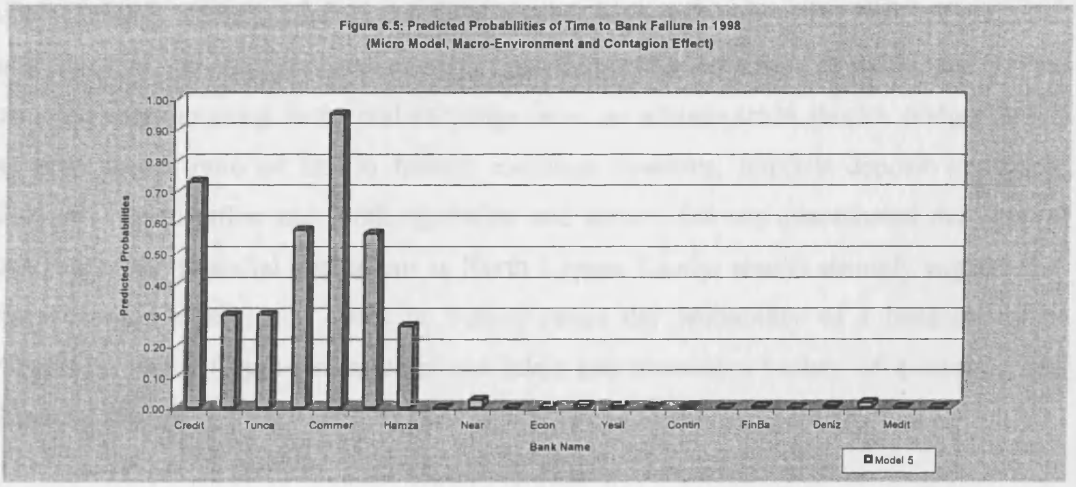
Figure 6.2 and 6.3 illustrate the predicted values of the probability of failure and time to failure based on only bank-specific variables. Specifically, micro model 5 (logit model analysis) reflects the probability of failure, and micro model 2 (survival analysis) reflects the time to bank failure, as identified in Chapter Five.





Although when the model is based on only bank-specific variables the predicted probabilities of failure work reasonable well in most cases, introducing macro variables (macroeconomic variables, financial and structural variables and external shocks) into the model, generally improves the predictive power, suggesting that the impact of both micro and macro factors are important in determining banking sector distress in North Cyprus.





On the other hand, Figures 6.4 and 6.5, display the predicted values when bank-specific factors, macro-environmental data and effect of contagion currency effect are included in the model. It is apparent that the predicted values are higher when macro data and the effect of contagion currency crisis are included in the model. Specifically, these graphs illustrate the probability of failure (logit model 12) and the predicted values of time to bank failure (survival model 5), which the combine micro model, macro-environment and contagion effects).

6.5 Conclusions

The results confirm that both micro and macro factors are important in determining bank fragility in North Cyprus. Likewise, and in line with several studies (see Cole and Gunther (1995), Gonzalez-Hermosillo *et al.* (1996), Gonzalez-Hermsillo (1999), Borovikova (2000), and Langrin (2001)), the findings support the view that in North Cyprus variables used to explain the likelihood of bank failure and the time to bank failure are different.

The empirical findings suggest that banking distress is associated with bank-specific factors such as low capital adequacy (proxy by total capital as a percentage of total assets); asset quality (proxy by total loans as a percentage of total assets), high interest expense (proxy by the total interest expense as a percentage of total deposits), low profitability (proxy by total net income as a percentage of total assets and net interest expense as a percentage of total assets), low liquidity (proxy by total deposits as a percentage of total assets) and small asset size (proxy by total assets as a percentage of total sectoral asset and natural logarithm of the total assets), as well as macroeconomic characteristics, namely a fall in real GDP growth, high inflation, rising real interest rates, and financial and structural characteristics, such as credit expansion to public and private sector, a sharp increase in the real exchange rates, an adverse trade shocks, budget deficit as well as the ratio of M2 to foreign exchange reserves, implicit deposit insurance, financial liberalization and weak regulation and supervision are exacerbated the internal troubles of the financial institutions in North Cyprus. Lastly, results strongly suggest that the existence of currency crises in Turkey raises the probability of a banking sector distress in North Cyprus, even after one takes into account a variety of economic and financial factors.

An empirical examination of the results on survival analysis reveal that the three variables, namely low asset quality (total loan as a percentage of total assets), low liquidity (total liquid asset as a percentage of total assets) and high credit extended to the private sector (ratio of the private credit to GDP) are the main factors that explain the survival time of banks in North Cyprus.

Overall, the empirical results are obtained by logit model analysis and logistic survival analyses are quite robust. The results also reveal the potential risk levels for some of the

surviving banks; such as Economy Bank, Sekerbank, Mediterenean Bank, Deniz Bank and Yesilada Bank.

Chapter 7:

Conclusions and Limitations of the Research

7.1 Introduction

A primary aim of this research was to provide an empirical analysis of the microeconomic and macroeconomic determinants of banking fragility in the North Cyprus economy between 1984 and 2002. The increase in the number of failures of commercial banks in North Cyprus has increased the attention on efforts to identify the reasons for bank failure. By the end of 1999, there were a total of 37 authorised commercial banks operating in North Cyprus. However, towards the end of 2002 ten of these banks were revoked from operation and three were taken over by another bank. Given the large costs associated with banking system failures, economists, managers, policy-makers and regulators in North Cyprus started to pay particular attention to identifying the determinants of bank failure and to being able to predict future problem banks.

The modern theoretical and empirical model of bank sector distress argues that the degree of banking sector fragility combines the internal troubles of individual banks with economic and financial weaknesses. From this point of view, this thesis implements a two stage empirical approach. The first stage of the thesis, Chapter Five, analyzes the impact of bank-specific factors as a sole determinant of bank failure. In particular, a model structure is explored by questioning the direct connections between financial ratios (that conform to the CAMELS criteria) and the particular outcome of bank failure for a sample of 23 banks. The findings in Chapter Five reveal that bank-specific variables play a significant role in explaining the probability and the time to bank failure in North Cyprus. Nonetheless, under the conditions of a rather deteriorated economic environment, it is quite normal to expect that the macro environment may also exacerbate the internal troubles of many of the financial institutions and contribute to banking sector fragility in North Cyprus. From this regard, in the second stage, outlined in Chapter Six, in addition to bank specific factors that are identified in Chapter Five, the influence of a wider

financial and economic environment is also considered. Furthermore, the contagion effect is examined, which allows the examination of whether a measure of speculative pressure on the Turkish Lira (measured by using the market pressure index) played any role in the escalation of the 2000-2002 banking distress in North Cyprus. Overall, evidence suggests that the macro environment and the contagion currency crisis also played an important role in the exacerbation of the internal troubles of many of the commercial banks in North Cyprus.

The central finding in Chapter Six is that there is a large correlation among macro variables. Therefore, due to the problematic potential for multicollinearity, which arises from the dependence among the variables, a stepwise procedure is used to combine backward and forward elimination techniques on one period prior to bank failure. For this reason the study clearly separates the impact between each macro factors (financial factors and economic factors, structural weaknesses and external shocks) and contagion effects from Turkey. Another important point to stress about the model is the fact that the North Cyprus banking sector is a small industry; therefore, the number of observations included in the model is considerably small. However, evidence from other empirical studies shows that the existence of a small number of observations can work well in bank failure estimations. [1]

The empirical analysis in this thesis focuses on two types of empirical models. In the first model a multivariate logit model analysis is used to estimate the probability of bank failure, and in the second model the logistic survival analysis is used to estimate the determinants of the time to bank failure.

7.2 What are the Main Determinants of Banking Sector Distress in North Cyprus?

The main inferences that can be drawn from the results of the empirical research carried out in this thesis can be summarized as follows:

According to the microeconomic results, the bank-specific determinants of bank failure suggest that low capital adequacy is one of the factors that increases the risk of bank failure in North Cyprus. As a consequence of the low level of minimum capital

[1] See also Gonzalez-Hermosillo *et al.* (1996), Heffernan (1996), Persons (1999), Brovikova (2000), Langrin (2001), Molina (2002), Yilmaz (2003), Canbas *et al.* (2004) and Rahman *et al.* (2004) on small sample investigations.

requirement of the Government, the banks in the study were seriously undercapitalized. Hence, the ability of banks to absorb internal and external losses was difficult. Another variable that is associated with banking sector distress is high leverage. In general, loans are perceived to be the most risky assets that banks hold. As banks were operating under a poor credit and risk management system, increase in leverage reflects poor asset quality. In particular, between the years 2001-2002 most of the debt accounts in North Cyprus are turned into non-performing loans. The figures show that banking institutions accumulated a large amount of non-performing loans, 82,988 Million US Dollars in 2001 and 60,109 Million US Dollars in 2002. Results reveal that high leverage increased the probability of failure and reduced the survival time in North Cyprus. Furthermore, high interest expense, which in particularly represents aggressive competition through interest rates, increased the probability of failure. The newly-established bank was giving a very high level of deposit interest rate, which increased the unjustified competition between the banks. The findings from the profitability measure confirm that low profitability significantly increased the likelihood of failure. Liquidity ratio (total deposits as a percentage of total loans) indicates that banks in North Cyprus face unexpected deposit runs, which increases the probability of failure in North Cyprus. Moreover, results also reveal that the higher the liquidity (total liquid asset as a percentage of total assets), the longer the survival time of banks. The last micro variable is the asset size, which suggests that larger banks experience a lower probability of failure compared to small banks. Probably, the "too big to fail" policy is cited as the reason to expect larger banks to have a lower probability of failure.

From a macroeconomic point of view, adverse macroeconomic shocks, such as high inflation, high real interest rate and low GDP growth, also deteriorated the quality of assets (probably by increasing the share of non-performing loans) held by banks and increased the likelihood of bank failure.

The weaknesses of banking sector distress often arise in times of rapid financial liberalization, weak regulation and supervision and great market competition which opens banks to higher risk on both the asset and liability side of balance sheets. The result reveals that in addition to the volatile macroeconomic environment, the rapid financial liberalization and poor supervision and regulation increased banking sector fragility in North Cyprus. As pointed out by Langrin (2001), the main problem in the financial sector

is that economies (especially in developing countries) liberalize the financial system before strengthening the weak regulatory and supervisory problem, which exacerbates the problem and leads to a period of financial distress. Two variables, namely the real interest rate and bank credit extended to private sector are proxy for financial liberalization. The findings suggest that the financial liberalization and the poor supervision and regulation increase moral hazards and hence create incentives for excessive risk taking by bank managers.

The results also reveal that extending high credit to the private sector increases the likelihood of failure in North Cyprus and shortens the survival time. In fact, non-performing loans are the major problem in North Cyprus. In particular, private banks constituted 85 percent of the total non-performing loans in 2001 and 76 percent of the total non-performing loans in 2002. This implies that an increase in credit extended to the private sector reflects a rise in risky credit.

The study also investigates the impact of two different deposit insurance policies, adopted in 1994 and 2000 respectively. On the one hand, between 1994 and 2000 the presence of the implicit deposit insurance scheme worsened the financial position of banks through incentives for moral hazard and adverse selection problems. This implies that the presence of implicit deposit insurance policy increased the risk of a crisis by weakening market discipline and encouraging banks to take excessive risks and allow bank shareholders to shift some of the risk in their balance sheets to the provider of deposit insurance. On the other hand, the presence of explicit deposit insurance (i.e. a full coverage scheme) between 2000 and 2002 increased confidence by reducing the risk of self-fulfilling or information driven depositors run. Depositors were no longer concerned about the solvency of their banks. Therefore, increased confidence eliminated the incentives of depositors to run on a bank during the 2000 and 2002 banking distress period.

In addition, unlimited credit to the public sector in the past also increased the likelihood of failure in North Cyprus. Over many years the North Cyprus Government has accumulated substantial fiscal deficits that are financed by the Central Bank. Due to sustained growth in the budget deficit, the government was not in a strong position to recapitalize problem banks and to prevent the crisis situation.

The ratios of broad money to foreign exchange reserves were also significant factors underlying the high probability of a failure in North Cyprus. This suggests that banks in North Cyprus faced runs associated with currency crises, which increased the likelihood of bank failure. Indeed, banks in North Cyprus were highly exposed to currency risks because there were large unhedged foreign liabilities and/or maturity mismatches between assets and liabilities. That is, as bank liabilities were in foreign currency, devaluation largely increased the value of those liabilities. Moreover, as banks generally lend in domestic currency, any devaluation within a country exposes them to the possibility of a crucial mismatch and worsening balance sheet.

External characteristics, such as exchange rate depreciation and adverse trade shocks, are important factors that increase the vulnerability of the financial system in North Cyprus. In particular, after the decision of the European Court of Justice, on the 5th of July 1994, the European Union Member states stopped accepting agricultural products exported by an unrecognised area of the TRNC. This imposed an embargo on agricultural products, which were the major export activity in the North Cyprus economy. The deterioration in the terms of trade negatively affected the ability of borrowers (especially traders' ability to pay their debts) to repay loans, resulting in the deterioration in bank balance sheets, thus threatening the solvency of domestic banks and increasing the probability of banking sector problems in North Cyprus.

The results also imply that the fixed exchange rate significantly increased the bank fragility in North Cyprus. As noted earlier, in December 1999 Turkey had launched a three-year IMF supported pegged exchange rate based stabilization program (fixed exchange rate regime) aimed to bring down inflation. The new policy initially increased the incentive of customers and banks to borrow in foreign currency. In other words, act as an implicit guarantee against loss, which might be due to unpredictability exchange rate. However, 14 months after the start of the program, in mid-February 2001, the currency peg had to be abandoned and replaced by a free-floating regime, which led to an increase in the risk of bank failure in the North Cyprus.

From the results it is also possible to infer that the contagion effect from Turkey increased the vulnerability of the North Cyprus financial system. The findings suggest that the exchange pressure in Turkey (i.e. speculative attack on Turkish Lira) in 1994 and 2001 put stress on banks operating in North Cyprus and led to banking sector distress.

The empirical analysis carried out in this thesis indicates that the predicted values obtained from the analyses explain high probability of failure for seven failed banks and three taken over banks. It is also important to emphasize that anticipated models also detect potential risk of fragility for some of the non-failed banks; such as Economy Bank Ltd., Sekerbank Ltd., Mediterenean Bank Ltd., Yesilada Bank Ltd and Deniz Bank Ltd. in year 2002. In this regard, authorities should pay important attention to the examination of these banks and alert management in time to take corrective actions, in order to prevent possible risk of bank failure.

Overall the econometric results confirm that that both micro and macro factors are important in determining banking sector distress in North Cyprus. The findings support the view that the failure of banks would have been anticipated one or two year ahead, before its critical time 2000, with an acceptable degree of confidence.

7.3 Limitations of the Study and Recommendations

Although this study employed a publicly available data, results may be suspect due to the quality of the annual reports. The argument is that the balance sheets and the income statements could not handle fraud. For this reason, if a substantial number of banks failed as a result of fraud, the results would be bias.

Furthermore, the variable selection was limited due to the information scarcity that is typical of an undeveloped and poorly supervised banking system. The lack of non-performing loans data means that it is not possible to test for the significance of a poor quality loan, which is an important measure of asset quality. In addition, there are 12 banks whose financial statements either are not available or contain some incomplete or missing accounts, or are contradictory hence they are deleted from observation.

Another shortcoming of the present study may relate to the sample size considered for the empirical analysis. The North Cyprus banking sector is a small industry; therefore, the number of observation included in the model is considerably small.

In future work the plan is to include non-performing loans in the model, which is an important indicator of bank failure. Moreover, other studies (see for example Barr and Siems (1994) and Wheelock and Wilson (1995)) point to the measure of the efficiency using DEA (Data Envelopment Analysis). Hence, the plan for later studies is to quantify

management quality, using DEA. Also approach may better distinguish contagion if it uses economic and financial ties from Turkey that are particularly susceptible to bank failure in North Cyprus banking sector.

APPENDICES

APPENDIX A:

Appendix A.2.1: Commercial Banks Operating in the North Cyprus

Bank Name		Date of Establishment
Public Banks		
1. Cyprus Vakiflar Bank Ltd		1982
2. Mediterranean Guarantee Bank Ltd.		1989
Private Banks[1]		
1. Turkish Bank Ltd.		1901
2. Cyprus Turkish Cooperative Central Bank Ltd.		1956
3. Limasol Turkish Cooperative Bank Ltd.		1939
4. Cyprus Credit Bank Ltd.	(Closed in 2000)	1978
5. Faisal Islamic Bank of Kibris Ltd.		1982
6. Industrial Bank Ltd.	(Transferred to SDIF in 2002)	1982
7. Cyprus Commercial Bank Ltd.	(Transferred to SDIF in 2001)	1982
8. Asbank Ltd.		1986
9. Cyprus Economy Bank Ltd.		1990
10. Cyprus Eurobank Ltd.		1992
11. Rumeli Bank Ltd.		1992
12. Cyprus Liberal Bank Ltd.	(Closed in 2000)	1992
13. Everest Bank Ltd.	(Closed in 2000)	1993
14. Finba Financial Bank Ltd.	(Renamed as Artam Bank Ltd. in 2001)	1993
15. Kibris Altinbas Bank Ltd.		1993
16. Denizbank Ltd.		1993
17. Tunca Bank Ltd. (Renamed as Kibris Yurtbank Ltd. in 1999; closed in 2000)		1994
18. Near East Bank Ltd.		1996
19. Med Bank Ltd.	(Renamed as Seker Bank Ltd. in 2001)	1996
20. Yasa Bank Ltd.	(Transferred to SDIF IN 2001)	1996
21. Erbank Ltd.		1997
22. Akfinans Bank Ltd.		1997
23. Yesilada Bank Ltd.		1997
24. Kibris Continental Bank Ltd.		1997
25. Viyabank Ltd.		1997
26. Hamza Bank Ltd.	(Sold to Seker Bank Ltd. in 2002)	1997
27. Cyprus Finance Bank Ltd.	(Closed in 2000)	1997
28. Universal Bank Ltd.		1998
29. Asia Bank Ltd.	(Transferred to SDIF in 2001)	1998
30. Tilmo Bank Ltd.	(Transferred to SDIF in 2001)	1999
31. Seker Bank Ltd.		2000
Foreign Banks[2]		
1. T.C. Agricultural Bank A. S.		1974
2. Turkish People Bank A.S.		1978
3. Turkiye Is Bank A.S.		1955
4. HSBC Bank A.S.[3]		2002

Source: Central Bank of the T.R.N.C. (2000, 2002)

1 Two banks, namely, Cyprus Investment Bank Ltd. (put under liquidation) and Home and Overseas Bank Ltd. (Formerly Independent Trade Bank Ltd., The Council of Minister permanently revoked the authority to carry on the banking business in 1997) are closed because of fraud.

2 Brances of Turkish banks operating in North Cyprus.

3 Former Demirbank Turk A. S. (5th largest bank in Turkey).

Appendix A.2.2: Ranking of the Banks in North Cyprus in 2002

Bank Name	**Total Assets (Million USD)**	**Share***
1. Cyprus Turkish Cooperative Central Bank Ltd	330.86	20.89
2. TC. Ziraat Bankasi A.S.	272.91	17.23
3. Turkish Is Bank A.S.	231.93	14.64
4. Turkish Bank Ltd.	171.44	10.82
5. Cyprus Vakiflar Bank Ltd.	96.59	6.10
6. Mediteerenean Guarantee Bank Ltd.	93.95	5.93
7. Limasol Turkish Cooperative Bank Ltd.	89.72	5.66
8. Industrial Bank of Kibris Ltd.	47.39	2.99
9. Asbank Ltd.	46.26	2.92
10. Altinbas Bank Ltd.	36.20	2.29
11. HSBC Bank A.S	27.65	1.75
12. Yesilada Bank Ltd	26.25	1.66
13. Turkish Halk Bank A.S.	24.58	1.55
14. Sekerbank Kibris Ltd	20.29	1.28
15. Near East Bank Ltd.	17.28	1.09
16. Universal Bank Ltd.	15.42	0.97
17. Faisal Islam Bank Ltd.	9.95	0.63
18. Viya Bank Ltd.	6.15	0,39
19. Kibris Continental Bank Ltd.	5.00	0.32
20. Erbank Ltd.	5.14	0.32
21. Akfinansbank Ltd.	2.62	0.17
22. Artam Bank Ltd.	2.56	0.16
23. Rumeli Bank Ltd.	1.38	0.09
24. Deniz Bank Ltd.	1.29	0.08
25. Kibris Euro Bank Ltd.	1.04	0.07
TOTAL	***1583.85***	***100.00***

Source: Central Bank of T.R.N.C., 2002.

* Denote share of bank assets to total banking sector assets in 2002.

APPENDIX B:

Appendix B.3.1: Summary of the Empirical Studies on Systemic Banking Crises and Individual Bank Failures[1].

B.3.1.1 Systemic Banking Crises

Author(s)	Objective	Methodology, Sample and Time Period	Explanatory Variables	Main Finding(s)
Demirguc-Kunt and Detragiache (1998a)	Determinants of banking crises	Logit Model 65 developed and developing countries (1980-1994)	**Macroeconomic Variables:** GGDP, RIR, INF, TT, ER, Budget Position **Financial Variables:** M2/Reserves, GCredit(-2), Liquidity, Private Credit **Financial Structure**: Insurance (Explicit), Law	• Low GDP growth, high inflation, high real interest rates, ratio of M2 to Reserves are highly significant and increase the probability of systemic banking sector problems. • Decline in Terms of Trade, liquidity risk (ratio of bank liquid reserves to bank assets), past credit growth and large banking sector credit to private sector has weaker effect. • Fiscal deficit and change in exchange rate have no effect. • Deposits insurance, weak 'law and order' increases probability of crises.
Demirguc-Kunt and Detragiache (1998b)	Impact of financial liberalization on banking sector fragility	Logit Model 53 developed and developing countries (1980-1995)	In addition to the variables employed in 1998a Liberalization is included.	• Financial Liberalization is a significant factor leading to banking sector fragility. • Low GDP growth, adverse terms of trade change, high real interest rate, high inflation, past credit growth and the ratio vulnerability of a speculative attack against a currency crisis are associated with banking crises. Other variables appear to be insignificant.
Demirguc-Kunt and Detragiache (2000)	Develop an EWS for monitoring banking sector fragility.	Logit Model 65 countries (1980-1995)	**Macroeconomic Variables:** GGDP, TT, RIR, INF, ER, GDP/Capita, Budget Position **Financial Variables:** M2/Reserves, Liquidity, GCredit (-2)	• High past credit growth, high real interest rate and high inflation, negative growth shocks and increase in the ratio M2 to reserves were the factors emerges high probability of banking crisis. • However, ratio of fiscal surplus to GDP and terms of trade change appears to be insignificant.

[1] See Appendix B.3.2 for abbreviation of the variables that are employed in the Table.

Hutchison and McDill (1999)	Determinants of banking sector distress, highlighting the experience of Japan	Probit Model 97 developed and developing countries (1975-1997)	**Macro-Environment** : GGDP, GCredit, ER RIR, INF, INF (Dummy) , Stock, Budget Position, M2/Reserves, ER **Financial Structure:** Insurance (Explicit), Liberalization (IR), CB Independence	• Growth rate of GDP and changes in stock prices are statistically significant. • Real credit growth has weaker effect. • All of the institutional characteristics are significant. • Japan had a strong macroeconomic position at the onset of crises.
Hutchison (2002)	Determinants of banking sector distress, highlighting the experience of the EU countries	Probit Model 90 developed and developing countries (1975-1997)	**Macro-Environment**: INF, GGDP, MPI **Financial Structure:** Liberalization (IR), Law	• During period of financial liberalization (domestic interest rate deregulation), weaknesses in the law and regulations, decline output growth, high inflation and severe exchange pressure increase probability of failure. • Low probability of banking sector distress/banking crises in EU countries.
Eichengreen and Arteta (2000)	Causes of banking crises in emerging markets.	Probit Model 75 Developing Countries (1975-1997)	**Macro-Environment:** RER, External Debt, Current Account Balance, Budget Position, Bank Liabilities, M2/Reserves, GCredit, IR, Insurance, Liberalization (IR), ER (Regime) etc.	• Domestic credit booms, large bank liabilities relative to reserves, ratio of M2 to reserves and deposit rate decontrol are associated with banking crises. • Relationship between exchange rate regime and banking crisis seem to be less significant. • Deposit Insurance reduces credit risk by solving the deposit run problem rather than encouraging crises by weakening market discipline.
Hardy and Pazarbasioglu (1998)	Determinants of the banking sector distress.	Logit Model 38 developing and developed countries (1980-1997)	**Macro-Environment:** RIR, RER, INF, TT, GIMP, GGDP etc. **Banking sector variables:** DepGDP, GCredit, Private Credit, Foreign Liabilities etc.	• Higher crises probability if low GDP growth, high inflation, high credit growth, high interest rates, fall in real exchange rate and adverse trade shock. • Particularly, in Asian countries financial variables; such as credit growth and rising foreign liabilities were more important than macroeconomic indicators.
Domac & Mertinez Peria (2003)	Relationship between banking crises and exchange rate regimes.	Logit Model, OLS, Hazard Function. Developed and developing countries (1980-1997)	**Macroeconomic Variables:** INF, RIR, GGDP. **Financial Variables:** M2/Reserves, GCredit, CreditGDP, Liquidity, Budget Position **External Shocks:** TT, RER **Financial Structure:** liberalization (IR), Liberalization (GCredit), Liberalization (Private Credit), ER (Regime)	• Fix-Exchange rate regime reduces the probability of banking crises, particularly in developing countries. • Credit growths, high ratio of M2 to reserves and high inflation have adverse effect on financial stability.

B.3.1.2 Individual Bank Failure

Author (s)	Objective (s)	Methodology, Sample and Time Periods	Explanatory Variables[2]	Main Finding (s)
Martin (1977)	Construct and EWS to predict the probability of future bank failure in US	Logit Model and Discriminant Analysis 5,700 US Banks - 58 failed (1970-1976)	**C:** tcta, tcrasset **A:** loanta, loanlt, chargeoperinc **E:** patta **L:** liqta	• Capital adequacy (tcrasset), asset quality (chargeoperinc) and profitability (patta) are statistically significant. • However, asset risk (loanta and loantl) appears to be insignificant and wrong sign coefficient.
Avery and Hanweck (1984)	Investigated US banks failure	Logit Model 1290 US banks - 100 failed (1979-1983)	**C:** tcta **A:** loanta and loantl **E:** patta **S:** lta	• Profitability (patta), capital adequacy (tcta) and asset quality (loanta and loantl) are statistically significant.
Espahbodi (1991)	Identify potential failure in US banking industry	Logit Model and Discriminant Analysis 70 US banks - 37 failed (1983)	**C:** loantc **A:** loanta, loanlosstl **M:** intexpoperinc, operexpinc **E:** intincpat intincoperinc, operincta, intincpat **L:** liqta	• Profitability (intincpat, intincoperinc) and management efficiency (intexpoperinc) measured to be significant. • Other variables were found to be insignificant.
Thomson (1991)	Investigated US banks failure	Logit Model 2506 banks - 770 failed (1983-1988)	**C:** tcta **A:** loanta **E:** patta **S:** lta **EC**	• Asset Quality (loanta), profitability (patta) and size variable (lta) are statistically significant. • Moreover, economic factors are appears to have an affect on the likelihood of bank failure.
Kolari *et al.* (2002)	Investigated US banks failure	Logit Model 1055 banks - 55 failed (1989-2002)	**C:** tcta **A:** loanta **E:** nintta, patta **S:** lta etc.	• The mean values of these variables are statistically significant for distinguishing failed banks from non-failed banks. Using stepwise logit model 4 variables found to be signigicant. However, these variables are not clarified.

[2] These variables are in the context of CAMELS criteria; **(C)** Capital Adequacy; **(A)** Asset Quality; **(M)** Management Efficiency; **(E)** Earning, i.e. profitability; **(L)** Liquidity and **(S)** Size.

Persons (1999)	Predict bank failure in Thailand (mid-1997)	Logit Model 41 banks - 26 failed (1993-1996)	**C :** tcloan **A:** loanta, npltl **M:** operexpta **E:** patta **L:** loandep, liqdep **S:** lta	• Profitability (patta), liquidity (loandep) and size variable (lta) have a negative impact, and management efficiency (operexpta) has a positive impact on the probability of failure
Canbas *et al.* (2004)	Construct an EWS for bank failure in Turkey	Logit Model, Probit Model and Discriminant Analysis 40 banks - 21 banks failed (1997-2003)	**A:** loanta,npltl **M:** intincexp **E:** patta, **L:** liqdep, liqta	• CAMEL criteria do not represent the characteristics of Turkish commercial banks
Rahman *et al.* (2004)	Identify financial distress indicators in South Asian countries (Indonesia, South Korea and Thailand)	Logit Model Indonesia:30 banks - 19 failed South Korea: 29 banks - 21 failed Thailand: 17 banks (12 failed) (1995-1997)	**C:** tcta **A:** loanta, npltl **M:** intexptl, intincexp, operexpppbt **E:** pbtpat, pbtta, pbttc, intincpat **L:** liqta, liqdep	• Capital Adequacy (tcta), loan management (intincexp) and operating efficiency (operexpppbt) are found to be significant indicators.
Lane, Looney and Wansley (1986)	Predict time to bank failure in US	Survival Analysis (CPH Model) 464 banks - 130 failed (1979-1983)	**C:** tcta, loantc **A:** loanta, loantl **M:** intexpdep, operexpinc **E:** patta, pattc, patoperinc, operincta **L:** loandep, liqta	• Asset quality (loantl), liquidity (loandep), capital adequacy (tcta) and operating efficiency (operexpinc) significantly determine the time to failure. • CPH Model is an effective early warning tool.
Whalen (1991)	Estimate the time to failure in US banks.	Survival Analysis (CPH Model) 1500 banks - 500 failed (1987-1990)	**C:** tcta **A:** loanta, npltl, nplta **M:** operexpta **E:** patta	• Asset Quality (loanta), profitability (patta) and capital adequacy (tcta) are significant determinant of time to bank failure. • PHM is an effective early warning tool.

Cole and Gunther (1995)	Investigated the determinants of time to bank failure in US.	Survival Analysis (Log-logistic distribution, standard logistic model and CPH Model) 10,843 banks - 811 failed	**C:** tcta **A:** nplta, loanta **M:** operexta **E:** patta **L:** cdta **S:** lta	• Capital adequacy (tcta), troubled assets (nplta) and leverage (loanta) and profitability (patta) and Liquidity (cdta) are significant in explaining the time to bank failure.
Henebry (1997)	Investigate time to bank failure in US	Survival Analysis (CPH Model) 238 banks - 92 failed (1985-1988)	**C:** tcta **A:** npltl **E:** patta and operexpta **L:** loanta	• Capital adequacy (tcta), asset quality (npltl) and liquidity (loanta) are significant in predicting time to bank failure.
Wheelock and Wilson (2000)	Investigate time to failure in US	Survival Analysis (CPH Model) 4,022 banks - 231 failed and 1,380 acquired (1984-1993)	**C:** tcta **A:** loanta, nplta **E:** patta **L:** liqta **S:** lta	• Lower capitalization (tcta), lower asset quality (loanta, nplta), lower earning (patta), lower liquidity (liqta) and smaller the size (lta) also result with high probability of failure.
Molina (2002)	Estimate the time to bank failure in Venezuella. (1994-1995 Banking Crisis)	Survival Analysis (CPH Model) 36 banks - 17 failed (1987-1996)	**C:** tcta **A:** govbonds **M:** operexpinc, intexpdep **E:** patta **L:** liqtl **S:** lta	• Banks with higher return on investment in government bonds (govbonds), higher return in assets (patta), more financial expense (intexpdep) and less operational expenses (operexpinc) are less likely to fail. • Some evidence that banks with higher capitalization are less probable to fail.

B.3.1.3 Banking Sector Fragility

Author (s)	Objective (s)	Methodology, Sample and Time Periods	Explanatory Variables	Main Finding (s)
Gonzalez-Hermosillo, Pazarbasioglu and Billings (1996)	Bank fragility in Mexico (investigate both the determinants of probability of bank failure and the time to failure)	Logit Model and Survival Analysis (Log-Logistic Specification) 31 banks (exclude foreign banks and some foreign banks) (1991-1995)	**Bank-Specific Variables:** tcta, npltl, loantl, operexpta, profit margin, deploan, liqta, tasecta etc. **Banking Sector Variables:** NPLTL, LoanGDP (a proxy of contagion effects), Risky Loans etc. **Macroeconomic Variables:** GGDP, RIR, INF, ER, RER	• Bank specific variables (non-performing loan to total loans) and contagion effects (measured by the ratio of the loans of the overall banking system to the region's GDP) explain the likelihood of bank failure. • Bank-specific variables (ratio of non-performing loan to total loans, and size variable), banking sector variables (banking sector risky loans), adverse macroeconomic shocks (nominal exchange rate, real interest rates) and contagion effect shorten the survival time of banks. • Rapid growth in bank lending is the main factor that affects fragility.
Gonzalez-Hermosillo (1999)	Investigate both macroeconomic and microeconomic determinants of bank failure in five country	Logit Model US Southwest (1986-1992) North East (1991-1992) California (1992-1993) Mexico (1994-1995) Columbia (1982-1987)	**Bank-Specific Variables:** tcta, loanta, npltl, nplta, operexpta, patta, lta etc. **Macroeconomic variables:** ER, IR, Stock, LoanGDP etc.	• A high ratio of non-performing loan to total assets and a low capital-asset ratio increase the probability of failure. • Liquidity risk and market risk seem to be an important determinant of bank distress, • Contagion (measured by the ratio of the loans of the overall banking system to the region's GDP) is present but its effect is small.
Langrin (2001)	Determinants of the 1996/1997 banking sector distress in Jamaica	Logit Model and Survival Analysis (Weibull distribution) 9 Banks	**Bank Specific Variables** lta, tcta, loantc, deploan, liqta, nplta, patta, nintta, fata **Macro-Environment:** Private Credit, INF, Stock, ER, M2/Reserves **Structural Variables:** Domestic, Liberalization	• Asset size, capital to asset ratio and troubled assets determine both probability and time to bank intervention. • In addition to above variables ratio of loan to capital, net income, domestic banks and financial liberalization explain time to failure.
Heffernan (1996)	Microeconmic and macroeconomic determinants of bank failure in	Logit Model 39 Banks-12 failed	**Bank-Specific Variables:** patta, nintta, pattc, tcta, liqdep, loanlosstl, lta **Macroeconomic Variables:** RIR,	• Real interest rates, exchange rates and inflation rates found to be the best performing macro indicators. • Asset size is an important determinant of bank failure and profitability (ratio of net income to total assets)

	Australia, Finland, France, Norway, Sweeden and the US	(1989-1992)	RER, ER, INF, GGDP	found to be the best performing micro indicator. • Also, capital adequacy appears to be significant when other profitability ratios are employed.
Borovikova (2000)	Determinants of bank failure and survival time in Belarusian banks	Logit Model and Survival Analysis (Log-Logistic Specification) 41 Banks - 15 failed (1992-1999)	**Bank-Specific Variables:** lta, patoperinc, tcta, loanta, nplta **Macroeconomic Variables:** GGDP, INF, ER, IR.	• Profitability, quality of assets (ratio of loans to total assets), asset size and low GDP growth rate are important indicators that explain the probability of failure. • Profitability, interest rates and exchange rates macroeconomic indicators appear to be an important indicator that determines the survival time of banks in Belarus.
Yilmaz (2003)	Determinants of bank failure in Turkey and whether presence of full coverage deposit insurance after 1994 worsened the financial position of banks.	Probit Model 36 privately owned commercial bank (1988-2000)	**Bank-Specific Variable:** liqdep, loanta, non-performing loans,tcta, lta **Macroeconomic variables:** RIR, ER, INF, GGDP, **External variables**: Capital Account Balance **Institutional Variables:** Insurance	• Ratio of ratio of loan to total asset (loanta), ratio of capital to asset (tcta), presence of deposit insurance, real interest rates and GDP growth rate are important factor that significantly determine probability of failure. • The presence of full coverage deposit insurance after 1994 led to deteriorations in financial ratios, which increased bank fragility through moral hazard and adverse selection.

Appendix B.3.2: Abbreviation of the Variables

Capital Adequacy (C)

loantc: Ratio of loans to total equity capital

tcloan: Ratio of equity capital to total loans

tcrasset: Ratio of gross capital to risky assets

tcta: Ratio of total capital to total assets

Asset Quality (A)

chargeoperinc: Ratio of gross charge-offs to net operating income

govbonds: Ratio of total government bonds to total assets

loanlosstl: Ratio of reserve for provision of loan losses to total loans

loanta: Ratio of loan to total assets

loantl: Ratio of commercial loans to total loans [Loan composition]

nplta: Ratio of non-performing loans to total assets

npltl: Ratio of non performing loan to total loans

Management Efficiency (M)

intexpdep: Ratio of interest expense to total deposits

intexpoperinc: Ratio of interest paid on deposit to total operating income

intexpta: Ratio of interest expense to total assets

intexptl: Ratio of interest expense to total loans [Management Efficiency]

intincexp: Ratio of interest income to interest expense [Loan Management]

operexpinc: Ratio of total operating expense to total operating income [Operating Efficiency]

operexppbt: Ratio of operating expense to profit before taxation

operexpta: Ratio of operating expense to total assets

Earning (E)

intincoperinc: Ratio of interest income to total operating income

intincpat: Ratio of interest income to net income

intincpat: Ratio of interest income to net income [Ratio of loan revenue to total income]

nintea: Ratio of net interest margin to total earning assets

nintta: Ratio of net interest income to total assets

operincta: Ratio of total operating income to total assets

patoperinc: Ratio of net income to operating income

patta: Ratio of net income to total assets

pattc: Ratio of net income to total capital

pbtpat: Ratio of the profit before taxation to net income

pbtta: Ratio of profit before taxation to total assets

pbttc: Ratio of profit before taxation to total capital

profit margin: ratio of net income to total operating income

Liquidity (L)

clca: Ratio of current liabilities to current assets

cdta: ratio of large certificates of deposit to total assets

deploan: Ratio of total deposits to total loans

liqdep: Ratio of liquid assets to total borrowing and deposits

liqta: Ratio of liquid asset to total assets

liqtl: Ratio of liquid assets to total loans

loandep: Ratio of total loans to total deposits

wcta: Ratio of the working capital to total assets

Asset Size (S)

fata: Ratio of fixed assets to total assets

lta: Logarithm of the total assets

tasecta : Ratio of total assets to total sectoral assets

Macro-Environment (Macroeconomic Variables, Financial Variables and External Shocks)

Bank Liabilities: Ratio of bank liabilities to reserves

Budget Postiton: Ratio of government surplus / deficit to GDP

Capital Account: Ratio of the capital account to GNP

Current Account Balance: Ratio of current account to GDP

DepGDP: Ratio of real bank deposits to GDP

EC (Economic Condition): unemployment, growth in personal income, business failure rate, measure of economic diversification

ER: Depreciation of exchange rate

ER (Regime): Dummy for exchange rate regime

External Debt: Ratio of external debt to GDP

Foreign Asset/M1: The ratio of foreign asset to M1

Foreign Liabilities: Ratio of bank gross foreign liabilities to GDP

GCredit (-2): Credit growth lagged for two years [Past credit growth]

GCredit: Growth in real domestic credit

GCrGDP (-2): Credit lagged for two years

GDP/Capita: GDP per capital

GGDP: Growth rate of real GDP

GIMP: Growth rate of real import

INF: Inflation

INF (Dummy): Dummy for high inflation countries

Investment/GDP: Ratio of investment to GDP

IR: Nominal Interest Rate

IR (Spread): Difference between bank lending and deposit rates

Liquidity: Ratio of bank liquid reserves to bank assets

LoanGDP: Ratio of the total banking sector loan to GDP

M2/Reserves: Ratio of broad money to foreign exchange reserves (banks vulnerability to currency crises) (vulnerability to speculative attack against the currency)

M2: Growth rate of M2

MPI: Market Pressure Index (Exchange Rate Pressure)

NPLTL: Banking sector non-performing loan to total loans [Banking Sector Fragility]

Private Credit: Ratio of domestic credit to the private sector to GDP

RER: Real exchange rate

Reserves: Foreign exchange reserves

RIR (-1): Lagged real interest rate

RIR: Real Interest Rate

Risky Loans: Ratio of the riskiest loans to total capital [Banking sector risky loans]

Stock: Change in the index of stock prices

Trade Balance: Indicate an overvalued exchange rate leading to slow export growth and increased import growth

TT: Terms of Trade

Structural Characteristics [Dummy Variables]

CB Independence[1]: The degree of central bank independence

Domestic: One for domestic banks and zero otherwise

Insurance[2]: Explicit / implicit deposit insurance

Law[3]: Weaknesses in law and regulations (Average Value of Rule of Law)

Liberalization (IR): Liberalization proxy as deposit interest rates

Liberalization (GCredit): Liberalization proxy as the growth rate of credit[4]

Liberalization (Private Credit): Liberalization proxy as the domestic credit to the private sector

1 Independent central banks are less closely aligned with the government and may also play a more credible role in the regulatory, supervisory and monitoring functions over financial institutions (see Hutchison and McDill (1999)).
2 One if government offered explicit or implicit guarantees during the crisis and zero otherwise.
3 Average value of rule of law and corruption that indicate government functioning.
4 Some studies connect financial liberalization as rapid rise in loan relative to GDP. (see Sundararajan and Balino (1991), Drees and Pazarbasioglu (1995)).

APPENDIX C:

Appendix C.4.1: Sample Balance Sheet of North Cyprus Banks

ASSETS

Cash and Balances at Central Banks[1]

Balances with banks[2]

Security portfolio[2]

Loans and advances to customers[2]

Other Assets

Payments and Accrued income

Investment in Subsidiary companies[2]

Tangible Fixed Assets

TOTAL ASSETS

LIABILITIES (Liabilities & Capital)

Customer accounts[3]

Deposits by banks

Other liabilities

Taxation

Accruals and deferred incomes

Shareholders' Fund[4]

TOTAL LIABILITIES

[1] Non-earning Assets.
[2] Earning Assets.
[3] Customer and short-term funding = customer accounts + deposits by bank.
[4] Shareholders' fund = paid up share capital + reserves.

Appendix C.4.2: Derivation of the Logit Model

In this research the logit model[5] (log of odds) predicts the probability of failure conditional upon the set of independent variables for the bank. Assuming a logistic distribution, the probability of a banking sector distress in period t can be expressed as;

$$\text{Log}\left(\frac{P_i}{1-P_I}\right) = Z_i \quad \ldots\ldots(1)$$

Where;

Z_i stand for the $\beta_O + \sum_{j=1}^{k} \beta_j X_{ijt}$

P_i: The probability that bank i fail

From the above equation P_i can be obtained by taking antilogarithms[6].

$$\left(\frac{P_i}{1-P_I}\right) = e^{Zi} \quad \ldots\ldots(2)$$

$$P_i = e^{Zi}\ (1-P_i)$$

$$P_i\ (1 + e^{Zi}) = e^{Zi}$$

Where;

e^{Z_i} : denotes e raised to the power of Z_i

e : represents the base of natural logarithms[7].

Then, the probability that bank i fail is written as

$$P_i = \frac{e^{Z_i}}{1+e^{Z_i}} = \frac{e^{\beta_0 + \sum_{j=1}^{k} \beta_j X_{ijt}}}{1+e^{\beta_0 + \sum_{j=1}^{k} \beta_j X_{ijt}}} \quad \ldots\ldots(3)$$

(see Aldrich and Nelson (1984), Pampel (2000), and Madalla (2001))

The above equation, referred as logistic function, is continuous and can take on any value from 0 to 1.

[5] Logit estimations are a discrete non-linear probability model that estimated by a method called Maximum Likelihood Estimation (MLE). MLE is concern with estimation of the unknown parameter β that maximize the probability (or likelihood) P_i of having obtained the observe sample Y.

[6] The natural logarithm has a base of e, where $e^{Zi} = Z_i$, and thus the antilog of Z_i is e^{Zi}.

[7] e is equal to 2.71828

Appendix C.4.3: The Kaplan-Meier (Product-Limit Estimators)

As a first step the survival function is estimated using the standard Kaplan-Meier (1958) as a non-parametric maximum likelihood estimator. The Kaplan-Meier estimator of the survival function $S_{KM}(t_j)$ can be written as;

$$\hat{S}_{KM}(t_j) = \prod_{j|t_j<t} \left(\frac{n_j - d_j}{n_j}\right) \quad \text{(See Jenkins (2004, 53))}$$

Where;

d_j represents the number of banks observed to 'fail' at t_j

t represent the survival time that are observed in the dataset. ($t_1, t_2, \ldots\ldots t_k$)

n_j represents the number of banks at risk of failure immediately at prior to t_j (i.e. ending their spell)[8]

From the above formula failure function can be derived as;

$$\hat{F}(t_j) = 1 - \hat{S}(t_j)$$

[8] $n_j = d_j + m_j$, where m_j is the number of banks whose observed duration is censored in the interval $[t_j, t_{j+1})$, in another words, still in distress at time t but not by time t+1.

Bibliography

Abdul-Majid, M. Z. and Yusoff, M. B. (2000), "Asean Currency Crises and Contagion Effects: Further Evidence", *Working Paper 8*, Faculty of Economics and Manegement, Universiti Putra Malaysia.

Abel, A., Bernanke, B. and McNabb, R. (1998), *Macroeconomics*, European Edition, Addison Wesley Longman.

Akerlof, G. A. and Romer, P.M. (1993), "Looting: The Economic Underworld of Bankruptcy for Profit", *Brooking Papers on Economic Activity, 2*, 1-17.

Akyuz, A. and Boratav, K. (2003), "The Makings of the Turkish Financial Crisis", *World Development*, 31, 9, 1549-1566.

Aldrich, J. H. and Nelson, F.D. (1984), "Linear Probability, Logit, and Probit Models", *Sage Publications* Inc., USA.

Allan, F. and Gale, D. (2000), "Optimal Currency Crises", *Carnegie-Rochester Conference Series on Public Policy*, 53, 177-230.

Allison, P. D. (1984), "Event History Analysis: Regression for Longitudinal Event Data", *Sage Publication Inc.*, USA.

Alper, C. E. (2001), "The Turkish Liquidity Crisis of 2000: What Went Wrong?", *Russian and East European Finance and Trade*, 37, 6, 51-71.

Altman, E. (1968), "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", *Journal of Finance*, 23, 589–609.

Altman, E. (1977), "Predicting Performance in the Saving and Loan Association Industry", *Journal of Monetary Economics*, 3, 443-466.

Altman, E. (1993), *Corporate Financial Distress and Bankruptcy*, New York: Wiley.

Altman, E., Haldeman, R. and Narayanan, P. (1977), "ZETA analysis: A New Model to Identify Bankruptcy Risk of Corporations", *Journal of Banking and Finance*, 1, 29-54.

Aricanli, T. and Rodrik, D. (1990), "The Political Economy of Turkey: Debt Adjustmant and Sustainability", *New York: St. Martin Press.*

Atiyas, I. (1990), "The Private Sector's Response to Financial Liberalization in Turkey:1980-1982" Edited by Tosun Aricanli and Dani Rodrik, *The Political Economy of Turkey: Debt, Adjustment and Sustainability*, St. Martin's Press New York.

Avery, R. B. and Hanweck, G. A. (1984), "A Dynamic Analysis of Bank Failures", Proceedings of the 20th Annual Conference on Bank Structure and Competition, *Federal Reserve Bank of Chicago*, 380-395.

Ayres, R. (2003), "The Economic Costs of Separation: The North South Development Gap in Cyprus", *Economia*, 6, 1, 39-52.

Babic, A. and Zigman, A. (2001), "Currency Crises: Theoretical and Empirical Overview of the 1990s", *Croation National Bank Survey.*

Baltagi, B. G. (1999), *Econometrics*, Springer-Verlag Berlin.

Banerjee, A., Dolado, J., Galbraith, J. W., Hendry, J. F. (1993), "Cointegration, Error-Correction and the Econometric Analysis of Non-Stationary Data", *Oxford University Press,* Oxford.

Banking and Capital Market (2001) available at: *http://www.tusiad.org/english/rapor/te/5.pdf.*

Banks in Turkey (1998), *The Bank Association of Turkey*, Istanbul.

Barker, D. and Holdsworth, D. (1993), "The Causes of Bank Failures in the 1980s", *Federal Reserve Bank of New York,* 9325.

Barr, R. and Siems, T. (1994), "Predicting Bank Failure Using DEA to quantify management quality", *Federal Reserve Bank of Dallas Financial Industry Studies*, 26, 1-31.

Barth, J. R., Brumbaugh, R. D., Sauerhaft, D. and Wang, G. H. (1985), "Thrift Institution Failures: Causes and Policy Issues", Proceedings from a Conference on Bank Structure and Competition, *Federal Reserve Bank of Chicago*, 184-216.

Bayir, H. (2001), "Measuring the Impact of Full Coverage Deposit Insurance Policy in a Probit Model: A Study of the Privately Owned Commercial Banks in Turkey", *Central Bank Review*, 1, 1-23.

Beaver, W. (1966), "Financial Ratios as Predictors of Failure", *Journal of Accounting Research*, 77-111.

Bell, J. and Pain, D. (2000), "Leading Indicator Models of Banking Crisis – A Critical Review", *Financial Stability Review*, 113-128.

Benston, G. J. (1985), "An Analysis of the Causes of Savings and Loans Association Failures", *Monography Series in Finance and Economics*, New York University.

Benston, G., Eisenbeis, R., Horvitz, P., Kane, E. and Kaufman, G., (1986), *Perspectives on Safe & Sound Banking: Past, Present, and Future*, MIT Press, Cambridge, MA.

Berg, A. and Pattillo, C. (1999), "Are Currency Crises Predictable? A Test", *IMF Staff Papers*, 46, 2, 107-138.

Berg, A. and Pattillo, C. (1999), "Predicting Currency Crises: The Indicators Approach and an Alternative", *Journal of International Money and Finance,* 18, 4, 561–86.

Berg, A., and Pattillo, C. (1998), "Are currency crises predictable? A test", *IMF Working Papers*, 98, 154.

Berger, A. N., Davies, S. M. and Flannery, M. J. (2000), "Comparing Market and Supervisory Assessments of Bank Performance: Who Knows What When?", *Journal of Money, Credit, and Banking*, 32, 3, 641-667.

Berger, A., and Davies, S. (1998), "The Information of Bank Examinations", *Journal of Financial Services Research*, 14, 2, 117-144.

Bernanke, B. and Gertler, M. (1989), "Financial Fragility and Economic Performance", *Quarterly Journal of Economics*, 105, 87-114.

Bernanke, B. S. (1983), "Non-monetary Effects of the Financial Crisis in the Propagation of the Great Depression", *The American Economic Review*, 73, 3, 257-276.

Bernanke, B., Gertler, M. and Gilchrist, S. (1992), "The Financial Accelerator and the Flight to Quality", *Review of Economics and Statistics*, 78, 1, 1-15.

Bernhardshen, E. (2001), "A Model of Bankruptcy Prediction" *Norges Bank Working Paper*, 10.

Bicak, H. A. and Akifler, U. (1998), "Two Economies on an Island: An Assessment of Macroeconomic an d Social Indicators of Turkish Cypriots and Greek Cypriots economy", *Second International Congress of Cyprus Studies*, Eastern Mediterenean University, TRNC.

Bocutoglu, E. and Celik, K. (2000), "The Effects of Russian Economic Crisis on Turkish Economy: A Brief Assessment", *Journal of Qafgaz University*, 3, 1, 123-132.

Bongini, P., Laeven, L. and Majnoni, G. (2002), "How Good is the Market at Assessing Bank Fragility? A Horce Race Between Different Indicators", *Journal of Banking and Finance*, 26, 1011-1028.

Bordo, M., Eichengreen, B., Klingebiel, D. and Martinez-Peria, M. S. (2001), "Is the Crisis Problem Growing More Severe?" *Economic Policy*, 32, 51-75.

Borovikova, V. (2000), "The Determinants of Bank Failures: the Case of Belarus". M.A Thesis, *National University, Kiev - Mohyla Academy.*

Box, G. and Jenkins, G. M. (1970), "Time Series Analysis: Forecasting and Control", *Holdencharem-day*, San Francisco.

Boyd, J., Chang, C. and Smith, B. (1998), "Moral Hazard Under Commercial and Universal Banking", *Journal of Money Credit and Banking*, 30, 426-468.

Burnside, C., Eichenbaum, M. and Rebel, S. (1998), "Prospective Deficit and the Asian Currency Crises", *Federal Reserve Bank of Chicago*, 5.

Calomiris, C. (1993), "Financial Factors in the Great Depression", *Journal of Economic Perspectives*, 7, 2, 61-85.

Calomiris, C. and Khan, C. (1991), "The Role of Demandable Debt in Structuring Optimal Banking Arrangements", *American Economic Review*, 81.

Calomiris, C. W. and G. Gorton (1991), "The Origins of Banking Panics: Models, Facts and Bank Regulation", G. Hubbard, ed., *Financial Markets and Financial Crises*, University of Chicago, 109-173.

Calvo, G. (1995), "Varieties of Capital-Market Crisis", *mimeo, University of Maryland.*

Calvo, G. (1996), "Capital Flows and Macroeconomic Management: Tequila Lessons" *International Journal of Finance & Economics*, 1, 207-224.

Calvo, G. and Mendoza, E. (1996a), "Mexico's Balance-of-Payments Crisis: A Chronicle of a Death Foretold", *Journal of International Economics,* 41, 235–264.

Calvo, G. and Mendoza, E. (1997), "Rational Herd Behaviour and the Globalization of the Securities Markets", *Institute for Empirical Macroeconomics*, Discussion Paper, 120.

Canbas, S., Cabuk, A. and Kilic, S. B. (2004), "Prediction of Commercial Bank Failure via Multivariate Statistical Analysis of Financial Structures: The Turkish Case", *European Journal of Operational Research*, 1-19.

Caprio, G. and Klingebiel, D. (1996), "Dealing with Bank Insolvencies: Cross Country Experience", *The World Bank*, Washington.

Caprio, G. and Klingebiel, D. (1999), "Episodes of Systematic and Borderline Financial Crises" *(unpublished) World Bank.*

Caprio, G. Jr. and Klingebiel, D. (1996), "Bank Insolvencies: Cross Country Experience", Policy Research Paper 1620, *The World Bank*, Washington D.C.

Caprio, G., (1998), "Banking on Crises: Expensive Lessons From Recent Financial Crises", *The World Bank*, Washington.

Caprio, G., and D. Klingebiel (1996a) "Bank Insolvencies: Cross-Country Experience", *Policy Research Working Paper*, 1620.

Caprio, G., and Klingebiel, D. (1996b), "Bank Insolvency: Bad Luck, Bad Policy, or Bad Banking?", *Paper presented to the Annual World Bank Conference on Development Economics*, Washington, D.C.

Caramazza, F., Ricci, L., Salgado, R. (2004), "International Financial Contagion in Currency Crises", *Journal of International Money and Finance*, 23, 51-70.

Celasun, O. (1998), "The 1994 Currency Crisis in Turkey", *Policy Research Working Paper,* 1913.

Central Bank of Republic of Turkey, available at: *http://www.tcmb.gov.tr/.*

Central Bank of the T.R.N.C (1999), *Annual Report*, 27, North Cyprus.

Central Bank of the T.R.N.C (2000), *Annual Report*, 28, North Cyprus.

Central Bank of the TRNC (2002), *Annual Report*, North Cyprus, available at: *http://www.kktcmb.trnc.net//.*

Cerra, V. and Saxena, S. C. (2000), "Contagion, Monsoons, and Domestic Turmoil in Indonesia: A Case Study in the Asia Currency Crisis", *IMF Working Paper*, 60.

Chaltabaeva, R. (2003), "The European Union Embargo on Turkish Cypriot Agricultural Products", *Second METU Conference on International Relations.*

Chang, R. and A. Velasco (1998), "The Asian Liquidity Crisis", *Federal Reserve Bank of Atlanta Working Paper*, 98, 11.

Chang, R. and Velasco, A. (1999), "Liquidity Crises in Emerging Markets: Theory and Policy", *Federal Reserve Bank of Atlanta Working Paper*, 99,15.

Chang, R. and Velasco, A. (2000), "Financial Fragility and the Exchange Rate Regime", *Journal of Economic Theory*, 92, 1-34.

Chang, R. and Velasco, A. (2001), "A Model of Financial Crises in Emerging Markets", *Quarterly Journal of Economics*, 489-517.

Chari, V. and Jagannathan, R. (1988), "Banking Panics, Information, and Rational Expectations Equilibrium", *Journal of Finance*, 43, 749-761.

Charoenseang, J. and Manakit, P. (2002), "Financial Crises and Restructuring in Thailand", *Faculty of Economics, Chulalongkorn University*, Thailand.

Choueiri, N. (2002), "A Model of Contagious Currency with Application to Argentina", *Journal of International Money and Finance*, 21, 435-457.

Claessens, S., Djankov, S., Fan, J., and Lang, L. (2000), "The Separation of Ownership and Control in East Asian Corporations", *Journal of Financial Economics*, 58, 81-112.

Cleves, M. A., Gould, W. W. and Gutierrez, R. G. (2002), *An Introduction to Survival Analysis Using STATA*, A Stata Press Publications.

Cole, H. L. and Kehoe, T. J. (1996), "A Self-fulfilling model of Mexico's 1994-1995 Debt Crisis", *Journal of International Economics*, 41, 309-330.

Cole, R. A. and Gunther, J. W. (1995), "Seperating the Likelihood and Timing of Bank Failure", *Journal of Banking and Finance*, 19, 1073-1089.

Cole, R. A., and Gunther, J. W. (1998), "Predicting Bank Failures: A Comparison of On- and Offsite Monitoring Systems", *Journal of Financial Services Research*, 13, 103-117.

Collet, D. (1994), *Modelling Survival Data in Medical Research*, Chapman and Hall.

Connolly, M. B. & Taylor, D. (1984), "The Exact Timing of the Collapse of an Exchange Rate Regime and Its Impact on the Relative Price of Traded Goods", *Journal of Money, Credit and Banking*, Ohio State University Press, 16, 2, 194-207.

Corbett, J. and Mitchell, J. (2000), "Banking Crisis and Bank Rescues: The Effect of Reputation", *Journal of Money Credit and Banking*, 33, 3, 474-519.

Corsetti, G., Pesenti, P. and Roubini, N. (1998) "What Caused the Asian Currency and Financial Crises? Part II: The Policy Debate", *NBER Working Paper*, 6834, Cambridge.

Country Profile: Cyprus and Malta (1995-1996), *The Economist Intelligence Unit.*

Country Update: Turkey (2001), "A New Economic Program Begins to Take Shape But Risk Remain Very High", *Austria and New Zealand Banking Group Ltd.*

Cox, D. R. and Oakes, D. (1984), *Analysis of Survival Data*, London, Chapman and Hall.

Cox, D.R. (1972) "Regression Models and Life-Tables," *Journal of the Royal Statistical Society*, Series B, 187-220.

Cramazza, F., Ricci, L. and Salgado, R. (2004), "International Financial Contagion in Currency Crises", *Journal of International Money and Finance,* 23, 51-70.

Cramer, J. S. (2003), *Logit Model from Economics and Other Fields*, Cambridge University Press.

Cunningham, A. (2001), "Assessing the Stability of Emerging Market Economies", *Banking System, Financial Stability Review.*

Cyprus Brief History: available at: *http://www.kypros.com/Cyprus/cyhistory.htm.*

Cyprus History: available at: *http://www.Cyprus History Breakdown of the 1960.*

Cyprus Map: available at: *http://flagspot.net/flags/cy(.htmll//.*

Cyprus: A Country Study available at: *http://www.country-data.com/frd/cs/cytoc.html.*

Cyprus: Geography, available at: *http://www.cyprus.com/cyprus-general-info-geography.php.*

Cyprus: The State and Economic Development: available at *http://www.state.gov/r/pa/ei/bgn/5376.htm.*

Davidson, J. D. F., Henry, F., Srba, F. and Yoe, S. (1978), "Economic Modeling of the Aggregate Time Series Relationship Between Consumers' Expenditure and Income in the UK", *The Economic Journal*, 88, 661-692.

Delong, J. B. (2002), *Macroeconomics*, McGraw-Hill.

Demir, F. (2004), "A Failure Story: Politics and Empirical Liberalization in Turkey, Revisiting the Revolving Door Hypothesis", *World Development*, 32, 5, 851-869.

Demirguc-Kunt, A. (1989) "Deposit-Institution Failures: A Review of Empirical Literature", *Federal Reserve Bank of Cleveland, Economic Review*, 4, 2-18.

Demirguc-Kunt, A. and Detragiache, E. (1997), "The Determinants of Banking Crisis: Evidence from Developed and Developing Countries", *IMF Working Papers*, 106.

Demirgüç-Kunt, A. and Detragiache, E. (1998a). "The Determinants of Banking Crises in Developing and Developed Countries", *IMF Staff Papers*, 45, 81-109.

Demirgüç-Kunt, A. and Detragiache, E. (1998b), "Financial Liberalization and Financial Fragility", *IMF Working Paper*, 83.

Demirguc-Kunt, A. and Detragiache, E. (2000), "Monitoring Banking Sector Fragility: A Multivariate Logit Approach", *The World Bank Economic Review*, 14, 2, 287-307.

Demirguc-Kunt, A. and Detragiache, E. (2002), "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation", *Journal of Monetary Economics*, 49, 7.

Demirguc-Kunt, A. and Detragiache, E. (2004), "Market Discipline and Deposit Insurance", *Journal of Monetary Economics*, 51, 2.

Demirguc-Kunt, A., Detragiache, E. and Gupta, P. (2000), "Inside the Crisis: An Empirical Analysis of Banking Sector Distress", *IMF Working Paper.*

Demirgunc-Kunt, A. (1991), "On the Evaluation of Deposit Institutions", *Federal Reserve Bank of Clevland, Working Paper,* 9104.

DeYoung, R. E., Flannery, M. J., Lang, W. W., and. Sorescu, S. M (1998), "The Information Advantage of Specialized Monitors: The Case of Bank Examiners", *Federal Reserve Bank of Chicago, Working Paper*, 84, 4.

DeYoung, R. E., Hughes, J. P. and Moon, C. G. (2001), "Efficient Risk Taking and Regulatory Covenant Enforcement in a Deregulated Banking Industry", *Journal of Economics and Business*, 53, 255-282.

Diamond, D. and Dybvig, P. (2001), "Bank Runs, Deposit Insurance and Liquidity", *Federal Reserve Bank of Minneapolis Quarterly Review*, 24, 1, 14-23.

Diamond, D., and Dybvig, P. (1983): "Bank Runs, Deposit Insurance and Liquidity", *Journal of Political Economy*, 91, 401-419.

Dickey, D. A. and Fuller, W. A. (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", *Journal of American Statistical Association*, 79, 355-367.

Disyatat, P. (2001), "Currency Crisis and the Real Economy: The Role of Banks", *IMF Working Paper,* 49.

Domac, I. and Martinez-Peria, M. S. (2003), "Banking Crisis and Exchange Rate Regimes: Is there a Link?", *Journal of International Economics, 61,1,41-72.*

Dornbusch, R., Goldfajn, I. and Valdes, R. (1995), "Currency Crises and Collapses", *Brookings Papers on Economic Activity*, 2, 219-295.

Drees, B. and Pazarbasioglu, C. (1995), "The Nordic Banking Crises: Fitfalls in Financial Liberalization?", *IMF Working Paper*, 61.

Dwyer, G. P. and Hafer, R. H. (2001), "Bank Failures in Banking Panics: Risky Banks or Road Kill?", *Federal Reserve Bank of Atlanta Working Paper*, 13.

Dziobek, C. and Pazarbasioglu, C. (1997), "Lessons from Systemic Bank Restructuring: A Survey of 24 countries", *IMF Working Paper*, 161.

Economic Survey of Turkey (2002), Policy Brief, *OECD Observer*.

Economidis, N., Hubbard, R. G. and Palia, D. (1999), "Federal Deposit Insurance: economic Efficiency or Politics?", *Banking and Credit, Regulation*, 15, 22, 3.

Edison, H. J. (2000), "Do Indicators of Financial Crises Work? An Evaluation of an Early Warning System", Board of Governors of The Federal Reserve System, *International Finance Discussion Paper*, 675.

Edwards, S. (1989), "Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries", *Cambridge, MA,* MIT Press.

Edwards, S. and Savastano, M.A. (1998), "The Morning After: The Mexican Peso in the Aftermath of the 1994 Currency Crisis", *NBER Working Paper*, W6516.

Eichengeen, P. and Rose, C. (2000), "The Empirics of Currency and Banking Crises", in NBER reporter 1999. Revised version published in *Wirtschaftspditishes Blatter, Austrian Economic Paper*.

Eichengreen, B. and Arteta, C. (2000), "Banking Crisis in Emerging markets: Presumption and Evidence", *Centre for International Development Economics Research Working Paper*, 115, Haas School of Business, University of California Berkeley.

Eichengreen, B. and Hausmann, R. (1999), "Exchange Rate and Financial Fragility", *NBER Working Paper*, 7418.

Eichengreen, B. and Rose, A. K. (1998), "Staying Afloat When the Wind Shifts: External Factors and Emerging-Market Banking Crises", *NBER Working Paper,* 6370.

Eichengreen, B. and Wyplosz, C. (1993), "The unstable EMS", *Brookings Papers of Economic Activity,* 1, 51-143.

Eichengreen, B., Rose, A. and Wyplosz, C. (1996), "Contagious Currency Crises: First Tests", *Scand Journal of Economics*, 98, 4, 463-484.

Eichengreen, B., Rose, A. K. and Wyplosz, C. (1995), "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Special Reference to the European Monetary System", *Federal Reserve Bank of San Francisco*, Working Paper, 04.

Eichengreen, B., Rose, A.K., Wyplosz, C. (1995), "Exchange Market Mayhem", *Economic Policy*, 21, 251–312.

Eichengreen, Barry (2000), "When to Dollarize", *unpublished manuscript*, University of California, Berkeley.

Espahbodi, H. and Espahbodi, P. (2003), "Binary Choice Models and Corporate Takeover", *Journal of Banking and Finance*, 27, 549-574.

Espahbodi, P. (1991) "Identification of Problem Banks and Binary Choice Models", *Journal of Banking and Finance*, 15, 53-71.

Esquivel, G. and Larrain, F. (1998), "Explaining Currency Crisis", Harvard Institute for International Development, *Development Discussion Paper*, 666,.

Estrella, A., Park, S. and Peristiani, S. (2000), "Capital Ratio as Predictors of Bank Failure", *FRBNY Economic Policy Review.*

Evans, O., Leone, A., Gill, M. and Hilbers, P. (2000), "Macroprudential Indicators of Financial System Soundness", *IMF Occational Paper*, 192.

Feridun, M. (2004), "Determinants of the Argentine Financial Crisis: Can We Predict Future Crises?", *The Lahore Journal of Economics*, 9, 2.

Fethi, S. (2003), "The Role of Trade Policy and Growth Models: The Case of Cyprus, 1960-1995", *PhD. Thesis*, University of Leicester.

Finkel, S. E. (1995), "Causal Analysis with Panel Data", *Sage Publications Inc.*, USA.

Flannery, M. J. (1998), "Using Market Information in Prudential Bank Supervision: A Review of the US Empirical Evidence", *Journal of Money, Credit and Banking*, 30, 273-305.

Flood, R. and Garber, P. (1984), "Collapsing Exchange-rate Regimes: Some linear Examples", *Journal of International Economics*, 17, 1-13.

Flood, R. and Maron, N. (1999), "Perspectives on the Recent Currency Crises Literature", *International Journal of Finance and Economics*, 4, 1-26.

Frankel, J. A. and Rose, A. K. (1996), "Currency Crashes in Emerging Markets: An Empirical Treatment", *Journal of International Economics*, 41, 351-366.

Friedman, M. and Schwartz, A. (1963), "A Monetary History of the US: 1863-1960", *Princeton University Press.*

Froot, K., Scharfstein, D., and Stein, J. (1992), "Herd on the Street: Information Efficiencies in a Market with Short-Term Speculation", *Journal of Finance*, 47, 4, 1462-84.

Fujikoshi, Y. and Satoh, K. (1997). "Modified AIC and *Cp* in multivariate linear regression", *Biometrika*, 84, 3, 707-716.

Gajewski, G. R. (1988), "Bank Risk, Regulator Behavior and Bank Closure in the mid 1980s: A Two Step Logit Model", PhD. Disseratation, *The George Washington University.*

Gajewsky, G. R. (1990), "Modeling Bank Closures in the 1980's: the Roles of Regulatory Behavior, Farm Lending and the Local Economy", in G. Kaufman, ed., *Research in Financial Services: Private and Public Policy*, Green, Conn., JAI Press Inc.

Galbis, V. (1993), "High Real Interest Rates Under Financial Liberalization: Is There a Problem?", *IMF Working Paper*, 93,7.

Garton, G. and Rosen, R. (1995), "Corporate Control, Portfolio Choice, and the Decline of Banking", *The Journal of Finance*, L, 5.

Gaston, G. and Sahay, R. (2000), "Financial Markets Spillovers in Transitions Economies", *IMF Working Paper.*

Gavin, M. and Hausmann, R. (1998), "The Roots of Banking Crises: The Macroeconomic Context", *Inter-American Development Bank*, Working Paper, 318, 1-20.

Gavin, M., and Hausman, R. (1996), "The Roots of Banking Crises: the Macroeconomic Context", in Hausman and Rojas-Suarez (Eds.), *Volatile Capital Flows: Taming their Impact on Latin America*, Washington, Inter-American Development Bank.

Gaytan, A. and Johnson, C. A. (2002), "A Review of the Literature on Early Warning Systems for Banking Crises", *Central Bank of Chile Working Paper*, 183.

Gerlach, S.and Samets, F. (1995), "Contagious Speculative Attacks", *European Journal of Political Economy,* 11, 45-63.

Gertler, M. (1992), "Financial Capacity and Output Fluctuations in and Economy with Multi-Period Financial Relationships" *Review of Economic Studies*, 59, 455-472

Gilbert, R. A., Meyer, A. P. and Vaughan, M.D. (1999), "The Role of Supervisory Screens and Econmetric Models in Off-Site Surveillance", *Review Federal Reserve Bank of St. Louise*, 31-56.

Gil-Diaz, F. (1994), "The Origin of Mexico's Financial Crisis", *The CATO Journal*, 17, 3.

Giorgio, G. D. and Di Noia, C. (2001), "Financial Regulation and Supervision in the Euro Area: A Four-Peak Proposal", *The Wharton School*, University of Pennsylvania.

Glick, R. and Hutchison, M. (1999), "Banking and Currency Crisis: How Common Are Twins", *Federal Reserve Bank of San Francisco*, PB99-07.

Glick, R. and Hutchison, M. (2001), "Banking and Currency Crisis: How Common Are Twins" in Reuven Glick, Ramon Monero and Mark M. Spiegel (eds.), *Financial Crises in Emerging Markets*, Cambridge University Press.

Glick, R. and Rose, A.K. (1999), "Contagion and Trade: Why are Currency Crises Regional?", *Journal of International Money and Finance,* 18, 4, 603–617.

Goldenstein, M. (1997), "The Case for an International Banking Standard", *Policy Analysis in International Economics*, Institute for International Economics, Washington.

Goldfajn, I. and Valdes, R. (1995), "Balance of Payments Crises and Capital Flows: The Role of Liquidity", *unpublished manuscript*, MIT.

Goldfajn, I. and Valdes, R. (1997), "Are Currency Crises Predictable?", *IMF Working Paper, 97,159.*

Goldfajn, I. and Valdes, R. (1997), "Capital Flows and the Twin Crises: the Role of Liquidity", *IMF Working Paper, 97,87.*

Goldstein, M. (1998), "The Asian Financial Crisis: Causes, Cures, and Systemic Implications", *Policy Analyses in International Economics, Institute for International Economics*, 55, Washington, DC.

Goldstein, M. and Turner, P. (1996), "Banking Crises in Emerging Economies: Origins and Policy Options", *BIS Economic Papers*, 46.

Goldstein, M., Kaminsky, G. L., Reinhart, C. M. (2000), "Assessing Financial Vulnerability: An Early Warning System for Emerging Markets", *Institute for International Economics*, Washington, DC.

González-Hermosillo, B. (1996), "Banking Sector Fragility and Systemic Sources of Fragility" *IMF Working Paper*, 12.

Gonzalez-Hermosillo, B. (1999), "Determinants of Ex-Ante Banking system Distress: A Macro-Micro Empirical Exploration of Some Recent Episodes", *IMF Working Paper*, 33.

Gonzalez-Hermosillo, B. (1999), "Developing Indicators to Provide Early Warnings of Banking Crisis", *Finance and Development*, 36, 2, 1-6.

Gonzalez-Hermosillo, B., Pazarbasioglu, C. and Billings, R. (1997), "Determinants of Banking System Fragility: A Case of Mexico", *IMF Staff Papers*, 44, 3, 295-314.

Gonzalez-Hermosillo, B., Pazarbasioglu, C., and Billings, R. (1996), "Banking System Fragility: Likelihood Versus Timing of Failure-An Application to the Mexican Financial Crisis", *IMF Working Paper*, 142.

Gorton, G. (1985), "Bank Suspension and Convertibility", *Journal of Monetary Economics*, 177–193.

Gorton, G. (1988), "Banking Panics and Business Cycles", *Oxford Economic Papers*, 40, 751-781.

Gorton, R. J. (2003), *Macroeconomics*, Pearson Education, Inc.

Greene, W. H. (1990), *Econometric Analysis*, Macmillan Publishing Company, New York.

Greene, W. H. (1993), *Econometric Analysis*, Macmillan Publishing Company, New York.

Greene, W. H. (2000), *Econometric Analysis*, 4th Edition, Prentice-Hall Inc.

Griffiths, W. E., Hill, R. C. and Judge, G. G. (1993), *Learning and Practicing Econometrics*, John Wiley and Sons, Inc.

Grossman, R. S. (1994), "The Shoe That Didn"t Drop: Explaining Banking Stability During the Great Depression", *Journal of Economic History*, 54, 3, 654-682.

Gujaratti, D. (1999), *Essentials of Econometrics*, 2nd Edition, McGraw-Hill Companies.

Gumus, I. (1995), "Effects of the Interest Rate Defence on Exchange Rates During the 1994 Crisis in Turkey", *The Central Bank of the Republic of Turkey, Research Department Working Paper*, 14.

Guney, G. (2004), "The Role of Banking Sectors in Micro and Small Enterprises Finance in T.R.N.C", *Eastern Mediterranean University*, 40-43.

Gungor, H. (1999), "The Proposal of a Supervisory Model for the North Cyprus in the Light of Developed Countries' Supervisory Systems", PhD. Thesis, *Marmara University Institute of Banking and Insurance.*

Hagle, T. M. (1995), "Basic Maths for Social Scientists", *Sage Publications Inc.*, USA.

Hardy, D. C. (1998), "Are banking Crisis Predictable", *Development and Finance*, 35, 4.

Hardy, D. C. and Pazarbasioglu, C. (1998), "Leading Indicators of Banking Crises: was Asia Different?", *IMF Working Paper*, 91.

Hardy, D. C. and Pazarbasioglu, C. (1999), "Determinants and Leading Indicators of Banking Crisis: Further Evidence", *IMF Staff Papers*, 46, 3, 247-258.

Hausmann, R. and Rojas-Suarez, L. (1996), *Banking Crisis in Latin America*, Inter American Development Bank, Washington.

Hawkesby, C. (2000), "Maintaining Financial System Stability: the Role of Macro – Prudential Indicators", *Reserve Bank of Nealand Bulletin*, 63, 2, 38-52.

Heffernan, S. (1995), "An Econometric Model of Bank Failure", *Economic and Financial Modelling*, 49-83.

Heffernan, S. (1996), *Modern Banking in Theory and Practice*, John Wiley and Sons.

Henebry, K. L. (1996), "Do Cash Flow Variables Improve the Predictive Accuracy of a Cox Proportional Hazards Model for Bank Failure?", *Quarterly Review of Economics and Finance,* 36, 3.

Henebry, K. L. (1997), "A Test of the Temporal Stability of Proportional Hazards Models for Predicting Bank Failure", *Journal of Financial and Strategic Decisions*, 10, 2.

History of Cyprus: available at: *http://www.historyofnations.nets/europe/Cyprus.html*

Hoggarth, G. (2003), "Resolution of Banking Crises: A Review", *Financial Stability Review*, 109-123.

Honohan, P. (1997), "Banking System Failures in Developing and Transition Countries: Diagnosis and Prediction", *BIS Working Paper*, 39, Switzerland.

Hooks, L. (1995), "Bank Asset Risk: Evidence From Early Warning Models", *Contemporary Economic Policy*, 13, 36-50.

Hosmer, D. W. and Lemeshow, S. (1999), *Applied Survival Analysis: Regression Modelling of Time to Event*, John Wiley and Sons, Inc.

Hristov, S. (2001), "The Crisis in Turkey", *Institude for Regional and International Studies*.

Hsiao, C. (1986), *Analysis of Panel Data*, Cambridge University Press.

Hsiao, C., Lahiri, L., Lee, L., and Pesaran, M. H. (1999), "Analysis of Panels and Limited Dependent Variable Models", *Cambridge University Press*.

Huh, C. and Kasa, K. (1997), "A Dynamic Model of Export Competition, Policy Co-ordination and Simultaneous Currency Collapse", *Federal Reserve Bank of San Francisco Centre for Pacific Basin Studies*, PB97-08.

Hutchison, M. (1999), "Determinants of European Banking Distress: Evaluating the Risks from EMU and Financial Integration", *Structural Change and European Economic Integration, Economic Policy Research Unit*, University of Copenghagen, Denmark.

Hutchison, M. (2002), "European Banking Distress and EMU: Institutional and Macroeconomic Risks", *Scand. Journal of Economics*, 104, 3, 365-389.

Hutchison, M. and McDill, K. (1999), "Are All Banking Crises Alike? The Japanese Experience in International Comparison", *Journal of Japanese and International Economics*, 13, 155-180.

Hwang, D. and Lee, C. (1997), "Forecasting Bank Failure and Deposit Insurance Premium", *International Review of Economic and Finance*, 6-317-334.

Im, K., Pesaran, M. H. and Shin, Y. (2003), "Testing for unit roots in heterogeneous panels", *Journal of Econometrics,* 115, 53–74

IMF (1998), "Financial Crises: Characteristics and Indicators of Vulnerability: Chapter IV", *World Economic Outlook*, 74-97.

IMF (1999) "International Financial Contagion. Chapter III", *World Economic Outlook.*

IMF Annual Report, available at: *http://www.imf.org/external/pubs/ft/ar/*

International Financial Statistics (1969-2002), *International Monetary Fund*, Washington DC.

Isik, I and Hassan, M.K. (2003), "Financial Distruption and Bank Productivity: The 1994 Experience of Turkish Banks", *The Quarterly Review of Economics and Finance*, 27, 8.

Jaccard, J. (2001), "Interaction Effect in Logistic Regression", *Sage Publications Inc.*, USA.

Jacklin, C. and Bhattacharya, S. (1988), "Distinguishing Panics and Information Based Runs: Welfare and Policy Implications", *Journal of Political Economy*, 59, 568-592.

Jagtiani, J. A. *et al.* (2000), "Predicting Inadequate Capitalization: Early Warning System of Bank Supervision", *Federal Reserve Bank of Chicago.*

Jenkins, S. P. (2004), *Survival Analysis*, Essex Summer School in SSDA, University of Essex.

Judijanto, L. and Khmaladze, E.V. (2003), "Analysis of Bank Failure Using Published Financial Statements: The case of Indonesia (Part 1)", *Journal of Data Science*, 1, 199-230.

Kaminsky, G. (1998), "Currency and Banking Crises: The Early Warnings of Distress", *International Finance Discussion Papers 629*, Board of Governors of the Federal Reserve System, USA.

Kaminsky, G. and Reinhart, C. (1995), "The Twin Crises: The Cause of Banking and Balance and Payment Problems", *Broad of Governor of Federal Reserve System and the IMF*, manuscript.

Kaminsky, G. and Reinhart, C. (1998), "On Crises, Contagion, and Confusion", *Journal of International Economics*, 51, 145–68.

Kaminsky, G. and Reinhart, C. (1999), "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", *American Economic Review*, 89, 3, 473-500.

Kaminsky, G. L. (1999), "Currency and Banking Crisis: The Early Warnings of Distress", *IMF Working Paper*, 178.

Kaminsky, G. L. and Reinhart, C. M. (1998), "Financial Crises in Asia and Latin America: Then and Now", *American Economic Review*, 88, 444-448.

Kaminsky, G. L. and Reinhart, C. M. (2000), "On Crises, Contagion and Confusion", *Journal of International Economics*, 51, 145-168.

Kaminsky, G., and Reinhart, C. M. (1996), "The Twin Crises: The Causes of Banking and Balance of Payments Problems", *Federal Reserve Board,* Washington, DC.

Kaminsky, G.L., Lizondo, S., Reinhart, C.M., (1998), "Leading Indicators of Currency Crises", *IMF Staff Papers*, 45, 1, 1–48.

Kane, E. J. (1986), "Appearance and Reality in Deposit Insurance: The Case for Reform", *Journal of Banking and Finance*, 10, 175-188.

Kane, E. J. (1989), "The S&L Insurance Mess: How Did it Happened?", *Urban Institute Press*, Washington D.C.

Kane, E. J. (1996), "Stopping Information Asymmetries in Government from Promoting Risk Shifting by Banks", *The Wharton School, University of Pennsylvania.*

Kaplan, E. L. and Meier, P. (1958), "Non-Parametric Estimation from Incomplete Observations", *Journal of American Statistical Association*, 53, 457-481.

Karaken, J. H. and Wallace, N. (1978), "Deposit Insurance and Bank Regulation: A Partial Equilibrium Exposition", *Journal of Business*, 51, 413-38.

Kaufman, G. (1994), "Bank Contagion: A Review of the Theory and Evidence", *Journal of Financial Services Research*, 8, 123-150.

Kaufman, G. G. (1995), "Bank Failures, Systematic Risk and Bank Regulation", *The CATO Journal*, 16, 1.

Kaufman, G. G. (1999), "How Real is the Risk of a Massive Banking Collapse?", *Regulation* 25, 23, 1.

Kaufman, G. G. and Seelig, S. A. (2001), "Post-Resolution Treatment of Depositors at failed Banks: Implications for the Severity of Banking Crisis, Systemic Risk, and To-Big-To-Fail", *IMF Working Paper.*

Kibritcioglu, A. (1998), "EMU, Euro and EU-Membership: An Evaluation from the Turkish Perspective", *Swiss Federal Institute of Technology*, Zurich, Switzerland.

Kibritcioglu, A. (2002), "Excesive Risk Taking, Banking Sector Fragility and Banking Crises", *University of Illinois, Working Paper*, 2, 114.

Kibritcioglu, B., Kose B. and Ugur, G. (1999), "A Leading Indicators Approach to the Predictability of Currency Crises: The case of Turkey", *unpublished.*

Kindleberger, C. P. (1978), "Maniac, Panics and Crashes: A History of Financial Crises", *New York Basic Books.*

King, R. & Plosser, C., (1989), "Real Business Cycle And The Test of the Adelmans", *University of Rochester - Center for Economic Research*, 204.

King, R. G. and Levine, R. (1993), "Finance and Growth: Schumpeter May Be Right", *Quarterly Journal of Economics*, 108, 717-37.

Kleinbaum, D. G. (1996), *Survival Analysis: A Self-Learning Text*, Springer-Verlag New York, Inc.

Kolari, J., Glennon, D., Shin, H., Caputo, M. (2002), "Predicting Large US Commercial Bank Failure", *Journal of Economics and Business*, 54, 361-387.

Krugman, P. (1979), "A Model of Balance-of-Payments Crisis", *Journal of Money, Credit and Banking*, 11, 3, 311-325.

Krugman, P. (1996), "Are Currency Crises Self-Fulfilling?", *NBER Macroeconomics Annual,* Cambridge, MIT Press.

Krugman, P. (1997), "Are Currency Crises Self-Fulfilling?", *NBER Macroeconomics Annual*, Cambridge, MIT Press.

Krugman, P. (1998), "What Happened to Asia?", MIT, Cambridge, available at: http://web.mit.edu/krugman/www/disinter.html

Krugman, P. (1998a), "Currency Crises" available at: *web.mit edu/krugman.*

Krugman, P. (1999), "Currency Crisis", International Capital Flows, *NBER and Chicago University Press*, 421-440.

Krugman, P. and Rotemberg, J. (1990), "Target Zone with Limited Reserves", *NBER Working Paper*, 3418.

Lancaster, T. (1990), *The Econometric Analysis of Transition Data*, Cambridge University Press.

Lane, W. R., Looney, S. W. and Wansley, J. W. (1986), "An Application of Cox Proportional Hazards Model to Bank Failure", *Journal of Banking and Finance*, 10, 511-531.

Langrin, R. B. (2001), "The Determinants of Banking System Distress: A Microeconomic and Macroeconomic Empirical Examination of the Recent Jamaican Banking Crisis", PhD. Thesis, *The Pennsylvania State University.*

Laviola, S., Reedtz, P. M. and Trapanese, M. (1999), "Forecasting Bank Fragility, the Evidence from Italy", in *Research in Financial Services: Private and Public Policy, II*, 35-60.

Levine, R. (1997), "Financial Development and Economic Growth: Views and Agenda", *Journal of Economic Literature*, 35, 2, 688-726.

Liao, T. F. (1994), "Interpreting Probability Models: Logit, Probit, and Other Generalized Linear Models", *Sage Publications Inc.*, USA.

Library of Congress Country Studies: available at: *http://lcweb2.loc.gov/cgi-bin/query*

Lien, H. (2001), "Essays on Financial Crises", PhD. Thesis, *Florida International University.*

Lindgren, C., Garcia, G. and Saal, M. I. (1996), "Bank Soundness and Macroeconomic Policy", *IMF Working Paper.*

Logan, A. (2001), "The United Kingdoms`s Small Banks Crisis of the Early 1990s: What were the Leading Indicators of Failure?", Bank of England.

Long, J. S. and Freese, J. (2001), *Regression Models for Categorical Dependent Variables Using STATA*, A Stata Press Publication, Stata Corporation, Texas.

Long, S. J. (1997), "Regression Models for Categorical and Limited Dependent Variables", *Sage Publications Inc.*, USA.

Maddala, G. S. (1983), *Limited-Dependent and Qualitative Variables in Econometrics*, Cambridge University Press.

Maddala, G. S. (1987), "Recent Developments in the Econometrics of Panel Data Analysis", *Printed in Great Britain*, Transpn. Res.- A, 21A, 4/5, 303-326.

Maddala, G. S. (1988), *Introduction to Economics*, Collier Macmillan Publishers, London.

Maddala, G. S. (2001), *Introduction to Economics*, 3rd Edition, John Wiley and Sons, Ltd.

Mahesh, K., Parmar, B. and Machin, D. (1995), *Survival Analysis: A Practical Approach*, John Wiley and Sons.

Mankiw, G. (2003), *Macroeconomics*, Worth Publishers.

Mariano, R., Shabbir, T. and Gultekin, A. (2001), "Financial Crisis in South East Asia", *Wharton Singapore Management University Research Center*, University of Pennsylvania.

Markus, G. B. (1979), "Analyzing Panel Data", *Sage Publications Inc., USA.*

Martin, D. (1977), "Early Warning of Bank Failure: A Logit Regression Approach", *Journal of Banking and Finance*, 1, 249-276.

Masson, P. (1998), "Contagion: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria", *IMF Working Paper*, 98, 142.

Masson, P. (1999), "Contagion: Macroeconomic Models with Multiple Equilibria", *Journal of International Money and Finance*, 18, 587-602.

Masyn, K.E. (2003), "Discrete Time Survival Mixture Analysis for Single and Recurrent Events Using Latent Variables", PhD. Thesis, *University of California, Los Angeles.*

Matyas, L. and Sevestre, P. (1992), *The Econometrics of Panel Data: Handbook of Theory and Applications*, Kluwer Academic Publisher.

McDill, K. M. (2000), "On the Causes, Cost and Persistence of Banking Crisis", PhD.Thesis in Economics, *University of Californio.*

Menard, S. (1995), "Applied Logistic Regression Analysis", *Sage Publications Inc., USA.*

Mendis, C. (2001), "External Shocks and Banking Crisis in Developing Countries: Does the Exchange Rate Regime Matters?", *Venuse Summer Institute 2001.*

Meyer, J. H. (2000), "Policy Watershed: Turkey"s Cyprus Policy and the Interventions of 1974", *WWS Case Study*, 3.

Meyer, P. and Pifer, H. (1970), "Prediction of Bank Failures", *The Journal of Finance*, 853-868.

Miller, M. (1998), "Banking Crises, Currency Crises, and Macroeconomic Uncertainty", *American Economic Review*, 88, 2, 439–443.

Miller, M. (1998a), "The Current Southeast Asia Financial Crisis", *Pacific Basin Finance Journal*, 6, 2, 225–233.

Miller, R. G. (1981), *Survival Analysis*, NY Wiley.

Miller, V. (1996), "Speculative Currency Attacks with Endogenously Induced Commercial Bank Crises", *Journal of International Money and Finance*, 15, 385-403.

Milliyet Newspaper (2000), "Yurtbank: Account owner need to seek offshore money in Cyprus", available at: *http://www.milliyet.com/2000/01/24/englishleco02.html.*

Mishkin, F. (1996), "Understanding Financial; Crises", *NBER Working Paper*, 5600, Cambridge

Mishkin, F. (1999), "Global Financial Instability: Framework, Events, Issues", *Journal of Economic Perspectives,* 13, 3-20.

Mishkin, F. S. (1991), "Asymmetric Information and Financial Crises: A History Respective", in R. Glenn Hubband, ed., *Financial Markets and Financial Crises*, Chicago, The University of Chicago Press.

Mishkin, F. S. (1999), "Lessons from the Asian Crises", *Journal of International Money and Finance*, 18, 709-723.

Molina, C. A. (2002), "Predicting Bank Failures Using a Hazard Model: The Venezuelan Banking Crises", *Emerging Markets Review,* 3, 31-50.

Munoz, S. (2000), "The Breakdown of Credit Relations Under Conditions of a Banking Crisis: A Switching Regime Approach", *IMF Working Paper*, 135.

Noe, W. and Watson, M. (2005), "Covergence and Reunification in Cyprus: Scope for a Virtuous Circle", *ECFIN Country Focus*, 2,3.

North Cyprus Bankers' Associations (2002), Information obtained directly from the Association.

Obstfeld, M and Rogoff, K. (1996), "Foundation of International Macroeconomics", *MIT Press*, Section 8.4.2.

Obstfeld, M (1996), "Models of Currency Crisis with Self-Fulfilling Features", European *Economic Review*, 40, 1037-1047.

Obstfeld, M. (1984), "Balance-of-Payments Crises and Devaluation", *Journal of Money, Credit, and Banking*, 16, 208-217

Obstfeld, M. (1986), "Rational and Self-Fulfilling Balance-of-Payments Crisis", *American Economic Review*, 76, 72-81.

Obstfeld, M. (1994), "The Logic of Currency Crises", *Cahiers Economiques et Monétaires, Banque de France*, 43, 189-213.

OECD Economic Studies (1988): available at: *http://www.oecd.org/document/5/0,2340,en_2649_33733_33840325_1_1_1_1,00.htm*

Ohlson, J. (1980), "Financial Ratios and the Probabilistic", *Journal of Accounting Research*, 109-131

Oney, B and Suphi, N. (2001), " Banking Crisis in T.R.N.C", *Famagusta*, 2-5.

Ozatay, F. (1996), "The Lessons from the 1994 Crisis in Turkey: Public Debt Management and Confidence Crisis", *Yapi Kredi Economic Review*, 7, 1, 21-37.

Ozatay, F. (2000), "The 1994 Currency Crisis in Turkey", Journal of Policy Reform, 3, 4, 327-352.

Ozdeser, H. (2002), "European Monetary Union, Euro and Impact of Euro on T.R.N.C Economy, Based on a Possible Membership of T.R.N.C to EMU", *Dogus University Dergisi*, 6, 97-110.

Ozkan, G. (2005), "Currency and Financial Crises in Turkey 2000-2001: Bad Fundamentals or Bad Luck?", *The World Economy*, 28, 4, 541-572.

Pampel, F. C. (2000), "Logistic Regression a Primer", *Sage Publications Inc.*, USA.

Patrick, R. A. (1976), "Political Geography and the Cyprus Conflict: 1973-1971", *Department of Geography Publication Series*, University of Waterloo, 4, 144-156.

Pazarbasioglu, C. (1996), "A Credit Crunch? A Case Study of Finland in the Aftermath of the Banking Crisis", *IMF Working Paper*, 96, 135.

Perron, P. (1989), "Great Crash, the Oil Price Shock and the Unit Root Hypothesis", *Econometria*, 57-6, 1361-1401.

Perron, P. (1990), "Testing for a Unit Root in a Time Series with a Changing Mean", *Journal of Business and Economic Statistics*, 8, 153-162.

Perron, P. (1997), "Further Evidence on Breaking Trend Functions in Macroeconomic Variables", *Journal of Econometric*, 80, 355-385.

Perron, P. and Vogelsang, T. J. (1992), "Testing for a Unit Root in a Time Series with a Changing Mean: Corrections and Extensions", *Journal of Business and Economic Statistics*, 10, 467-70.

Persons, O. S. (1999), "Using Financial Information to Differentiated Failed vs. Surviving Finance Companies in Thailand; An implication for Emerging Economies", *Multinational Finance Journal*, 3, 2, 127-145.

Pill, H. and Pradhan, M. (1995), "Financial indicators and financial change in Africa and Asia", *IMF Working Paper,* 23.

Podesta, F. (2000), "Recent Developments in Quantitative Comparative Methodology: The Case of Pooled Time Series Cross Section Analysis", *DSS Papers*, Soc, 3, 2.

PolitInfo US: Country Profile Cyprus: available at: *http://us.politinf.com/Imformation/Country_Profiles/country_profile_156.html.*

Power, D. A. and Xie, Y. (2000), *Statistical Methods for Categorical Data Analysis*, Academic Press, USA.

Puri, T. N., Kuan, C., Maskooki, K. (2002), "An Analysis of Currency Crises in South Korea", *Global Finance Journal*, 13, 121-146.

Radelet, S and Sachs, J (1998), "The Onset of the East Asian Financial Crisis", *NBER, Working Paper*, 6680, Cambridge, Massachussetts.

Radical Newspaper (2002), "Cost of Bank Failures in North Cyprus", *Daily Newspaper*, Turkey.

Rahman, S. Tan, L., Hew, O. and Tan, Y. (2004), "Identifying Financial Distress Indicators of Selected Banks in Asia", *Asian Economic Journal*, 18, 1.

Ramanathan, R. (1998), *Introductory Econometrics with Applications*, 4th Edition, Harcourt Brace and Company.

Ratti, R. A. and Seo, J. (2003), "Multiple Equilibria and Currency Crisis: Evidence for Korea", *Journal of International Money and Finance*, 22, 681-696.

Rijckeghem, C. V. and Weber, B. (2001), "Sources of Contagion: is it Finance or Trade?", *Journal of International Economics*, 54, 293-308.

Rojas-Suárez, L. (1998), "Early Warning Indicators of Banking Crises: What Works for Emerging Markets", *Inter-American Development Bank*, Washington.

Rojas-Suarez, L. and Weisbrod, S. R. (1995), "Financial Fragilities in Latin America: The 1980s and 1990s", *IMF Occational Paper*, 132.

Rojas-Suarez, L. and Weisbrod, S. R. (1995), "Financial Fragilities in Latin America. The 1980s and 1990s", *IMF Occasional Paper*, 132.

Rojas-Suarez, L. and Weisbrod, S. R. (1996), "Banking Crises in Latin America: Experiences and Issues", Ricardo Hausmann and Liliana Rojas-Suarez (eds), *Banking Crises in Latin America*, Baltimore: Johns Hopkins University Press, 3-21.

Sachs, J. D., Tornell, A. and Velasco, A. (1996a), "Financial Crises in Emerging Markets: The Lessons from 1995", *Brooking Papers on Economic Activity*, 1, 147-198.

Sachs, J. D., Tornell, A. and Velasco, A. (1996b), "The Collapse of the Mexican Pesso: What Have We Learned?", *Economic Policy*, 22, 15-63.

Sachs, J. D., Tornell, A. and Velasco, A. (1996c), "The Mexican Peso Crises: Sudden Death or Death Foretold", *Journal of International Economics*, 41, 265-283.

Safakli, O. (2003), "Basic Problems of the Banking Sector in the T.R.N.C with Partial Emphasis on the Proactive and Reactive Strategies Applied", *Journal of Dogus University*, 4, 2, 217-232.

Salant, S. and Henderson, D. (1978), "Market Anticipations of Government Policies and the Price of Gold", *Journal of Political Economy*, 86, 4, 627-48.

Sandararajan, V. and Balino, T. (1991), "Banking Crises, Cases and Issues", *IMF.*

Santor, E. (2003), "Banking Crises and Contagion: Empirical Evidence", *Bank of Canada Working Paper*, 1.

Saracoglu, R. (1996), "Financial liberalization in Turkey", *Interest Rate Liberalization and Money Market Development*, IMF.

Sargan, J. D. (1964), "Wages and Prices in the UK: A Study in Econometric Methodology", *Econometric Analysis of National Economic Planning*, P. E. Hart, G. Mills, and J. N. Whittaker (eds.) Butter Worths, London.

Saxena, S. C. (2004), "The Changing Nature of Currency Crises", *Journal of Economic Surveys*, 18, 3.

Sayrs, L. W. (1989), "Pooled time Series Analysis", *Sage Publications Inc., USA.*

Sbracia, M and Zaghin, A. (2000), "Crisis and Contagion: the Role of the Banking System", *BIS Papers*, 1.

Seddighi, H. R., Lawler, K.A., Katos, A.V. (2000), *Econometrics: A Practical Approach*, Routledge, London and New York.

Sengonul, A. (2003), "Monetary Policy Bank Lending and Risk Management: The Turkish Case", PhD. Thesis, *George Mason University.*

Sharma, S. (1999), "The Challenge of Predicting Economic Crisis", *Finance and Development,* 36, 2.

Singer, J. D. and Willett, J. B. (1993), "It's About Time: Using Discrete Time Survival Analysis to Study Duration and the Timing of Events", *Journal of Educational Statistics*, 18, 2, 155-195.

Sinkey, J. E., Jr. (1975), "A Multivariate Statistical Analysis of the Characteristics of Problem Banks", *Journal of Finance*, 20, 21–36.

Sinkey, J. E., Jr. (1985), "The Characteristics of Large Problem and Failed Banks", *Issues in Bank Regulation*, 43–53.

Sleet, C. and Smith, B. D. (2000), "Deposit Insurance and Lender of Last Resort Functions", *Journal of Money, Credit and Banking*, 32, 3, 518-575.

Spiegel, M. (2005), "Solvency Runs, Sunspot Runs, and International Bailouts", Journal of International Economics, 65, 203-219.

STATA Corporation (2000), *STATA Statistical Software: Release 6.0*, College Station, Texas.

STATA Corporation (2003), *STATA Statistical Software: Release 8.0*, College Station, Texas.

State Institute of Statistics in Turkey, available at: *http://www.die.gov.tr/ENGLISH/.*

State Planning Organization of Turkey, available at: *http://www.dpt.gov.tr/dptweb/ingin.html.*

Stuhr, D. P. and Van Wicklin, R. (1974), "Rating the Financial Conditions of Banks: A Statistical Approach to Aid Bank Supervision", *Federal Reserve Bank of New York*, 233-238.

Sundararajan, V. and Balino, T. J. T. (1991), "Issues in Recent Banking Crises", *Banking Crises: Cases and Issues*, Washington, D.C.: International Monetary Fund, 1-57.

Sunderarajan, V., Enoch, C. and Armida, S. J., Hilbers, P. L., Moretti, R. K. M and Slack, G. (2002), "Financial Soundness Indicators: Analytical Aspects and Country Practices", *IMF Occasional Paper*, 212.

Sydsaeter, K. and Hammond, P. (2002), *Essential Mathematics for Economic Analysis*, Prentice Hall, Pearson Education.

Tam, K. and Kiang, M. (1992), "Managerial Applications of Neural Networks: The Case of Bank Failure Predictions", *Management Science*, 38, 926-947.

Taylor, L. and O'Connell, S. (1985), "A Minsky Crisis", *Quarterly Journal of Economics*, 100, 871-885.

Theodossiou, P., Kahya, E., Saidi, R. and Philippatos, G. (1996), "Financial Distress and Corporate Acquisitions: Further Empirical Evidence", *Journal of Business Finance and Accounting*, 23, 699-719.

Thomson, J. B. (1989), "An Analysis of Bank Failures: 1984-1989", *Federal Reserve Bank of Cleveland Working Paper*, 8916.

Thomson, J. B. (1991), "Predicting bank failures in the 1980"s", *Federal Reserve Bank of Cleveland, Economic Review*, 27, 9–20.

Thomson, J. B. (1992), "Modeling the Bank Regulator"s Closure Option: A Two-Step Logit Regression Approach", *Journal of Financial Services Research.*

Tirapat, S. and Nittayagasetwat, A. (1999), "An Investigation of Thai Listed Firms' Financial Distress Using Macro and Micro Variables", *Multinational Finance Journal*, 3, 2, 103-125.

Turkish Cypriot State Planning Organization (2004), Economic and Social Indicators, available at: *www.devplan.org.eng ind.html.*

Ucer, E. M., Rijkeghem, C.V. and Yolalan, O. R. (1998), "Leading Indicators of Currency Crises: The Case of Turkey", *Yapi Kredi Bank Research Department Discussion Paper Series*, 98-03.

Ugur, M. (2003), "Mind the Gap: Unification, EU Membership and Regional Disparity in Cyprus", *Economia*, 6,1, 53-71.

Valesco, A. (1987), "Financial and Balance of Payment Crises", *Journal of Development Economics*, 27, 263-283.

Velasco, A. and Cespedes, L. F. (1999), "Exchange Rate Arrangement: A Developing Country Perspective", *unpublished manuscript.*

Whalen, G. (1991), "A Proportional Hazards Model of Bank Failure: An Examination of its Usefulness as an Early Warning Tool", *Federal Reserve Bank of Cleveland, Economic Review*, 1, 21-31.

Whalen, G., and Thompson, J. B. (1988), "Using Financial Data to Identify Changes in Bank Condition", *Federal Reserve Bank of Cleveland, Economic Review*, 2, 24, 2, 17-26.

Wheelock, D. C. and Wilson, P. W. (1995), "Explaining Bank Failures: Deposit Insurance, Regulation and Efficiency", *Review of Economics and Statistics*, 77, 689-700.

Wheelock, D. C. and Wilson, P. W. (2000), "Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions", *Review of Economics and Statistics*, 82, 1, 127-138.

Wheelock, D. C., and Wilson, P. W. (1994), "Can Deposit Insurance Increase the Risk of Bank Failure?", *Federal Reserve Bank of St. Louis Review*, 76, 57-71.

White, E. N. (1984), "A Reinterpretation of the Banking Crises of 1930", *Journal of Economic History*, 44, 110-38.

Wolf, H.C. (1997), "Regional Contagion Effects in Emerging Markets", *Working Papers in International Economics*, G-97-03, Princeton University.

Wooldridge, J. M. (2000), *Introductory Econometrics: A Modern Approach*, South-West College Publishing.

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, MIT Press, London.

World Bank (2000), "East Asia: The Road to Recovery", *World Bank Publications.*

Yap, J. T. and Lamberte, M. B. (2001) "Monitoring Economic Vulnerability and Performance: Application to Phillipines", *Institute for Development Studies, Discussion Paper Series*, 11.

Yapi Kredi Bank (2000), *Annual Report*, Turkey.

Yilmaz, R. (2003), "Bank Runs and Deposit Insurance in Developing Countries: The Case of Turkey", PhD. Thesis, *American University, Washington D. C. 20016.*

Zivot, E. and Andrews, D. K. (1992), "Further Evidence on the Great Cash, the Oil Price Shock and the Unit Root Hypothesis", *Journal of Business and Econometrics*, 10, 251-270.

Zorlu, D. (2004), "A Comparative Analysis of North and South Cyprus Financial Sectors", Dissertation, *Eastern Mediterranean University.*