Banking Failures In Chile During The Period Of Financial Liberalisation

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Abstract.

It is argued that the banking crisis in Chile had its origin in the deterioration of key macroeconomic variables and that financial liberalisation played a secondary role. Proponents contend that no financial system can be expected to withstand a fall in output of nearly 15% in 1982 and they draw parallels here with the banking crisis of the 1930's in the US. On the other side, it is argued that the ability of the financial system to withstand any macroeconomic shock have been shaped by the financial liberalisation which took place in the years before the collapse of the macroeconomy. Conduct derived from ownership concentration and "related portfolios", sharp deregulation on interest rates, belief in an implicit bail-out provision, and the ineffective and inadequate prudential regulation led to pervasive banking structure and a pattern of behaviour marked by moral hazard. As a result, banks exhibited excessive risk taking with a deterioration of banks' financial position. Only the prompt rescue by the Central Bank of leading financial institutions averted a massive loss of confidence and a bank run.

This thesis examines the evolution of the Chilean financial system during the period of economic reforms and banking failures. Three specific questions are examined and evaluated empirically: How important was the adverse macroeconomic environment relative to the banking conduct and management which exhibited considerable moral hazard and adverse selection type of behavior in the banking failures in Chile ? Secondly, in what ways might a more favorable general economic conditions and/or a more effective prudential regulation have helped to reduce the likelihood of bank failures ? Finally, might some of the bank failures been anticipated years before the crisis by an early warning system ?

In order to answer these questions this thesis develops a logit model for cross-section and panel data with information from banks' balance sheets to estimate the probability of bank failure/problem for the period between 1979 and 1983.

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Declaration.

I hereby declare that the work submitted in this thesis is the result of my own investigation. Due references and acknowledgements have been made, where necessary, to the work of other researchers.

I further declare that this thesis has not previously been accepted in substance for any degree, and is not being concurrently submitted in candidature for any degree.

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Chapter 1. Introduction.

(1.1) Background to the Study.

This thesis discusses and evaluates empirically the Chilean experience with financial liberalisation during the 1970's and early 1980's. Special consideration has been given to the study of the origins and the magnitude of the collapse of the banking system in 1982-83.

The Chilean liberalisation programme, which included the deregulation and the opening-up of the goods and financial markets as well as a package for macroeconomic stabilisation has been of considerable interest to economists and researchers working in the areas of economic development, international trade, and finance.

There are several reasons why the Chilean case is been of great interest. First, the Chilean economy pursued two distinctly different development strategies. From the 1930's to the early 1970's the economy followed inward-looking strategies which included a financially repressed financial system; and from the late 1973 onwards an outward-looking strategy which included financial liberalisation and stabilisation policies. This sharp and sustained changes in policy implies that the links between policy and performance may be more clearly discernible in the Chilean case than in most others.

Secondly, the process of liberalisation after the military coup of September 1973 was considered to be a "pure monetarist strategy" as the economy was subject to free market oriented policies under the guidance of the military government and Chicago-trained economists. The performance of the economy under the influence of Chicago liberalism provided evidence for their detractors particularly with the debacle of the banking system in 1982-83.

Finally, the performance of the Chilean economy both during and after the liberalisation reforms have been completed contained some dramatic change of fortunes which still are considered rather puzzling. Chile`s economic performace between 1973 and 1983 shows sharp contrasts. For instance, the average growth rate of real GDP between 1976 and 1981 was 7.1% and the inflation rate was less than 10% by 1981. However, by 1982 and 1983 GDP fell by nearly 14% and 3% respectively. At the same time, once the liberalisation of trade was completed on schedule in 1979 which among other things meant the attainment of a uniform nominal tariff of 10%, and the financial system was open to flows of foreign capital in 1982 the whole process was stopped and reversed during the second half of 1982. The trade regime was restricted with the rise in tariffs and controls and the financial system was overhauled and its losses socialised to avoid its inminent collapse. Although the collapse of the economy in 1982 and the abandonment of the Neo-Liberal approach have been subject to considerable scrutiny, some of the issues, particularly the debacle of the banking system and its empirical verification, remain largely unsettled.

During the mid-1970's, Chile adopted a new approach to policy-making. This new strategy consisted of a combination of measures to deal with macroeconomic instability as a short-run objective and economic growth as a long-run objective. The new package of economic policies consisted initially of traditional orthodox monetarism for stabilisation and liberalisation reforms in the goods and financial markets. The liberalisation of the financial market was considered one of the backbone of the Neo-liberal reforms. Indeed, in retrospect, it could be argued that the success or failure of financial liberalisation was paramount in the overall result of this new approach of economic development in Chile.

The authorities were absolutely committed to short run stabilisation as a pre-condition for the introduction of long run structural and institutional reforms. At the beginning, the lack of success in reducing the inflation rate and the high cost in terms of output and employment, particularly in 1975 as output fell by nearly 13%, forced the authorities to overhaul closed economy monetarism. Instead, an open economy approach was introduced in 1978 where the exchange rate became the nominal anchor of the economy as well as the key variable in expectations formation. This approach was desirable and necessary as the economy was becoming more integrated to the international world markets.

The itinerary of liberalisation was on schedule and with no political opposition. The goods market was deregulated domestically and followed by the removal of trade restrictions. The financial market was deregulated simultaneously with the goods market although it remained closed to external capital flows until the last stage of the reform package. This order and timing of liberalisation was considered theoretically sound and accepted by economists and policy-makers working in Chile and other developing countries.

The acceptance of the Neo-Liberal approach was based on economic, social, and political factors. The performance of the Chilean economy was unsatisfactory, particularly during the Allende's social government between 1970 and 1973. The economy was suffering from hyperinflation induced by the financing of large fiscal deficits. At the same time, the balance of payments deficit and the shortage of international reserves was becoming symptomatic of the fiscal deficit and especially of the inward-looking strategy. Obviously some action was required to correct these macroeconomic disequilibria.

The rate of growth of real GDP was poor relative to other Latin American and East Asian economies during the

1950's and the 1960's. This gap widened during the early 1970's. For instance, the average annual rate of growth of real GDP between 1965 and 1973 was 10% and 10.4% for Korea and Taiwan. Brazil and Mexico also exhibited impressive growth rates with 9.8% and 7.9% respectively. In contrast, Chile shows a poor performance with only 3.4% over the same period.

It could be argued that much of the difference in performance can be attributed to the fact that the East Asian countries were pursuing outward-looking strategy and by promoting a well developed financial markets. In contrast, Chile followed a systematic inward-looking strategy and financially repressed financial market as the industrialisation strategy. It must be said in retrospect that East Asian countries have continued outperformed Latin American countries during the second half of the 1970's and during the 1980's even though the latter countries have pursued very aggressive liberalisation strategies.

It is clear by now that economic factors such us macroeconomic instability, the failure of inward-looking strategy, and the superior performance of those countries following a more open strategy towards international trade and financial markets motivated the Chilean authorities to embrace a Neo-Liberal approach. At the same time, the political turmoil during the socialist government produced a climate for the establishment of both, a military dictatorship and the economic regime.

It must be said that, at least in the economic front, Chile`s economic liberalisation accomplished many positive achievements. Trade liberalisation made a significant contribution to the rate of economic growth during 1976-81. Some sectors were sufficiently flexible to react to changes in relative prices resulting from trade reforms. In fact, resource reallocation from import substitution to the export sector was possible. Furthermore, there was a change in the pattern of production in the export market as non-traditional exports such as agricultural products, timber, and fishing expanded relative to traditional exports such as copper.

Similarly, financial liberalisation brought about significant benefits by expanding the level of financial intermediation through the formal banking system. At the same time, the rise in the number of financial institutions produced significant improvemement in operative efficiency and financial widening. However, in spite of these positive results, these reforms produced other unexpected and undesirable outcomes. High and stubborn interest rates, lack of effective supervision, imprudent practices by banks and non-banks financial institutions conspired against the establishment of an efficient and stable liberal financial market. The debacle of the banking system in 1982-83 is the reflection of the effects of an ill-designed and mistaken implementation of financial liberalisation. Admittedly, the completation of financial liberalisation and the collapse of the banking system coincided with the economic recession of 1982 when output fell by nearly 15%.

The Chilean experience is still a contentious issue in spite of the substantial literature on this topic. This is more significant when we attempt to explain the debacle of the Chilean banking system. On one side, it is argued that the financial crisis in Chile had its origin in the deterioration of key macroeconomic variables and that financial liberalisation played a secondary role. Proponents contend that no financial system can be expected to withstand a fall in output of nearly 15% in 1982 and they draw parallels here with the banking crisis of the 1930's in the US. On the other side, it is argued that the ability of the financial system to withstand any macroeconomic shock will depend on the structure of the banking system. This had been shaped by the financial liberalisation which took place in the years before the collapse of the macroeconomy. Conduct derived from ownership concentration and "related portfolios", sharp deregulation of interest rates, belief in an implicit bail-out provision, and the ineffective and inadequate prudential regulation led to a pattern of behaviour marked by moral hazard and to a lesser extent adverse selection problems. As a result, banks exhibited excessive risk taking with a deterioration of banks' financial position. Only the prompt rescue by the Central Bank of leading financial institutions averted a massive loss of confidence and a bank run.

If we accept that both arguments have some merits, the question is the relative weight of these hypotheses. The relative importance of macro and micro as causal factor in bank failures and the implications for the failure rates in a more stable macroeconomic environment and/or less risky bank management are important empirical questions which remain unanswered in the literature on Chile.

(1.2) Aims, Methodology and Structure of the Study.

This thesis examines the evolution of the Chilean financial system during the period of economic reforms and banking failures. Three specific questions are examine and evaluated empirically: How important was the adverse macroeconomic environment relative to the banking conduct and management which exhibited considerable moral hazard type of behavior in the banking failures in Chile ? Secondly, in what ways might more favorable general economic conditions and/or different implementation of financial reforms including a more effective prudential regulation have helped to reduce the likelihood of bank failures ? Finally, might some of the bank failures have been anticipated years before the crisis by an early warning system ?

In this thesis, I develop a logit model for cross-section and panel data with information from banks' balance sheets to estimate the probability of bank failure/problem. Banks are classified in two groups. The first group corresponds to those financial intermediaries with no problems and the second group includes banks with problems/failed. In the latter, I have followed a wide definition of problem/failure to conform to the list which includes problem banks which sold bad debts to the Central Bank, and those institutions in which the authorities intervened directly.

At a first stage, I use symptomatic variables derived from banks' balance sheets among them I include a broad categories of financial and accounting ratios assessing a bank's liquidity, credit risk, liability risk, capital adequacy, and profitability. This model will enable me to estimate the ex ante probability of bank failure/problem and to evaluate whether the model was providing an early warning signal at least with a year or more. At the same time, the use of these symptomatic variables will permit the constructing of a banks's ex ante classification on quarterly basis.

In the second stage of the empirical work, I proceed to run the logit model with quarterly panel data against macroeconomic and microeconomic explanatory varaiables. This model will help to test macro and micro factors affecting the probability of bank failure/problem and to simulate different environments to assess its impact on the likelihood.

Specifically, this thesis is composed of ten chapters, including the introduction and the conclusions. Following the introduction, chapter 2 provides a background on the Chilean financial reforms and the institutional structure. It also contains an assessment of the results which were expected a priori.

The first section begins with an account of the theoretical underpinnings of financial liberalisation and the case against financial repression. In addition, it is shown what is regarded to be desirable and acceptable in terms of the dynamics and the transition involved in the path from financial repression to a deregulated financial market. Some evidence from selected countries is presented to support financial liberalisation.

The second section contains a detailed description of the package of financial reforms implemented between 1973 and 1983. This includes reforms towards the liberalisation of the domestic banking sector as well as the opening to external capital inflows. This description follows the chronological order adopted by the monetary authorities.

Finally, this chapter ends with a general evaluation of the effects of financial liberalisation. It provides evidence on financial deepening and widening, the pattern of interest rates, the effect on savings and investment, and the allocation of financial resources. At first sight a significant expansion of the peso and dollar liabilities occurred along with increases in intermediation and the number of financial institutions, both domestic and foreign. But deregulation and increasing competition meant an alarming deterioration of banks' asset portfolios and profitability during 1981-83. Several financial institutions were rescued in 1981 and in particular in 1983 to avert a contagious panic and a bank run.

Chapter 3 is a continuation of chapter 2 as it gives an overview of the different episodes of financial difficulties during the period of liberalisation, although the emphasis is put on the banking crisis of 1981-83. Moreover, it discusses the magnitude of the collapse and the measures taken by the authorities.

This chapter is divided into two main sections. The first one carries out an autopsy of the banking system and some financial institutions. By means of financial data from annual banks' balance sheets and income statements we construct financial indicators on performance and fragility to study the evolution of the banking system between 1977 to 1983. Moreover, the data enable us to estimate indicators for individual banks and thus compare their individual performance. Clearly, according to the indicators there are marked differences between those banks which experienced intervention and/or sold bad debts to the Central Bank and those intermediaries which remained healthy. Such comparison were also made between the group of domestic banks and foreign banks where the latter group suffered minor distresses during this period.

The second section shows the magnitude of the intervention in terms of the rescue package enacted by the monetary authorities. One of the most important mechanisms in aid of those in financial distress was the agreement number 1.555. This enabled banks to sell bad debt to the Central Banks.

Following the description and evaluation of the banking crisis, chapter 4 reviews the theories of bank failures and banking instability. After providing a theoretical justification for the existence of financial intermediaries as information producers and liquidity insurers, the analysis passes to the explanation for bank failures. One can identify three factors which explain banks failures, namely external factors like the macroeconomic environment, industry-changes as a result of financial liberalisation, and internal factors such as fraud, and the banks' attitude towards risk-taking. It is suggested that two testable hypotheses can be conducted to explain the failures of the Chilean financial institutions. That is, adverse macroeconomic changes which are external to the banks, and excessive risk-taking and moral hazard by bankers responding to industry changes from financial liberalisation.

Chapter 5 discusses the econometric methodology applied to study the banking crisis in Chile. This includes a revision of some previous empirical studies and the use of logit models.

The first section contains a review of some of the early studies available in this area using particularly binary choice models. This literature contains special reference to the failures of US financial institutions, including Saving and Loan Associations. One observes that binary-choice models, especially logit models, have been used very successfully to explain financial failure/problems of the 1930's, early 1970's and 1980's.

The following section presents a brief discussion of a univariate dichotomous model with special reference to the logit model. I concentrate on the model estimation procedure which involve a non-linear maximum likelihood estimation technique. Also, there is a review of the hypothesis testing procedure and the development of model selection criteria for alternative specifications. This section is completed with the inclusion of specific econometrics difficulties for the case of panel data.

Chapter 6 deals specifically with the issue of developing an appropriate bank classification technique using financial information from banks' balance sheets and income statements. One of the limiting problems to estimate the logit model using quartely panel data is the fact that we do not have information available on the banks' financial strength prior to 1983. In order to overcome this difficulty we construct an early warning system to predict the ex ante probability of bank failure/problem.

This chapter is organised in three main sections. The first one contains a description of the model in terms of definitions concerning bank failure/ problem and their relative merits. This section is follows by a description of the different categories of independent financial and accounting variables which will help us to discriminate and classified financial institutions into the two broad groups. Finally, the last section reports and assesses the empirical findings using univariate and multivariate statistical techniques.

Chapter 7 contains three main sections. Section 1 introduces the hypothesis concerning the role played by the macroeconomic environment and the proponents who sustain this view. This section is followed by an evaluation of the prevailing macroeconomic environment in Chile between 1977 to 1983. There are two phases identified in terms of the boom-bust cycle. It is shown the severe misalignment of some key macro prices such as the real exchange rate, the real interest rate, and the sharp and unexpected changes in the stock prices and capital inflows. Other studies are cited to stress the importance of these factors on the recession of 1982-83.

The third and final section reports the empirical results from the econometric analysis. I run regressions between the discrete dependent variable and a set of chosen macroeconomic variables using quarterly panel data. This exercise aims to assess empirically the relevance of macroeconomic factors in determining the likelihood of bank problems/failure.

Chapter 8 reports the results from the estimation of the logit model as we regress the discrete dependent variable against microeconomic variables as proxies for excessive risk-taking. There is a discussion of the hypothesis which relates the banking crisis to moral hazard type of behaviour by bank management.

My main concern is to evaluate how moral hazard problems could have affected the likelihood of bank failure/problem. It is argued that much of the banking conduct was affected by the implementation of financial liberalisation per se. These results are estimated independently of any macroeconomic shock.

In order to test for moral hazard I have used some proxies and measuring any deviation of the proxy from its trend. Furthermore, we include some dummy variables to capture some specific banks characteristics such us "related portfolios".

Chapter 9 offers a comparison between the regression results of chapter 7 and 8 in terms of the robustness of each model. At the same time, it shows some of the results from some simulation exercises conducted by assuming different scenarios. Specifically, I simulate changes in the macroeconomic environment and liberalisation reforms. We offer some comparisons by introducing some hypothetical question such us what would have happen to the likelihood of bank failure/problem if we simulate the model with a more stable macroeconomy or if more effective prudential regulation was introduced to influence more conservative bank management and risk taking ?

Finally, chapter 10 sets out the main conclusions from this empirical study. At the same time, it highlights the limitations of this study and venues for further reserach.

Chapter 2. From Financial Repression to Financial Liberalisation: Chile in 1970-1983.

(2.1) Introduction.

This chapter provides a background on how the Chilean financial system evolved from a financially repressed to an unregulated and more competitive market. It discusses and evaluates the impact of both, repressive financial policies and financial liberalisation reforms.

Although this thesis focuses on the bankruptcy of the banking system, it is important to place the banking failure of 1983 against the backcloth of the financial reforms implemented during the 1970's. Apart of providing both, some of the theoretical underpinnings and the evidence against financial repression, this chapter also presents a detailed description of the Chilean banking system and the itinerary of financial liberalisation between 1973 and 1983.

Financial liberalisation was undertaken within a broader development strategy including trade liberalisation and stabilisation policies. The development of an efficient and a stable financial system and its opening-up to the world financial market was the backbone of the overall package of the structural reforms from the very beginning. The elimination of interest rates disequilibrium, selective credit controls, non-interest reserve requirements, and inflation tax combined with institutional changes such as the privatisation of financial institutions, the lifting of entry barriers, and the establishment of a multi-purpose banking was expected to produce some positive benefits. Specifically, it was expected that there would be an increase in financial deepening (financial savings), a rise in the level of domestic savings, increases in the volume and quality of investment, and an improvement in resource allocation and operative efficency. At the same time, there was the belief that a market oriented financial system would promote and secure financial stability.

As we will see in this chapter, financial liberalisation partially achieved the objective set originally. However, the most worrying sign which emerged from the financial liberalisation experience was the rise in financial instability as the private financial system ended practically bankrupt and experienced considerable intervention by the economic authorities.

In developing countries the terms financial system and banking system are used interchangeably since banking dominates financial intermediation. As we will see from chapter 3, the case of Chile is no the exception to this rule.

(2.2) The Banking System and Financial Repression in Chile: The Pre-Liberalisation Period.

(2.2.1) Financial Repression and Economic Development.

As we will see shortly the government of Chile undertook a comprehensive programme of economic liberalisation. One of the central components of the economic strategy was a drastic overhaul and the deregulation of the country's financially repressed banking system. This reform clearly reflected the spirit of the Mckinnon-Shaw prescription that abolishing financial repression is essential for a sustained economic development.

Before we procede to assess the empirical relevance of financial repression and the process of financial liberalisation in Chile, a revision of the main theoretical underpinnings will be provided.

In retrospect, one observes that the literature on money and finance have gone considerable changes since the Great Depression of the 1930's. To begin with, Friedman and Schwartz's reinterpretation of the US depression and the collapse of the US banking system has revindicated the role of money after the challange of the Keynesian Revolution where money did not matter. In the monetarist counter-revolution, money was important as much as it was the role of the Federal Reserve when failed to supply liquidity as a result of the fall in the currency-deposit ratio and hence the money supply.

The second major revision in monetary theory has been on the role of finance in the economy. The terms money and finance have been used almost interchangeably during many years. This can be explained partly by the fact that the financial system was dominated by both, commercial banks and the Central Bank. The former accepted demand deposits and the latter issued currency as their key liabilities. Money, defined as currency plus demand deposits, was the only acceptable asset as a medium of exchange. However, the evolution and innovation of the financial system was materialised in terms of the introduction of new intermediation services and the supply of new financial instruments and institutions. This led to a redefinition of money and the nature of the financial services provided by financial institutions. Indeed, today currency and demand deposits constitute only a fraction of the total assets (liabilities) of the financial system. In addition, an increasing number of economists have given a greater weigh to the role played by the contraction of banks' intermediation services during the episodes of the Great Depression.[1]

While money and finance have been recognised as having an effect on the output cycle, it also began to emerge a body of the literature where money and financial intermediation have been incorporated into growth models. This direction has had important theoretical as well as practical implications, especially among developing countries which over the years have been striving to achieve a higher rate of economic growth.

Tobin (1965) introduced a modified version of the Harrod-Domar growth model which incorporated money as outside or deadweight money. Tobin considered money as wealth and hence as an alternative asset to savers. The substitutability between money and physical capital implied that any increase in the real return of money, other things being equal, would generate a portfolio shift away from capital and towards money. This in turn will reduce the accumulation of physical capital and hence the rate of output growth.

The neoclassical monetary growth theory can be condensed in the following expressions. The production function Y=F(K,L) is assumed to be linearly homogeneous with constant return to scale. It is also assumed that the marginal product of capital (MPk) and labour (MPl) are both positive and subject to diminishing returns. Moreover, the model considers the quantity of labour growing at a constant rate of n. It is possible to write the production function in per capita terms by dividing through by L as shown by (1a).

(1a) $y = (k)$ where $y=Y/L$ and $k=K/L$

$dy/dk>0$ and $d^2y/dk^2<0$

The demand for money function shown in (1b) suggests that money is held as a medium of exchange. The neoclassical assumption of perfect capital market (i.e. homogeneity and perfect divisibility of capital, no transaction and informational costs) leaves the monetary system as performing a payment function with no comparative advantage on intermediation. According to (1b) an increase in r relative to (d-p) will produce a portfolio shift from money to physical capital and viceversa. This substitution dominates the neoclassical monetary growth theory.

(1b) $M/P = H(Y, r, (d-p))$

where Y = real income
r = real rate of return on capital
$(d-p)$ = real deposit rate of interest
and $\delta H/\delta Y > 0$ $\delta H/\delta r < 0$ $\delta H/\delta(d-p) > 0$

Expression (1c) represents the rate of capital accumulation (investment function) and shows the substitution between money and aggregate investment in the steady state. Given that the marginal propensity to save (MPS) is taken as a constant then actual savings are allocated between real money balances (M/P) and physical capital.

(1c) $I = dK/dt = s(k) + (s-1)[d(M/P)/dt]M/P$

where s = MPS
K = capital

(1d) $(d-p) = r$ where $r=dy/dk$

Given that $0<s<1$ and in a growing monetary economy $d(M/P)/dt > 0$ then it follows that $(s-1)[d(M/P)/dt]$ is clearly negative. Thus, money competes with capital. If the equilibrium condition in (1d) is disturbed then a portfolio adjustment will take place.

It follows from this model that the accumulation of money holdings will retard the growth of output.[2] If the rate of capital accumulation is low and the authorities wish to accelerate the rate of output growth then they must make the holding of money unattractive by introducing ceilings on interest rates (d) and/or increasing the rate of inflation (p).

One aspect of the neoclassical monetary growth theory which is puzzling if not inconsistent concerns the reason of why will people hold money at all. Indeed, the underlying assumptions of the model, particularly the homogeneity of output, the perfect divisibility of capital, and perfect information which are explicitly or implicitly incorporated into the model does not provide, if we follow the logic, any justification for holding money. On this point, Levhari and Patinkin (1968) have incorporated money in the utility function as part of the services rendered by money balances, particularly liquidity services. Similarly, Mckinnon (1973) also presented, as we will see shortly, a critique to the neoclassical monetary growth model and a modified version of the model for a developing economy in which there is a rationale for holding money.

Mckinnon (1973) and Shaw (1973) have challanged the central implications of the traditional growth model by questioning the model's assumptions and rejecting the role of financial restriction as an output's enhancing strategy for a developing economy. Mckinnon and Shaw provided a theoretical framework to show that misguided government financial policies, especially ongoing price inflation combined with low or even negative real interest rates, would be conducive to a repressed financial sector, low investment and economic growth.

Mckinnon kept the outside (deadweight) money assumption while he advanced some institutional features inherent to developing economies. One of the most important characteristics of these economies is the existence of a significant fragmentation in the economy.[3] All economic units are confined to self-finance, and investment is assumed to be indivisible and lumpy. This implies that any potential investor must accumulate money balances or inventories to carry out its investment plans. This is a sufficient reason for holding money balances in comparison to the neoclassical model where the assumption of perfect capital market leaves the demand for money indetermined.[4] These assumptions were fundamental to conform the Mckinnon's complementary hypothesis between money and physical capital. The complementary hypothesis condradicts the neoclassical model in the sense that, the more attractive money balances the greater the incentive to invest in productive capital.

The Mckinnon's complementary hypothesis is stated in the demand for money and investment functions defined in expressions (2a) and (2b) respectively.

(2a) $M/P = h(Y, I/Y, (d-p))$

where I/Y= gross investment GNP ratio.

and $\delta h/\delta Y>0$ $\delta h/\delta (I/Y)>0$ $\delta h/\delta (d-p)>0$

(2a) $I/Y = m(r,(d-p))$

where $\delta m/\delta r>0$ and $\delta m/\delta (d-p)>0$

The complementary hypothesis between money and capital is shown by the derivatives $\delta h/\delta (I/Y)>0$, $\delta m/\delta r>0$, and $\delta m/\delta (d-p)>0$. That is, the average real cash balance of a small saver-investor will rise as a result of the increase in the desirable rate of capital accumulation which in turn respond to increases in the real return of capital and/or money.

Thus, in the Mckinnon model financial savings determines the supply of funds. Savings are distributed between tangible assets and interest-earning deposits. The views of Mckinnon and Shaw differ on the process by which bank deposits are transformed into investment. In the Mckinnon model investment is self-financed so that in a segmented economy investor need to accumulate real balances to finance lumpy investment projects. In consequence, a rise in the real return from money will enable savers to accumulate money and invest into higher-yield physical assets. It could be argued from Mckinnon's view that in an economy with no money, the introduction of fiat money as opposed to commodity money will serve as a "conduit" for capital formation by making money and capital complementary assets. A similar conclusion is obtained if we include further development of financial instruments such as bank deposits and so on. Mckinnon described an extreme case of financial repression with no possibilities for external finance in the form of bank credit. The process of saving and investment involves a single and dual individual. In contrast, Shaw has emphasised the role of external financing as the effective constraint on capital formation. Like Mckinnon, Edward Shaw in his book Financial Deepening and Economic Development published in 1973 questioned the benefits from low interest rates and inflation, and stressed the negative effect of financial repression on economic growth.

In Shaw's monetary model, there are two important modifications with respect to the definition and meaning of money. Firstly, the model describes an inside money economy where money is treated as debt. This clearly contradicts the Mckinnon's outside money assumption which recognise money as wealth. In Shaw's debt-intermediation view, an asset such as money is cancelled out against financial liabilities. In other words, money and demand deposits which correspond the liabilities issued by commercial banks and the Central Bank are backed by productive investment loans. Thus, the remaining asset in this economy's aggregate balance sheet is physical capital. In consequence, the accumulation of money neither is a substitute nor a complement of capital.

Secondly, money is seen as one of many financial assets. Moreover, the financial system is considered as a provider of financial services which is included directly as a factor input in the production process. Thus, policies which limits the quantity and quality of financial assets and hence the supply of this intermediate factor input in less than optimal quantities should be avoided.

The Shaw's demand for money function is despicted in expression (3)

$$(3) \quad M/P = h(Y,Z,(u-p))$$

$$\text{where} \quad \delta h/\delta Y>0 \quad \delta h/\delta Z<0$$

$$\text{and} \quad \delta h/\delta(u-p)>0$$

Expression (3) differs only slightly with Mckinnon's demand for real balances given by (2a). Shaw included an opportunity cost of money defined by Z which includes a set of inflation hedges such as precious metals, pieces of arts, and land and properties. At the same time, the relevant rate of return of money is the real rate of interest in all financial assets (u) rather than the narrow real deposit rate (d-p). The term I/Y which reflects the complementary hypothesis is not included in expression (3) since investors are not constrained to self-finance. In fact, if institutional credit is not available then an informal credit market will emerge.

Although both theoretical framework were conceived under different assumptions they have thrown a similar policy implications. They both challanged the conventional wisdom of a low interest rates, higher price inflation, and government intervention in the financial system to enhance growth. Instead, they emphasise the importance of financial liberalisation and the effect of financial deepening in accelerating the rate of economic growth in a developing economy. Specifically, they advocate low inflation and positive real interest rate policies for developing economies.

Fry (1982a) argued that many developing countries have apparently slipped into financial repression inadvertenly. Indeed, financial repression was the result of the unintended consequences of taxing and regulating the financial system to obtain resources to finance government deficits. Most governments in developing countries have been technically constrained with respect to the amount of tax revenues can be rise from direct and indirect taxation. The problem of tax evasion and the existing lags in collecting tax revenues (Olivera-Tanzi effect) are quite significant. Moreover, the absence of well established and developed open market in primary securities had ruled out the possibility of issuing government securities to finance government large deficits.[5]

Another motivation for repressing the financial sector is explained by the fact that regulation of financial institutions and their influence on the allocation of resources via selective credit allocation has enhanced the government's ability to channel financial resources into specific sectors of the economy as part of the overall development and political strategy. As we have seen in chapter 1, Chile as well as many other developing economies were pursuing inward-looking strategies since the 1930's. This policy package included both a highly protectionist foreign trade policies among them tariffs, subsidies, quantitative restrictions, and an overvalued real exchange rate. This trade regime was complemented with a selective credit allocation and disequilibrium interest rates to promote import-substitution.[6]

The public finance hypothesis and the inward-looking strategy seems as two equally plausible explanations of financial repression in Chile as well as other developing economies. However, in my view is equally true that the simplistic view of the neoclassical monetary growth model has driven policy-makers in LDC's to readily accept the recommendations from this model and hence to overlook the implications of money and finance on capital accumulation and economic growth.

Whichever the reasons for the acceptance of financial repression, governments had an ample list of instruments at their disposal to serve its objectives. In order to collect revenues to finance the government's uncovered budget deficit, they explicitly and/or implicitly tax the financial system by means of a compulsory reserve requirement on bank deposits and inflation tax on currency and reserves respectively.[7] Similarly, the introduction of usury restrictions on interest rates and selective credit allocation have enabled governments to extend subsidies to specific sectors. Ceilings are set deliberately below equilibrium interest rates so that credit can be allocated following non-price criteria.[8] Moreover, Nichols (1974) maintained that restricting the interest rates payable on private assets has been helpful in curtailing the availability of good substitutes and hence making the demand for money more inelastic with respect to inflation.

All in all, one may conclude that introducing an explicit and implicit taxation in the form of non-interest reserve requirements, and price inflation respectively, and/or usury restrictions on interest rates will contribute to exacerbate both interest rate disequilibrium and the burden of taxation on the banking system. The overall impact will fall upon the resource allocation and the development and maturity of the banking system. The shrinking of the amount of loanable funds and introduction of a non-price rationing of financial resources will affect adversely the amount of investible funds and the quality of investment in the economy. Therefore, financial repression will be conducive to slow or retard the rate of economic growth in developing countries. As we will see from next section, these conclusions are supported by the evidence from Chile and some selected countries.

(2.2.2) The Evidence of Financial Repression for Chile and Some Selected Countries.

This section presents simple calculations of both the magnitude of the explict and implict tax levied on the Chile's banking system as well as the degree of interest rates disequilibrium during the decade of the 1970's. These results are compared with the estimates of the list of selected countries. Although this is not a comparative study it was thought that the inclusion of a selected list of countries would be helpful to make even a strong case against financial repression.

I have included the US, Germany, and Japan as industrialised and non-inflationary economies. At the same time, among the newly industrialised countries (NIC's), Korea and Singapore are the most appropiate representatives from this region. Singapore and to a lesser extend Korea had consistently deregulated and liberalised their financial system.[9] Finally, Mexico was incorporated in the list of selected countries representing those less developed and inflationary economies. The Mexican banking system has long been financially repressed, a syndrome which became more acute during the nationalised era between 1982 and 1989.

Although there are substantial structural differences among the selected countries which makes detailed comparison somewhat cumbersome, the fact that the financial system in these economies was dominated by organised banks, state and/or private ownership, still provides an angle for useful comparisons.

The evidence from Chile during the 1970's shows the detrimental effects of government interference in the banking system. Explicit and implicit taxes on financial intermediation and disequilibrium interest rates have affected adversely the financial deepening in Chile measured by the M2/GDP ratio. This proxy for financial intermediation indicates the amount of loanable funds intermediated through the organised banking system. Those countries which have levied a heavy tax burden in their banking system and accepted disequilibrium interest rates in the form of negative real deposit interest rates exhibit low M2/GNP ratios.

Table 2.1 Indicator of Financial Deepening for Chile and Selected Countries.(a)(b)

M2/GDP	70	71	72	73	74	75	76	77	78	79	Av
USA	.62	.65	.67	.64	.62	.64	.66	.65	.62	.60	.64
FRG	.50	.45	.52	.51	.51	.54	.53	.55	.57	.55	.52
Japan	.74	.83	.91	.87	.82	.85	.85	.85	.87	.87	.85
Korea	.33	.32	.35	.36	.32	.31	.30	.32	.35	.31	.33
Singap.	.66	.61	.65	.60	.55	.61	.63	.61	.61	.63	.62
Mexico	.16	.16	.16	.17	.15	.15	.18	.28	.30	.31	.20
Chile	...	...	...	.13	.06	.07	.08	.10	.12	.14	.10

Source:IMF,International Financial Statistics,Various Issues

(a) M2 and GDP are measured at current prices.
(b) M2 is the sum of money plus quasi-money.

Table 1 exhibits the estimates of the ratio of the broad money supply (M2) to gross national product (GNP) for Chile and some selected countries. Chile's estimates of the M2/GDP ratio indicates that the average holdings of broad money as percentage of GDP was 10% per annum during the decade of the 1970's. This figure is comparatively small to those from industrialised and non-inflationary economies. For instance, Japan and US exhibit a ratio of 85% and 64% respectively. In addition, developing countries such as Korea and particularly Singapore also show high M2/GDP ratios. It appears that the flow of loanable funds grew more rapidly in industrial and rapidly emerging developing economies than in slow growth economies such as those in Latin American. As we will see shortly, these results are also confirmed by the evidence available from wider cross-country comparisons.

Chile's financial deepening is well below those selected countries and similar to Mexico. There are two inmediate questions which arise from the evidence. How can we explain the magnitude of financial repression in Chile ? And are there common factors between Chile and Mexico and differences with industrialised and rapidly-growing economies to explain their relative financial performances ?

It can be proven that those countries which implicitly and/or explicitly tax their banking system, and deliberately choose disequilibrium interest rates, should have a lower M2/GDP ratios than those economies which present a more deregulated financial sector and have levied a lower tax burden on financial intermediation.

The imposition of a high reserve requirement on bank deposits is equivalent, as we have seen from the theory, to a explicit tax on deposits and lending. Similarly, the inflation tax on currency holdings and on bank reserves can be seen as an implicit tax on intermediation. The hypothesis is that both forms of taxation should affect adversely financial deepening.

I have estimated an effective reserve ratio and the magnitude of the inflation tax on currency and reserves for Chile and the selected countries. These results are presented in table 2,3, and 4 respectively.

The effective reserve ratio is calculated from the following expressions and expressed as a percentage of bank deposits. These estimates are shown in table 2.

(4) $Rr = R/D$

(4a) $Rr = (H - C)/(M2 - C)$

where Rr= Effective Reserve Ratio
R = Bank Reserves
D = Bank Deposits
H = Monetary Base
C = Currency Held Outside Banks
M2= Money plus Quasi-Money.

Table 2.2 Effective Reserve Ratios for Chile and Selected Countries.

	70	71	72	73	74	75	76	77	78	79	Av
USA	5.2	5.4	4.4	4.7	4.7	4.2	3.6	3.3	3.6	3.6	4.3
FRG	10.5	11.2	13.7	13.9	11.8	10.1	10.8	10.1	10.5	10.5	11.3
Japan	2.2	1.8	1.9	3.5	3.6	2.8	2.5	2.3	2.3	2.5	2.5
Korea	21.7	13.6	17.0	18.8	18.0	21.5	21.5	22.7	22.0	22.5	19.9
Singap	5.2	5.6	6.8	13.3	9.6	8.5	8.5	8.7	9.5	9.0	8.5
Mexico	17.5	20.8	47.7	50.6	64.8	79.1	31.2	47.3	45.4	45.3	45.0
Chile	24.7	49.8	57.0	55.8	37.2	63.9	68.3	54.3	46.4	35.6	49.3

Source:IMF,International Financial Statistics,Various Issues

The evidence from table 2 supports the hypothesis that high reserve requirements inhibit the flow of loanable funds through the formal banking system. For instance, the estimate on Chile's effective reserve ratio was on average nearly 50% of total bank deposits during the 1970's. A similar result was obtained for the case of Mexico where on average 45% of bank deposits were held as legal reserve with the Central Bank. In contrast, the evidence from industrial countries and emerging developing economies shows high M2/GDP ratios with low effective reserve ratios. For instance, Japan's effective reserve ratio was only 2.5% of bank deposits and M2/GDP ratio of 0.85 during the 70's. Identical conclusions were obtained from the newly industrialised countries (NIC's) such as Singapore and Korea.[10]

With respect to the implict tax on currency and on bank reserves, the simplest method to calculate the total tax revenue obtained by the authorities is to use the change in the monetary base over the entire year. As we know the monetary base consist of currency and bank reserves held with the Central Bank. The choice of the monetary base as the inflation tax base for my estimates was considered superior and simpler over other monetary variables. For instance, M1 which includes currency and sight deposits is not accurate to estimate the magnitude of the revenue from inflation tax since commercial banks capture most of the revenues from sight deposits. Therefore, the monetary base which is the monetary liability of the Central Bank should be more accurate.[11]

The method of calculating the ratio of nominal change in the money base to the annual nominal GNP can seriously overstate the seigniorage in high inflation countries. Moreover, if interest are paid on reserves then it should be discounted to obtain an unbiased estimate of the government's seignorage. Unfortunately, this data is not available for some countries and also very few developing economies actually pay interest on reserves.[12]

Beyond the specific issues concerning the accuracy of government's seigniorage and the simplicity of the model, the results from the estimation should help us to highlight any difference among the selected countries. I have proceeded by estimating the total revenues from inflation tax using separate components of the model. The estimates of the inflation tax on currency are obtained from expression (5) and reported in table 3.

(5) $Cs = (Ct - Ct\text{-}1)/GDP$

where Cs = Revenues from Inflation Tax on Currency
C = Currency Held Outside Banks

Table 2.3 Revenues from Inflation Tax on Currency.(a)

	70	71	72	73	74	75	76	77	78	79	Av
USA	0.3	0.3	0.4	0.3	0.5	0.4	0.5	0.5	0.5	0.4	0.4
FRG	0.3	0.4	0.6	0.2	0.4	0.5	0.3	0.5	0.6	0.2	0.4
Japan	1.0	1.0	1.9	1.2	1.2	0.6	0.8	0.7	1.0	0.4	1.0
Korea	0.8	0.8	1.3	1.7	1.3	0.9	1.2	1.5	1.7	0.8	1.2
Singap	1.9	1.1	2.4	1.0	1.5	2.5	2.1	1.8	1.9	1.7	1.8
Mexico	0.4	0.3	0.9	1.1	0.9	0.9	2.0	0.5	1.1	1.1	0.9
Chile	2.0	3.6	8.0	5.6	2.8	2.8	2.4	1.7	1.5	1.1	3.1

Source:IMF,International Financial Statistics,Various Issues

(a) Revenues express as a % of GDP.

The revenues from inflation tax on reserves were obtained from expressions (6) and (6a) and presented in table 4.

(6) $Rs = (Rt - Rt-1)/GNP$

(6a) $Rs = [(H - C)t - (H - C)t-1]/GNP$

where Rs = Revenues from Inflation Tax on Reserves

Table 2.4 Revenues from Inflation Tax on Bank Reserves.(a)

	70	71	72	73	74	75	76	77	78	79	Av
USA	0.1	0.5	-0.2	0.4	0.1	0.03	0.06	0.02	0.3	0.1	0.1
FRG	1.4	0.9	1.8	0.6	-0.5	-0.1	0.6	0.2	0.6	0.2	0.5
Japan	0.1	0.05	0.3	1.5	0.3	-0.2	0.0	0.05	0.2	0.3	0.3
Korea	2.2	-1.2	2.0	1.9	0.7	2.0	1.4	2.0	1.3	1.4	1.4
Singap	0.3	0.4	1.2	3.7	-1.0	0.1	0.4	0.3	0.7	0.5	0.7
Mexico	0.1	0.5	3.4	1.5	2.4	2.3	-2.7	8.4	2.5	3.2	2.2
Chile	0.5	7.3	8.1	15.1	4.8	4.4	6.5	3.2	2.7	1.3	5.4

Source:IMF,International Financial Statistics,Various Issues

(a) Revenues express as a % of GDP.

Finally, total government seignorage can be calculated from (7)-(7b). It is simply the sum of the inflation tax on both currency and reserves. These estimates are shown in table 5.

(7) $St = Cs + Rs$

(7a) $St = (Ct - Ct\text{-}1)/GNP + (Rt - Rt\text{-}1)/GNP$

(7b) $St = (Ct - Ct\text{-}1)/GNP + [(H - C)t - (H - C)t\text{-}1]/GNP$

where St= Total Seignorage

Table 2.5 Total Revenues from Inflation Tax.(a)

	70	71	72	73	74	75	76	77	78	79	Av
USA	0.5	0.8	0.1	0.7	0.6	0.4	0.4	0.5	0.8	0.5	0.5
FRG	1.7	1.3	2.4	0.8	-0.1	0.4	0.9	0.5	1.2	0.4	0.9
Japan	1.2	1.1	2.2	2.8	1.5	0.4	0.8	0.7	1.3	0.7	1.3
Korea	3.1	-0.4	3.4	3.6	2.0	2.9	2.6	3.5	3.0	2.1	2.6
Singap	2.1	1.5	3.7	4.7	0.6	2.6	2.5	2.1	2.6	2.3	2.5
Mexico	0.4	0.8	4.3	3.3	3.2	-0.7	8.9	3.6	4.3	4.9	3.3
Chile	10.9	16.1	20.7	7.5	7.2	8.9	4.9	4.1	2.4	2.3	8.5

Source:IMF,International Financial Statistics,Various Issues

(a) Total Revenues as a % of GDP.

The estimates from tables 3-5 suggest that Chile has severely taxed its banking system in comparison to industrial countries and emerging developing economies. In effect, the average total revenues collected by the Chilean government during the 1970's was 8.5% of GDP per annum. This figure greatly exceeds the estimates for developed economies which hardly reached in most cases the figure of 1%. At the same time, economies like Singapore and Korea exhibit a low dependence on inflation tax although it is still higher than the US and Japan.

Another important observation from the data is that Chile collected a larger proportion of the inflation tax from bank reserves than from domestic currency. The currency component of the inflation tax accounted only 3.1% per annum during the 1970's whereas the reserve component was nearly 5.5%. This result is also true for Mexico and to a lesser extent Korea. In contrast, US, Germany , Japan , and

Singapore show a reversal in the relative importance of currency and reserve as a source of revenues from the inflation tax.[13]

The evidence from the estimates of governments' seignorage gives support to the hypothesis that those countries which have collected a substantial revenues from inflation tax from depositors and borrowers as well as from currency holders coincide with low M2/GDP. According to the data, Chile did indeed systematically burden the banking system with heavy taxes contributing partly to financial repression and a low M2/GDP ratio.

Finally, as we have seen in the previous section interest rates disequilibrium can also contribute to curtail the amount of loanable funds through the formal banking system. Low or even negative real yields on money and particularly on quasi-money should discourage the demand for financial assets. Negative real deposit rates will be consistent with a portfolio shift away from financial assets, measured by the growth of broad money (M2), and towards inflation hedges such us real estate, gold, foreign currency, and even consumption of durable goods. In contrast, countries that have sustained positive real interest rates had exhibited both a high growth of financial savings and rising flow of loanable funds through the formal banking system.

Table 6 provides estimates of the ex post real deposit rates for Chile and selected countries.

Table 2.6 Real Deposit Rate in Chile and Selected Countries.(%)

	71	72	73	74	75	76	77	78	79
USA	0.03	0.74	0.78	2.81	-3.00	-0.41	-0.86	0.55	-0.08
FRG	1.90	0.09	4.76	2.71	-0.85	0.00	0.67	0.35	1.00
Japan	4.73	3.05	-10.26	-19.84	2.26	-0.57	1.89	5.86	-3.71
Korea	6.17	0.26	8.52	-7.48	-8.22	0.78	3.81	3.58	0.25
Singap	...	1.44	-11.5	-11.03	1.75	6.16	0.83	0.04	2.11
Mexico	...	...	...	...	...	...	-14.37	-6.42	-3.55
Chile	...	...	...	...	-16.60	8.60	18.50	24.90	4.40

Source:IMF,International Financial Statistics,Various Issues

Real Deposit Interest Rate = {[(1+i)/1+%CPI)]-1}*100

The evidence suggest that those countries which have maintained positive or moderate negative real yield on deposits show high M2/GDP ratios. In contrast, countries with severe and systematic negative real deposit rates exhibit relatively low deepening ratios.

According to the data from table 6, the real deposit interest rate for Chile in 1975 was minus 16.6%. Moreover, judging from the inflation data in table 7a and the existence of interest ceilings, one can assert that interest rates were also negative during the early 1970's. In effect, the average rate of inflation between 1972 and 1974 was nearly 350% per annum with a peak of 508% in 1973.

In the absence of data for nominal deposit interest rate, we observe that nominal lending interest rate did not adjust in line with price inflation. The average nominal lending rate between 1972-74 was only 100% per annum with a peak of 200% in 1974. It is not unrealistic to expect real deposit interest rates were much lower than lending rates as much as it was the flow of loanables funds during the first half of the 1970's. Indeed, the M2/GDP ratio should not be that different from the 1974's estimate of 6.5%.

As we will see later in the paper, the phasing out of interest rates control in October 1974 contributed to a rapid transformation of negative to positive interest rates from 1976 onwards as shown in table 6. This in turn coincided with an increasing demand for financial savings intermediated through the banking system. In fact, the M2/GDP ratio was continuously climbing and by 1979 was at 14%. The positive correlation between financial savings and the real deposit interest rate appears to be valid for the case of Chile according to this preliminary examination.

Table 2.7a Interest Rates, Inflation Rates, and Financial Savings in Chile and Selected Emerging Economies.

	71	72	73	74	75	76	77	78	79
Korea									
Interest Rate	20.4	12.0	12.0	15.0	15.0	16.2	14.4	18.6	18.6
Inflation Rate	13.4	11.7	3.2	24.3	25.3	15.3	10.2	14.5	18.3
M2/GDP	32.1	34.8	36.4	32.1	30.8	30.0	32.5	35.5	31.5
GDP Growth	9.2	5.9	14.4	7.9	7.1	12.9	10.1	9.7	7.6
Singapore									
Interest Rate	...	3.5	11.6	8.9	4.4	4.1	4.0	4.7	6.2
Inflation Rate	1.8	2.1	26.2	22.4	2.6	-1.9	3.2	4.7	4.0
M2/GDP	61.6	64.7	59.7	55.2	61.0	62.8	61.1	60.9	62.8
GDP Growth	12.5	13.4	11.5	6.3	4.1	7.5	7.8	8.6	9.3
Mexico									
Interest Rate	...	...	...	...	...	...	10.6	11.1	13.2
Inflation Rate	5.0	4.7	13.6	24.0	16.1	13.8	29.2	18.8	17.4
M2/GDP	15.8	16.1	16.6	15.4	14.9	17.7	28.4	29.9	30.9
GDP Growth	4.2	8.5	8.4	6.1	5.6	4.2	3.4	8.3	9.2
Chile									
Interest Rate	...	...	...	...	267	197.7	93.7	62.8	45.0
Inflation Rate	22.1	163	508	375	340	174.3	63.5	30.3	38.9
M2/GDP	...	...	...	...	6.5	6.8	9.2	12.1	14.0
GDP Growth	9.0	-1.2	-5.6	1.0	-12.9	3.5	9.9	8.2	8.3

Source:IMF,International Financial Statistics,Various Issues

The estimates for industrialised and the rapidly emerging economies have consistently showed positive yields on bank deposits and coincided with a large flow of loanable funds through their organised banking system. However, the M2/GDP ratio fell somewhat during the unexpected oil shocks during 1973-74 and 1978-79. Inflation accelerated rapidly and nominal interest rates failed to adjust fully producing negative deposit interest rates as shown by table 7b.

This evidence confirms the hypothesis that positive yields on financial savings defined in terms of broad money

(M2) should increase its demand and intermediation through the organised banking system. Countries such as Chile which have consistently inhibited nominal interest rate from adjusting to price inflation have paid a cost in terms of small flow of loanable funds and an immature and repressed banking system.

Table 2.7b Interest Rates, Inflation Rates, and Financial Savings in Selected Industrialised Economies.

	71	72	73	74	75	76	77	78	79
US									
Interest Rate	4.3	4.0	7.0	7.8	5.8	5.2	5.5	8.2	11.2
Inflation Rate	4.3	3.3	6.2	11.0	9.1	5.7	6.5	7.6	11.3
M2/GDP	65.3	67.1	64.0	62.3	64.5	65.8	65.2	62.2	59.5
GDP Growth	3.2	4.8	5.4	-0.5	-1.1	5.1	4.6	4.8	2.8
Germany									
Interest Rate	7.2	5.6	12.1	9.9	5.0	4.3	4.4	3.0	5.1
Inflation Rate	5.2	5.5	7.0	7.0	5.9	4.3	3.7	2.7	4.1
M2/GDP	35.0	36.0	36.0	35.0	37.0	38.0	39.0	39.0	38.0
GDP Growth	3.0	4.3	4.8	0.1	-1.3	5.5	2.6	3.4	4.0
Japan									
Interest Rate	4.0	3.8	4.0	5.3	5.3	4.5	3.8	2.6	3.3
Inflation Rate	-0-7	0.8	15.9	31.4	3.0	5.1	1.9	-2.5	7.3
M2/GDP	83.6	91.2	87.6	81.9	84.6	85.5	85.2	87.4	87.5
GDP Growth	4.3	8.4	7.6	-0.8	2.9	4.2	4.8	5.0	5.6

Source:IMF,International Financial Statistics,Various Issues

One could conclude from the evidence that a heavily taxed banking system and substantial interest rate disequilibrium should have an adverse impact on the return to savers, the accumulation of financial savings and the maturity of the banking system.

Another significant finding from the data suggests that a repressive financial system was also consistent with low rate of economic growth. The real deposit rate as a return for financial savings is paramount for higher volumes of investment as well as increasing the average efficiency of investment. As we have seen from the theory, real deposit rate affects the accumulation of financial savings, investment, and growth either through the Mckinnon's complementary hypothesis or Shaw's financial deepening approach.

If we look at the data on M2/GDP ratios and real growth rates for Chile and selected countries in tables 7a and 7b we observe an apparent positive correlation between high financial deepening ratios and real GDP growth rates. For instance, Chile presents a M2/GDP ratio well below 10% and an average real growth rate of nearly minus 2% during the period of severe interest rate disequilibrium. In contrast, industrialised economies and the NIC's which systematically showed positive and in some years moderately negative real interest rates they also exhibit high M2/GDP ratios and high real GDP growth. Indeed, for the group of industrial nations the average M2/GDP ratio during the 70's was 67% and coincided with an average real GDP growth of 3.8%.. Similar results are found with rapidly emerging developing countries where an average of 48% on the M2/GDP ratio was associated with a GDP growth rate of 9.3%.

These results and conclusions concerning the relationship between interest rates, financial savings, and economic growth are consistent with other empirical findings using a wider cross-country analysis. For instance, Mckinnon (1980,1988) using cross-country comparisons between semi-industrial less developed countries and rapidly growing economies also found that the former group have fairly low M2/GDP ratios as compared with the latter.

Similarly, Lanyi and Saracoglu (1983) provides a study on four member countries: Argentina, Brazil, Korea, and Turkey. In fact, countries such us Brazil and Korea which maintained positive real interest rates throughout the 1970's enjoyed a rapid expansion in financial assets, measured by the real growth rate of money plus quasi-money (M2). Argentina and Turkey were example of financially repressed economies with negative yields on financial assets and low and even negative real growth rate of financial assets. The econometric verification was done by classifying a larger list of countries in three groups. Group A which included countries with positive real deposit rates and was allocated a value of 1. Group B was conformed by countries with moderate negative interest rate and assigned the value of 0. Finally, group C was integrated by countries with severe negative yields on deposits and given a value of -1. They regressed the growth rate of financial savings (M2) against the interest rate policy indicator defined for each group with sample data for the period between 1970 to 1980.

The interest rate coefficient turned up very large, positive, and statistically significant. Similar results were obtained by replacing M2/GDP ratio for the growth rate of M2. At the same time, they also found that interest rate coefficient was positive and significant when regressing against the rate of growth of GDP.

Equally, Fry (1978,1988) was also interested in the empirical assessment of the impact of financial conditions on aggregate savings, but in a much wider framework including variables such as income, terms of trade, population, and branching among others. According to Fry (1988), most of the evidence for LDC's pointed out that real deposit rates were statistically significant although with a small positive coefficient. For example, Fry (1978) estimated a general aggregate saving equation in order to test how changes in financial conditions affect savings and economic growth. He pooled together annual observations for Taiwan, Singapore, Korea, Malaysia, Phillipines, India, and Burma. The aggregate saving function $Sd/Y=f(g,y,r,Sf/Y,Sd/Y)$ where Sd,Sf,g,y,and r are defined as gross national savings, foreign savings, income growth, real per capita income, and the real deposit rate of interest respectively, was estimated by a two-stage least square method and have thrown the following results: Firstly, the signs of all coefficient were consistent with a priori expectations and statistically significant. Secondly, the coefficient of the real deposit rate of interest was found positive and significant.

Fry using the same series of observations also tested the significance of real deposit rate of interest on the rate of growth of GDP. The ordinary least square estimate was significant and consistent with a priori expectations.

The empirical results of this section and existing evidence should be treated with caution. Firstly, in relation to the importance of the rate of interest on financial deepening, it could be argued that although the estimates are significant its magnitude was rather small. Moreover, even if financial savings have risen substantially the increase in the overall savings was not granted. The case of Chile is an example of this puzzle.

Secondly, more recent findings have questioned the significance of interest rates. Giovannini (1985) rejected some of the existing findings on the interest elasticity of savings, particularly those by Fry (1978). He argued that in Fry's sample two observations of Korea's financial reform period had a disproportionately large influence. The re-estimation of the Fry's saving function with the omission of 1967 and 1968 observations for Korea showed that the interest elasticity was insignificant. Similar results were obtained with a larger sample to demonstrate the importance of the choice of the sample period in the results.[14] However, Fry (1988) challanged Giovannini's results by excluding Korea altogether from the sample and reporting that the significance as much as the coefficient of the real deposit interest rate became even larger. Equally, Gupta

(1987) has challanged Giovannini's findings as well as those by Fry (1978) on the grounds that both studies includes Asian and Latin American countries. As a result of large differences in the effects of various variables including interest rates, a disaggregation between these two groups was seen as most desirable. The coefficient of the nominal interest rate for the pooled sample was found insignificant and the restriction that nominal interest rate equal expected inflation did not hold either. In contrast, the nominal rate of interest was significant although the equality condition did not hold for the Asian sample (Malaysia, Sri-Lanka, Singapore, Taiwan, Phillipines, India, Korea, Thailand, and Pakistan). For Latin America (Venezuela, Panama, Honduras, Guatemala, El Salvador, Paraguay, Mexico, Ecuador, Uruguay, Peru, Colombia, Bolivia, Rep. Dominicana) the equality condition was not met and the coefficient of nominal interest rate, although correctly signed, was not significant.

Thirdly, the relationship between financial deepening and growth runs in both ways. A high rate of economic growth may be the result of high and rising flows of loanables funds but rising M2/GDP ratios may also be the result of the economy's growing output. Therefore, the question of deciding between exogeneous and endogenous variables is far from being a trivial issue. Furthermore, different interpretations may arise from regression results between output growth and real deposit interest rate. On the one hand, positive interest rates may increase financial deepening and the rate of economic growth or increase the quality of investment and the rate of output growth on the other.

King and Levine (1993) introduced an endogenous growth model in which the financial system evaluate prospective entrepreneurs, mobilised savings to finance the most promising productivity-enhancing activities, diversify the risk associated with these innovative activities, and reveal the expected profits from engaging in innovation rather than the production of existing goods using established techniques. Thus a more developed and mature financial system stimulate growth by accelerating the rate of productivity growth via innovation. Their evidence from cross-country analysis and case studies support the positive correlation between financial deepening and economic growth. At the same time, they found that financial distortions reduce the rate of economic growth by reducing the rate of innovation. Indeed, implict and explicit taxes on intermediation rises the cost of innovation (higher costs of evaluating and financing entrepreneurs) and hence a lower rate of return at any given growth rate.

Although this paper confirms the importance of financial deepenning on productivity growth and economic development as well as rejecting those policies which distort the financial system the issue of causality still remain unanswered.

(2.3) The Banking System and Financial Liberalisation in Chile:1973-1983.

(2.3.1) Financial liberalisation in Chile: What was done ?

This section presents and discusses the liberalisation reforms introduced between 1973 and 1982. A chronological synthesis with the principal liberalisation reforms is shown in table 8. The itinerary of financial liberalisation is included with the rest of the market liberalisation reforms of Chile's new development strategy, including economic stabilisation and the liberalisation of other specific markets. The process of financial liberalisation began shortly after the military coup of September 1973. The itinerary of financial reforms was accompanied by other equally important liberalisation reforms and economic stabilisation. At the same time, financial liberalisation reforms included institutional, regulatory, and international changes aiming at the achievement of a more competitive, mature, efficient, stable, and liberal financial order.

The financial reforms started in May 1974 with a set institutional changes which included the privatisation of 19 nationalised banks with the exception of Banco del Estado. The privatisation also included the 259 intervened and/or nationalised enterprises during Allende's government as well as 183 firms with minority or majority stake shareholding.

At the same time, the lowering of barriers to entry for both foreign and domestic financial institutions and the elimination of interest rates for non-bank financial institutions encouraged the establishment of foreign banks and "financieras".

This first phase of financial liberalisation was undertaken almost simultaneously with the deregulation of domestic goods prices which began in October 1973.

Table 2.8 Economic Reforms in Chile 1973-83.

Date	Reforms
1973	Domestic Goods Market: Many product prices deregulated. (October)
1973	Exchange Rate Policy: Multiple exchange rate reduced to three-rate system; 300% devaluation and the establishment of crawling peg. (October)
1973-74	Foreign Trade Market: The authorities removed quotas and reduce average tariff from 105% to 69%; maximum tariff rate cut from 750% to 140%
1974	Privatisation: Sale of publicly owned financial and non-financial firms. (May)
1974	Domestic Financial Market: Interest rates freed for capital market transactions of Non-Bank Financial Institutions.(May)
1974	Domestic Financial Market: Interest rates freed for commercial banks. A maximum debt-capital ratio set at 20% (October)

Table 2.8 (continued)

Date	Reforms
1974	Domestic Financial Market: Minimum capital limits were established together with specifications of operations that were permitted. Limits on investment and credits to any individual or legal entity are imposed. No individual could own more than 1.5% of a bank's capital and 3% for a legal entity. For newly established bank, this limit would be enforced five years after operations started. Commercial, Development, and Mortgage banks were not allowed to acquire shares of small financial institutions. Foreign banks were permitted to establish branches and offices. (December)
1975	Taxation: Extension of the value-added tax coverage; one-year surcharge on personal income tax; and 10% consumption tax on luxury goods. The improvement in tax collection was complemented with 19% cut of government spending on goods and services. The reduction of the fiscal deficit from 30.5% of GDP to only 2.6% in one year was complemented with a tight monetary policy.
1976	Domestic Financial Market: Central Bank began paying competitive interest rates on reserve requirements starting in May. Subsequently, reserve requirements were gradually lowered from 47% in 1977 to 20% in December 1978. By December 1980 the legal reserve requirement was 10% for sight deposits and 4%/ for time deposits. Also interest payments on reserves were phased out.
1976	Exchange Rate Policy: Introduction of a unified exchange rate was reached by August.
1976	Foreign Trade Market: New tariff structure proposed with rates of 25%,30%, and 35% for primary, semimanufactured, and manufactured goods respectively.
1977	Domestic Financial Market: A free state deposit insurance was introduced equivalent to a maximum of U$ 2.789. However, depositors in general thought that there was a de facto 100% guarantee as a result of the government bail out of Banco Osorno a day before the introduction of the limited explicit guarantees for small depositors. (January)

Table 2.8 (continued)

Date	Reforms
1977	External Financial Market: Commercial banks authorised to intermediate capital inflows up to monthly ceilings of inflows of 5% of bank's capital and reserves under the articule 14 of the foreign exchange law.(a)(September)
1977	Foreign Trade Market: Following Chile's withdrawal from the Andean Pact, effective tariffs of 10%-35% proposed for implementation
1977	Exchange Rate Policy: The government announced that the devaluation rate would exceed the inflation rate to compensate for tariff reductions.(December)
1978	Exchange Rate Policy: A formal "tablita" consisting of devaluations at a decreasing rate was introduced.(February)
1978	External Capital Market: Global limit on debt under the articule 14 was set at 25% of capital and reserves and raised to 160% in March and again raised to 180% with a sub-limit of 160% in April. By December, the stock limit was set at 215% with a sub-limit of 180%. Monthly limits was raised to 45% and 60% in April and December respectively.
1979	Exchange Rate Policy: The exchange rate was fixed at a rate programmed for December 1979 with the objective that its fixing will last until February 1980. In December of this year, the fixed rate was extended indefinitely at $39.
1979	Labour Market: Collective bargaining authorised at plant level; Backward wage indexation with respect to the consumer price index.
1979	Foreign Trade Market: A uniform tariff of 10% set (except for automobiles with engine larger than 850cc. (June)

Table 2.8 (continued)

Date	Reforms
1979	External Financial Market: In April global limits on external borrowing was raised again to 225% with a sub-limit of 215%, and a monthly limit of 70%; a variable reserve requirement was set for external credits depending on the lenght of maturity of the loans: 10% for 48-66 months, 15% for 36-48 months, and 25% for 24-36 months. In June, global limits and and debt limits under articule 14 were eliminated. The only limitation on bank indebtedness was the 20% debt-capital ratio. Monthly limits was reduced to 5%.
1980	External Financial Market: In April all monthly limits were eliminated.
1981	External Financial Market: In December commercial banks were allowed to lend short-term (180 days) with external credit for purposes other than financing commercial operations.
1982	External Financial Market: Commercial banks were permited to obtain external credits with a maturity under two years subject to a reserve requirement of 20%.(May)
1982	Exchange Rate Policy: The fixed rate regime was abandoned in June. An 18% devaluation was enacted and followed with a floating rate in August.
1982	External Financial Market: Commercial banks were allowed to use part of their short-run foreign credits to lend in pesos with a limit of 50% of capital and reserves.(July)
1982	Exchange Rate Policy: A new "tablita" with monthly devaluations equivalent to the previous month's inflation rate minus 1% was announced. Access to the exchange market was restricted.

Sources: Corbo (1987), Corbo and De Melo (1987)

(a) Articule 14 refers to the permission given by the Central Bank to the borrowers for future access to the exchange rate market to serve a foreign debt.

The second phase consisted of the financial deregulation of the domestic capital market. Controls in interest rates were lifted in October 1974 and by 1975 quantitative and qualitative restrictions on credit were phased out. At the end of 1974, requirements on banks`capital were increased to take into account past inflation and thereafter were automatically adjusted once a year according to the increase in the CPI. Moreover, Maximum debt-capital ratio and limits on individual ownership of banks` shares and credit concentration were introduced during the same year. For instance, in October 1974 the maximum leverage ratio was set at 20% and the individual ownership of banks` shares could not exceed 1.5% of bank capital. Commercial, Development, and Mortgage banks were not allowed to own shares of small financial institutions.

In May 1976, the Central Bank began paying a competitive interest rate on reserve requirements. By the end of 1980, reserve requirements were significantly lowered and the interest payments phased out. For instance, reserve requirements were gradually lowered from 47% in 1977 to 20% in December 1978. By December 1980 the legal reserve was set at 10% for sight deposits and 4% for time deposits.

As we notice from the summary of liberalisation reforms, interest rate deregulation and the significant reduction in reserve requirements coincided with fiscal reforms to eliminate the fiscal deficit. Cuts in government spending combined with an improvement in tax collection were decisive in the marked reduction in the government's deficit from 1975 onwards. In fact, table 9 shows that the fiscal deficit as a percentage of GDP fell from 10.5% in 1974 to 2.6% in 1975. By 1980, the government exhibited a fiscal surplus of 3.1%. This enabled the financial system to escape from financial repression by reducing both the inflation tax and reserve requirements, and also interest rate controls.

The last phase of financial liberalisation focused on the liberalisation of the external capital market. International capital inflows were deregulated gradually and mainly on medium and long-run maturities, that is over two-year maturity. Initially, banks' access to external credit was severely limited and permitted to finance foreign trade operations. However, from September 1977 to April 1980, access to medium and long-run foreign credit was allowed but with specific limits on global and monthly indebtness as percentage of banks' capital and reserves. According to the summary in table 8, the 5% monthly limit on foreign indebteness under article 14 of the foreign exchange law was raised to 45% and 60% of bank capital between April and December of 1978. Also, as we can see in table 8, global limits were continuously relaxed from 25% in 1978 to 225% in April 1979. By June of the same year, global limits and limits on indebtness under article 14 were eliminated and by April 1980 all monthly limits left were eliminated.

Banks were allowed to borrow abroad in foreign currency (dollars) but not to assume the exchange risk. Later in December 1981, commercial banks were authorised to lend on a short-term basis with external credit for purposes other than financing foreign trade transactions. Towards the middle of 1982, short-term capital inflows were liberalised but subject to a reserve requirement of 20%. Finally, in July 1982 commercial banks were permitted to assume the exchange risk so that a portion of their short-run foreign credit was lent in pesos with a limit of 50% of capital and reserves.

There are important points to make on the process of deregulation of international capital flows in Chile: Firstly, the opening of the capital account was complemented with the introduction of a preannounced exchange rate "tablita" which culminated with a fixed exchange rate. Although, the exchange rate regime made investing in Chile very appealing by reducing the exchange rate risk still domestic interest rates remained stubbornly high.

Secondly, the liberalisation of short-term capital inflows was responding to a growing financial distress from the sudden and rapid reduction in the rate of capital inflows during 1981-82 rather than a pre-conceived policy. Table 9 provide some evidence on the magnitude of capital inflows, an issue which will be raised shortly.

All in all, the itinerary of liberalisation of the domestic capital market was preceded by a significant progress in the government's public finance. In addition, the liberalisation of the banking system to capital inflows was conceived gradually and only after the domestic capital market was fully deregulated. With respect to financial liberalisation inserted within the overall liberalisation strategy, domestic capital market was freed simultaneously with the goods market. The liberalisation of capital inflows lagged substantially behind the liberalisation of trade.

The itinerary of the Chilean liberalisation appeared to be consistent with what appears to be the consensus among theorists. However, there were two issues overlooked by the authorities in the liberalisation of the financial system. Firstly, the process of privatisation led to the establishment of large and powerful economic groups which controlled both commercial and financial institutions. In fact, Dahse (1979) argued that no more than fifty individuals owned the entire financial system. The structure of bank holding companies and high bank concentration in Chile were an undesirable and negative for the success of financial liberalisation.

Secondly, financial liberalisation did not involve the modernisation of the existing regulatory framework in order to ensure the bankers' compliance with ownership and credit concentration limits of the new bank legislation. The combination of bank holding company structure and an effective prudential regulation have played an important part in the ex post results of financial liberalisation, particularly with the debacle of the banking system in 1983.

The issues concerning bank holding company structure, credit concentration and related portfolios, and the role of prudential regulation, will be addressed in more detail in chapters 4 and 8. The following sub-section will address and evaluate the ex post results of financial liberalisation.

(2.3.2) The Impact of Financial Liberalisation in Chile.

The central objective of financial liberalisation was to develop and modernised the financial system, particularly the banking sector which represented the most important segment of the financial system. As I have argued earlier, positive real yields on domestic financial assets, the establishment of a competitive multi-purpose banking, and a market allocation of bank credits was thought to be paramount in both raising financial deepening and widening (financial savings) and the quantity and quality of investment, including the allocation of loanable funds. At the same time, the integration of domestic financial market to world financial market was bound to generate a rapid convergence of domestic financial prices to those prevailing in world markets. Equally, it was expected that the role played by the increasing competitive forces should contribute to some gains in operative efficiency. However, above all there was a conviction among "liberalisationists" and policy-makers that the liberal financial arrangements were bound to promote ultimately financial stability.

Before we begin with the assessment of the impact of financial liberalisation, it has to be said that there were also a series of additional factors. As we have seen in table 8, financial liberalisation was implemented together with anti-inflationary policies given the initial macroeconomic disequilibrium on both fronts internal and external. Both the inflation rate and the current account deficit were very high. In effect, Table 9 indicates that consumer price inflation was 358% per annum between 1971 and 1975. At the same time, the current account deficit was getting bigger and unmanageable at 4.5% of GDP in 1975.

Table 2.9 Economic Indicators For Chile.

	71-73	74	75	76	77	78	79	80	81
GDP(a)	0.7	1.0	12.9	3.5	9.9	8.2	8.3	7.5	5.3
GDPp(b)	1438	1345	1152	1172	1266	1347	1434	1516	1568
VCPI	231.2	375.9	340.1	174.3	63.5	30.3	38.9	31.2	9.5
FDf/GDP	15.1	10.5	2.6	2.3	1.8	0.8	-1.7	-3.1	-1.6
CAcc/GDP	2.9	...	4.5	-0.9	3.7	5.3	5.5	7.8	16.5
Unemp.	4.6	9.7	16.2	16.8	13.2	14.0	13.6	11.8	11.1

Source: Banco Central de Chile, Boletin Mensual, Various Issues
Banco Central de Chile, Cuentas Nacionales 1960-80

(a) The rate of growth of GDP are estimated at 1977 prices.
(b) GDPp correspond to real per capita GDP express in US dollars

Notes: VCPI=variation of the consumer price index.
FDf/GDP=fiscal deficit as a proportion of GDP.
CAcc/GDP=curret account deficit as proportion of GDP
Unemp. = Correspond to the unemployment rate.

Furthermore, with financial liberalisation other reforms such as the deregulation of the goods market and the opening of the trade regime, changes in labour legislation, and privatisation were undertaken during this period. In consequence, it is difficult to isolate and identify the specific impact of the financial liberalisation vis a vis other reforms and to link them with the ex post results.

(2.3.2.1) Financial Deepening, Saving, and Investment in Chile.

As it was expected financial deepening increased strongly during the liberalisation period. The evidence from table 10a provides different measures which account for the spectacular expansion in financial intermediation (deepening).

The degree of financial deepening measured by the M2/GNP ratio shows that it increased from its lowest figure of 6.4% in 1974 to nearly 32% in 1982. More importantly, there was a remarkable increase in the proportion of GNP held in the form of time and saving deposits. In effect, the ratio of quasi-money to GNP went from 1.1% in 1974 to 25.3% in 1982. Similar results were obtained from the non-monetary assets/total financial assets ratio (NMA/TA) which shows a marked increment between 1974 and 1982 of 14% to more than 70% of total assets respectively. This portfolio shift away from money was responding to the upward trend observed in short-term interest rate paid on quasi-money following interest rates deregulation, and to the availability of a wider options of financial assets. The average ex post real deposit rate between 1975 and 1982 was 15.2 per annum with a peak of 25.4 in 1981 in comparison to the negative rates which prevailed during 1970-73.

Table 2.10a Indicators of Financial Deepening and Growth of Financial Assets. (a)

	M1/GNP	QM/GNP	M2/GNP	TFA/GNP	MA/TA	NMA/TA
1973	10.6	2.3	12.9	14.9	53.0	14.3
1974	5.3	1.1	6.4	20.0	27.7	14.0
1975	4.5	2.6	7.1	19.7	26.1	16.2
1976	3.9	3.7	7.6	19.0	25.4	25.0
1977	4.5	6.0	10.5	21.0	24.1	38.6
1978	4.8	7.7	12.5	23.0	24.6	48.6
1979	4.9	9.7	14.6	29.6	21.1	50.1
1980	5.5	10.7	16.2	34.9	19.8	59.8
1981	5.0	14.6	19.6	39.0	14.7	69.8
1982	6.6	25.3	31.9	48.1	14.0	70.7

Source:Banco Central Chile,Monthly Bulletin,Various Issues
(a) Share of GDP on amounts in pesos each year.
Notes: M1= notes and coins+demand deposits
QM= quasi-money defined as time and savings deposits
M2= M1+quasi-money
TFA= total financial assets defined as M1 plus deposits in banks,non-bank financial institutions, saving and loans institutions. i.e.total liabilities of the financial system
MA= M1
NMA= non-monetary assets which includes paper issued by commercial and development banks as well as non-bank financial institutions.

The total financial asset/GNP ratio (TFA/GNP) which is estimated at constant 1977 peso prices in order to eliminate the inflationary distortions and which comprise a wider definition of financial assets have also thrown similar results. By 1973, the ratio was indicating that total financial assets was nearly 15% of GNP and by 1982 was more than 48%.

The thesis on the spectacular rise in financial deepening (financial savings) came out mainly from a change in wealth composition has been challanged by some commentators of the Chilean economy. For instance, Barandarian (1983) sustained the view that expectations of buoyant future of the economy generated a rise in perceived wealth. Indeed, financial deepening grew along side private sector wealth as capital gains in booming stock market were capitalised through the banking system. The evidence shows that real stock prices between 1977 to 1981 grew more than 320%.[15]

Similarly, Arellano (1983) maintained that changes in wealth composition were small and the rise in financial savings came mainly from the privatisation of the government social security in May 1981 and the rise in external liabilities. The excess of external financing over the current account deficit was destinated towards the accumulation of international reserves and deposits in the domestic financial system.

The impressive rise of financial deepening was also accompanied by a growing number of participants in the financial system. According to table 10b the number of domestic banks increased from 20 to 27 between 1974 to 1981 although it began to fall in 1982 after the liquidations of financial institutions beginning in 1981-82. This syndrome became more acute after the banking crisis of 1983 as it will be shown in chapter 3.

With respect to foreign financial institutions, the number of foreign commercial banks have been continuously rising from a single foreign entity in 1974 to 19 in 1983. It appears that the expansion in the number of foreign banks remained untrammel despite the banking crisis of 1983.

After an auspicious start of non-bank financial institutions several "financieras" were liquidated particularly from 1981-82 onwards. The number fell from 17 between 1977 and 1980 to only 7 in 1983. As we will see in chapter 3, although there was a large number of "financieras" many of which experienced financial difficulties during the early 1980's, their share of total liabilities and assets of the system was very small as compared with banks. In general, the number of total financial institutions went from 21 in 1974 to its highest number of 60 in 1981 with a predominance of domestic banks over foreign banks and financieras.[16]

Table 2.10b Financial Institutions in Chile.

	Domestic Banks	Foreign Banks	Financieras	Total
1974	20	1	...	21
1975	21	2	...	23
1976	21	2	...	23
1977	22	3	17	42
1978	22	5	17	44
1979	25	10	17	52
1980	25	13	17	55
1981	27	17	16	60
1982	19	19	9	47
1983	19	19	7	45

Source: SIBF, Informacion Financiera, Various Issues.

However, despite the spectacular growth of financial intermediation financial liberalisation did not contribute to deepen the maturity of financial assets hold by economic agents. The evidence in table 10c shows that assets with maturities of less than 90 days were dominant in the holders' portfolio although maturities beyond 1 year also experienced an important increase between 1979 and 1982. For instance, financial assets with maturities of less than 90 days were accountable for 48.1% of total financial assets during 1981. Those assets with maturities of more than 90 days and less than a year exhibited a continuous decline. However, there was a positive rise in the share of assets with maturities over a year from 3.4% in 1973 to 25.3% in 1982 although still was well below the assets' share with short-term maturity.

Table 2.10c Maturities of Financial Assets in Chile.

	MA/TA	0<Fa<90	90<Fa<365	365<Fa
1973	53.0	3.1	40.5	3.4
1974	27.7	18.3	47.2	6.8
1975	26.1	19.9	39.0	15.0
1976	25.4	27.2	28.8	18.6
1977	24.1	38.0	25.4	12.5
1978	24.6	44.7	19.5	11.2
1979	21.1	37.6	20.6	20.7
1980	19.8	35.8	22.7	21.7
1981	14.7	48.1	13.3	23.9
1982	14.0	44.0	16.7	25.3

Source: Arellano (1983)

Notes: Monetary assets = private money holdings (M1)

Less than 90 days (0<Fa<90) = include deposits in banks and financieras,short-term savings,Central Bank promissory notes.

90 days to 1 year (90<Fa<365) = includes deposits in banks and financieras, time savings, deposits in Saving & Loan institutions, adjustable mortgages, time deposits with Banco del Estado.

More than 1 year(365<Fa) = Adjustable savings accounts, adjustable treasury promissory notes, bonds from mortgage coys.,debentures,

High interest rates on short-term assets combined with high and variable rate of inflation made it very difficult to attract borrowers to hold longer run assets, although towards the end of the 1980's when the inflation rate was rapidly falling towards one-digit the holding of long-run assets was picking-up.

As second important observation is that despite the impressive growth of financial deepening (financial savings) and high nominal and real interest rates, gross national savings dropped substantially during the liberalisation period.

Table 10d presents some evidence on the evolution of savings in Chile. The comparison between the peak of 20.7% in 1974 and the trough of 2.1% in 1982 serve to illustrate the pattern of the gross national savings. At the same time, by excluding the observations for the recession years of 1975 and 1982 we observed that the average gross national savings ratio remained stagnant around 12% per annum. This figure hardly differs from the average for the periods between 1960-65 and 1966-70 corresponding to 11% and 15% per annum.

Table 2.10d Savings and Investment in Chile.

	GNS/GDP	FS/GDP	GDS/GDP	GFCF/GDP	GCFg/GDP	GCFp/GDP	TGCF
60-65	11.0	...	...	15.1	10.5	3.8	14.3
66-70	15.0	...	...	14.5	11.3	4.7	16.0
1974	20.7	0.4	21.1	17.0	12.8	8.4	21.2
1975	7.9	5.2	13.1	17.7	8.5	4.6	13.1
1976	14.5	-1.7	12.8	13.3	5.4	7.4	12.8
1977	10.7	3.7	14.4	13.3	6.7	7.7	14.4
1978	12.6	5.2	17.8	14.7	6.2	11.6	17.8
1979	12.4	5.4	17.8	14.9	5.2	12.6	17.8
1980	13.9	7.1	21.0	16.6	5.4	15.6	21.0
1981	8.2	14.5	22.7	18.4	5.1	15.6	20.7
1982	2.1	9.2	11.3	14.0	...	...	11.3

Source: Banco Central de Chile, Cuentas Nacionales 1974-85.

Notes:
Share of GDP on amounts in pesos of each year.
GNS= Gross national savings,FS=Foreign savings,GDS=gross domestic savings
GFCF= Gross fixed capital formation, GCFg= gross capital formation public sector,GCFp=gross capital formation private, TGCF= total gross capital formation.

There are two general points to make on the evolution of national savings. As we have already seen, the spectacular growth in financial savings appears to have resulted from changes in the composition of wealth rather than from a significant change in consumption and saving patterns. This substitution may had included a shift away from informal capital markets towards the organised capital market.

The second point is that overall savings may have also been influenced by several factors depending of course on theoretical framework being used.[17] Harberger (1982) for instance, identified three contributing factors on the dismal performance of Chile's savings. Firstly, a substantial rise in asset prices by more than 320% between 1977 and 1980, measured by the real index of stock prices, and consequently a perceived wealth by forward looking consumers. This was leading to higher consumption and thus dissavings. This effect takes place as part of the adjustment of actual wealth holdings back to the desirable level in a Meltzerian fashion.

Secondly, private sector used funds which otherwise might have augmented the national capital stock to buy back part of the existing capital stock during the privatisation phase. Edwards (1985) argued that the government used the proceeds from privatisation to finance current expenditure. Thus, the private savings used in acquiring these firms were matched by a negative government savings.

Thirdly, the recession of 1975 and the fall in real GDP by 14.3% was also important particularly if the circumstances were thought to be transitory. In consequence, a transitory fall in income should have produced an important shift in the pattern of savings.

Dornbusch (1985) maintained that there appeared to be a strong real exchange rate effect on the composition and level of spending. As it is show in chapter 7, by 1981 the sustainability of the increasingly overvalued exchange rate was becoming uncertain so that a sharp increase in the demand for imported durables took place with the subsequent deterioration in the trade balance. In fact, the data from table 9 shows that the deficit of the current account was 16.5% of GDP during 1981.

The series on foreign savings in table 10d appears to be negatively correlated with national savings. In other words, external savings substituted domestic savings. Abundant world liquidity and external financial liberalisation stimulated capital inflows to finance higher consumption levels.

In general, it could be argued that the evolution of national savings was strongly influenced by the incentives toward consumption from the misalignment of key macroeconomic prices particularly the real exchange rate and real stock prices, the economic recession of 1975, institutional and structural changes, and the degree of substitution between domestic and external savings. The role of financial liberalisation was indirect as its incidence was felt on the explosive rise in the stock prices, the failure of supervision to avoid this speculative bubble financed by bank credits, and the undesirable ownership concentration from privatisation. Further disccussion of these issues will be provided shortly.

Finally, table 10d presents evidence on the performance of investment during the liberalisation period. The rate of gross investment measured by the gross fixed capital formation (GFCF) was 15.5% of GDP between 1974 and 1982. This figure appears to be slightly above the figures for the period of 1960-65 and 1966-70 with 15.1% and 14.5% respectively.

This stagnant performance of investment in Chile during the liberalisation period can be explain by the concurrence of two factors. Firstly, public sector investment was severely curtailed. The public sector gross domestic capital formation fell from 12.8% of GDP in 1974 to 5.1% in 1981. The fiscal stabilisation enacted in 1975 and the ideological bias against the public sector conspired against any initiative to encourage public investment particularly on public infrastructure.

Secondly, private sector investment did not rise sufficiently to offset the reduction in public investment. In effect, if we look at the series between 1974 and 1977 private sector gross domestic capital formation never exceeded the 1974 value of 8.4% of GDP. This performance can be explain partly by the 1975 recession, and in my view from the fact that for many decades private sector investment was led indirectly by actual and expected public sector investment.

However, in 1978 private investment started to rise from 11.6% to 15.6% in 1981. This performance was superior to the period of 1960-65 and 1966-70 and even outstripped the figures for public sector gross domestic capital formation during the 1960's.

As a whole, the rate of investment remained poor even during the liberalisation period. Additional factors such as the short-term maturity of the asset structure, asset speculation in the stock exchange, and as we have seen the incentive towards consumption conspired against private investment. At the same time, as we will see later high ex post real domestic lending interest rates was also important for those who did not have access to a much cheaper credit such as foreign lending at least before 1978. I have estimated that average domestic real lending interest rate between 1975 and 1977, date at which the authorities began the process of dismantling controls in capital inflows, was 70% per year. The liberalisation of capital inflows contributed to reduce domestic interest rates, and to rise foreign savings. In fact, lending rates have fallen to 15.5% and 11.3 in 1979 and 1980 respectively. Also foreign savings accounted by 7.1% in 1980 and 14.5% in 1981. This figure is important if we also considered that that gross fixed capital formation was 18.1% during 1981. This is a clear indication that the increase in investment during the late 1970's was financed by foreign savings.

Even if the rate of capital accumulation did not exhibit a significant increment during the liberalisation period, it was expected a substantial improvement in the allocation and quality of investment as result of financial deregulation and price allocation. In relation to credit allocation, there are two proxies which serve to reject the view that an improvement in credit allocation occurred during the liberalisation period. The first one was the emergence of two related issues: a high credit concentration and the "related portfolio problem".

By 1980 the Superintendency of banks started showing some concern on the levels of credit concentration among bank holding companies (groups). This credit concentration on related firms occured despite the existence of legal norms for credit concentration and beyond any doubts it was exacerbated by an inadequate supervision.

As it will be argued in chapter 3, the first intervention action in 1981 and particularly in 1983 enabled the Superintendency to have a glimpse of the magnitude of credit concentration among economic conglomerates. Table 10e shows the magnitude of the loan portfolios allocated in affiliated firms. The most dramatic cases correspond to Banco Chile and Banco Santiago, the two largest banks in Chile.

Table 2.10e Related Portfolios In Chile.(a)

	1982	1983	1984
Banco Chile	39.369(19.3)	56.272(23.8)	50.618
Banco Santiago	51.360(42.9)	70.858(61.8)	85.907
Total	141.307(13.9)	183.493(16.7)	202.734

Source: SIBF, Informacion Financiera, Various Issues.

(a) The data is express in millions of pesos.The figures in brackets correspond to the related portfolio/total loans ratio.

Indeed, by 1983 Banco Chile and Banco Santiago had nearly 24% and 62% of their loan portfolio allocated into affiliated firms. Moreover, this ratio for the overall financial system was nearly 14% and 17% in 1982 and 1983 respectively. Clearly, this does not suggest an efficient allocation of investible resources nor an efficient allocation of risk. At the same time, it surpasses the 5% limit established by the Superintendency in June of 1982. Further analysis of the related portfolio problem is provided in chapter 8.

Another proxy for the allocation of investible resources is the data on the GDP growth by sector. According to the data from the Central Bank, construction rose by an annual average of 18.5% between 1978 and 1981. Most of the investment on construction was concentrated in large and expensive shopping centres and luxury flats. Similarly, the data available on commerce and financial services also confirms a rapid expansion rates of 11.9% and 19.7% respectively over the same period. These figures are well above of the 7.3% overall GDP growth per annum during these four years. This evidence against the background of a per capita GDP of U$1500, and an unemployment rate of over 13% during the second half on the 70's and early 80's as despicted by table 9, can hardly be seen as rational priority in the allocation of investible resources.

(2.3.2.2) Financial Indebtness, and Interest Rates in Chile.

It is evident from the discussion of the evidence that financial liberalisation did contribute to the expansion of the number of intermediaries and financial intermediation. The counterpart of this spectacular growth of financial assets (liabilities of the financial system) was the strong financial indebtness of the private sector. Increasing private sector debt was not a worrying issue per se but the terms and the structure of the private sector's liabilities were a matter of greater concern. Such debt was acquired at extremely high interest rates, predominantly short-term, and denominated in dollar terms particularly during 1981-82.

Table 2.11a Loans of the Financial System to the Private Sector.

	Loans/GDP	Loans $			Loans U$		
		L<365	L>365	Total	L<365	L>365	Total
1973	4.4	...	...	...	...	...	...
1974	5.0	...	...	...	...	...	...
1975	8.3	...	...	...	...	...	...
1976	10.4	...	...	...	...	...	...
1977	16.6	...	...	...	...	...	...
1978	23.2	65.5	19.2	84.7	45.1	31.8	76.9
1979	28.2	120.7	41.0	161.7	71.6	55.1	126.7
1980	37.6	238.9	90.9	329.8	116.1	107.1	223.2
1981	50.4	328.6	164.6	493.2	143.3	163.3	306.6
1982	71.2	283.3	236.6	519.9	147.1	306.3	453.4

Sources: SIBF, Informacion Financiera, Various Issues.
Arellano (1983).

According to table 11a, total loans to the private sector exhibited a substantial increment as a percentage of GDP. In 1973 the private sector indebtness was only 4.4% as compared with 1982 which reached 71.2% of GDP. At the same time, the evidence shows that the rising debt was predominatly short-term although it was beginning to show some decline relative to longer term liabilities. In effect, between 1978 and 1981 the share of short-term debt as a proportion of the total went from 77.3% to 66.6%. Moreover, we observed that loans were predominantly in pesos although dollar loans also had a significant share. For instance, in 1981 nearly 62% of total loans were denominated in pesos and 38% in dollar terms. It is clear that the short term nature of peso loans and increasing share of dollar loans can be regarded as two factors which have enhanced the weakness of the banking system especially during the collapse of Chile's economic activity in 1982. At the same time, high real interest rates and the forced maxi-devaluation in June 1982 have also proven to be paramount.

As we have already seen, one line of reasoning relates the increasing financial indebtness with the incentives toward consumption financed mainly by bank credit. At the same time, euphoric expectations on the future prospects of the economy may have played an important role in the increasing demand for credit despite extremely high lending interest rates. However, it could be argued that demand for bank credit was actually responding to ex ante interest rates which were much lower than the ex post rates. To reconcile this story with the data we have to assume that economic agents were making systematic mistakes which is inconsistent with the rational expectation hypothesis. However, it is equally true that rational individuals could have also be financing imports while correctly perceiving the exchange rate as being unsustainable in the medium and longer run.

A second line of enquiry relates to some institutional features which emerged after the privatisation of the financial system. As we recall from table 8, the process of financial reforms started with the return of financial and non-financial institutions to their previous owners and/or auctioned to the highest bidder. However, differential access to domestic and foreign credit determined that banks' assets were acquired by economic conglomerates (group) which already had a large ownership of non-financial firms. By the time of privatisation, high real domestic interest rates, tight monetary policy, and controls on capital inflows made peso borrowing too expensive to the general public and encouraged economic groups to borrow at cheaper rates by exploiting their private contacts abroad. The access to low cost foreign credit by a minority coupled with the lack of effective monitoring on assets acquisition led to a large ownership concentration and as we have already seen, to the problem of "related portfolios". As the control of the economic conglomerates increased over financial institutions they were able to increase their economic power by buying out those firms which were under severe financial strain after the recession of 1975. Also, they were capable of raising their capital values on the stock exchange by lending to themselves and by buying shares from affiliated firms. Clearly, financial indebtness was used to finance the expansion of economic groups as well as to inflate stock prices. In turn, this sharp increment in assets' prices permitted a more "solid" borrowing capacity by offering overpriced collaterals and guarantees. At the same time, as pointed out by Luders (1986), this credit was also devoted to purchase banks themselves in a process that he called "the bicycle": that is, a bank would grant a loan to a corporation controlled by the new owner of the same bank and this entity would use the proceeds of the loan to pay for the shares it was acquiring.

In consequence, bank credit was partly used to finance the speculative bubble in stock prices and to finance the consolidation and/or expansion of economic groups. The increasing indebtness and particularly the emergence of vulnerability from systemic risk was becoming a time bomb.

Another complementary hypothesis which explains private sector indebtness highlights the importance of certain banks' practices involving the rolling-over of bank credit and the capitalisation of the interest. As it will be thoroughly reported in chapter 3 and particularly chapter 7, sustained high real interest rates, and the accumulated appreciation of the real exchange rate between 1978 and 1982 became major sources of difficulties for the tradable sector. At the same time, the estimates of non-performing loans/total loans and non-performing loans/capital ratios rose alarmingly from 1981 onwards. In order to stave-off bankruptcies, banks were willing to roll over what were essentially bad loans. Arellano (1983), Harberger (1985a), Zahler (1985), and Luders (1986) maintained that the rolling-over of bad debts created a false demand for loans and hence such practices accounted for a large share of the expansion of bank credit (private sector indebtness).

In general, I would agreed that the institutional features which emerged as a result of financial liberalisation was extremely important in encouraging certain practices conducive to a dangerous rise in indebtness. Moreover, it led, as it will be shown in chapters 3 and 8, to excessive risk-taking and unsound lending practices which ultimately caused the debacle of the banking system in 1983.

However, there was something more specific behind private sector indebtness, the rapid expansion of banks' loans, and excessive risk-taking which directly concerned banking firms. In my opinion, banks' attitudes and conducts should be considered as the centre-piece of most of the hypotheses which explain the rapid bank credit expansion and the collapse of the banking system. As stated by Barandiaran (1983), the banking system was determinant in the collective euphoria as they aggresively promoted different lines of businesses. Indeed, banks actively sought borrowers on a door to door basis. This strategy clearly contradicted a more conservative approach where borrowers seek funds and banks acting as lenders would carry out a complete evaluation of the borrower's profile in terms of its projects, assets, and personal wealth. The critical factor which induced this type of banks' behaviour was the structure of incentives which arose from financial liberalisation. Among them we include the development of close ownership links between financial and non-financial firms, the implicit government insurance on domestic and foreign liabilities, and increasing competition among financial institutions. Chapter 8 will provide a an empirical evaluation of these specific issues.

Although some measures were adopted in late 1981 in order to limit banks' exposure and some other risky practices, there was a total failure to introduce comprehensive and effective steps to supervise banks' conducts and management. The failure of prudential regulation combined with those institutional features which emerged from financial liberalisation facilitated and excerbated risky and unconservative conduct of financial institutions. Indeed, in chapter 6, I have found econometric evidence which indicates that the likelihood of bank problems was becoming evident as early as 1979. Therefore, an early warning mechanism and an effective credit classification combined with publicly provided information would had averted this type of conduct.

What remains to be discussed is one of the most puzzling aspect of financial liberalisation which concerns the behaviour of interest rates. As we have seen previously, increasing private sector indebtness occurred despite extremely high lending interest rates.

As expected, financial deregulation brought about initially an overshoot of nominal and real interest rates. However, they remained too high and volatile as well as they failed to converge toward international level. Moreover, the spread between lending and borrowing rates remained stubbornly high. These unexpected results occurred in spite of both substantial increases in peso liabilities as shown in table 10a and a spectacular rise in capital inflows after restrictions on long and medium run capital inflows were lifted. According to data exhibited in table 11b, capital inflows and the capital account surplus attained its peak in 1981 with 16.2% and 26.4% of GDP respectively. This impressive performance in attracting foreign capital occurred despite the remaining restriction on short-term capital inflows.

Table 2.11b Capital Inflows in Chile.

	Capital Inflows			
	K(a)	K/GDP(b)	Capital Account(c)	KAccount/GDP
1975	57.9	0.5	491.0	4.1
1976	238.0	1.9	-148.0	1.2
1977	240.2	1.8	551.4	4.0
1978	678.7	4.6	1088.0	7.3
1979	921.8	5.8	1189.0	7.4
1980	1809.0	10.5	1971.0	11.4
1981	2947.5	16.2	4814.0	26.4
1982	859.5	5.5	2382.0	15.2

Source:Banco Central de Chile,Boletin Mensual,Various Issues

(a) Correspond to net capital inflows through articule 14 in millions of US dollars.
(b) GDP is express in millions of dollars at 1989 prices.
(c) In millions of US dollars.

The evidence from table 11c shows that the peso lending rate exhibited a continuous reduction from 498.3% to 51.9% between 1975 and 1981. This gradual reduction in nominal lending rates was expected as the rate of domestic inflation was gradually falling during the liberalisation period. In fact, the rate of increase of the CPI went from 340.1% to 9.5% between 1975 to 1981. At the same time, we saw that peso liabilities and capital inflows experienced a spectacular growth during the liberalisation period.

Table 2.11c Interest Rates in Chile.

	Lending Rates			Deposit Rates			
	Nominal(a)	Real(b)	Dollar(c)	Nominal	Real	Dollar	Infl
1975	498.3	114.8	11.4	234.0	18.6	96.8	340.1
1976	350.7	51.3	-27.4	197.9	8.6	45.4	174.3
1977	156.4	45.9	-7.6	93.7	17.1	20.7	63.5
1978	85.3	35.8	-4.0	62.8	22.5	34.1	30.3
1979	62.0	15.5	-7.4	45.1	4.4	26.2	38.9
1980	46.9	11.3	-12.8	37.4	4.6	37.4	31.2
1981	51.9	33.1	6.4	40.8	25.4	40.8	9.5
1982	63.1	30.6	77.0	47.8	20.5	-21.5	20.7
Av	164.3	42.2	4.4	94.9	15.2	34.5	88.5

Source:Banco Central de Chile,Boletin Mensual,Various Issues
IMF,International Financial Statistic, Various Issues

(a) Nominal interest rates both deposit and lending correspond to short-term interest rate (30-90 days)

(b) Real interest rates correspond to ex post rates which are estimated by deflating short-run interest rates by the variation of the consumer price index. That is {[(1+i)/(1+CPI)]-1}*100

(c) The ex post real dollar lending interest rates were obtained deflating LIBOR by nominal devaluation and variations in the consumer price index. That is {[(1+LIBOR)(1+e)/(1+CPI)]-1}*100.

(d) The ex post dollar deposit interest rates were obtained by deflating the short-run nominal deposit interest rate by the nominal devaluation. That is {[(1+i)/(1+e)]-1}*100.

Also the data shows a downward movement of the real lending rate from 114.8% to its lowest level of 11.3% in 1980. There are two observations from the data which is worth looking at with some care. Real lending rate in 1979 and 1980 were well below in comparision with both the average for the whole period and with the previous year and the two following years. While it coincided with the lifting of restrictions on capital inflows, changes in international conditions also had played an important part on the behaviour of real interest rates. Sjaastad (1985, 1989) and Cortes Douglas (1985) argued that the fluctuations in real interest rates between 1979 and 1982 can be explained by sharp changes in the value of the dollar. They maintained that in a small open economy with fully integrated capital and goods markets, domestic nominal interest rates will be fairly well arbitraged with external rates. However, real interest rates would be affected by fluctuations in the exchange rate of major currency countries whereby such fluctuations will be transmitted into the inflation rate via price of traded goods.

Table 11d provide some useful evidence to support the international influence on real interest rates. Firstly, the fluctuations in real lending rates between 1979-80 and 1981-82 does not come from similar fluctuations in LIBOR nor in nominal peso lending rate which still remain too high. Secondly, if we compare the movements of real and nominal US exchange rates with the dollar price of Chilean tradables we observe some correlation. In effect, between 1977 and 1979 we see that there was a dollar inflation as the US currency depreciated 7.4% in real terms during these three years. This coincided with both a sharp rise in tradable prices in US dollars by 34.3% and the significant fall in the real lending rate over the same period. The process is reversed from the late 1980 onwards as the dollar began appreciating very rapidly. The collapse of the Chilean inflation coincided with the appreciation of the US dollar followed by a rise in real lending rates.

Table 2.11d US Exchange Rates, Tradable Prices, and Interest Rates. (a)

	77	78	79	80	81	82
NEFF EX. Rate	124.0	111.2	108.3	108.3	121.1	135.2
REFF EX. Rate (b)	117.6	108.6	108.9	110.0	125.2	134.7
Tradable Price(c)	183.5	196.4	246.5	296.8	297.3	266.7
LIBOR (d)	6.1	8.8	12.1	14.2	16.8	13.2
Nominal LendingR	156.4	85.3	62.0	46.9	51.9	63.1
Real Lending Rate	45.9	35.8	15.5	11.3	33.1	30.6

Source:Banco Central de Chile,Boletin Mensual,Various Issues
IMF,International Financial Statistics,Various Issues
ECLA, Statistical Yearbook, Various Issues.

(a) Indices were constructed with 1970=100
(b) Real effective exchange rate (REFF EX.Rate) was obtained by deflating the nominal effective exchange rate (NEFF.EX.Rate) with the WPI.
(c) The average dollar price of tradables was calculated as follows 0.5Px+0.5Pm where Px=unit value of exports and Pm=unit value of imports.
(d) Nominal LIBOR is the three months Eurodollar rate.

While this argument seems logically correct the question which remains to be answered is why nominal domestic interest rate failed to return to market equilibrium. As we will see shortly, the reduction in inflation during 1980-81 coincided with both a drop in the rate of capital inflows particularly in 1981, and the belief that the level of capital inflows were not sustainable in the long-run. Rising devaluation expectations, country-risk premium, and credit demand affected nominal interest rates.

Another important observation from the data in table 11c and 11e is that domestic interest rates failed to converge to international levels particularly during the period in which the exchange rate was being devalued according to a pre-announced "tablita" and large capital inflows were flooding the economy.

Table 2.11e Spreads of Interest Rates.

	1	2	3a	3b
1975	228.9	83.9	264.3	67.1
1976	62.1	37.7	152.8	20.7
1977	50.6	13.9	62.7	30.8
1978	40.4	23.3	22.5	15.5
1979	25.9	12.7	16.9	9.2
1980	28.5	20.1	9.5	5.9
1981	30.4	20.8	11.1	8.9
1982	-23.7	-30.8	13.3	11.8

Source:Banco Central de Chile,Boletin Mensual,Various Issues
IMF,International Financial Statistics,Various Issues
Arellano (1983)

Note: Spread 1=Difference between the interest paid by the domestic debtor who borrows in the domestic market and the interest paid if he borrows in the international financial market. That is,
{[(1+real lending rate)/(1+LIBOR)(1+e)]-1]}*100

Spread 2= Difference between interest in dollar terms received by a foreign creditor that lends in the domestic market and LIBOR rate. That is,
{[[(1+deposit rate)/(1+e)]/(1+LIBOR)]-1}*100

Spread 3a= Correspond to the gross spread between nominal peso lending rate and deposit rate.

Spread 3b= Correspond to the net spread between lending and deposit interest rates including the cost of legal reserve requirements

For instance, table 11c shows real peso lending rate proved to be well above LIBOR adjusted for devaluation. The annual average real peso lending rate was 42.2% between 1975 and 1982 whereas the adjusted LIBOR was as low as 4.4%. If we exclude the observation for 1982 the cost of dollar lending was minus 6%. Moreover, the deposit rate adjusted for devaluation was 34.5% per annum over the same period. This rate is definitely superior to the return from three month Eurodollar rate which hardly exceeded 12% per annum between 1977-82 as shown in table 11c. Similar conclusions are obtained by looking at the calculations for spread 1 and spread 2 in table 11e. In consequence, this differential was very attractive to foreign capital as much as it was for resident to borrow in foreign currency.

Several hypothesis have been introduced to explain why interest parity did not hold in Chile. A useful way to assess those factors affecting the parity is setting the interest parity condition for an open economy as follows:

$$(8) \quad i = i^{*} + e^{e} + \emptyset$$

In an economy where foreign and domestic assets are close substitute and where the financial market is fully integrated with the world financial market, domestic interest rate (i) should equal the yields on comparable foreign assets (i^{*}) plus the expected rate of exchange rate depreciation (e^{e}). This uncovered interest rate parity will not hold so long as the domestic interest rate will deviate from the foreign rate adjusted for expected depreciation by three additional factors. Country-specific institutional factors such as tax regimes, reserve requirements, and limits on exchange-risks; country-specific risks among them the imposition of exchange rate controls at the time of repatriation, and political risks; and exchange risks which arises from the fact that assets are denominated in different currencies, and there is uncertainty about future value of the exchange rate. These factors will lead to a premium (ø) on the yield on domestic assets to compensate risk-averse economic agents which in turn results in a differential between domestic and foreign rates after adjusting for expected exchange movements.[18] Thus, the answers for the spread between domestic and foreign interest rates lies with the concurrence of some of these factors and/or the relaxation of the underlying assumptions of the parity condition.

Sjaastad (1982) maintained that lack of correlation between the large inflows of capital and the spread, which for the periods between August 1979 to December 1980 and January 1981 to March 1982 was -0.53 and -0.12 respectively, can be explained by country-specific institutional factors. He argued that if the spread remained unaffected by increases in peso deposits, inflows of capital, and/or devaluation risk then the explanation should lie in the cost of arbitrage. This cost arose from the restrictions imposed on Chilean commercial banks to take positions in foreign currency. They could not borrow dollars abroad and lend pesos in Chile. Some non-bank institutions converted dollars into pesos and lent the proceeds in pesos which subsequently returned to banks in the forms of peso deposits and back again to non-bank entities in the form of loans. Given the transaction costs and the risk of default, this indirect arbitrage mechanism proved to be very expensive as compared with a case where banks were permitted to arbitrage directly. Although it was considered as theoretical possibility, its empirical relevance was insignificant.

With respect to country-specific risk, Edwards (1986) argued that only a small fraction of the spread can be explained by the premium over LIBOR charged by world financial markets. In effect, he showed that average premium charged on loans hardly exceeded 1% between 1979 to 1982. For instance in 1979 and 1980 the premium was 0.99%.

Instead, Edwards and Cox (1988) maintained that the role of exchange risk started playing an increasing role from 1980 onwards during the fixed exchange rate regime. As we have seen in table 8, after nearly two years of a "tablita" regime the exchange rate was fixed at $39 in 1979. The expectations of devaluation increased steadily as the appreciation of the real exchange rate and its effects on the current account deficit made the fixed exchange rate regime unsustainable. According to the data presented in chapter 7, the accumulated real appreciation between 1978 and 1981 was more than 30%. At the same time, the evidence from table 9 suggest that the current account deficit was nearly 10% of GDP per annum. With rising expectations of devaluation of the peso so did domestic nominal interest rates. At the same time, some firms and households began substituting foreign credit for domestic credit putting more pressure on domestic rates. As we will see shortly, there is evidence to support the validity of this hypothesis.

Other authors have questioned the validity of the underlying assumptions of the parity conditions. The work of Corbo and Matte (1984) indicates that Chilean assets and foreign assets were imperfect substitutes. In an economy with perfect capital mobility, a fixed exchange rate regime, perfect substitution between assets, and no sterilisation, the money supply is endogenous. Thus, a reduction in credit expansion is matched by a rise in foreign exchange reserves so that the monetary base remains unchanged.[19] In Corbo and Matte's model, the coefficient of compensation which relates the net flow of private capital as dependent variable with the internal credit of the Central Bank as independent was -0.24 for a sample period between 1975-83. This result suggest that asset substitution was between 0 and 1 so that it was less than perfect. Although this evidence is useful, the model itself does not relate directly to the issue of interest rates nor does it identify those factors which determine the low substitutability found for the case of Chile.

There are other studies which have questioned the assumption of perfect capital mobility. In fact, as we have seen from the itinerary of financial reforms, the liberalisation of the economy to capital inflows was gradual and initially it focused on the elimination of restrictions on long and medium run flows. Short-term borrowing in foreign currency was allowed as late as 1982. Edwards and Khan (1985) provide a very handy theoretical framework for interest rate determination for a semi-open economy. For example, in the case of fully open capital account the domestic rate of interest depends on the three elements stated in the parity condition stated by expression (1) that is $i^{o} = i^{*} + e^{e} + \phi$. In contrast, in a closed economy interest rate determination is influenced by domestic monetary conditions (demand and supply of money) and the expected rate of inflation (π^{e}) that is $i^{c} = r + \pi^{e}$ where r is the actual real interest rate. The value of r is determined by the excess liquidity in the economy that is $r = k + \mu EMS + u$ where k is the long-run real interest rate, EMS is the excess of money supply and u is random term.[20] Thus, in the semi-open economy both external as well as domestic factors interact in the interest rate determination. Expressions (9) and (9a) correspond to the nominal interest rate determination for a semi-open economy.

$$(9) \quad i = \Theta i^{o} + (1 - \Theta) i^{c}$$

$$(9a) \quad i = \alpha + \beta(i^{*} + e^{e}) + \tau \log m_{t-1} + \sigma \log Y + \delta \pi^{e} + \Gamma \phi + \varepsilon$$

If $\beta=1$ and $\tau=\sigma=\delta=0$ then expression (9a) becomes the interest rate determination for an open economy. Moreover, if β and τ are found statistically significant it would indicate that external and domestic factors are important in the interest rate determination. Edwards (1986) reports the results from the estimation of (2a) using quarterly data for the period 1977-82 and applying the OLS corrected for serial correlation. He found that the coefficient for $(i^{*} + e)^{e}$ and log(m)t-1 was significant and with the correct sign. This gives support to the view that internal monetary conditions played a decisive role affecting nominal interest rate in Chile. At the same time, it gives empirical support to the expected devaluation hypothesis discussed earlier. The coefficient measuring the risk premimum was found insignificant. These result should be treated with caution given some the simplication introduced into the model. Firstly, it assumes that $\pi^{e} = \pi$ under rational expectations.

Secondly, ϕ was express as constant plus a serially correlated random term. However, in practice this premium depends among other things on the stock of debt/GDP, political factors, and government assets etc.

Finally, the proxy for expected devaluation was estimated as the difference in percentage points between that quarter's effective real exchange rate and the one prevailing in June 1979 when the nominal rate was fixed. This expected realised real devaluation is an ex post rate rather than an ex ante rate.

Looking at the demand factors, we have seen that the rolling-over of bad debts and the interest rate capitalisation increased the demand for credit generating as suggested by Harberger (1985a) a false demand for credit. From his view, this problem started at very early stage as a result of loss-making enterprises which were privatised and continued generating losses afterwards. He maintained that as early as in 1976 the rolling-over was a significant factor raising both the demand for credit and interest rates. We also saw that most of the demand pressure for credit came from the action of economic conglomerates to boost their assets prices and continue their expansion. The empirical verification of these hypotheses is beyond the scope of this study.

The final query from the behaviour of interest rates is the spread between the lending and deposit interest rates. Table 11e column 3a presents the estimates of the gross spread between lending and deposit rates. The spread was extremely large in 1975 and 1976 with 264.3% and 152.5% per annum respectively. The magnitude of this spread can be explained by high reserve requirements and high inflation rates. Recalling the evidence from tables 9, the inflation rate in 1975 and 1976 was 340% and 174% and the effective reserve ratio estimated in table 2 was nearly 64% and 68.3% respectively. The spread began falling very rapidly from 62.7% in 1977 to 9.5% in 1980. These results coincided with the payments of a competitive interest rates on reserve requirements from 1976 onwards and the gradual reduction of the legal reserve as we have seen in table 8. At the same time, inflation did experienced a significant but gradual drop to 9.5% in 1981.

However, the lowest spread attained in 1980 was still too high even when inflation rate was reduced to one digit in 1981 and the legal reserve requirement were set at 10% for sight deposits and 4% time deposits in 1980. Even worse, the gross spread began rising in 1981 and 1982.

The data of column 3b in table 11e shows the estimates of the net spread (adjusted for reserve requirements). The net spread fell from 67.1% in 1975 to its lowest value of 5.9% in 1980 and thereafter it began rising again. These results would indicate that much of the explanation of the spread adjusted for reserve requirements lies in structural characteristics of the banking system particularly between 1980 and 1982.

The answer to this puzzle should be found in the oligopolistic structure of the Chilean financial system. As we have seen earlier, a liberalisation of the financial market with high concentration and bank holding company structure could also explain high interest rates and a large spread. It appears that the restoration of a bank holding company structure that resulted from the privatisation of the Chilean banking system together with increasing pressure from domestic and foreign competitors drove the newly established "groups" to compete for market shares. This in turn should account for high interest rates and a large spread between asset and liabilities rates throughout the liberalisation period. Indeed the evidence from chapter 3 suggest that the bulk of intermediation was concentrated in three major commercial banks and the share of non-bank financial institutions and foreign banks was extremely small. Also, table 10e confirms that two of these three large financial entities had over 50% of the loan portfolios in affiliated firms.

The effect of rising non-performing loans and increasing provision on the spread can also be taken as an equally possible explanation. Table 12 shows that the portfolio expenditure/total asset ratio support this assertion as it went up from 1.3% in 1980 to 6.7% in 1982. Chapter 3 provide more detailed evidence on the behaviour of the non-performing loans and the provisions for bad debts particularly between 1982-83.

Finally, it could be argued that the Chile's financial system did not exhibit any significant gain in operative efficiency and hence it can held accountable for relatively high net spread. The evidence from next sub-section does not give much support to this hypothesis.

All in all, it could be argued that the hypotheses introduced to explain the behaviour of interest rate in Chile are valid according to the point in which the economy was located in the itinerary of economic reforms. Probably the role of expected devaluation was even more important than a credit crunch between 1979-1982. At the same time, external shocks such as a dollar appreciation became more serious as the economy was totally integrated to the world economy in both trade and finance. In contrast, high interest rates during the period 1974-1978 can be better explained by initial deregulation of interest rates, tight restriction of capital inflows, the fiscal austerity and particularly the monetary tightening during 1975-76, and the lack of credibility of the anti-inflationary programme. However, one factor which appears systematically in both period is the excess demand for loans. It was argued that the purchase of assets from privatisation during 1974-78 was financed by bank credit and the rolling-over of bad loans specially during 1979-82 contributed to the excess demand and high interest rates. In addition, the financing of both the expansion of economic conglomerates and the stock exchange`s speculative bubble became decisive factor which went totally unnoticed and uncontrolled by the authorities. In my view, this issue was paramount in the behaviour of private sector indebtness and interest rates. The conduct of banks and banks managers in response to the incentives from financial liberalisation and the relaxation of supervision were at the centre of this story and as it will tested in Chapter 8 on the debacle of the banking system.

(2.3.2.3) Operative Efficiency in Chilean Banks.

One of the expected results from financial liberalisation particularly the lifting of restrictions for entry into the financial system and the establishment of a multi-purpose banking system was a rise in the level of operative efficiency. The significant reduction of the net spread between 1975 to 1980 confirms this result although still remained significantly large for international standards.

One indicator of operative efficiency is the salaries and administrative expenses/total asset ratio shown in table 12. This ratio was estimated using information from banks' balance sheets and income statements.

Table 2.12 Salaries and Administrative Expenses in Chile.

	NFOEx/TA	AdEx/TA	SEx/TA	PortEx/TA
1975	8.5	...	...	8.8
1976	8.1	...	...	1.8
1977	7.3	...	...	1.1
1978	5.4	...	...	1.8
1979	5.0	1.04	2.83	2.0
1980	4.3	1.06	2.65	1.3
1981	3.7	1.14	2.42	4.3
1982	3.4	0.86	1.95	6.7

Sources: SIBF, Informacion Financiera, Various Issues.
Chamorro (1985a)

Notes: NFOEx/TA=Non-financial operative expenses/total asset ratio includes administrative expenses and salaries
AdEx/TA = Adminitrative expenses/total asset ratio
SEx/TA = Salaries/total asset ratio
PortEx/TA= Portfolio expenses including provision relative to total assets.

The evidence suggest that the non-financial operative expenses/total asset ratio continously fell from 8.5% to 3.5% between 1975 and 1982. These results prompt us to confirm a significant gains in operative efficiency. However, these figures are still above those of a more competitive banking system. For instance, Chamorro (1985a) found that this ratio for the US was only 2.5% between 1979 and 1983.

The largest component of the non-financial operation expenses correspond to salaries. For instance, in 1981 salaries were 2.42% of total assets as compared with 1.14% for administrative expenses.

The evidence indicates that financial liberalisation contributed to a significant increases in operative efficiency although it remained somewhat higher than a more competitive financial system such as the US. These results tend to over estimate the efficiency gains as the value of total assets goes in the denominator. As we have seen in previous sections, the growth of financial assets was spectacular during this period. Indeed, if we observe the growth of nominal non-financial operative expenses we obtain a different conclusion. Between 1978 and 1982 these expenditure item grew by 325% with salaries having the biggest share.

(2.3.2.4) Financial Stability in Chile.

The single most puzzling and disturbing issue of Chile`s financial liberalisation was the collapse of the banking system in 1983. A large number of both private banks and non-bank financial institutions were liquidated, intervened, and/or supported with public money. As we will see in chapter 3, Banco del Estado (state bank) and Banco Industrial and Comercio Exterior remained the only exceptions which did not required any financial support. It could be argued that as much as financial liberalisation affected the performance of the financial system, the focus should be placed on the new incentives to bankers which emerged from an unregulated financial market. They became the main actors in affecting some of the unexpected ex post results of financial liberalisation, particularly the financial crisis of 1983. The deterioration of the macroeconomic environment although important as a triggering mechanism, should not be considered as the central hypothesis to explain the performance of the financial sector. Indeed, according to the early warning model estimated in chapter 6, the ex ante probability of bank failures/problems was significant three years before the financial debacle. Internal influences from financial liberalisation and external factors from adverse changes in some key macroeconomic variables are two testable hypotheses which will be studied and empirically evaluated in chapters 7 and 8.

In general, one would conclude that the expected results from financial liberalisation were achieved only partially. Although, the evidence indicates a substantial increase in financial intermediation (deepening), and a marked gains in operative efficiency, the level of savings and investment remained stagnant. There were no clear signs of an improvement in both resource allocation and the quality of investment. Instead, the banking system was fostering an unsustainable private sector indebtness, a risky concentration of loan portfolios with their affiliate firms, and financing stock market bubbles and the consolidation of economic "groups". All this behaviour occurred in spite of stubborn high interest rates, and a significant deterioration of the macroeconomic environment. Finally, the collapse of the banking system in 1983 is clear evidence of the unsuccessful liberalisation of the financial system in Chile.

Chapter 3 will discuss the magnitude of the banking failures in Chile and the steps taken by the authorities in order to avoid the total collapse from widespread panic. At the same time, it will provide a glimpse at the measures introduced to rehabilitate the financial system.

Endnotes.

(1) Bernanke (1983) was one of the first in introducing a link between financial disruption and output decline. This came to complement the monetary forces behind the repression of the 1930's. In Bernanke's view, in an imperfect capital market banks perform a real service by differentiating good from bad risk borrowers.

(2) Tobin also showed that the steady-state value of k in the monetary growth model was smaller than in a model with no money. In other words, the monetary model exhibits a smaller output per capita. This is shown by the equilibrium condition for k which is given by $[s-(1-s)xn]f(k)=nk$ which is smaller than $sf(k)=nk$ where x is the fraction of f(k) held in the form of real money balances.

(3) The coexistence of small and large firms producing a similar product but with a different factor proportion, an unequal access to technology, and a different growth and use of human capital confirm the degree of fragmentation in underdeveloped economies. However, most of this fragmentation has been largely the outcome of misguided government policies which have condemned some sectors of the economy to be technologically backward. For instance, Galbis (1977) modelled a fragmented economy with two sectors: one with a modern technology and the other with a backward technology. The lack of well developed financial market permitted the coexistence of these two sectors, the disparities in the rate of return of capital in the economy, and a lower rate of economic growth.

(4) The homogeneity and perfect divisibility of capital enable households to use only fractions of their capital to carry out their transactions and settle their debts obligations.

(5) Most governments of developing countries have been technically constrained in the amount of fiscal resources they could rise from direct and indirect taxation, especially the problem of tax evasion and existing lags in collecting tax revenues or known as the Olivera-Tanzi effect. In addition, the absence of well established and developed open market in primary securities has ruled out the possibility to issue and trade government and private sector paper. For Mckinnon and Mathieson (1981) the absence of open markets for primary security has little to do with a distortion and more with a low level of income per capita and the resulting small scale of savers and investors. Transaction costs and information asymmetries would be unmanagable in LDC's. However, Fry (1982a) maintain that private bonds and equity markets are supressed as a result of government taxation such as transaction taxes, stamp

duties, taxes on capital gains. The government's rationale to supress these markets lies on the fact that seigniorage cannot be taken easily from bonds and equities.

(6) According to Mckinnon and Mathieson (1981), firms in the import-substitution sector which were protected from potential imports normally they were granted official bank credits at negative real interest rate. Indeed, official intervention in the allocation of credit were so pervasive, detailed, and bewildering as much as the restrictions on foreign trade policies.

(7) Authorities tend to place a heavy reserve requirements on most liquid monetary assets and it gradually falls as the assets is less liquid. In effect, one should find that reserve requirements on time deposits is smaller than demand deposits. In addition, the effective reserve requirement in a liberalised and financially matured economy should be lower than in a less developed economy.

(8) In his review of disequilibrium interest rates in developing countries, Fry (1982b) argues that the prevalence of interest rate ceilings has a number of explanations. To begin with, he identifies the Keynesian liquidity preference as a floor for nominal interest rate and an above-equilibrium for the real interest rate. Unless the opportunity cost of holding money and/or real income fall the disequilibrium will persist. Beside the Neoclassical monetary growth theory and the substitution of money and capital, there are also political and religious factors which explain these ceilings.

(9) The list of selected countries both, developed and developing were chosen in order to compare their financial development with the Chilean's case. Among developed economies, the US, Germany, and Japan correspond to growing economies with a developed and mature financial system. Korea and Singapore represent rapidly growing developing economies where a mature banking system have emerged as result of financial liberalisation during the 1960's and 1970's. Among repressed developing countries, it was included the case of Mexico, although the peak of financial repression was reached during the nationalisation period between 1982-89. This list of countries is by no mean exhaust so further result from other studies will be address.

(10) However, the exactitude of these estimates should be treated with caution since no adjustments were made for any interest paid on bank reserves. Lack of data on interest payments precluded any attempt to obtain more accurate calculations.

(11) The empirical investigations on government seignorage suggest that the choice of a monetary aggregate depends on the nature of the empirical investigation. If we are interested in estimating how much the non-financial private sector pays to use money then M1 will suffice. However, if we want to assess how much the government collects from the inflation tax then the monetary base should be considered more useful. Equally, if the object of the study is to establish the amount of inflationary finance in the long-run then M1 is preferable to M2. For instance, any loss in financial assets from expectation errors or policy surprises on inflation and hence ex post real interest rates will be rapidly corrected. This effect has indeed short run implications. Also, it will probably involve transfers among private agents without the government's involvement.

(12) More sophisticated models enable us a more accurate estimation of the seignorage. An alternative specification of the government seignorage can be stated as Ss=M/P=Mt-Mt-1 plus Mt-1(Pt/1+Pt) where M is a well defined monetary aggregate and P the inflation rate. This gross estimate of the real seignorage can be adjusted in order to include the revenue losses from the time lag on tax collection. This is known as the Olivera-Tanzi effect. Thus, net government seignorage can be written as follows Ss=Mt-Mt-1+Mt-1(Pt/1+Pt) - Tt-1(Pt/1+Pt).

(13) Similar results and conclusions were found by Brock (1984). He also used the monetary base to estimate a nominal seignorage from the inflation tax on intermediation during the 1970's. In his sample apart from US, UK, and Mexico, his study also included Germany, Colombia, and Brazil.

(14) Giovannini also questioned the empirical results with respect to the econometric problems of specifying and estimating the aggregate saving functions. Due to lack of disaggregated data on private and government savings, the use of total domestic savings as a dependent variable was not satisfactory. The aggregation of savings is satisfactory only under the Ricardian-Equivalence Theorem. The exogeneity assumptions of the explanatory variables of the model was also challanged. Looking at the consumption-saving relationship as an intertemporal optimisation, approach he estimated and tested the coefficient of intertemporal substitution of consumption over time for a group of countries. Using annual data, he found that in 5 out of 18 countries does the expected path of consumption changes at all with changes in the real interest rate. Indeed, in most case the interest rates is insignificant.

(15) Meller and Solimano (1983) provided econometric evidence which support the view that asset prices were unrelated to fundamentals (flow of future dividends) even

under rational expectations and full information efficiency (arbitrage) conditions. Instead its value was determined by a speculative bubble.

(16) The predominance of domestic banks over foreign banks and financieras is even more significant as measured in terms of liabilities and assets. This evidence is presented in chapter 3. Additional information with respect to the size of the financial sector measured in terms of its contribution to GDP is shown in chapter 7.

(17) If we start from the basic proposition that savings is the difference between income and consumption then the theoretical and empirical differences on approaches will be centered on the definition of income and consumption and some of the underlying assumptions concerning some institutional and structural characteristics. The Modigliani's life-cycle hypothesis and the Friedman's permanent income hypothesis is confined within a Fisher's intertemporal optimisation model where intertemporal consumption (optimal) depends on current income but more important on long-run income. In addition, wealth, demographic variables, factors afecting the present value of income such as the rate of interest should be also considered. These models contrast with the traditional Keynesian model where household consume a fraction of current disposable income and thus changes in both current income and the MPC would affect consumption and henceforth savings. The introduction of assumptions specially imperfect capital markets and credit rationing will ample and transform this framework into liquidity constraint models. Another type of theoretical framework is the generational model. The time horizon exceed one generation so that factors affecting optimal consumption and hence savings pattern are also influenced by pensions and insurance, magnitude of transfers, and uncertainty.

(18) The dynamic of the adjustment of the parity condition can be stated as follows. Suppose that we start from equilibrium where the interest rate parity does hold. Suppose that the risk premium (ø) fall as a result of a pre-announced "tablita" for the future path of nominal exchange rate. It follows that a fall in the exchange rate uncertainty will reduce the risk premium on domestic assets. A positive spread between domestic and foreign rates will emerge and, other things being equal, capital inflows should increase forcing domestic interest rates to fall until the differential is consistent with the new and lower risk premium.

(19) The adjustment of the model comprise an excess demand for money over its supply which rises the domestic rate of interest and accelerate the purchase of assets in domestic currency. This portfolio adjustment will put pressure on the exchange rate so that under a fixed regime the authorities would need to defend the fixed regime by purchasing dollars and accumulating them as reserves.

(20) The excess money supply over the demand for money is given by $EMS=\log(m)t-\log(md)t$ so that when $EMS>0$ then $r<k$ in the short run. In the long run $EMS=0$ so that $r=k+u$. The real demand for money is given by $\log(md)t= a+b\log(y)t-c(k+\pi e)-d\pi e$ where y is real income and πe is expected inflation rate. Finally the stock of real money balances adjust according to the variation in $[\log(m)t-\log(m)t-1]= Z(\log(md)t-\log(m)t-1$ where Z is the adjustment coefficient and lies between 0 and 1. If $EMS>0$ because m is greater than the long-run money demand then short run nominal interest rate will be below equilibrium. The market will be equilibrated via a fall in real money balances.

Chapter 3. Banking Failures in Chile during 1981-83.

(3.1) Introduction.

This chapter provides an evaluation of the magnitude of the banking crisis in Chile. It analyses the performance and the degree of vulnerability of financial institutions by examining balance-sheet data. Moreover, there is a description and an assessment of the mechanisms to rescue and to rehabilitate the Chilean financial system. As it will be shown the banking crisis in Chile which began to unfold in 1981 involved a large number of bank failures which required an aggressive handling to avoid the total collapse of the financial system and the whole economy. The authorities have chosen the intermediate solution by letting shareholders and the government absorb the losses.

From a theoretical point of view, a bank fails just like any other enterprise if its net worth becomes negative or if it is unable to continue its operations without incurring losses that would immediately result in a negative net worth.

In practice, however, most bank failures do not occur at the precise time when the value of the bank reaches zero or negative. In fact, most situations are resolved in ways that do not entail bankruptcy. Thus, the authorities may encourage a merger between a sound financial institution and a problem bank. Alternatively, the authorities may introduce emergency measures like the transitory substitution of bad assets for cash and/or other government assets. As we will see this is the approach followed by the monetary authorities in Chile. Chapter 5 discusses further the issue of a working definition of bank failures.

(3.2) The Stylised Facts and the Magnitude of the Banking Failures in Chile 1981-83.

As we have seen from the previous chapter, the measures enacted by the government in order to liberalise the financial system did yield initially some positive and encouraging results. The banking sector experienced a period of rapid growth and it showed some signs of increased efficency. Among the most encouraging signs the M2/GDP ratio rose, the spread between lending and borrowing rates declined, lending rates showed some steady decline although they remain high relative to world interest rates. In this more deregulated environment increasing competition and the introduction of new products from new banks and non-bank financial institutions, both domestic and foreign, were providing savers and investors with a wider range of financial services. However, after 6 years of sustained financial growth and stability, the banking system experienced one of the worst financial crises in the country's history starting in 1981 and reaching its peak of intensity in 1983. Severe solvency and profitability problems came to affect a large segment of the banking sector which overshadowed the performance of the banking sector during the late 1970's.

(3.2.1) The Chronology and the Stylised Facts of the Crisis.

The period of financial liberalisation which ran from 1974 to 1982 contains several financial episodes involving the failure and/or problem of some financial institutions. The first financial disorder occurred in 1974-75 with the insolvencies of a number of non-bank financial institutions, both formal and informal. Unlike commercial banks, this form of financial intermediary flourished as a result of the lack of any capital requirement and supervision. They were soon discouraged with the introduction of a minimum capital requirement.[1]

During the mid-seventies we also witnessed a process of transformation, fusion, and the closed down of the Saving and Loan Associations (SINAP). The establishment of a multi-banking financial system which enabled banks to enter into the mortgage business and the introduction of some restrictions on the asset and liability composition of the SINAP resulted in a rapid fall in the numbers of this type of institution as they began merging among themselves. By the end of 1978 there was one left and two years later this finally closed its doors.[2]

These financial disorders did not pose any real threat to the stability of the financial system nor required the intervention of the Superintendency of Banks and Financial Institutions (SIBF) which were in charge of regulating and supervising the system. However, the 1977 rescue of Banco Osorno not only was the exception to the rule but also it left a dangerous precedent to the public as whole. Given that there were clear signs that this important bank was threatened by bankruptcy, the authorities, who also feared the drain of the internal and in particular external confidence in the financial system, rescued all depositors and the institution.[3]

Although we cannot trace the origin of the banking crisis to this single financial episode, one could equally maintain that the decision to bail out the bank produced lasting effects in terms of the expectations of the public on the safety of the system.

The Chilean banking crisis began to unfold in late 1981. The failure of CRAV in May 1981, a large sugar refinery, was causing concern to the public and the authorities as some domestic commercial banks made loans without collateral. By December 1981, the government decided to intervene in order to liquidate 4 banks and an equal number of non-bank financial institutions. As we see from table 1 and 2 the financial institution involved were Banco Talca, Banco

Linares, Banco Español, Banco de Fomento de Valparaiso, and Financieras Cash, de Capitales, Compañia General Financiera, and Finansur among non-bank financial institutions. Altogether, they accounted for 10.2% of the total loans of the financial system.

Rumours and fears of a rapid deterioration of the banking system were taking place as a result of the growing number of firms' bankruptcies during 1982 . The evidence indicates that the number of bankruptcies among corporate enterprises and general establishments went from 314 in 1978 to 885 in 1982. These worries were confirmed with the emergence of an acute banking crisis and the intervention of the banking authorities in January 1983. The evidence from the tables indicates that 5 banks had to be intervened, and 2 banks and 1 financiera had to be liquidated. Among those financial entities which were intervened we include Banco de Chile, Banco de Santiago, Banco de Concepcion, Banco Internacional, and Colocadora Nacional de Valores. They accounted for 43% of the total loans of the system. Moreover, the liquidation of Banco Hipotecario de Chile, Banco Unido de Fomento, and Financiera Ciga corresponded to nearly 6% of total loans of the system.

Table 3.1 Private Domestic Banks Intervened and/or Liquidated.

Banks	Year	Process	Size (d)
Osorno	1976	Capitalised	2.0
Español(a)	1981	Liquidated & Sold	2.4
Talca (b)	1981	Liquidated & Sold	4.0
Linares	1981	Liquidated	0.1
Fomento Valp.	1981	Liquidated	1.1
Austral	1981	Liquidated	0.8
Fomento Bio Bio	1981	Liquidated	0.3
Hipotecario Chile	1983	Liquidated	3.4
Unido de Fomento	1983	Liquidated	2.2
Chile	1983	Capitalised & Sold	20.4
Concepcion	1983	Capitalised & Sold	4.1
Internacional	1983	Capitalised & Sold	1.1
Santiago	1983	Capitalised & Sold	12.0
Colocadora Nac.(c)	1983	Merged	2.0
Hipotecario Fomento(d)	1983	Capitalised & Sold	3.3

Source: SIBF, Informacion Financiera, Various Issues.

(a) This bank was sold to the Spanish Santander Group.
(b) Banco Talca became in Centrobanco
(c) It was merged with Morgan Finanza
(e) This bank was considered to be linked to Banco Santiago.
(d) Measured as % of total loans of the system.

Appendix 1 provides a complete list of the number of financial institutions both banks and non-banks entities which were part of the financial system and experienced financial difficulties.

Table 3.2 Non-Bank Financial Institutions Liquidated.

Institution	Year	Process	Size(a)
Cia.Gral. Financiera	1981	Liquidated	0.5
Cash	1981	Liquidated	0.4
De Capitales	1981	Liquidated	0.3
Del Sur	1981	Liquidated	0.3
Adelantos & Creditos	1982	Liquidated	0.1
Ciga	1983	Liquidated	0.2

Source: SIBF, Informacion Financiera, Various Issues.

(a) Measured as % of the total loans of the system.

All in all, the total sum added up to around 50% of total loans which were at stake and Banco de Chile and Banco de Santiago were the two largest banks in Chile with 20% and nearly 12% of loans relative to the total intermediation in December 1982. According to Arellano (1985) the support of the Central Bank for those financial institutions in liquidation and in emergency loans added up to more than 15% of GDP of 1982. Although the government was not forced to intervene by the existence of an explicit deposit insurance arrangement, they had to pick-up the bill to avoid systematic panics and bank runs, together with a deeper financial crisis.

However, the dimensions of the 1983 banking crisis were much wider if we also include those financial intermediaries which, although they were not intervened by the SIBF, had to sell part of their nonperforming loans to the Central Bank. Table 3 contains information about the institutions which made use of the Central Bank's directives number 1.450 and 1.555 authorising banks to sell nonperforming loans to the Central Bank. These two directives from the Central Bank permitted both banks subject to intervention (intervened banks), and non-intervened vulnerable banks (non-intervened banks) to substitute non-performing assets for cash and promissory notes issued by the Central Bank as we will see later.

The data from table 3 points out three important issues which will be a matter of a closer scrutiny later on the paper. Firstly, those banks which were subject to intervention show a significant proportion of loans as nonperforming. This is quite evident in Banco de Chile, and Santiago, the two largest commercial banks in the system, with nearly 40% and 60% of their total loan portfolio respectively.

Table 3.3 Nonperforming Loans Sold to the Central Bank.(a)

Intervined Banks	NPL/TL(b)	Non-Intervined Banks	NPL/TL	Size
Chile	39.0	O'Higgins	14.2	2.9
		Continental	18.0	1.1
Concepcion	55.8	Sudamericano	14.8	4.7
		Credito e Inversion	12.0	5.2
Internacional	60.0	Trabajo	12.3	2.9
		Morgan(c)	11.8	1.6
Santiago	52.5	Pacifico(d)	15.1	0.6
		Nacional(e)	16.2	1.9
Colocadora Nac.	10.0	Edwards(f)	20.2	3.1
		Desarrollo(g)	19.5	0.4
Hipotecario F.	26.0	Estado(h)	0.0	14.9
		BICE(i)	0.0	1.2

Source: SIBF, Informacion Financiera, Various Issues.

(a) It corresponds to the highest value of NPL/TL between 1984 and 1986
(b) The ratio nonperforming loans (NPL) to total loans (TL) is expressed in % terms.
(c) Ex Colocadora Nacional de Valores.
(d) Ex Agrobanco.
(e) Ex Banco Curico
(f) Ex Banco de Constitucion
(g) This bank was open only in 1983.
(h) This is the only State Bank in the financial system.
(i) Banco Industrial y de Comercio Exterior.

Secondly, the problem of non performing loans also emerged among non-intervened banks with ratios above the 10% and just below the 21% mark. Additional evidence from SIBF and Held (1989) shows that the total nonperforming loans sold to the Central Bank was equivalent to 27.7% of total loans of the system and 18.2% of GDP of 1985.

Thirdly, the evidence also showed that there were only two domestic banks, Banco del Estado and BICE, which did not need to transfer a proportion of their nonperforming loans to the Central Bank.

Thus, between 1981 and 1983 the SIBF intervened 14 domestic banks and 6 non-bank financial institutions from a total of 26 banks and 17 financieras, excluding the state bank Banco del Estado. From there the authorities liquidated a total of 8 banks and all the intervened financieras.

The present empirical study on the banking crisis will be centered in the 1983 period. Although the beginning of the Chilean banking crisis can probably be dated in 1981, the crisis really came to a head in 1983. As we saw already, it did compromise a significant proportion of the intermediation and involved the two largest banks. In addition, the rescue package involved a substantial amount of public money. There are two additional justifications for concentrating on studying those institutions who failed or showed problems during 1983. The first one is that our interest is to test how important were the macroeconomic environment relative to the bank management in the debacle of the banking system. As we have seen from chapter 2, 1982 and 1983 were years where output fell dramatically.

Secondly, as explained in chapter 6, data limitations force me to consider a sample of data between 1979 to 1983. The alternative would restrict the sample to a period between 1979 to 1981, and hence drawing inferences on 8 quarterly observations and with a smaller sample of individual banks.

(3.2.2) An Autopsy of the Banking Sector.

The next step is to carry out an autopsy of the banking system and each individual financial institution in order to assess the magnitude of the crisis and to establish some tentative differences in their relative performance. The tables are constructed from the information obtained from the banks balance sheets and the income statements published by the SIBF. Appendix 2 provides a sample of the format and structure of a balance sheet and income statement of a Chilean bank.

The data from tables 4 and 5 give evidence of the change of fortunes of the financial sector .

Table 3.4 Indicators of the Financial System Boom in Chile. (a)

	77	78	79	80	81	Av
Growth Bank Assets(b)	50.4	41.3	29.6	40.3	11.3	34.5
Loans/GDP	16.6	23.2	28.2	37.6	50.4	31.2
Growth Bank Liability(c)	47.8	51.0	29.9	42.8	11.6	36.6
Gross Profits/Capital	8.7	18.5	23.0	23.5	11.4	17.0
Sector GDP Growth	14.5	20.1	28.0	24.7	14.2	20.3
GDP Sector/GDP	6.3	7.0	8.1	9.5	10.6	8.3

Sources: SIBF, Informacion Financiera, Various Issues.

(a) It includes banks and non-banks financial institutions.
(b) Wide definition of bank assets i.e. loans+financial investment+accrued interest and available funds+ Central Bank note from the selling of nonperforming loans. All in nominal terms.
(c) Total obligations with third parties.

The data on GDP growth for the financial sector show a significant increase with an average annual growth rate of 20% and with a peak of 28.0% in 1979. The share of the financial sector GDP growth relative to the overall GDP of the economy was 8.3% per annum. Looking at the profitability and the rate of return of bank capital measured by the gross profits/capital ratio shows a marked rise from 8.7% to nearly 24% in 1980 with an annual average of 17%. These impressive results are not surprising given the high growth rate in bank assets and growing value of total loans relative to GDP. In fact, the data shows that the annual average growth rate of bank assets was 37.5 and the loans/GDP ratio over 31%. The peak of the loan/ GDP ratio occurred in 1981 with a 50% ratio during a period where output was still expanding very fast. At the same time, as we have seen from the previous chapter, the abnormal high nominal and real lending rates as well as the persistence and ever increasing spread between lending and deposit interest rates in the face of increasing demand for credit should explain the astonishing profitability and growth of the banking sector. This rapid growth in bank assets took place in an environment of falling inflation. As we have seen from chapter 2, the rate of inflation went from approximately 30% p.a in 1978 to 9.5% in 1981.

However, the financial boom turned sour from the last quarter of 1981 onwards. The evidence from table 5 give an indication of the magnitude of the change between 1982 and 1983 years at which the full blow of the emerging banking crisis was felt and the authorities inmplemented the rehabilitation programmes.

Table 3.5 Indicators of the Financial Sector Collapse in Chile.

	1982	1983	1984	Av
Growth Bank Assets	22.6	12.3	19.0	17.9
Loans/GDP	71.2	72.4	74.5	72.7
Growth of Bank Liabilities	24.7	11.8	19.8	18.7
Gross Profits/Capital	4.1	-24.0	-24.7	-14.8
Sector GDP Growth	-4.4	-40.5	-9.2	-18.0
GDP Sector/ GDP	11.7	7.5	6.5	8.5

Source: SIBF, Informacion Financiera, Various Issues.

The evidence from table 5 shows the magnitude of the deterioration of the financial system between 1982-84. For instance, the GDP growth of the financial sector fell by an annual average of 18% during those three years with a trough of nearly 41% in 1983. Equally dramatic was the return on bank capital which shows a significant fall in 1982 and becomes more acute in 1983 and 1984 with minus 24%. This performance coincided with the large fall in GDP in 1982 and 1983 of 14% and 0.7% respectively. Given the increasing financial fragility of firms, we observe a rise in the loan/GDP ratio in the face of falling output and increasing real lending rates which indicates some form of distress borrowing.

Further evidence from banks' balance sheets shows the increasing vulnerability and insolvency of the financial system. Looking at the risk exposure, table 6 shows that the amount of nonperforming loans grew very dangerously during 1982,1983, and 1984. For instance, in 1983 nonperforming loans almost reached 50% of the capital of the financial system and by 1984 was still rising to 60%. However, these figures underestimate the magnitude of the exposure since as we will see in the next subsection, the authorities allowed more flexible accounting procedures which among other things permitted banks longer recogniton time of nonperforming loans and the constitution of provisions. In addition, the authorities enabled banks to remove from their balance sheet nonperforming and risky loans using the agreement 1.450 in 1982 and later on the agreement 1.555 of 1983. Therefore, the indicator which accounts for the nonperforming and risky loans sold to the Central Bank should be more meaningful and accurate.

Table 3.6 Financial Indicators of Vulnerability and Insolvency of the Financial System in Chile.(%)

	81	82	83	84	Av
NP Loans/Loans	2.9	7.5	5.5	3.8	4.9
NP Loans/Capital	24.4	41.9	49.5	60.0	44.0
NP Loans Sold/Loans	--	6.8	9.6	14.2	10.2
NP Loans Sold/Capital	--	67.1	95.4		
NP& Risky Loans Sold/Capital	--	78.8	158.1	186.3	141.0
Bank Liabilities/Capital	10.6	11.0	11.4	12.0	11.2
Gross Profits/Total Assets	1.0	0.3	-1.7	-1.5	0.4
Provisions/Total Assets	1.1	3.6	4.3	4.8	3.4

Source: SIBF, Informacion Financiera, Various issues.

NP= Nonperforming

By 1983 and 1984, the selling of nonperforming loans and risky assets reached 158% and 186% of capital respectively. At that time, the amount of bad and risky credit purchased by the Central Bank had exceeded the capital of the financial system, thus showing the full extent of the banking crisis. Equally, we see the deterioration of the average return of each asset unit in 1983 and 1984, measured by the negative figures of the gross profit/total asset ratio.

The growing vulnerability and the poor profitability combined with a relaxation on the constitution of provisions and capital requirement forced the authorities to rescue those institutions, as we have seen in tables 1-3, which were facing insolvency and/or experiencing a severe deterioration of their asset quality. Disaggregated data will show the financial vulnerability of each individual institution which was rescued and/or required some financial aid. The individual data will produce some interesting clues on the comparative performance and their state of financial health.

Tables 7 to 13 are organised as follows. The first 8 financial institutions in the first group correspond to those which were liquidated and intervened in 1983. The second group is composed by those banks which sold nonperforming and risky loans to the Central Bank. Finally, the two remaining institutions correspond to those which were not required to participate in any of the initiatives enacted by the authorities to rescue the banking system. They both remained healthy throughout the period of study. This configuration not only shows the increasing deterioration of each individual financial institution but also permit us to compare at first sight marked differences in the ratios between groups. Chapter 5 provides a more thorough and sophisticated statistical analysis for groups differences.

Table 3.7 Financial Indicator of Vulnerability: Asset Quality.

	(a) NPL/Loans				NPL/Capital			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	29.2	4.1	0.4	--	407.1	57.9	93.0	--
Hipotecario Chile	1.6	1.4	2.0	--	22.5	25.1	68.0	--
Chile	1.5	2.0	1.9	11.3	14.1	23.5	68.9	177
Concepcion	1.8	2.0	4.2	14.5	27.1	28.4	45.3	175
Internacional	0.6	1.0	3.0	11.1	6.9	12.2	66.8	102
Santiago	0.3	0.5	7.2	30.7	4.7	6.3	18.6	297
Hipotecario Fto.	1.2	0.8	3.5	3.6	20.8	14.8	33.0	147
Ciga (b)	2.0	1.6	6.2	--	3.4	12.3	35.8	--
O'Higgins	1.2	2.1	5.2	7.4	12.3	22.7	42.9	76
Continental	2.2	2.5	1.2	17.0	18.9	26.5	89.0	182
Sudamericano	1.3	1.3	4.1	2.7	15.0	19.3	38.1	39
Credito	1.4	1.7	2.9	3.2	17.0	24.7	57.3	43
Trabajo	1.7	2.2	4.2	2.0	22.8	29.0	45.1	25
Pacifico	0.1	0.7	5.2	2.0	0.4	7.3	38.4	21
Nacional	1.5	0.7	5.0	3.9	7.3	7.1	44.1	37
Edwards	0.5	1.0	3.9	4.8	6.5	13.0	40.4	72
BICE	0.3	0.2	6.4	2.8	1.8	2.0	15.2	36
Estado	4.8	2.9	9.0	5.3	31.7	15.4	33.5	28

Source: SIBF, Informacion Financiera, Various Issues.

(a) NPL= Nonperforming Loans in the balance-sheet.
(b) Non-bank financial institution.

Table 7 contain individual data on the deterioration of the quality of banks' loan portfolios. The NPL/Loans ratio begin to show a notorious rise in 1983 in particular among those banks which were intervened in the same year. Banco Chile, Banco Santiago, and Banco de Concepcion present the largest deterioration of their loan quality in particular as we measure it against their capital and reserves. For instance, the worst case of all correspond to the Banco Santiago as the amount of nonperforming loans is nearly three time its capital. According to the preliminary estimates, some worrying signs started to emerge in 1982 although it became quite obvious during the intervention year. Similar observations can be made on those entities in the second group, although their capital obligation were less serious at least with respect to the first group. As we argued earlier, the accounting of nonperforming loans could be a misleading indicator given the recognition lag, the unwillingness to report, and above all its usefulness is seriously limited as an early indicator of those institutions which should be monitored. Nor may it provide evidence of the real magnitude of the deterioration of bank assets.

Table 8 provides a better measure of the magnitudes involved for each institution as well as an ex post indicator of the actual deterioration of banks' asset quality. It should be pointed out that any difference between the values of NPL and loans sold to the Central Bank demonstrate the effect of under-reporting of the former. The data for 1982-83 begin to show the magnitude of the fall in the quality of banks' credit and the extent of the rescue operation. Individual banks were allowed to sell nonperforming and risky loans to the Central Bank initially through the agreement 1.450 enacted in 1982 and later in 1983 the agreement 1.550.

Table 3.8 Additional Financial Indicator of Asset Quality.

	(a) Loans Sold/Loans				Loans Sold/Capital			
Institutions	81	82	83	84	81	82	83	84
Unido de Fomento	0.0	9.7	--	--	0.0	176.0	--	--
Hipotecario Chile	0.0	4.8	--	--	0.0	75.1	--	--
Chile	0.0	4.0	9.3	7.7	0.0	64.5	148.8	--
Concepcion	0.0	6.1	13.1	11.0	0.0	74.2	164.1	--
Internacional	0.0	9.1	10.9	8.6	0.0	89.4	104.2	--
Santiago	0.0	1.5	20.1	19.0	0.0	14.6	166.3	--
Hipotecario Fto.	0.0	2.4	9.0	11.4	0.0	43.9	165.3	--
Ciga	0.0	9.4	--	--	0.0	73.9	--	--
O'Higgins	0.0	2.5	5.8	14.2	0.0	25.5	58.5	--
Continental	0.0	0.0	9.2	18.0	0.0	0.0	93.2	--
Sudamericano	0.0	6.5	7.4	14.1	0.0	100.1	116.1	--
Credito	0.0	8.0	15.0	12.0	0.0	112.7	210.8	--
Trabajo	0.0	11.4	10.5	9.6	0.0	154.3	140.1	--
Pacifico	0.0	8.1	8.5	15.1	0.0	101.1	88.0	--
Nacional	0.0	1.9	6.7	16.2	0.0	18.8	65.5	--
Edwards	0.0	6.2	10.8	15.0	0.0	97.5	156.7	--
BICE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Estado	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--

Source: SIBF, Informacion Financiera, Various Issues.

(a) Loans sold to the Central Bank includes nonperforming and risky loans

There are two interesting observations from the data which is worth to comment on. Firstly, the ratio of NPL/Capital in the case of the intervened banks is similiar to the ratio Loans Sold/Capital in spite of a wider definition of the latter. Secondly, the largest quantities of loans sold is concentrated in the second group of the table and exceed the banks capital. We also observe that in 1982 the second group of banks sold a larger quantities of loans to the Central Bank than the first group. The answer lies in the fact that, unlike the second group, the agreement 1.555 restricted intervened banks from selling nonperforming and risky loans until they were recapitalised.

In general, the asset deterioration which according to NPL/Capital ratio was somewhat submerged in the case of Banco Continental, Sudamericano, Credito, Trabajo, Pacifico, and Edwards emerged with a full blast in 1982-83. At the same time, Banco del Estado and Banco Industrial y de Comercio Exterior remained as the only two exceptions which did not sell any nonperforming and risky loans to the Central Bank.

With respect to the profitability, the data should reflect the overall performance of a bank. An inadequate profitability will give a signal of the vulnerability and a high likelihood of a bank insolvency as the bank net worth start falling. The profit/asset ratio shows the average return of each unit of bank asset and it can also be interpreted as a proxy for the quality of bank assets. The data on the average return on assets not only shows that the trend in profitability has been downward but also its lowest values occurred in 1983. For instance, Banco Santiago is the worst performer with a negative average return of almost 7% followed by Banco Concepcion and Banco Chile with minus 5.4% and 2.6% respectively. The same conclusions are reached for the second group in the tables although the fall in profitability was more moderate than in the first group. Banco Continental is the only comparable case as the figures shows a marked deterioration which had started in 1982.

Table 3.9 Financial Indicators of Vulnerability: Profitability.

	(a) Profits/Assets				Profits/Capital			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	0.4	0.3	0.0	--	5.4	5.1	-0.1	--
Hipotecario Chile	0.9	0.2	0.1	--	16.8	4.1	1.2	--
Chile	1.4	0.2	0.4	-2.6	17.8	4.7	6.3	-54
Concepcion	0.4	0.2	0.5	-5.4	8.3	3.4	6.6	-77
Internacional	0.6	0.7	0.1	-2.3	9.0	9.9	1.5	-26
Santiago	0.2	-1.0	0.5	-6.9	4.0	-15.1	5.4	-77
Hipotecario Fto.	0.3	0.1	0.3	-0.1	5.6	2.0	6.6	-1
Ciga	0.0	-0.5	-0.7	--	0.1	-5.0	-7.6	--
O`Higgins	1.0	0.6	0.9	0.0	12.6	8.0	10.7	0
Continental	0.7	0.1	-2.1	-5.1	8.5	1.1	-23.1	-68
Sudamericano	0.3	0.4	0.2	-0.1	5.8	7.6	2.5	-1
Credito	0.3	-0.3	0.4	-0.6	4.9	-4.7	5.4	-14
Trabajo	0.5	0.5	0.0	0.0	8.2	7.2	-0.3	0
Pacifico	0.1	0.3	0.1	-0.7	1.6	3.8	1.1	-9
Nacional	0.8	0.6	0.5	-0.1	5.3	7.1	6.2	-1
Edwards	0.1	0.1	-0.1	-0.1	1.3	2.2	-1.1	-1
BICE	0.4	0.6	0.3	0.1	4.6	8.3	4.3	1.2
Estado	0.3	0.7	0.5	0.3	3.9	5.7	3.5	3.3

Source: SIBF, Informacion Financiera, Various Issues.

(a) Bank Assets includes loans, financial investment, and cash. Also profits are defined as the difference between the total income account and the total expenses account.

The profit/capital ratio which is the more traditional measure of the rate of return on investment also presents evidence of the fall in profitability. The same conclusions emerge from the profit/capital ratio. Individual banks exhibit both a declining trend in the rate of return of capital and the lowest figures in 1983. Among the largest banks Banco Chile and Banco Concepcion showed the best and the worst rates of return of capital with 17.8% and 8.3% in 1981 and -54% and -77% in 1983 respectively. In addition, Banco Santiago systematically showed the worst performance between 1981 to 1983. Again in the second group, Banco Continental shows a comparable performance with the largest banks with a negative rate of return in two consecutive year with -23% in 1982 and -68% in 1983. Again, BICE and Banco del Estado were the only two exceptions as they remain profitable even in the worst year of the banking crisis.

If we look at the NPL/capital, loans sold/capital and profit/assets ratios the downward trend in profitability which started to emerge in 1982 and fully developed in 1983 coincide with the worsening in the quality of the banks loan portfolios over any significant increase in operating costs. The estimated ratios for both intervined banks and those in the second group consistently showed a deterioration in these three ratios in particular in 1982 and 1983. Banco Santiago, Banco Concepcion, and Banco Chile were the worst cases in the former group and Banco Continental and Banco Credito in the latter.

The provision/loans ratio and the liabilities/capital ratio are additional indicators of increasing vulnerability. The former attempt to measure the provisions made in order to cover any potential losses from any expected and unexpected deterioration of the loan portfolio. In this case, the numerator reflects the bank's total provision. As we will see later much of this figure is determined by the country's banking regulation on specific and global provision. There are two general observations to be inferred from this data exhibited in table 10.

Table 3.10 Additional Indicators of Vulnerability.

	(a) Provision/Loans				Liabilities/Capital			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	9.8	1.2	4.4	--	--	17.0	15.6	--
Hipotecario Chile	9.4	1.1	4.7	--	--	19.5	14.1	--
Chile	7.6	0.9	3.2	5.6	--	15.2	20.5	24.0
Concepcion	5.0	1.1	2.4	5.5	--	15.3	15.5	18.3
Internacional	6.5	1.8	3.2	6.9	--	13.6	11.5	10.6
Santiago	5.0	1.1	3.1	8.0	--	15.3	11.0	9.3
Hipotecario Fto.	5.6	0.8	1.4	3.0	--	17.5	19.2	17.4
Ciga	10.9	0.9	3.5	--	--	9.8	0.9	--
O'Higgins	8.7	1.6	2.8	3.9	--	13.8	12.9	8.7
Continental	6.1	0.2	3.1	12.3	--	10.7	11.6	24.3
Sudamericano	5.0	1.1	1.7	2.4	--	16.9	17.9	17.1
Credito	6.0	0.8	2.1	3.0	--	16.1	16.6	15.2
Trabajo	5.3	1.5	2.1	2.7	--	13.6	15.8	14.4
Pacifico	14.5	0.8	1.1	3.0	--	13.0	13.5	9.5
Nacional	6.3	1.1	2.2	3.5	--	13.8	11.3	11.1
Edwards	3.2	0.8	1.3	2.4	--	14.4	17.8	15.3
BICE	5.0	1.1	1.9	3.8	--	13.3	14.5	14.4
Estado	14.3	5.2	7.1	10.5	--	7.0	7.3	7.8

Source: SIBF, Informacion Financiera, Various Issues.

(a) These estimates were elaborated with the data available for December.

Firstly, the lower provision made in 1981 as compared with 1980 can be explained by the change in regulation. As we will see in the next section, the requirements for the constitution of a global provision were reduced from 2% to 0.75%. In addition, the accounting flexibilities gave banks more time to build up individual provision for each type of credit classification.

Secondly, the low values coincide with very rapid expansion in the growth rate of loans as shown by table 11. In both the first and second group of banks a low provision/loans ratio coincided with a rapid expansion of bank loans, in particular in 1980 and 1981. For instance, according to my estimations, in 1981 Banco Chile experienced a loans growth of 102% combined with a provision/loan ratio of 0.9 % . The same is true in the cases of Banco Concepcion and Banco Santiago. Among the second group, Banco Pacifico and Banco Nacional exhibited the highest growth rate among its group and the whole banking system for the period of 1981 with figures reaching 313% and 178% respectively. These figures for both banks coincided with a low values for the provision ratio of 0.8% and 1.1% in each case.

Table 3.11 Financial Indicator of Bank Expansion.(%)

	(a) Loans Growth				Liabilities Growth			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	84.7	104.9	1.1	--	5.8	4.8	3.6	--
Hipotecario Chile	198.4	143.7	18.6	--	9.2	6.2	4.9	--
Chile	95.1	102.1	17.0	16.8	4.9	4.5	4.5	2.7
Concepcion	39.2	95.5	-0.2	18.7	3.2	4.0	4.0	3.0
Internacional	110.2	59.5	-13.6	19.1	7.0	2.0	1.7	3.1
Santiago	129.2	81.6	62.5	-4.3	6.6	4.4	6.4	3.0
Hipotecario Fto.	141.8	108.1	3.4	17.2	7.8	4.4	3.0	3.6
Ciga	85.9	70.5	-11.1	--	6.8	4.1	1.6	--
O'Higgins	48.5	61.6	10.7	15.8	2.5	4.4	2.4	3.9
Continental	67.9	54.2	5.0	10.4	4.2	1.8	3.1	5.6
Sudamericano	69.0	74.3	1.5	26.2	3.9	3.0	3.9	4.4
Credito	43.1	73.7	-8.3	13.9	3.0	3.1	2.8	3.9
Trabajo	42.8	36.9	1.8	23.3	2.3	1.4	4.0	3.9
Pacifico	47.5	313.7	18.6	25.0	4.7	11.1	3.4	4.0
Nacional	95.6	178.1	3.7	16.8	5.8	7.2	3.4	4.6
Edwards	198.9	111.5	52.6	8.7	8.9	4.9	6.7	3.5
BICE	268.4	164.3	22.5	22.3	12.0	5.7	5.8	8.2
Estado	45.9	79.2	4.9	21.7	4.1	1.9	3.3	24

Source: SIBF, Informacion Financiera, Various Issues.
(a) It refers to the rate of change from December to December measured in nominal terms.

On the liabilities side of the banks balance sheet we see that deposits became the principal source of funds of the rapid growth of bank credit. This is the result of the financial liberalisation reforms to increase the financial deepening and widening of the financial system. The data on the banks' liability growth rate and the deposit/liabilities ratio from tables 11 and 12 provide support to this assertion. The evidence does not suggest very large differences in the monthly annual average growth rate of liabilities among the two groups in the table, although the case of exception again correspond to Banco del Estado. One point is worth mention from the data for 1983. We observe that the growth of liabilities in the two big groups experienced some fall unlike Banco del Estado which exhibited a significant rise in their liabilities by 24%. This can be interpreted as a run to safety, although not in a massive shift reflecting a widespread panic.

By examining the liabilities/capital ratio of individual banks in table 10, we observe no significant differences in their leverage although it was almost doubled as compared with the 1978 average ratio for the financial system which was estimated at 8.1%. The two opposite exceptions correspond to Banco Chile and Banco del Estado. The former bank presents a leverage ratio of 20.5% and 24% in 1982 and 1983 while the latter bank shows a leverage ratio of around 7% for 1981 to 1983.

Table 3.12 Financial Indicator of Vulnerability: Liability Quality.(%)

	(a) Deposits/Liabilities				(b) Lbts FC/Lbts			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	8.2	16.2	14.0	--	34.1	31.7	58.1	--
Hipotecario Chile	33.1	36.4	27.7	--	28.5	26.7	42.0	--
Chile	37.6	39.7	36.6	18.9	38.4	47.1	55.1	50.3
Concepcion	49.2	46.3	48.9	26.3	22.5	28.8	38.5	33.7
Internacional	47.0	61.4	63.9	32.9	21.5	18.4	22.8	23.6
Santiago	45.3	41.4	36.6	14.0	26.2	37.5	46.5	41.2
Hipotecario Fto.	29.4	32.1	22.8	14.3	9.6	14.0	23.3	25.5
Ciga	90.6	87.0	91.6	--	--	--	--	--
O'Higgins	42.1	44.5	40.2	27.7	31.2	37.3	46.6	46.3
Continental	38.7	39.5	46.5	24.6	25.3	30.0	40.0	35.9
Sudamericano	40.9	39.3	30.8	22.4	32.4	39.9	52.0	51.3
Credito	41.0	49.4	49.7	37.5	26.7	31.2	36.9	33.9
Trabajo	47.1	45.6	52.3	35.0	30.9	39.1	40.9	37.5
Pacifico	65.2	59.5	64.9	50.8	9.5	12.0	20.9	20.6
Nacional	54.1	51.3	53.8	42.7	18.3	19.1	29.9	33.7
Edwards	52.1	49.5	45.7	35.7	25.1	35.8	43.9	40.9
BICE	24.4	31.6	32.7	23.5	31.8	43.0	52.5	46.8
Estado	75.3	76.0	63.5	87.7	13.8	12.0	19.6	48.3

Source: SIBF, Informacion Financiera, Various Issues.

(a) Liabilities are defined as total deposits, foreign and domestic loans, contingent and mortgage liabilities
(b) Liabilities in foreign currency (Lbts FC) correspond to total deposits in foreign currency and loans obtain abroad.

One interesting and worrying observation can be established from the estimates of table 12. It appears to be a large change in the composition of the banks' liabilities as the restriction on foreign credits were phased out gradually from 1978 onwards. For instance, Banco Chile and Banco Santiago show a growing share of liabilities in foreign currency relative to domestic currency. By 1982 and 1983 the former had more than 50% of its liabilities denominated in foreign currency. Among the banks in the second group, Banco Sudamericano had shown a systematic rise in foreign indebtness with a Lbts FC/Lbts ratio of 52% and 51.3 for the years 1982 and 1983 respectively.

As a whole, the evidence does not suggest that the vulnerability comes from the liabilities side of the banks balance sheet nor support the view that the differences among the three groups in the liabilities composition may be regarded as important. As a matter of fact, BICE exhibited higher liability ratios than the intervened banks. Moreover, the evidence from chapter 6 supports this conclusion and also finds that any difference in foreign indebtness between sound banks and problem/failed banks is statistically insignificant and thus an unreliable early warning variable.

It is clear from the evidence that all those institutions which exhibited spectacular growth rates in their loan portfolios were later intervened and/or forced to sell bad credits to the Central Bank. Furthermore, the higher were the growth rate of loans, then the higher the ratios measuring the deterioration in asset qualities, in particular the loans sold/ capital. In contrast, Banco Industrial y de Comercio Exterior (BICE) and Banco del Estado which clearly grew at a relatively lower rate and exhibited better performance in terms of the other financial indicators remained healthy. On this issue, their relatively superior profitability, in particular towards 1982 and 1983 enabled these two banks to build up higher provision. This is particularly relevant in the case of Banco del Estado.

Finally, table 13 present a simple estimation of the banks of the net capital ratios (NCR). The most important component of the NCR is the nonperforming loans which is substracted from bank's capital and reserves. As reported in chapter 5, banks that failed in recent years in the US almost invariably had low or even negative NCR months before the failure. According to the evidence for Chile, those institutions which were intervened clearly exhibited a negative or extremely low positive NCR. The ratio indicate a fall in the ratio from 1981 onwards in particular in the cases of Banco Chile, Banco Internacional, Banco O'Higgins and Banco Continental.

Table 3.13 Banks Net Capital Ratio.

	Net Capital/Assets				Net Capital/Liability			
Institutions	80	81	82	83	80	81	82	83
Unido de Fomento	-19.1	2.5	0.4	--	-19.7	2.3	0.4	--
Hipotecario Chile	4.7	4.1	2.0	--	4.8	3.9	1.8	--
Chile	7.5	5.3	1.9	-3.8	7.6	5.4	1.7	-3.2
Concepcion	3.8	4.6	4.2	-5.3	3.8	4.3	3.6	-3.8
Internacional	7.0	5.9	3.0	-0.5	7.1	5.7	2.6	-0.4
Santiago	5.3	6.0	7.2	-17.2	5.5	5.9	6.8	-13
Hipotecario Fto.	4.3	4.7	3.5	1.2	4.2	4.6	3.4	1.1
Ciga	11.9	9.5	6.2	--	12.9	9.2	5.6	--
O'Higgins	7.2	6.1	5.2	-0.5	7.4	5.9	4.7	1.5
Continental	7.3	6.3	1.2	-6.5	7.6	6.1	1.2	-5.2
Sudamericano	11.1	4.9	4.1	3.4	11.0	4.7	3.6	2.4
Credito	5.7	4.7	2.9	3.4	5.7	4.5	2.5	2.6
Trabajo	4.8	4.7	4.2	4.9	4.8	4.4	3.4	3.5
Pacifico	12.2	8.9	5.2	6.2	12.1	8.8	4.8	5.2
Nacional	13.4	8.9	5.0	5.5	14.0	8.9	4.6	3.9
Edwards	6.3	5.7	3.9	1.6	6.4	5.5	3.6	1.2
BICE	9.3	7.9	6.4	3.6	9.7	8.1	6.1	2.7
Estado	8.4	10.3	9.0	7.7	9.0	10.5	9.3	8.8

Source: SIBF, Informacion Financiera, Various Issues.

The data produced from the banks' balance sheet and income statement not only had permitted to see the move from a boom to a bust of the whole financial system but also enabled us to assess and identify those banks in difficulties which later on were intervened and/or required the support from the banking authorities. At the same time, these results are serving as a useful agenda of research to establish statistical differences between healthy and unhealthy banks for classification purposes and the estimation of an early warning function. This will allow us to draw inferences on the likelihood of failure from external and internal factors affecting the banks odds. These issues will be part of chapters 6,7,8, and 9.

(3.3) The Rehabilitation of the Banking System: A Quick Glimpse on the Treatment and its Results.

The intervention and the rehabilitation of the banking system became a pressing need for two different but equally important reasons. Firstly, the intervention of the banking authorities avoided the total disruption of the intermediation and payment mechanisms from the contagious lack of confidence and prevented a further deepening of the economic recession. Secondly, the measures taken to rehabilitate the banking system not only can be seen as a short run strategy but also as an aid to reactivate the economy in a longer run perspective.

The rehabilitation of some of the banks started at the end of 1981 and the beginning of 1982. That is right at the beginning of the banking crisis. However, in spite of this, it seems to me that the extent of the crisis was overlooked and even perhaps considered as a transitory phenomenon. Moreover, just as goverment officials were a firm believers in an automatic adjustment for any macroeconomic disequilibrium, so they were at the microeconomic level in the case of a bankruptcy.[5]

At first, the Superintendency of Banks and Financial Institutions (SIBF) responded by introducing more flexibility in the accounting procedures applied by those banks with problems, in particular with the losses which started to emerge from nonperforming loans. Among the most important changes in the banking accounting procedures were the recognition of losses, the instruction guiding the provision for risky loans and losses, the purchase of nonperforming loans, and the limits on banks leverage. Also, this approach included the payment of interest on bank reserve requirements.

The SIBF (1982,1983) reported that banks were authorised to consider as outstanding all those loans that had been in arrears for 90 days rather than 30 days. Consequently with the previous measure, the SIBF also extended the time available to make provisions to cover potential losses from their loans portfolio. For instance, the time limit to build up the global provision was extended from 36 to 60 months.

By the same token, banks were instructed to make individual provision depending on the risk classification of bank loans.[6] At the same time , the rules governing the composition of provisions also demanded additional coverage in the case of nonperforming loans. For instance, for all those loans covered partially by collateral and entered as nonperforming, full provision was required at the end of each year of an amount equal to the uncovered portion of the loan. This percentage was reduced to only half for all those nonperforming loans recognised during the second semester of each year. Initially, this provisions had to be made within the year. But later on, the more flexible and gradual approach in the constitution of provisions meant the extension of this prudent time to 2 years.

Moreover, it was stated that the period to write off a bad loan against profits or provision, which originally was set at 13 months after becoming outstanding, was extended to 18 months. For those credits with collateral, the time was increased from 24 to 36 months.

In 1982 the Central Bank introduced an accounting procedure contained in the directive 1.450 which allowed banks to sell nonperforming loans in return for a Central Bank note (letra de cambio) and with a repurchase agreement with 10 years' limit and a minimum of 5% repurchase of sold loans hold by the Central Bank in each semester. The repurchase of nonperforming and risky loans was carried out with the bank's financial surpluses. This mechanism did not involve Central Bank resources as compared with its twin directive 1.555 enacted in 1984 but just to deferred banks' losses. The mechanism adopted in 1982 also included the relaxation on the banks leverage which before it was set with a maximum debt to capital ratio of 20.

As whole the mechanism adopted in 1982 was basically giving a greater flexibility in order to defer any bank losses and as such it did not involve any significant transfer of financial resources from the Central Bank to the banking system. At the same time, it did not tackle the root of the problem which, as will be argued and evaluated empirically, revolved around the excessive laxity in the banks' management, in particular on those decisions concerning risk taking and credit allocation. Instead, the mechanism came to relax even further the accounting regulation and hence the recognition of nonperforming loans. I would agree with the assertion of Barandiaran (1983). He maintained that by mid-1981 firms' and banks' problems were still of a magnitude that a wave of liquidation would have been feasible. Moreover, the empirical evidence from chapter 6 not only supports this assertion but also shows that the banking difficulties were predictable with three years in advance, that is as early as 1980.

These accounting flexibilities were phased out during 1984 and 1985 soon after the positive effect of a more direct package of measures were having its impact in the rehabilitation of the banking system. By mid-1982 the self-correcting mechanism introducing more flexibilty was not any more a viable solution as the magnitude of both the banking crisis and the economic recession was getting worse. At that time, a macroeconomic initiative and the rehabilitation of the banking sector was called for in order to set the condition to activate the economy and reinitiate the economic growth.

More radical steps were needed to rehabilitate and strenghten the banking system. The increasing volume of nonperforming loans endangered a large number of institutions with insolvency which, as we have seen previously, accounted for a large proportion of the intermediation and also included the two largest banks of the system.

There were two mechanisms to rehabilitate the banking system in 1983: a indirect one which contained an aid package of different debt relief measures to banks' debtors, and a direct mechanism which comprised both the purchase of nonperforming loans by the Central Bank, and a mechanism of recapitalisation of those banks intervened in January 1983.

One of the first initiative taken by the SIBF was the intervention of 6 major banks in January 1983, including the two largest entities. The main objective of this approach apart from rescuing the system from a major collapse was to replace the management before any other palliative actions were introduced.

This was followed by the indirect mechanism which comprised measures of debt relief included a preferential exchange rate to reduce the increasing costs on foreign currency borrowers after the devaluation of the peso in June 1982. This subsidy which initially was paid in cash and later on paid with negotiable interest bearing bonds came as valuable relief to the borrowers solvency and profitability, although at a cost to the Central Bank as we will see at the end of this section.[7]

Debtors in domestic currency also had access to some financial relief as they were able to reschedule the maturity and the cost of their debts. As we have seen in chapter 2 , although interest rates were gradually converging to lower values after deregulation, lending rates were still significantly high and loans were mainly on a short-term basis. With regards to the cost of borrowing, the Central Bank extended funds to banks in order to cover the difference between the market-prevailing lending rate and the 7% real lending rate set as a maximum by the monetary authority in June 1983. In addition, maturities were extended to 10 years and included a 5 years and 1 year grace on the principal and the interest. Later in June 1984, the reference lending rate was reduced to 5% for the same year and 1984, 6% from 1985 to 1988, and 7% for thereafter. At the same time, the maturities could not exceed 15 years and fall below a minimum maturity of 5 years.[8]

According to the report of SIBF (1984), they estimated that 35% of total loans in the system were covered by some form of reprogramming of the original terms of repayment and with Central Bank resources accounting more than $470.000 millions which was equivalent to U$ 7.8 billion at a exchange rate of $60 per US dollar.[9]

The effects of the debt relief mechanism was expected to be reflected in the improvement in the debtor financial obligations, in particular lower financial costs and longer maturities to settle their debts. As a result, it was expected that banks' balance sheet would show an improvement in the quality of their loan portfolios and thus lower provision requirements. Equally, bank profitability was also expected to show some improvement as a result of the payment corresponding to the differential between the rate of interest of the Central Bank promissory notes (pagares) and the corresponding obligation of the debtor.[10]

However, the magnitude of the banking crisis was becoming deeper and more widely spread in particular with respect to the quality of banks' assets so that any bank rehabilitation using their own means was unthinkable. A direct mechanism was required to enhance the solvency, liquidity, and profitability of non-intervined banks.

In December 1983 the Ministry of Finance (Hacienda) announced a mechanism to improve the asset position of the banks by substituting the bad quality assets with Central

Bank resources (cash and assets). This recognised the fact that the decapitalisation of the banking system was underlay on the significant deterioration of the banks loan portfolios. At the same time, there was an implicit recognition that a prompt and durable rehabilitation of the banking system was a necessary condition for sustainable recovery of the economy as a whole.[11]

In order to recapitalise the problem banks, the authorities permitted non-intervened but vulnerable banks to sell nonperforming loans to the Central Bank according to the directive 1.555. This enabled non-intervened banks to sell bad credits at face value up to 1.5 time their capital and reserves. This percentage was raised to 2.5 for those banks which required to increase their capital. In return the Central Bank paid 60% in cash and the rest by means of a noninterest-bearing Central Bank note (letra) which is adjusted according to inflation.

In order to reduce the impact on the monetary growth, banks were instructed to use the cash proceeds to repay the outstanding emergency loans made by the Central Bank and the purchase promissory notes (pagares) which carried a 7% real return and 4 years` maturity. Although this represented an important financial support, the agreement contained a clause which forced banks to repurchase their nonperforming loans using any financial surplus. This meant that shareholders had to retain their dividends in order to pay for their obligations with the Central Bank. The price to buy back the nonperforming loans was adjusted in line with inflation and carried an additional 5% surcharge.[12]

For those banks which were intervened in January 1983, the mechanism introduced by the agreement 1.555 did not allow them the sale of nonperforming loans and even if they could, it was clearly insufficient to restore their normal functioning. In fact as we have seen in the previous section, the amount of risky and nonperforming loans exceeded several times their capital.

Initially, the law 18.401 passed in February 1985 allowed the SIBF to enforce among intervened banks a rise in their capital base to make them financially viable. The new stock should be offered to the existing shareholders and after a short time to the public in general, including the government. As reported by Velasco (1988) and Larrain (1989), a government development agency (CORFO) could buy any stock left over although with some restrictions. They should not hold these equities for more than 5 years and should not exceed 49% of the intervened bank's capital. In order to make this recapitalisation option attractive in particular to small investors, the government offered an attractive package of incentives such as credit facilities and subsidies.[13]

According to Feller (1987), the mechanism for rehabilitation based in the agreement 1.555 was the pillar in the government's strategy. The debate as to whether or not the programme was merely a cosmetic accounting trick which provided generous subsidies has to be settled according to the empirical evidence. Although this issue is not part of the agenda of the study, some evidence will corroborate the magnitude of the crisis by looking at the numbers involved in the rescue and the effect from the rescue.

Chamorro (1985b) and the SIBF (1984) reported that 20 financial institutions, among them 12 commercial banks, 3 foreign banks, and 5 non-bank financial institution, subscribed to the agreement 1.555. The amount of risky loans net of provisions was 156% of capital and reserves and the banks' losses reached 6.6% of capital at the end of December 1983. By June of 1984, the ratio of risky loans to capital and reserves felt from 156% to only 50%.

Table 14 taken from Chamorro's paper shows the effect of the Central Bank directive number 1.555 on non-intervened but vulnerable bank. There are some interesting results which is worth mentioned.

Table 3.14 Income Statement from the Non-Intervened Institutions.

	(a) 1983	April 1984 to 1985
1 Operating Surplus	34.578	54.013
2 Adm. Expenses	28.784	28.721
3 Operating Margin(1-2)	5.795	25.293
4 Other Net Income	6.198	9.971
5 Monetary Correction	4.236	7.789
6 Surplus before provision(3+4+5)	16.200	43.084
7 Provisions & Reduction	19.339	19.800
- Loans Provision	13.174	10.568
- Other Provision	3.117	4.805
- Reductions from Bad Loans	2.625	1.779
- Reduction from Bad Investment	33	1.322
- Other Reductions	390	1.325
8 Surplus (6-7)	-3.140	23.251
9 Surplus Allocation	1.054	21.497
- Paying Losses	--	1.490
- Making Provisions	--	16.198
- Repurchase of Risky Loans	1.054	3.089
10 Net Profits (8-9-10-11)	-4.194	1.754

Source: Chamorro (1985b).

(a) Expressed in millions of pesos at July 1985.

Firstly, there is a marked increase in the operating surplus and given that administrative expenses remain constant, is reflected directly in the operating margin. This can be explained by the positive effect derived from the replacement of nonperforming and risky assets (loans) which were generating no income, by government's documents which were producing a return of 7% in real terms. At the same time, the quality of the banks' loan portfolio improved as a result of both the debt relief scheme and the improvement in economic activity.

Secondly, the sale of risky and nonperforming loans resulted in a reduction in the required provision. The agreement 1.555 enabled these entities to dispose from the asset side of their balance sheet risky and nonperforming credit and thus contribute to a reduction in risk and provisions.

Thirdly, the financial surplus was allocated to the absorption of accumulated losses and the purchase of loans from the Central Bank.

With respect to the intervened banks, although the agreement 1.555 restrained them from selling loans to the Central Bank at least before their recapitalisation, it was soon modified by the agreement 1.632. They could sell risky and nonperforming assets under the authority of the SIBF.

The situation of the two largest commercial banks intervened was quite dramatic as we have seen in the previous section. During 1983 the Bank of Chile and Bank of Santiago had a risky loan portfolio of 14.5% and 30.7% of their loan portfolios respectively. These values with respect to capital were even more dramatic. By December 1984 the ratio of risky loans to capital for Banco Chile and Banco Santiago reached 633% and 513% respectively. Moreover, these losses of each bank represented more than 150% and 145% of the bank's capital respectively. By April 1985 they were authorised to sell loans to the Central Bank.[14]

The effects of the rehabilitation programme were felt almost immediately as the ratio of risky loans to capital felt to 160% for Banco de Chile and 117% for Banco de Santiago. In addition, it is reported that in July these two entities generated financial surpluses equivalent to 17% and 113% of capital respectively. It is clear that the effect of selling risky loans to the Central Bank and the recapitalisation showed some positive result in terms of improvement in capital as well as profitability. Perhaps the most important evidence of success was the return to the private sector of the 5 intervened banks during 1986. They were fully recapitalised and sold to the public, including Banco de Chile and Banco de Santiago, the two largest financial institutions. The objective behind the banks' obligation to repurchase those loans in the Central Bank portfolio was to impose a discipline by forcing banks to accept a liability.

As a whole one would agree that the effect of the indirect and direct measures adopted by the authorities to rehabilitate the banking system were aimed at raising the banks' net worth and their solvency condition. The replacement of unproductive assets for government paper and the debt relief measures improved the banks' income which combined with the retention of dividends and the recapitalisation improved the banks' net worth. In this respect one would argue that the Chilean banking crisis was managed very successfully by the SIBF and the Central Bank. The overall result from the rescue package was helped by a significant improvement in the the overall economic activity as GDP grew by 6.3%, 2.7%, and 5.7% between 1984 to 1986 respectively. At the same time, the international scenario in terms of world interest rates, and economic growth was becoming more favourable. These views are also shared by Larrain (1989).

Although the evidence has shown some encouraging signs on the rehabilitation of the banking system after the rescue programmes we should not stop short from asking how much did the intervention cost and whether the authorities are at fault for not being able to detect banks' problems at an early stage and thus prevent the crisis from happening. If the answer to the second part of the question is affirmative then an early reaction would have reduced significantly the cost and perhaps even the need of a massive rehabilitation programme. As we will see in chapter 6 the empirical evidence point in that direction.

Table 15 will give some idea of the cost of the rehabilitation programme. As we have seen the direct and indirect mechanism involved a large amount of Central Bank resources.

Table 3.15 Operation of Central Bank and other Indicators.(%)

	1982	1983	1984	1985
Net Domestic Credit	94.4	433.4	174.3	199.6
Credit Private Sector	-0.4	21.2	-0.9	0.4
Credit Financial Entities	167.0	375.8	-30.4	18.6
Other Assets	26.7	75.9	62.8	239.6
Liabilities to Private Sector	-6.4	105.2	27.5	89.7
Currency	-1.6	18.0	10.6	10.9
Others (a)	-4.9	87.2	17.0	78.8
Inflation Rate (b)	20.7	23.1	23.0	26.4

Source: Banco Central de Chile

(a) Include medium term notes issued by the Central Bank to finance the subsidies in the preferencial exchange rate.
(b) Measured by the consumer price index. (CPI)

The evidence from the table indicates that net domestic credit increased very rapidly between 1983 to 1985. This coincided with the beginning of the mechanism whereby the Central Bank bought nonperforming and risky loans from problem banks. At the same time, the government was granting subsidies as part of the debt relief scheme, including the preferential exchange rate. For instance, net credit to financial intermediaries in 1983 increased by nearly 376% as part of the programme of purchasing loans. At the same time, the item "other assets" which reflects the losses arising from preferential exchange rate and the subsidies on debt restructuring rose by nearly 76% and by 1985 it became the main factor in the rise of domestic credit by almost 200%.

Although the evidence does show a rapid and significant growth of Central Bank credit to the banking system, its impact on the monetary aggregates appears to be somewhat lower than expected. The data show that most of the credit increases was financed by Central Bank paper and hence limiting the liquidity effect from subsidies. The liabilities to the private sector increased by nearly 90% in 1985 which is much lower than the figure of 1983. Further evidence is provided in table 16 which includes the rate of growth financial assets holding by the private sector.

The data shows that the money growth was moderate over these 4 years. If we deflate theses figures by the rate of inflation they become negative. Thue the impact of the Central Bank credit facilities on money growth has been moderated by the massive issue of Central Bank paper, in particular Central Bank notes and treasury notes which is quite significant in 1983 and 1985.

Table 3.16 Holding of Financial Assets. (a)

	1982	1983	1984	1985
Money	7.3	27.7	12.0	11.3
Other Assets	14.9	20.2	33.8	58.2
Quasi-Money (b)	11.1	1.3	36.4	48.9
Central Bank Notes	38.5	424.0	32.5	144.5
Treasury Notes	--	263.8	-0.4	22.7

Source: Banco Central de Chile.

(a) These percentual changes are expressed in nominal terms.
(b) Includes time and savings deposits, mortgage bonds, and foreign currency deposits.

Equally, the data on the inflation rate do not show an explosive growth. It never exceeded 27% during the second half of the 1980's. In fact, the peak occurs in 1985 with a a rate just above 26%. However, this is not a comforting thought if the fight against inflation to reach a one digit figure in 1982 required nearly 10 years and two severe recessions. But above all, the progress made was suddenly thrown over board in order to rehabilitate the banking system and the economy as a whole.

It seem reasonable to conclude with two assertions: Firstly, the impact of the rehabiliation programme had spread the impact of the banking crisis over time in particular the costs of such intervention. Above all, the rescue operation mounted by the authorities left a precedent which will last for a very long time and it will pose a formidable obstacle to the establishment of a free banking system.

Secondly, fluctuations in exchange rates, interest rates, and the overall recovery of the economy made the costs and the fortunes of the banking system very uncertain. If these variables would have turned against them then it would have created strong pressures for further reprogrammings, and concessions.

Although in retrospect the evidence had shown that the overall economic condition did move in the desirable direction and banks became profitable, efficient, and stable, the issues relating to what caused the banking crisis and whether it was possible to recognise it in an early stage and prevent it from happening still is a highly inconclusive issue and lacking of any empirical verification. The answer to these queries will be the la "raison d' etre" of this study.

In the next chapter, a review of the theories of bank failure and banking instability will be provided to identified some testable hypothesis for the bank failures in Chile.

Endnotes.

(1) By the end of 1976, the banking authorities decided to introduce and increase the capital requirement by 7 times and introduce supervision. This marked the end of the episode with free banking in Chile.

(2) The authorities introduced restrictions on the SINAP asset composition as well as restricting assets below one year maturity. The first restriction was responding to the mismatching between assets and liabilities during the collapse of the construction industry in the recession of 1975. The second measure however, made things worse and set the fortunes of the SINAP.

(3) At this time as we have seen in chapter 2 the monetary authorities were gradually liberalising the economy to capital inflows.

(4) This does not mean that banks were passive victims of the adverse general economic climate but merely a symptomatic description of crisis.

(5) According to Velasco (1988), the government's early reaction to the mounting macroeconomic disequilibrium, quite evident in the last quater of 1981 and throughout 1982 was resting on the belief of an automatic adjustment. High real interest rates will reduce demand pressures on both tradables and non-tradables, the overvalued real exchange rate will be transitory and the accumulated trade deficit will be corrected via a monetary approach.

(6) The global provision consists of 0.75% of total loans. The individual risk classification of bank loans carries different provision requirements. For instance A and B plus carries no provision. In contrast, B minus , C, and D carries 20%, 40% and 100% provision respectively. Nonperforming credits not cover by any collateral partially or totally require 100% provision.

(7) The subsidy was equal to the difference between the higher official exchange rate prevailing at the moment of the debt repayment and the level of the preferencial exchange rate.

(8) These measures were available to small borrowers in domestic and foreign currency as well as productive borrowers. Larger debtors were subject to additional restrictions concerning the use of company profits. A productive borrower is defined as a debtor other than consumption and mortgage debtor, and a debtor involved in foreign trade. For a more detail see SIBF (1983).

(9) This estimate include the data for 1983 and 1984 as well as a projection for the next 3 years.

(10) It was argued that the steps taken to reprogramme debts have been important in alleviate the debtors distress and indirectly to smooth out the effect of the banking crisis. However, it was also argued that the speed of the reactivation of the economy was going to be equally important. Therefore, the Central Bank introduced different credit lines during the second semester of 1983 among them we include subsidised credit on working capital, hiring labour, housing and infrastructure, reforestry, and for refinancing of wages and salaries. See SIBF 1983.

(11) The existence of a stable, solvent, and efficient banking system should affect directly the confidence of the public, and thus the magnitude of the financial saving both internal and external for productive investment.

(12) There were two exceptions to this obligation. Firstly, unless there were no financial surplus, the obligation continued until all loans were acquired back. Secondly, unless the bank has boosted its capital base. Thus, all preferential shares were exempted from the repurchase obligations.

(13) As part of an incentive mechanism applicable to shares of effectively bankrupt banks, investors were allowed to pay only 5% as a down payment and the outstanding sum in a period which will not exceed 15 years. Also, there was a 5% surcharge in real terms and fiscal exemptions such us tax free for dividends and a tax credit equivalent to 20% of the values of the shares purchased.

(14) According to Chamorro (1985b), Banco Chile sold a total of $ 127.000 millions and in return he received $ 32.000 millions in promissory notes of the Central bank and repaid $ 42.700 millions in emergency loans. Banco Santiago sold $ 95.000 millions and in return he recieved $ 24.000 millions in promissory notes and he repaid $ 33.200 millions in emergency loans.

Chapter 4. The Theory of Bank Failures and Banking Instability: A Review of the Literature.

(4.1) Introduction.

The previous chapter provided an evaluation of the dismal performance of the Chilean banking system, particularly between 1982-83. By 1983 a large majority of commercial banks technically failed or were considered as problem banks. Its intervention meant that an important amount of public money was used to avert a complete financial collapse, as well as growing doubts on the effect of financial liberalisation in LDC's.

In this chapter, I will review the literature on banking instability and bank failures in order to cast light on the hypotheses which could explain what caused the increasing number of bank failures. It will be argued that any theory which could explain banking instability should also provide a reason for the existence of financial intermediaries (banks).

Two general testable hypotheses will be derived by reviewing the theories on banking instability and bank failures. On the one hand, external factors to the banks such as the general economic environment could affect the likelihood of bank failures. On the other hand, equally important is the banks' response to changes in the industry shaped by financial liberalisation reforms.

Most of the literature on banking instability and bank failures has been developed as part of the study of the Great Depression of the early 1930's and its aftermath on the US banking system. In consequence, many of the references will involve different features of the US banking system.

(4.2) **The Issue of Existence of Financial Intermediaries.**

It could be argued from a positivist point of view that if a theory of bank failure and instability is to explain this phenomena as well as to derive some normative propositions regarding the policy implications, the models involved must explain why financial intermediaries exist in the first place.

Lewis (1994) shows that a financial intermediary acts actively as a third party in the process of lending and borrowing as well as undertaking the purchase and sale of financial securities. Moreover, financial intermediaries exhibit as characteristics a high financial assets/real assets ratio and a high gear ratio (liabilities/capital ratio). This is particularly true in the case of a mutual fund and deposit-taking institutions (banks) as they hold claims on the borrower and issue claims to the lender (portfolio transformation) as opposed to the simple case of a broker which merely facilitates transactions between the two parties and does not hold and issue claims. Thus, financial intermediation needs to be justified and proven to be a superior mutually beneficial voluntary arrangement between the parties compared to the voluntary unintermediated market alternative. In other words, any explanation on the existence of financial intermediaries needs first to show why it is not possible for lenders and borrowers to mutually benefit from a direct contract between them and why a financial intermediary, particularly a deposit-taking institution (bank), can indeed resolve this problem.[1]

According to Dowd (1992) one of the reasons behind the need to establish the existence question as a first step is to leave out those theories of bank instability which predict that there should be no intermediaries in the first place. It could be argued that in an ideal and perfectly competitive financial market with full and symmetrical information, no transaction costs, divisible capital, and complete spot and future markets there is no need for a financial intermediary.[2] Indeed, Benston and Smith (1976) stated that in a frictionless economy, with no transaction costs, information costs, and indivisibilities, financial intermediaries would not exist. Even if a bank is introduced into this economy, Fama (1980) expects this financial institution to act as another trader or equity-financed mutual fund and perform as the economy's accountant. That is, to register the changes in both liabilities and assets after a transaction has taken place in the economy.

In order to justify the presence of a financial intermediary and avoid relying on an ad hoc approach which treats the existence of banks as given, we have to depart from the ideal and perfect economy and to accept the inherent imperfections which exist in the economy. In a less than an ideal world, surplus units (lenders) will need to search for potential borrowers, verified borrowers' credentials and project proposal, introduced optimal financial contracts, and to monitor and enforce borrowers' efforts and willingness to comply with their financial obligations. The existence of asymmetrical information among market transactors and hence high search, verification, monitoring, and enforcement costs should lead to significant adverse selection and moral hazard problems. Left to their own devices, lenders and borrowers will fail to undertake mutually beneficial exchanges which can be considered a Pareto superior state.

Moreover, the existence of uncertainty as a result of incomplete information about future outcomes will also explain the existence of financial intermediaries. For instance, the need for liquidity in the case of an unexpected shock in consumption on risk-averse depositors should also be considered.

Therefore, as Lewis (1992) had clearly pointed out the existence of financial intermediaries emerge as an endogenous response to these market imperfections by providing information as well as liquidity insurance.

(4.3) Financial Intermediaries as Information Producers and Liquidity Insurers.

Before we look at these two strands of the new theory of financial intermediation, some reference should be made on the transaction approach to financial institutions. Benston and Smith (1976) maintained that the raison d` etre for a financial institution is the existence of transaction costs. Their model suggests that these institutions should possess some scale economies in dealing with transaction costs. However, this theory on the existence of financial institutions is incomplete as it fails to explain the sources from which the cost-advantage of financial institutions arise.

(4.3.1) Banks as Information Producers.

One strand of the new literature views banks as producers of information. Information asymmetries between lenders and borrowers combined with a high information cost and the public good nature of information production are intrinsic features in any organised financial market, and hence the raison d` etre for the existence of financial intermediaries (e.g. bank).

Stiglitz (1991) maintained that while the existence of an organised financial market enable both a voluntary agglomeration and transfer of financial resources, it would also contribute to an appropiate allocation and management of those resources. Specifically, in a process of capital accumulation those firms who are in the best position to invest in large scale projects would normally lack sufficient resources of their own while the availability of capital (savings) from a single surplus unit would fall short of the firm's investment requirement. However, in atomistic economy with several competing investment projects and management teams the agglomeration and transfer will also need to be complemented with the screening and monitoring of the best alternatives.

In this type of contingent market where money today is exchanged for a promised return in the future, an entrepreneur raising capital (borrower) has more information than the provider of capital (lender). This information asymmetry is manifested in two ways: Firstly, the borrower knows better the probability of loss from its investment project (i.e ex ante asymmetrical information).

Secondly, once the investment project has been selected the provider of capital will be unable to assess the entrepreneur's quantity and quality of its effort and resources put into the project (i.e ex post asymmetrical information)

Therefore, the screening and monitoring activities which may involve significant evaluation and monitoring costs will be necessary to distinguish between good and bad projects (borrowers). Financial intermediaries will exist as a result of the need to monitor individual lender.

The reliance on equity financing is very limited as a result of information imperfections, particularly informational asymmetries. In the absence of any signalling activity, entrepreneurs and existing shareholders have more information than outsiders. Greenwald,Stiglitz,& Weiss(1984) and Myers and Majluf (1984) have shown that under ex ante asymmetrical information and a large number of informationally indistinguishable projects (firms) the market interprets equity issues as an adverse signal about the firm's market value. This may deter any issue of equities to raise resources to finance what could be a profitable project.[3]

Moreover, imperfect information and the nature of the contractual relationship between the provider of capital (lender) and the user of capital (borrower) also introduces incentive effects which will further discourage equity financing. To begin with, an equity contract introduces an enforcement problem as the fraction of profits paid to a shareholder is under the manager's discretion. Moreover, the return from any managerial effort is shared with shareholders so that it dilutes the manager's incentive to maximise shareholders' return. At the same time, there is an increasing scope for the diversion of the firm's resources towards the manager's own uses.[4] The nature of the equity contract and the presence of asymetrical information produces a conflicting interest between the supplier and user of capital. This explains both why managers act with considerable autonomy and the lack of market discipline from take-over bids, shareholder voting, and other schemes.[5]

Despite the existence of some advantages in rising capital by means of equity issue, particularly the possibility of a better risk-sharing between the provider and the user of capital, and the existence of no fixed committment to repaying the funds, information limitations undermine its use.

The reliance on bank debt to rise capital suggests that banks may have advantages over equity financing in dealing with selection and control functions (i.e screening and monitoring) under the assumption of information asymmetries. For instance, Leland and Pyle (1977) argue that if economies of scale are available then a gathering information organisation could sell information about particular classes of assets so long as it could internalise the return from information which by its nature is a public good. Specifically, a financial intermediary which buys assets from the entrepreneur on the basis of specialised information will internalise the benefit in terms of increased value of his portfolio.

While the Leland and Pyle's model addresses the problem of ex ante information asymmetries, Diamond (1984) deals with ex post asymmetrical information. He developed a model where a risk-neutral lender cannot observe the realisable value (Y) of an indivisible investment project whose output is a random variable ($\bar{Y}$) bounded between {0,Y<Φ}. Both the lender and the borrower agree about the distribution and boundries of $\bar{Y}$. In consequence, the lender has to monitor the borrower by spending C>0 (physical cost of monitoring) to make Y observable. If individual lenders monitor every borrower (m>1), the total cost (m*Cm) will be significantly large and increasing with respect to m. Moreover, monitoring cost is even larger than expected deadweight non-pecunary penalty of E[Φ($\bar{Y}$)] introduced in the entrepreneur's contract with no monitoring. At the same time, even if the information from monitoring can be obtained at a low cost, there will be free-riding problem as a result of the from the public nature of information.

Diamond (1984) has shown that an intermediary can monitor on behalf of lenders if C+D < min[EΦ($\bar{Y}$),(m*C)] where D is the expected cost of providing incentive to the monitor. In other words, if the sum of the physical cost of monitoring plus the cost of incentive is less than the cost of monitoring with no delegation. There still remains an incentive problem as the payment recieved by the intermediary is not observed by the depositor. It is shown that there is a minimum cost contract which provides incentives to the intermediary for a minimum payment equal to the rate of interest r or a total payment (m*r). This will force the intermediary to effectively monitor $\bar{Y}$.[6]

Given the high deadweight cost $\Phi(Zn)$ plus the total monitoring cost (C+D), it is not viable for the intermediary to contract with a single entrepreneur. Diamond proved that if the entrepreneurs' projects have both bounded returns and are distributed independently then as the number of entrepreneurs tend to infinity $n \to \infty$ then $D \to 0$. Thus, portfolio diversification by firms and markets makes delegation cost very small.

In consequence, the models by Leland and Pyle (1977), and Diamond (1984) have demostrated that an efficient way to reduce the cost of monitoring borrowers is to form a coalition of lenders (i.e. financial intermediary). In this context, it is implicitly assumed that a bank should have information advantages over other forms of financial intermediaries given its long-term financial relationship with the clients. However, it is argued that the banks' definite advantage lies on the fact that they are able to obtain additional information due to their role as their customers' bookeeper. Once the loan has been made the transaction account becomes a continuing source of credit information. This link between transaction services and lending has been suggested by Stiglitz and Wiess (1990). The banks' role as efficient monitors and social accountants is vital for their existence.

It should be mentioned that banks' effective control over loans is also enhanced by the possibility of refusing to renew the loan at a future date. Stiglitz and Weiss (1983) have formally proven that a contingent contract which involves the threat of termination encourages a borrower to maximise the bank's expected return while avoiding the negative effects arising from changes in the term of the contract. Specifically, in a two-period model with identical risk-neutral borrowers (i.e. no ex ante asymmetrical information) the bank faces a probability of loan default and therefore a financial loss as the collateral is below the amount loaned. The bank cannot observe the project chosen and the amount of effort put into it (ex post asymmetrical information) but is aware of how the term of the contract may affect the borrower's behaviour. The most important conclusion from this model is that a risk-neutral bank makes the availability of credit to the second period contingent on the outcome from the first period project performance.

Therefore, the existence of a financial intermediary (bank) emerges as an endogeneous response to the imperfections (i.e asymmetrical information) by providing information services.

(4.3.2) Banks as Liquidity Insurers.

The demand for liquidity insurance arises in this less than ideal economy as a result of uncertainty. In this case, a financial intermediary (bank) will provide liquidity insurance to risk-averse depositors who are uncertain about their future consumption.

Edgeworth (1888) provided the first attempt to show formally how banks can supply liquidity to the system. He assumed that depositors' withdrawls are both stochastic and independent events so that there is an optimal amount of cash reserves to respond to the expected demand for cash balances from bank depositors. Specifically, maintaining reserves equal to some multiple of the standard deviation of deposit withdrawals over a selected time period would enable a bank to respond to the demand for liquidity from banks' depositors as well as to invest the remaining on assets. Thus, under the law of large numbers and the principle of pooling risks, a bank issuing demand deposits is actually pooling independent risks and providing liquidity insurance to depositors.

The bank's liquidity insurance function became central to the literature of financial intermediation. In the seminal paper by Diamond and Dybvig (1983) followed by Haubrich and King (1984), Smith (1984), and Waldo (1985) banking institutions play an insurance role in the face of liquidity uncertainty.

Diamond and Dybvig`s model demonstrated that simple competitive markets can not provide liquidity insurance against the contingency of being in liquidity need, information which is private to the agent in need. Moreover, they demonstrated that a bank is able to transform illiquid assets by offering liquid liabilities with a different smoother pattern of returns over time than a liquid asset. This transformation would enable a bank to provide liquidity insurance and hence to provide better risk-sharing among agents who need to consume at different random times and improve upon the unintermediated outcome.

This model considers two type of consumer-investor inserted in a three period framework T=0,1,2. Type 1 agent after investing one unit of input (initial endowment) in T=0 is forced to consume after one period in T=1. The investment return from one unit input at t=1 is equal 1 (initial investment). This costly interruption of investment may occur from random shocks to his consumption plans. In contrast, type 2 agent consumes at T=2 when his investment has fully matured and provides a return R>1. At period T=0 all investors-consumers are identical, although each of them carries a risk of facing a consumption shock and thus interrupting his investment before it matures. In other words, a risk of being type 1 investor-consumer and with a probability of t.

Given that investment decisions have to be made in $T=0$ and there is a risk of being type 1 investor-consumer, he has to decide whether to be self-sufficient and carry the risk on himself or get into optimal risk-sharing arrangements. Thus, if we let C_{ij} being consumption of type i agent in period j, then the agents choose $C_{11}=1$, $C_{12}=C_{21}=0$, and $C_{22}=R>1$. Diamond and Dybvig show that if types were publicly observable at $T=1$ it is possible to implement an optimal insurance that gives ex ante optimal share of output between both types of agents.[7]

Diamond and Dybvig argue that the lack of observability of agents' type rules out the possibility of this mutual insurance contract that indemnifies the holder in case of being type 1 (interrupt investment). Given that claims will depend on nonverifiable private information (asymmetrical information), this type of contract will entail moral hazard. Indeed, by announcing himself of being type 1 agent he can claim indemnity from other individuals and protect his own resources from claims.

Diamond and Dybvig maintained that a bank will supply an optimal risk-sharing insurance contract by offering demand deposit contract (liquid liabilities) and then invest them in earning assets with a promise of a positive return to those depositors type 1 (withdraw deposits at period 1). The promised return per unit deposited at $T=0$ and withdrawn randomly at $T=1$ is $R1=C_{11}>1$ by liquidating bank assets.

Thus, the payoff per unit deposit withdrawn at T=1 which depends on the random arrival to the bank and independent of each depositor is given by V1(Fj,R1)=R1 if Fj<1/R1 and 0 if Fj>1/R1 where Fj is the number of deposit withdrawals before agent j as a proportion of total deposits denoted as F. Similarly, V2(F,R1)=max[R(1-R1F)/(1-F),0] is the deposit payoff at T=2 which depends on total withdrawls at T=1.

In consequence, a demand deposit contract supplied by a bank permits the attainment of a full information optimal risk sharing which enables a type 1 investor-consumer to consume C1 and a type 2 agent to consume C2 where 1<C1<C2<R. In this equilibrium type 1 agent withdraw at T=1 and type 2 agent postpones consumption until investment has fully matured at T=2. This is what constitute a "good" equilibrium, although as we will see shortly it is not unique equilibrium.

The Diamond and Dybvig`s model succeeds in explaining the emergence of a deposit-taking institution (bank) in the event of random shocks in consumption and the need of liquidity insurance combined with the illiquidity of agents` assets. Banks are able to provide transformation services by offering liquid liabilities (demand deposits), a contract which has at least two equilibria: one the one hand a good equilibrium associated with optimal risk sharing, and on the other hand a bad equilibrium associated with bank runs.

(4.4) Theories of Bank Failures and Banking Instability.

(4.4.1) Banking Panics and Bank Failures.

One of the earliest views about bank failure and instability was that a fractional reserve banking system is inherently unstable. As we have seen in the previous section, the existence of random and independent deposit and withdrawals enabled banks to issue liabilities payable on demand while holding earning assets and an estimated cash reserve sufficient to respond to stochastic demand for deposits. In this fractional reserve banking system, the bank's asset transformation and the provision of liquidity insurance by means of a deposit demand contract offer an optimal risk sharing (good equilibrium). However, it was also pointed out that a demand contract also has a bad equilibrium consistent with a bank run. This result was also shown formally by Diamond and Dybvig's model where those investor-consumers who were forced to withdraw their funds due to consumption shocks in T=1 are followed by others which otherwise would have waited until their investment had matured in T=2. According to Lewis (1996), bank failures and banking instability can be seen as an unfortunate and undesirable by-product of banks' intermediation activities, particularly the provision of liquidity insurance.

In Diamond and Dybvig's two type investors-consumers and three period modelling with consumption risk there is another equilibrium where type 1 and type 2 agents panic and try to withdraw their deposits at T=1. This occurs because type 2 agents anticipate both that others will demand the redemption of their deposits and that the bank will face a value of its deposits which will be larger than the value of the bank's assets. In this sense, assets will be liquidated at a significant loss so that the bank's potential liability in T=1 will exceed the assets' value when liquidated in this period.[8] In this model, agents' expectations about bank runs become universal and self-fulfilling regardless of the true financial condition of the intermediary. Therefore, the dividing line between a good equilibrium and bank run equilibrium in a fractional reserve banking system is very thin. This makes the optimal risk sharing equilibrium very fragile and dependant on depositors' confidence.

In this model a bank run equilibrium and the optimal risk sharing equilibrium depends on the depositors' commonly observed random variable in the economy. Among them the model includes bad earning reports, commonly observed runs at other banks, or sunspot. It is clear that under this exogeneous-imposed uncertainty the loss of confidence and a bank run equilibrium is a very likely event in this model.

Waldo (1985) in his three-period four-agent model arrived to a similar run equilibrium where bank run is a random event. Like Diamond and Dybvig, Waldo considers a bank run when each depositor believes other depositors will withdraw their deposits, losses which can be avoided by an early withdrawal. Again the cause of a run is extraneous and unrelated to any fundamental.

Given that in this model savers have an initial endowment W at T=0 and can split it into storage and bank deposit and for each saver there is a long term investor and a short term investor financed by short term and long term bonds, then the bank will act as intermediary by the issue of deposits and the holding of both short term and long term securities (asset transformation).[9] Thus, a bank by exploiting economies of scale provides small savers with access to the market of primary securities with the issue of deposits which exceed short term yields as well as the benefit from the storage of the savers` initial endowment which in this model serves as liquid currency but sterile store of wealth. In the event of a run, banks can meet withdrawls out of their revenues from first period short terms securities and from the sale of their long term assets to a short term investor in the secondary market.

Thus, Waldo`s model re-affirms Diamond and Dybvig`s bank instability in the form of bad equilibrium and the cause of a run being extraneous and unrelated to any fundamental, although it differs from the role of banks as well as on some empirical observations concerning bank runs.[10]

These models which treat bank failures and banking instability as a result of a lack of confidence in fractional reserve financial institutions providing liquidity insurance have important shortcomings. Firstly, it could be argued that a good equilibrium can be supported by equity contracts. Indeed, it is demonstrated that an equity contract provides the same optimal sharing contract than Diamond and Dybvig's bank contract, but without the run equilibrium.[11] Moreover, the existence of an intermediary is not necessary for optimal risk-sharing as anyone could issue and offer shares to interested buyers, unless we drop the model's restrictive assumption which suggest that all projects and hence shares are the same.

Secondly, a bank run occurs partly due to an exogenously-imposed sequential service constraint, where as stated by Lewis (1996), the "fixed-price-first come-first served" payout rule on deposits demand operates.

Thirdly, the models do not introduce any role for collateral and/or capital adequacy in order to assure that depositors' claims can be met. For instance, if we allow for bank' shareholders to commit sufficient assets as collateral to assure depositors' confidence then a bank run may not occur. Similarly, banks may have access to interbanking funds (liquidity) by offering shareholders' assets as collateral. However, the Diamond and Dybvig's type of model has made no distinction between depositors and shareholders. Moreover, even if they allowed for it, the role of any collateral may have certain limits on enhancing depositors' confidence.[12]

Fourthly, these models of banking instability fail to distinguish panics and information-based bank runs. Jacklin and Bhattacharya (1988) identify private information about bank loan/asset payoffs on the part of depositors as the source of banking instability (run) as opposed to Diamond and Dybvig's model which view a run as a sunspot phenomena. By introducing uncertainty on the return to production and the irreversibility of long term assets, they show that deposit contracts tend to be better suited for financing low-risk assets as compared with equity contracts which are more suitable for higher-risk assets. Moreover, they obtained a unique equilibrium and discuss those factors which could trigger a run, particularly bad interim information. Thus, under uncertain return to production, a run can be a systematic event conditional on the news about an asset quality at T=1

Finally, the evidence from different episodes of banking instability suggest that runs were systematic events. Friedman and Schwartz (1963), and particularly Bernanke (1983) and Gorton (1988) have shown that bank failures tend to be associated with high currency-deposit ratio, output contraction, and explosive demand for banks' liabilities. For instance, Gorton (1988) found that panics are systematic and predictable events linked to the business cycle. Indeed, panics resulted from changes in risks predicted on the basis of prior information. Liabilities of failed non-financial firms as proxy of recession was the best prior information in forming conditional expectations. If banks hold claims on firms and if they begin to fail as a result of a recession depositors will re-assess the risk. Moreover, it was shown that the larger the movement of the predictor and hence in the percieved risk, the larger the movement in the currency-deposit ratio. Thus, these models in which a bank run is a sunspot equilibrium do not provide a theory of bank failure. This remark becomes even more important today as bank failures have not provoked runs and systematic collapse of financial institutions.

(4.4.2) External and Internal Factors in Bank Failures.

As we have seen in the previous section, banks as liquidity insurers in a fractional reserve system can be inherently unstable in the sense that they are vulnerable to runs and panics in the absence of a safety net of deposit insurance and a lender to the last resort policy. This sunspot equilibrium was influenced by extraneous and unrelated factors to the true financial condition of a bank. That is, to the market value of its liabilities and assets structure, as well as its capital and reserves. Moreover, a bank failure could occur at any point in the business cycle rather than in the turning point of the cycle.

A run equilibrium is likely to emerge as result of sunspot, bad report, the failure of a large financial institution, or any other relevant factor in depositors` self-fulfilling expectations on the bank's inability to respond to depositors' demand for currency. In this argument, there is no theory of failure nor an explanation behind the failure of a large financial institution.

Friedman and Schwartz (1963) have provided a useful insight into the more than 9.000 bank failures (from 40.000 to 14.000) and the three day suspension of bank trading during March of 1933 at the time of the Great Depression. In their view, this wave of bank failures was determined by a contagious panic which started with the collapse of the Bank of the United States in December 11, 1930.[13] Both the rise in the banks currency-deposit ratio, and reserve-deposit ratio led to a fall in the money supply and a shortage of bank liquidity. The monetary contraction and the widespread rumours which followed produced additional bank failures independently of the banks' initial financial soundness (asset quality). Sound banks were forced into insolvency by a fall in the value of their assets caused by the scramble for liquidity.

This monetarist interpretation of the 1930's banking debacle suggests that the monetary authorities should follow a stable and predictable path for money supply as well as the readiness to supply the economy with liquiditity to avoid widespread runs and panics. Futhermore, a deposit insurance provision should complement the lender to the last resort so as to keep the public's confidence in the safety and stability of the banking system snd to protect small depositors.

The view that the wave of bank failures can be explained from a contagion fear originated from the failure of large financial and/or non-financial institution is ad hoc , and an exception to the general rule when we look at several bank failure episodes. Indeed, according to Beston and Kaufman (1986) there is little evidence of a currency run in recent years despite the fact of well publicised large bank failures such as Continental Illinois in 1984, and the two largest Savings and Loans Associations (thrifts) in the US. Moreover, they found that in only one single year between 1865 and 1914 more than 200 banks failed and in only nine years in which more than 100 banks failed. The failure rate during this period, which before the safety net was established, was only 0.8%. Lewis and Davis (1987), Feldstein (1991), and Davis (1992) have also identified several financial episodes during the mid-1970's and mid-1980 which did not ended in a wave of bank failures.

Moreover, it appears that the number of bank failures per se has become more frequent now than in past despite the fact that the economy appears to be stable. In the case of the US banking system, from 1934 to 1943 the Federal Deposit Insurance Corporation (FDIC) closed 490 banks averaging 54 banks per year. This average was much smaller between 1943 and 1981 with 6 banks per year (total of 232). However, these figures increased drastically between 1982 and 1988 as the FDIC closed 811 banks which is equivalent to 115 banks per year.

The relevant question which should concern us is the identification of the underlying factors behind the rise in bank failures and whether these factors were under the banks` control (internal) or outside their influence (external). Specifically, the causes of bank failures are either internal or external to the institution, or some combination of the two. Internal causes are identified as those factors which the managers and directors of a bank have direct control. For instance, a bank can exert control on its loan and investment policy, particularly asset and loan concentration, as well as the growth rate of asset expansion. Moreover, self-serving loans, embezzlement, and fraud are also within the responsibility of the bank management. Managerial inefficiency, dishonesty, or insufficient internal provision will lead to excessive risk-taking and bank failures. It could be argued that this classification correspond to a firm-specific factor.

External causes of bank failures are those over which the manager and directors of a bank have no control such as structural changes in banking (industry-specific) and the economic environment (macroeconomy). In the former we include increasing competition from financial liberalisation, regulatory and supervisory changes, and technological innovation. In the latter, we refer to adverse changes in output and key macroeconomic prices such as the rate of interest, real exchange rate, or commodity prices.

Although, in theory we can draw a definite line between internal and external factors on bank failures, in practice this distinction becomes somewhat blurred. Bank managers can in fact respond to changes in external factors depending on their capacity and objectives. For instance, financial liberalisation entails more opportunities for profit maximisation but at the expense of additional risk-taking. The managers' response depends on their attitude toward risk-taking, the existence of remaining distortions like fixed rate deposit insurance and related portfolio structure (bank holding companies), and the effectiveness of prudential regulation and supervision to monitor banks' operations.

Before we progress towards the examination of those factors responsible for bank failures it is desirable to technically define a bank failure and to present a bank's balance sheet in order to identify the sources of risk. As we have seen in chapter 2, a bank fails in economic terms when the market value of their assets is below the market value of their liabilities. Therefore, all depositors and creditors cannot be expected to be paid in full and on time.

With reference to a bank balance sheet, we can consider a simplified balance sheet as follows:

ASSETS	LIABILITIES
Cash	Deposits
Securities	Non-Deposit Liabilities
Loans and Advances	Capital

On the asset side, the bank's balance sheet is dominated by loans and advances. Financial securities have a smaller share in the asset portfolio, and the cash item is even less important. On the liability side, deposits represent the largest share in the liability structure. Similarly, banks are highly geared as their liability-capital ratio is very high.[14]

By looking at the structure and composition of a bank balance sheet, it could be argued in broad terms that banking instability can arise on the asset side, on the liability side, or on both. For instance, as we have already seen changes in the percieve risk on bank deposits can originate a shock on bank liabilities as depositors rush to claim back their funds. This liquidity risk could impair a bank's ability to respond unless there is access to a discount window and/or assets can be sold at short notice at a large undervalued price.

Similarly, on the asset side of the balance sheet there several factors affecting both the bank's loan portfolio and the security investment. For instance, adverse changes in the bank's external economic environment such as output and price deflation, significant price misalignment due to gross macroeconomic policy inconsistency and/or exogenous shocks to the economy affect the quality and riskiness of the bank's loan portfolio. The effect can be magnified in the event of excessive loan concentration on a limited number of borrowers or related group, industry, countries, or regions.

Equally important is the role played by a mismatching between the bank's assets and liabilities, particularly in the event of interest rate risk. There are banks which, given the nature of their activities (thrifts), present assets and liabilities that are unbalanced with respect to their maturity. Thrift institutions hold long term fixed interest mortgages (assets) funded by short term saving deposits (liabilities) which an increase in the level and volatility of interest rates can cause the market value to fall and be worth less than the value of its deposits.

It should be pointed out that a bank's balance sheet may not only reflect external shocks from the macroeconomy but also can be affected from increasing competition and innovation in the banking industry as a result of financial liberalisation which is also considered external to the bank. However, banks are not passive victims of changes in the underlying economic environment where they operate. Moreover, bankers' attitudes towards risk-taking in terms of a more aggressive management can also increase the vulnerability of banks. A less conservative attitude by the bank's management is reflected in an inadequate capital and provision for bad loans, poor asset and liability quality from the lack of diversification, rapid growth in assets and liabilities, and a low profitability.

(4.4.2.1) External Factors in Bank Failures.

It is argued that bank failures (financial instability) are related to the business cycle, as a downturn weakens banks' balance sheet. This link is indirect via the financial fragility of non-financial institutions following their overindebtness and unexpected deflationary shocks.[15]

Fisher (1933), and later Kindleberger (1978) and Minsky (1977) focused on a link between bank failures and deflation. The development of a fragile financial structure leads to a wave of bank failures at the turning point of the business cycle and not at any point of the cycle as argued by the monetarist. Moreover, they disassociated with the view that a wave of bank failures is the result of some exogeneous factor, accident, or a policy mistake by the Central Bank.

The whole economic cycle is described by a process in which a buoyant output growth caused by an exogeneous event (new inventions, the opening up of new markets as a result of economic liberalisation) which improves profit opportunities leading to an investment boom in both physical and financial investments financed by bank loans. Rising prices reduce the percieved value of outstanding debts, and increasing demand for financial investment increases the value of debtors` collateral. Both factors plus widespread optimistic expectations lead to a significant overindebtness. According to Fisher (1933), a significant overindebtness and a deflation will bring a downturn in the business cycle. It could be argued that a deflation in commoditity prices, falling output, and even rising real interest rates should increase both the value of outstanding debt and difficulties to service the debt. Debtors unable to pay their debt and refinance its position may force creditors to liquidate assets adding additional pressure to falling prices and hence increasing the magnitude of the deflationary pressures. Thus, falling prices, rising real interest rates, and falling output will reduce firms` net worth and profits and hence lead to loans default which in turn will certainly raise the likelihood of bank failures.

Kindleberger (1978) identifies three stages of the same process leading to the transformation of the economy from a buoyant and euphoric stage (boom) to a fragile and collapsing stage (bust). This include overindebtedness, significant relaxation of safety and risk provision by banks, and subsequently bankruptcies and bank failures. The first stage is a mania where investors shift money to real and financial assets during the expansion of the business cycle. The second stage is a panic as they start moving back to money at the turning point of the cycle. The final stage ends with a crash as commodity and stock prices collapse, output falls and the number of bankruptcies and bank suspensions increase.

Minsky (1977) also provide a theory for the build-up of financial fragility over the upturn of the business cycle and the subsequent downturn of the cycle and the rising number of bankruptcies. He identifies three factors which may produce systemic fragility; first, the mix of hedge, speculative , and ponzi finance. Second, liquidity of the portfolio. Third, the ratio of external-internal finance. The hedge, speculative, and ponzi finance units are vulnerable to several events which will affect cash flows from assets. For instance, a decrease in operating income as a result of unrealistic expectations about the market and growth prospect may transform an hedge financing unit into a speculative unit. That is, from a unit in which his assets' cash-flows exceed cash payments over a long period into a financing unit where cash payments exceed the short run cash receipts. Changes in the money market (interest rates) should affect an speculative unit by trying to refinance its position and make himself vulnerable to the disruption of financial flows. A margin of safety may exist if the present value (PV) of assets is greater than the liabilities' present value. This margin exists for the hedge and speculative financing unit but not for ponzi finance as the

PV is clearly negative. Thus, for Ponzi units a rise in interest rates can entail negative net worth and bankruptcy. Once this form of financing becomes a significant portion of the financial structure of the economy there will be either a debt-deflation and depression or there will be rise in expected cash flows from capital assets as a result of inflation.

The model's mechanism suggests that in the upswing of the cycle larger demand for investment (physical and financial) financed by external resources (bank debt) leads to rising interest rates and a shift from hedge to speculative, and even Ponzi finance. Shifts from long term to short term financing and reductions in margins of safety for banks increase their vulnerability to further rises in interest rates. Ponzi finance units unable to refinance their position (roll-over of their debts) will result in liquidation of assets leading to further deflation and bankruptcies of both non-financial and financial firms.

In these models of financial fragility instability in the macroeconomy arising from both exogenous factors like innovation, wars, or swings in investment, and policy induced changes from liberalisation reforms can be seen as prime shock to the financial system. These disturbances are amplified by over optimistic expectations by both non-financial and financial firms which lead to overindebtedness and subsequent reversal when a deflationary shock affects fragile firms. The likelihood of bank failures and the subsequent contagious effect on other financial institutions becomes a real threat to the stability of the financial system.

Although these models of financial fragility offers an alternative on the causes of bank failures and a re-interpretation of the Great Depression, it lacks a solid foundations based on rationality and endogeneous expectations.

To begin with, the model introduces a debt-type of contract and rules out alternative form of financing without formally introducing assumptions concerning agency cost, and other imperfections which explain the importance of debt finance over equity finance.

With respect to rational behaviour, models of financial fragility have departed from the assumption of rational economic behaviour. Investors are assumed to be overoptimistic about the expected returns and traders' purchases are responding to rising prices rather falling prices (low prices). Moreover, the model does not explain expectation formation and the sources of wrong risk perceptions.

Guttentag and Herring (1984) introduce a model where rational individuals (banks) during a period of boom will relax both credit policy (rationing) and their capital position, and the existence of uncertainty will lead to underpriced risk. Once a shock occurs this leads to a rise in a subjective probability of disaster combined with low capital level producing credit rationing and a crisis. This is known as a "disaster myopia".

Disaster myopia explain why in a booming economy with a long period of stability lenders (banks) expand loans rapidly and accept a decline in their capital position. In this case there is a increased vulnerability which is not percieved at such until a shock to confidence occurs. This leads to a revision of subjective probability and subsequently to a higher risk premium and credit rationing. Credits will be unavailable for some class of borrowers, investment will be cut-back from previous buoyant levels, and production stopped with a subsequent fall in the economy's output (crisis).[16]

The rational expectation school and the model of speculative bubbles also provide a framework to model Kindleberger's irrational euphoria and bank instability (run). According to the model provided by Flood and Garber (1982) and Blanchard and Watson (1982) a mania can be associated with a speculative bubble. Under rational expectations where agents' anticipations are conditional to the information set of the underlying structural model so that prediction error will not be systematic, an asset price depends on its current value but also on the expected rate of change. Asset prices depart from the fundamentals as rational agents anticipate changes in asset prices (price bubble). The bubble will last so long as the average return is sufficient to compensate for the risk of crash. The price of the asset will need to be increased exponentially.[17]

Bernanke (1983) also embraced the view that an unanticipated deflation due to a collapse of stock prices can cause borrowers to default and banks to fail as a result of the reduction of borrowers' net worth and the rise in the real stock outstanding debt. At the same time, growing fears of total financial collapse lead to a marked preference for liquid assets and hence the shrinking of loanable funds available for lending. Bernanke's model also introduces a link between financial disruption as consequence of Fisher's deflationary shock, and output decline which came to complement the monetary forces behind the depression of the early 1930's.

There are also factors within the industry which are outside the control of the bank. Institutional, and structural changes in the form of technological improvements, and innovation play a significant part in increasing the fragility of the banking system.

For instance, government policies can affect the banks' ability to cope with risk. It is argued that in the US banking system prohibition of interstate and intrastate branching, obstacles to takeovers, and restrictions on banks activities had made banks more vulnerable as a result of the lack of diversification. There is considerable evidence which demostrates that restrictions on branching limits the banks` ability to withstand economic shocks (external). As local economic conditions deteriorate an increasing proportion of their loan portfolio becomes non-performing and their deposits are increasingly withdrawn. Lack of diversification will disable banks` ability to offset their losses forcing these banks to fail. White (1984) holds the view that pervasive restriction on branching in the US created a large number of small and specialised banks with a limited portfolio diversification. He argues that one important factor in the bank failures during the Great Depression of the 1930`s was the banks` inability to withstand any real and/or monetary shock. A system of nation wide branching could have reduced or eliminated bank failures by establishing intermediaries with loan portfolios that were sufficiently diversified to manage regional risk.[18] Further evidence is provided by Amos (1992) for the regional distribution of bank closing between 1982 and 1988. The data indicate a significant concentration of bank closings in states with oil and gas extraction and to a lesser extent, farming. Moreover, it confirms that those states with unit banking regulation account for nearly 57% of total bank failures.

Other regulation like the Glass-Steagall Act of 1933 which prohibited commercial banks from engaging in securities-related activities (separation of commercial and investment bank) have also contributed to reduce banks` diversification possibilities. According to the evidence from White (1986), it appears that banks with security operations before 1933 had a lower probability of failure than other banks.

Similarly, the introduction of interest rate ceilings can also affect the banks' capacity to adjust in the face of economic shocks like inflationary instability and the subsequent desintermediation via off-shore markets. In the case of regulation Q in the US which prohibited interest payments on demand deposits and introduced ceilings on savings and time deposits it made more difficult for banks to compete for funds relative to unregulated financial institutions.

(4.4.2.2) Internal Factors in Bank Failures.

One of the most important criticisms of the hypothesis that banks' failures can be affected by factors outside the banks' control is that they are treated as passive adjusters and henceforth victims of an adverse economic environment, and the changes and annomalies of the financial market per se (industry). On the contrary, financial institutions are actively responding to changes in both the macroeconomy and in particular to conditions within its own market (industry) as a result of deregulation, liberalisation reforms, and technological change and innovation.

It could be argued that financial liberalisation in the form of interest rate deregulation, geographical and functional deregulation (products) have contributed to the increment in competitive pressures and followed by an appropiate response from banks. Indeed, there is a substantial literature which suggest that deregulation and greater competition has shifted banks` strategy from safety towards a greater risk-taking. Moreover, it is argued argued that excessive risk-taking in a deregulated banking system (liberalised) reflects the effect of a subsidy from the government safety net and the failure of prudential supervision.

The evidence has given considerable support to the importance of internal factors on bank failures. For instance, Peterson and Scott (1985) found that most bank failures in the US between 1982 and the first quarter of 1984 were the result of internal causes, particularly fraud and manipulation, poorly managed rapid growth, and sustained low performance.

According to Beston and Kaufman (1986) fraud can take many forms. Banks can make loans to business associates, subsidiaries, and relatives violating the legal restrictions and limits established by the authorities. The loans` proceeds which are allocated to very risky ventures involve risky concentrations relative to the bank`s capital on entities and persons controlled by or associated with controlling stockholders and bank managers. The evidence from the failure of the United States National Bank of San Diego in 1973, the failure of the Hamilton Bank of Chattanooga in 1976, and as we will see in chapter 8 the overwhelming loan concentration with affiliates in the Chilean banking system during the liberalisation episodes are examples of fraud, excessive risk-taking and its effect on bank failures.[19] Further evidence from different period of the US banking history confirms the importance of fraud in bank failures. While Peterson and Scott's research confirms the importance of fraud where 66% of the 80 failures between 1982 and 1984 were the result due wholly or partly to some form of fraud. Sinkey (1979) also confirm this finding for the pre-insurance (1865-1920) and the post-insurance periods (1960-1974).

Similarly, a rapid growth in a bank's loan portfolio would increase the likelihood of bank failure as it becomes extremely dificult for management to support such strategy. Management should ensure that growth in loans is fueled with good credit risk, proper documentation, a reward in quality being favoured instead of growth per se, and loan growth and risk which are sufficiently diversified. Limited management resources like training, as well as the existence of asymmetrical information do not help the maintance of management quality. Moreover, rapid growth of loans portfolios in a scenario with high interest rates will exacerbate the moral hazard and adverse selection problems.

Therefore, under a rapid growth scenario excessive loan concentration, poor quality loans, and fraud may be very serious affecting the likelihood of bank failures. Short, O'Driscoll, and Berger (1985) provide evidence on the effect of poorly managed rapid growth as a determinant of bank failure. Further discussion of this model is presented in chapter 5 and 8.

Although the evidence tends to support the importance of internal factors on bank failures, there are still important difficulties in the analysis. There is a fine dividing line between bad luck, fraud, and incompetent management so that it may in practice be difficult to prove any mis-conduct by bankers. Moreover, the presence of fraud does not mean that fraud caused bank failure.

(4.4.3) The Role of Moral Hazard in Bank Failures.

One of the most important shortcomings in the incidence of internal factors is the fact that these internal factors are not exogeneous in the sense that bank defaults take place in a vacuum. Indeed, bankers respond to certain incentives and distortions (i.e policy-induced or instrinsic) which are present in the banking system (industry). For instance, while fraud and rapid growth syndrome could be the result of the strategy "hit and run", it could also reflect moral hazard from deposit insurance and weak prudential regulation (government safety net and regulation). Moreover, the increases in bank vulnerability as a result of unsound loan concentration reflects the increasing interdependency between affiliates of bank holding company structure.

It could be argued that the presence of policy-induced distortions (e.g. financial liberalisation as external factor) will encourage excessive risk-taking (moral hazard) by banks, raising the likelihood of bank failures. Specifically, the existence of a bank holding company structure combined with a fixed rate underpriced deposit insurance, rapid deregulation of interest rates, and a weak and inefficient prudential regulation and supervision provide banks with greater incentives to increase risk-bearing. The increases in banks' vulnerability should be reflected in a deterioration of assets quality, higher leverage, lower capital and reserve requirements. Financial and accounting ratios constructed fom banks' balance-sheet should reflect the banks' incentives to take greater risks raising the ex ante probability of bank failures.

- Bank Holding Company Structure and Market Concentration.

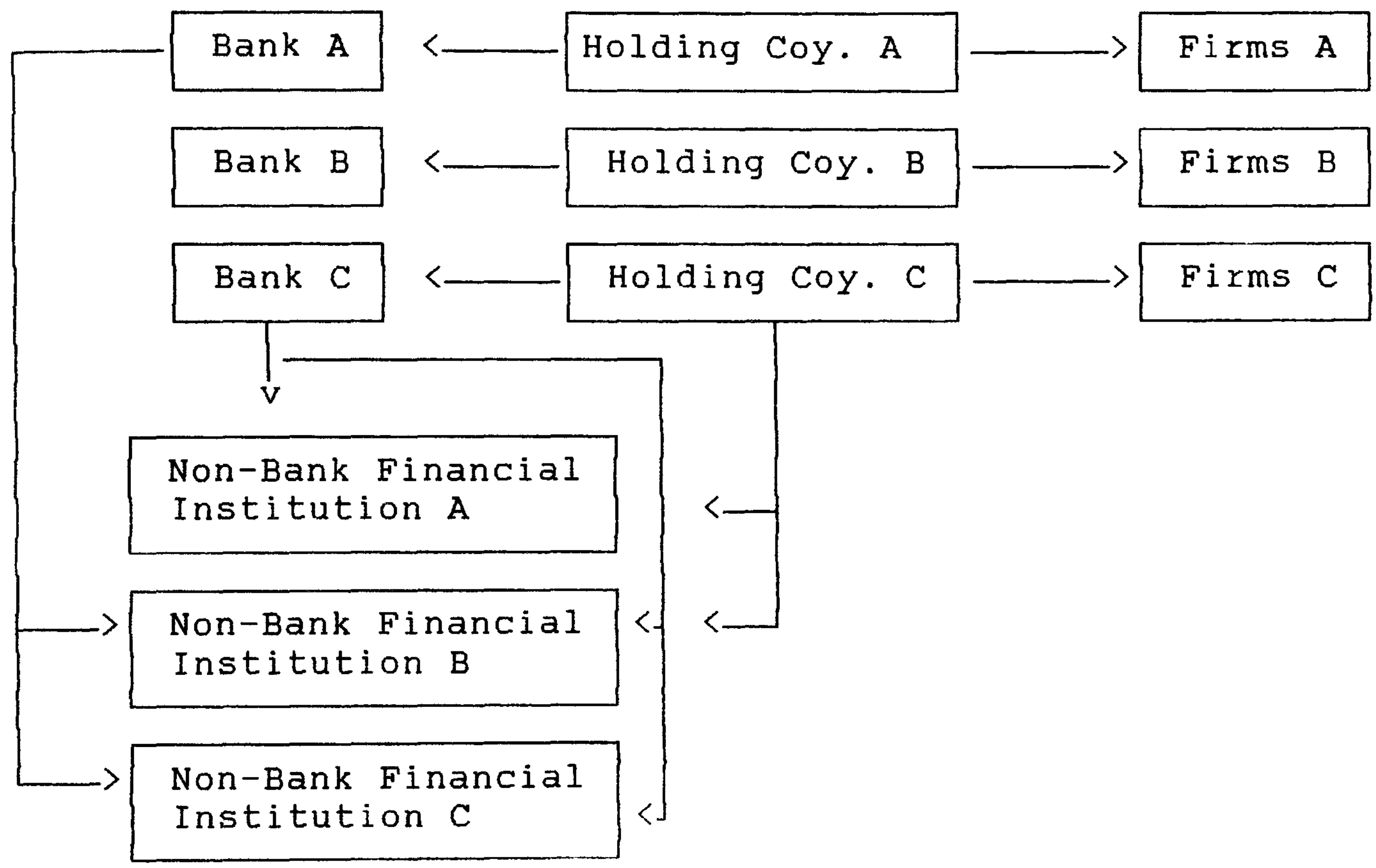
To begin with, a bank holding company can be defined as a multi-company firm which operates under a common management and financial control. Its scope of ownership and economic influence can be made extensive into both financial and non-financial firms operating in different markets and segments.

While this specific form of company organisation carries legal recognition and is subject to regulation in the US, and economies like Japan, and Germany, its identification has been more implicit in LDC`s, particularly before the episodes of financial liberalisation and banking crisis during the late 1970`s and early 1980`s. Some of the literature on development economics recognises this form of industrial organisation as "economic conglomerates" or "group". It is identified as an informally established multi-company firm which like the bank holding company also operates under common management and financial control.

Generally, the centre point of an economic "group" is constituted by a "parent company" or holding company which is valued in the stock exchange or owned by an extensive web of family inter-relationships. This nucleus company directly or indirectly controls several subsidiaries as well as financial institutions. The ownership of banks and other financial institutions enable a "group" to exercise direct influence on banks` decisions, particularly credit concentration and credit terms. It is also possible for this "parent" company to exert indirect control over financial institutions through their own subsidiaries which in turn own one or several intermediaries. This web of interlocking relationship can be extend even further by allowing financial institutions themselves to directly control financial and non-financial firms.

The common form of this network of financial and managerial inter-relationships is despicted in diagram 2.

Figure 4.1. Bank Holding Company Structure.



For instance, holding company C owns and directly control a number of firms in C, and financial institutions in C both bank and non-bank entities. In addition, holding company C also holds and influences indirectly non-bank financial institutions in C through bank C.

According to Leff (1978), this form of industrial organisation has flourished as a mean to expand the size of the economic conglomerate. Indeed, the ownership of financial institutions has permitted them to attract resources from other segments outside the "group's" market influence. It will be relatively easy for a "parent" company having a controlling interest in a financial institution to use the bank's resources to purchase a controlling interest in other non-financial firm. Moreover, if the legislation permits it, they could even acquire other financial institutions to further their expansion.

Apart from the feature of economic conglomerates, the financial market can also be highly concentrated among a few financial institutions.[20] More often than not, a re-current characteristic of LDC's banking structure is the presence of three or four large banks controlling more than half of the system's assets and liabilities while the remaining share is held by several small financial institutions. Therefore, we may say that there is skewed distribution of assets, liabilities, and capital in this banking system.

Galbis (1986) maintained that a bank holding company structure and a significant bank concentration should lead to an oligopolistic market-structure behaviour by financial institutions. This pattern of conduct should be reflected upon the growth of bank asset portfolios and concentration, risk diversification, and the level and spread of domestic interest rates.

From oligopoly theory we can establish two possible outcomes; one inefficient which entails collusion, and the other an unstable one with a price warfare.[21]

Depending on the relative strength of the bank holding company group and the stability of their collusive agreements, we should expect a mixture of a significant loan concentration among its affiliates and a low average spread between deposit and loan interest rates. The more intense the affiliates' need for funds the larger the loan concentration and hence the riskier the bank's loan portfolio.

Although collusion is in the interest of the oligopoly, there are instances where a predatory price warfare dominates over a collusive agreement. Increases in competition for fund among "groups" to finance their relative expansion will increase the probability of a price war. At the same time, free entry into the financial system by both domestic and foreign institutions will make competition for funds stiffer. As a result, a financial market dominated by "economic conglomerates" and facing unrestrained competition for funds will be conducive to high real deposit and lending interest rates and lower spread and bank profits. It is clear from the evidence of chapter 8 that the restoration of bank holding company structure (i.e. economic groups) in Chile as a result of the privatisation of the financial system, together with the unbounded pressures from domestic and foreign banks were responsible for increasing competition for funds to finance the "groups'" economic expansion. Excessive concentration of bank's loans with its own affiliates which clearly represented related risks (joint) contributed to an increase in the likelihood of bank failure in Chile.

- Implicit and Explicit Deposit Insurance.

It could be argued that the existence of a safety net (deposit insurance and lender to the last resort) can make the bank default more likely. Indeed, this government policy combined with the uncertainties of deregulation can encourage banks to take excessive risk (moral hazard) affecting the likelihood of bank failure.

As we have seen in the previous sections, Diamond and Dybvig (1983) demostrated that one of the equilibrium from a bank contract supplying liquidity insurance was consistent with a run sunspot equilibrium. However, this model demonstrated that there is a feasible contract (unconstrained optimum) which allows banks to provide the asset transformation service without the event of a run equilibrium. Specifically, the model shows that demand deposit contracts with government deposit insurance achieve the unconstrained optimum as a unique Nash equilibrium if the government imposes an optimal tax to finance a deposit insurance.

The government can tax type 1 agents who withdraw in T=1 (early withdrawl). The amount of tax raised depends on the number of type 1 agents who decide to go for an early withdrawal and the amount promised in return (assuming no panic). The government infers the realised value of t (probability of withdraw) after all type 1 have come forward. If the realised value of t is greater than the expected value of t then it charges a tax on the type 1 individual and a subsidy in the opposite case. The tax-subsidy policy ensures that type 1 receives its optimal consumption bundle contingent on the realisation of t. Similarly, given that the tax-subsidy is costless to operate type 2 also receives its optimal bundle of consumption and hence no incentive to withdraw in T=1.

However, Diamond and Dybvig have warned us about the danger of moral hazard if the risk of bank portfolios selected by bank managers are unobservable by outsiders. Since the expected value of the bail-out to any bank increases with the probability of default which in turn rises with promised return to withdrawals in T=1, then bank optimisation of the bail-out subsidy will provide an incentive to bankers to compete more agressively for deposits by offering higher interest rates (return) to those withdrawn in T=1. It follows that the rate of interest for T=1 rises to a point where the anticipated return on T=2 falls so low that no one want to keep deposits beyond T=1. Type 2 depositors demand their deposits at T=1 (run) and a bail-out of deposits will be necessary.

According to Mckinnon (1988), the bank is a beneficiary of an unfair bet against the government. The bank can provide risky loans at extremely high interest rates without having to compensate insured depositors for additional risk-taking. The bank will have accrued extraordinarily high profits without having to pay the full cost of large losses from bad loans.

White (1989) considers an implicit deposit insurance as a specific form of insurance which is analogous to medical or legal malpractice insurance contracts or to a third party car liability insurance. The purchase of an insurance policy forces the insurer to pay a compensation to the beneficiary (i.e. depositor, medical patient,legal client, or motorist/pedestrian) in the event in which the action of the insured (i.e. bank/thrift, doctor, lawyer, or driver) has caused some loss to the third party. This comparison between deposit insurance and a typical insurance contract allow us to identify the drawbacks and possible corrections which are available in a typical insurance contract.[22]

Based on the state-preference model, Karaken and Wallace (1978) and Furlong and Keeley (1989) have formally shown that a value maximising bank will maintain the highest degree of leverage and an increasing asset portfolio unless there are limits set by regulation. Similarly, Merton (1977) arrived to the same conclusions by modelling deposit insurance as a put option. In his model a deposit insurance is introduced "as if" bank shareholders purchase the right to "put" the asset portfolio onto the insurer at a price equal to the value of the outstanding deposit liabilities.

The price of put option depends on the riskiness of the bank asset portfolio, the degree of leverage, and the proportion of insured deposits. It follows that unless the insurance price is variable, insured banks will need to be subject to prudential regulation to limit excessive risk-taking.

Furlong and Keeley (1989) in a two-period model with two possible future states with P1 and P2 payouts, and two risky assets, $X(x1,x2)$ and $Y(y1,y2)$ where $x1<y1$ and $x2>y2$ or more generally $x1<y1<1y2<y1$ (i.e. X is riskier than Y), the current value of a maximising bank Vo that can meet its obligations in both states is given by the expression $Vo= [(Co+Do)/P][sx1+(1-s)y1]P1 + [(Co+Do)/P][sx2+(1-s)y2]P2 - Do$ where Co and Do are the initial amount of capital and deposits (claims), and s is the percentage of bank assets allocated into a riskier asset X. We take that the sum of the current pay-offs on assets in each state minus the current value of depositors' claims are equal to its initial capital (i.e $Vo=Co$).

If we assume that there is a free deposit insurance and a given Co and a bank asset quality (risk) such that bankruptcy occurs at state 1, then the current value of the insurance policy Io will be given by $Io = (Do/P)P1- [(Co+Do)P][sx1+(1-s)y1]P1 > 0$. The expression for Io is positive since the current values of depositors' claims fell short of the assets' pay-offs. Therefore, an optimising bank will maximise its equity value $Vo=Co+Io$ by maximising the value of Io. The maximisation of the insurance policy involves maintaining both a high bank leverage, and a high asset risk.

Specifically, the effect of a change in leverage on the value of Io is given by $dIo/dDo=[P1/P][1-(sx1+(1-s)y1)]>0$ since $x1<y1<1$. Similarly, the effect of risk-taking on Io is given by the partial derivative $dIo/ds=-Ao[P/P1](x1-y1)>0$ since $x1<y1$. In theory a value-maximising bank with free deposit insurance will choose $s=1$ and a large leverage.

In consequence, it is demonstrated that fixed price deposit insurance should encourage maximising banks to excessive risk-taking (moral hazard) as their liability is limited to the value of their net worth. Once its net worth is exhausted, the outstanding claims of insured depositors will be covered by the deposit insurance. Full coverage combined with a flat rate insurance premium will make both bankers and depositors tolerant and indifferent about risk-taking. In other words, a distortion to the market discipline which according to Eisenbeis and Gilbert (1985) will prevent depositors to ask for a higher risk compensation to hold riskier bank's liabilities, and encourage bankers to restructure their portfolio to reduce risk. An undistorted market mechanism may also discipline bankers by a reduction in the availability of funds or withdrawal of bank deposits from risky financial institutions.

The same conclusion follows in the case when there is the expectation of a de facto insurance. In effect, the public will hold the expectation that the monetary authorities will bail-out uninsured depositors from large banks in order to avert any loss of public confidence in the financial system. It could be argued that the belief in a de facto insurance guarantee feeds itself from the authorities' lack of reputation and credibility exhibited in the past with respect to the intentions and objectives of their banking policy.

Karaken and Wallace (1978) have shown that deposit insurance and the need for regulation will not be necessary even in an unregulated fractional reserve banking system. Indeed, unregulated banking system will be inherently stable under their assumptions. If depositor are fully informed about banks' asset risk then bank managers will voluntary choose a maximising strategy which lower the risk of bankruptcy.

Clearly the susceptibility of an unregulated fractional reserve banking system had given a major justification for government intervention in the form of deposit insurance complemented by regulation either to prevent bank panics and to oversee bank failures from inefficient units.

As we have seen earlier on from the evidence from the US the number of failures have increased significantly during the 1980's and also have involved large financial institutions and thrifts. Most of the studies concluded with a different emphasis the important role played by a fixed price deposit insurance on excessive risk-taking and bank failures. At the same time, they proposed urgent reforms to the existing deposit insurance scheme to remove some of the incentives to take additional risks beyond the social optimum.[23]

- Prudential Regulation and Supervision.

As we have seen from the previous analysis the central problem with a government improperly priced mandatory deposit insurance is that it encouraged insured maximising banks to exacerbate risk-taking (moral hazard) and hence to increase the probability of bank failure. Indeed, as demonstrated by Merton (1977), and Furlong and Keeley (1989), the value of deposit insurance for a bank was increasing in asset risk, and decreasing on capital. Thus, it was optimal for banks to hold high risk assets and maintain as little capital as possible raising the likelihood of bank failure unless portfolio constraints and minimum capital requirements were introduced.

Indeed, Buser, Chen, and Kane (1981) show diagrammatically that a bank with free insured deposits and no regulation (treated as tax) his optimal maximising value for a given level of leverage (deposit) is greater than in the case when there is a positive cost of bankruptcy. This difference in value measures the benefit of free insurance so that an optimal premium on insurance to reduce the increment in the bank's value can be arranged. However, there is no incentive to accept this "fair-value" rule which goes with the added regulatory mandate. Instead, they show that in the case of an explicit flat rate premium on deposits, a risk-rated structure of implicit premia in the form of regulatory interference can achieve a comparable effect relative to the risk-related premia option. Thus, regulation and supervision in this model is to find the appropriate mix between regulatory interference, and flat-rate premia to contain excessive risk-taking.

As it was established in an earlier section of this chapter, the lenders' need for continous and extremely expensive monitoring of informationally indistinguishable borrowers was overcome by means of delegating this monitoring task to a financial intermediary (bank). However, a depositor face another incentive-informational problem as the bank may fail to fulfill its monitoring obligations so that a depositor must bear both a fall in deposit rates and a rise in the probability of failure (i.e. the return from the bank portfolio below the depositors' claims).

Again, the cost of continously monitoring their bank for an early detection of problem and insolvency will be large, and even if possible, any information from its monitoring is basically a public good. Therefore, there will be no incentive to monitor. The problem of delegating a monitoring task to a third party is monumental since it has to provide the right incentives, to be discrete, and deal with contagious panics.

One of the solutions is to appoint a government agency as a guarantor of bank deposits (i.e. Diamond and Dybvig's deposit insurance) and to monitor the banks. In this context, the government as a guarantor solves the monitoring problem since it is legally liable for any depositors' losses.

Benston (1983) indicated that from the records of the US banking history it appears that the deposit guarantee system which also empowered officials to monitor banks' operations and control excessive risk-taking proved to be successful in comparison to a banking system arrangement which did not include supervision.[24] Dooley and Mathieson (1986) also hold similar views with respect to LDC's experience. In an economy where the government is no longer directing and distorting credit allocation (i.e. financial repression) and is unable to reduce its insurance committment, there is a need for both regulation and supervision of financial intermediaries in order to restrain excessive risk-taking, and hence reducing the probability of failure. They also argued that the problem of joint ownership of financial and non-financial firms which encourage loan concentration will also demand regulation to limit the emergence of joint risks.

Within the context of a newly liberalised financial system, prudential regulation and supervision should play an important role which in a sense is against the logic of liberalisation.[25] Financial liberalisation represents a shift of decision-making away from the government and towards the private sector. However, the existence of asymmetrical information and some remaining distortions will make the risk evaluation and assets return highly inadequate and distorted. As Dooley and Mathieson (1986) have put it, there is a principal-agent problem in the sense that a liberalised and competitive market does not work well unless bankers (agent) are induced to act in the interest of the depositors (principal).

A complex institutional framework has evolved in developed countries to ensure that financial intermediaries act in the interest of depositors. As has been discussed extensively in the literature on financial regulation in industrial countries, particularly in the case of the US, the authorities have the responsibility of ensuring safety and the prevention of bank failures together with the guarantee of bank deposits.

According to Golembe and Mingo (1986), prudential regulation and supervision involves a direct and close observation of individual institutions as well as indirectly influencing management decisions which affect risk. Normally, regulation entails specific rules while supervision oversee for direction. For instance, regulation introduces portfolio restrictions in terms of limits on loan exposures and types of assets allowed to hold. At the same time, regulation may restrict entry, branching, and the type of product being offered and its price, although today these are less important than minimum capital requirements. In contrast, supervision is concern with overseeing and evaluating portfolio restrictions and capital requirements amongst other things.

The central question is whether regulation and supervision can indeed be efficient in restraining bank risk. According to Blair and Heggestad (1978), the introduction of portfolio restrictions by excluding high-risk, high return assets may increase the probability of bank failure instead of reducing it. In their mean-variance model, the banking firm will not be able to diversify therefore it cannot choose a market portfolio which is in the unregulated efficiency frontier and entails a lower probability of bank failure. These results stem from a failure to appreciate the existence of significant

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covariance between assets.

Similarly, Koehn and Santomero (1980) also applying a mean-variance model to utility maximising banks demonstrated that higher capital ratios could lead to a higher probability of bank failure by means of higher asset risk. They showed that for a bank with a smaller value for the coefficient of relative risk-aversion the banks' reaction to an increase in capital is a larger shift towards riskier assets which more than offsets the effect of rising capital. Therefore, the likelihood of bank failure will increase accordingly. In consequence, it appears to be significant theoretical ground to sustain the view that regulation on bank portfolios and bank capital is not effective by itself in lowering the probability of bank failure.

However, Kahane (1977) with a mean-variance model, and Furlong and Keely (1989) with state-preference model have shown formally that capital requirements combined with portfolio restrictions can actually affect the risk of bank default. Moreover, there are many empirical studies, as we will see in chapter 5 , which suggest that capital ratios, and proxies for asset quality are significant variables in the ex ante probability of bank failure.

Supervision also contributes to ensure that portfolio regulation and minimum capital standard are observed by the financial institution under surveillance. Sinkey (1977,1978) shows that the authorities have two main weapons to supervise financial institutions namely, on-site bank examination, and early warning statistical models.

With reference to on-site examination, although the identification and inclusion of a bank in the list of "problem banks" is a multi-dimensional problem (e.g.

compliance with law and regulation, management quality, liability structure, accounting practices), the authorities tend to concentrate their efforts on the quality of loans portfolios, and capital adequacy. These two items are likely to reflect some of these multi-dimensional factors, particularly management quality. The examiners look at the documentation and collateral of both large loans and a random selection of small loans in order to classify them accordingly. In the US, loans are listed as "loss" if they are uncollectable, "doubtful" if they have a high probability but with a chance of partial collection, and "substandard" if the loan has an inadequate collateral and an uncertain capacity of debtor`s payment. The Federal Deposit Insurance Corporation (FDIC) in the US has reduced this process to single ratio, namely the net capital ratio (NCR) which combined both asset quality and capital adequacy. Briefly, the NCR is defined as $NCR=K+R-C/A$ where K,R,A are capital, reserves, and total assets. Also C is defined as the sum of loss,doubtful, and substandar loans. The evidence from the US suggest that examiners have been successful in detecting problem banks.[27]

Supervision can also be aided by the introduction of early warning models. They are not designed to substitute on-site examination but to complement it. The early warning from these models will help the authorities in determining the order, scope, intensity, and frequency of banks` examinations. This should enable the authorities an efficient allocation of the agency's resources, particularly in a large financial system. In these models bank problems and failures can be predicted in advance through the use of balance-sheet information. The ability of these models are undermined in the case of fraud, embezzlement, and misapplication of funds. In this case, the information is deliberately masked, and manipulated so that it cannot be uncovered by the supervisors and hence the bank failure is an explosive and sudden phenomena. However, Meyer and Pifer (1970) concluded in his pioneer study that even in the case of those failures which result from fraud, and embezzlement are picked-up by bank failure prediction model. Chapter 5 provides a thorough account of the concepts and techniques of these models.

Acharya and Udell (1991) argue that under the assumption of symmetric information between banks and the regulator/supervisor, the government agency can observe a bank's capital and asset risk through the examination process and early warning models. Indeed, malfeasance, fraud, and misconduct will be spotted immediately. If the market value of assets fall short of the market value of liabilities during the examination the individual bank can be forced into liquidation or into merger with a financially viable bank. Moreover, a deposit insurance to prevent any panic run will be supplied with a premium which increases with the bank's asset risk and decreases with any increment in capital. Under theses optimal rules, banks may be induced to both voluntary monitor their asset risk and capital and follow more conservative banking management. In this scenario regulators/supervisors duties are simplified and carried out effectively and efficiently by sharing these duties with banks themselves.

Under the assumption of asymmetrical information, regulation/supervision becomes a complicated problem between a principal (regulator) and the banks (agent). As we have seen previously, supervisors will be unable to clearly see the banks' asset quality. Moreover, banks could even have the incentive of altering their portfolio risk and capital between examinations. This severely undermines the role of monitoring by the regulator/supervisor, and forces them to charge a fixed-rate insurance premium which promote moral hazard unless it is limited by regulation. It is clear that under aymmetrical information the regulator no longer can establish minimum capital requirements nor observe banks' asset quality with certainty. At the same time, it can introduce risk-weighted related premium for deposit insurance. Thus, as the regulator (principal) faces moral hazard since he cannot observe the activities controlled by his agent (bank), the role of supervision will be undermined severely. Moreover, even if a failure can be identified by the regulator/supervisor there are still principal-agent conflicts between regulators, politicians, and taxpayers. Specifically, regulators will try to avoid visibly large failures by delaying bank liquidations. This can be explained by their own fear about the public's perception of their work, the existence of funding constraints, and political calculations.

As we have seen earlier the collapse of Saving and Loan Associations in the US clearly represents a failure of the regulatory agency to effectively regulate and supervise these financial institutions. And as we will see in chapter 8, the failure of the Chilean banking authorities in their supervisory duties, particularly in the presence of bank holding company structure, explicit free deposit insurance and rapid financial deregulation contributed to excessive risk-taking and the large number of bank failures.

- Deregulation of Interest Rates.

Finally, the timing of interest rate deregulation has an important incidence in the problem of moral hazard and the likelihood of bank failures. There is considerable theoretical and empirical grounds to sustain this view.

Although the role of a bank has important advantages in the selection and control functions as producer of information reducing the ex ante and ex post information asymmetries of capital markets, important incentive and selection problems still remain. Stiglitz and Weiss (1981) have shown that the rate of interest ($\hat{\imath}$) charged by a bank may in itself affect the riskiness of a loan by affecting both the mix of applicants (i.e. adverse selection) and the action of chosen applicants (i.e. incentive/moral hazard). The model assumes that there are two groups of observationally indistinguishable borrowers (good and bad risks). Although a risk-neutral bank is able to distinguish the mean return of a project, he cannot ascertain the riskiness of the project measured as mean preserving spread (i.e. given two projects A and B with equal mean, if every risk-averse prefers A to B then B is riskier than A). Therefore, given that the bank cannot ascertain both type of borrower and his actions it designs a loan contract which includes the cost of lending ($\hat{\imath}$), collateral (Cl), and equity (E). The value of $\hat{\imath}$, Cl, and E serve as signalling mechanism as well as inducing borrowers to take actions which are in the interest of the bank.

In their model two important results are derived: Firstly, the quality of the mix of applicants changes adversely lowering the bank's expected return from loans as the interest rate charged to borrowers increases (adverse selection).[28]

Secondly, a rise in interest rates introduce an incentive effect where successful applicants undertake riskier projects with a lower probability of success but a higher pay-off. As before, a higher $\hat{\imath}$ reduces the bank's expected return from loans (incentive/moral hazard)[29]

Although the increment in collateral and/or equity requirements may have a positive effect by increasing the borrowers' wealth at stake in the case of default and hence reducing the risk of loan losses, there are limitations. Stiglitz and Weiss (1981) have shown that if borrowers have different wealth holdings and similar utility functions with decreasing absolute risk-aversion then any increase in collateral would discourage the most risk-averse borrowers and hence reduce the bank's expected return from loans.

It is clear from the model that the Walrasian equilibrium interest rate at which demand and supply for credit are equal can be considered as an inferior equilibrium. Indeed, there should be a lower interest rate at which the bank's expected profits are maximised. This equilibrium is consistent with excess demand and credit rationing. It is not profitable nor optimal to a rise interest rates and collateral beyond the optimal point even if borrowers are willing to pay higher rates. Mankiw (1986) has shown that a small increase in the rate of interest would cause the loan market to dissappear for some borrowers even if their projects are socially productive at higher interest rates.

This provide sufficient theoretical support to the view that a rapid deregulation of interest rates can produce moral hazard and adverse selection problems raising the likelihood of bank failure. In addition, the availability of deposit insurance combined with both bank holding company structure and a weak prudential regulation will encourage banks to undertake a rapid expansion of risky lending even at high lending interest rates. Furthermore, Villanueva and Mirakhor (1990) and Leite and Sundararajan (1990) suggest that the flow of credit demand becomes fairly interest inelastic as the stock of non-performing loans rises rapidly as the macroeconomy deteriorates. Thus, as business profitability deteriorates and banks extend fresh credits which will turn-up to be irrecuperable, they will be increasing the likelihood of its own failure.

Looking at the deregulation of deposit interest rates, there is also evidence which pin points a link between deposit interest rates deregulation and moral hazard. Keeton (1984) provides two reasons why banks` risk-taking will increase with the removal of deposit rate ceilings. Firstly, the removal of ceilings on insured deposits would increase the distortion which already exists under a fixed price deposit insurance. Assuming that a deposit insurance covers both the principal and the interest of a bank deposit up to a specific limit, then a rise in the deposit rate paid on insured deposits below the set limit will increase the insurer`s potential liability. Therefore, banks will have an undue incentive to take additional risks by choosing a mix of riskier assets.

Secondly, it introduces additional distortions on risk-taking as banks whose risk is under-priced succeed in attracting deposits from sound banks whose insurance premium is over-priced. Despite this risk difference, they all face a similar premium per dollar worth of deposit. This will result in a cross-subsidisation of relatively risky banks by relatively safer banks. Thus, while interest rate ceilings make more difficult for risky banks to outbid safe banks, deregulation removes this constraint and distorts risk-taking.

Another issue which arises from a sharp deregulation of interest rates involves the increase in interest rate risk as a result of the imbalance resulting from the maturity transformation by financial institutions. On this point, Leite and Sundararajan (1990) maintained that those financial institutions which are involved in long-term lending at fixed rate but whose funds are mostly short-term can face serious difficulties during the deregulation period. However, it is not the mismatching per se which could drive a financial institution into insolvency, but its reaction to changes in its own market. Given that loans pacted at regulated interest rates would not pay sufficient to cover the interest rate cost, then new loans arranged at higher interest rates may exceed the cost of funds. Thus, as old loans mature and are replaced by new ones, the imbalance between assets and liabilities can be eased and the entity could become profitable. Thus banks will be seeking rapid growth in their assets as well as looking into higher yield assets. This excessive risk-taking in the pursue of higher growth and asset yields can be aided by both a fixed deposit insurance and the relaxation of prudential regulation, particularly with respect to capital adequacy and allowing investment into risky assets. This clearly represent a gamble in the sense that if it succeed the improvement in profitability will be accrued by the bank, and the losses from bank failures if the bet does not pay-off is absorbed by the insurance agency. This description clearly reflect and explain the failures of Saving and Loan Associations in the US during the 1980's.[30]

The arguments for a rapid deregulation of interest rates have been disputed not only at the theoretical level but also on empirical grounds. Villanueva and Mirakhor (1990) have established that those countries which followed a gradual approach towards deregulating interest rates succeeded in liberalising their financial system. For instance, Taiwan, Singapore, and Korea engaged in a gradual and flexible management of interest rates with frequent adjustments which resulted in low and sustainable rates, low non-performing loans, and the absence of mismatching and any financial difficulties which could have endangered the stability of the financial system.[31]

In contrast, countries like Argentina, Uruguay, Turkey, Philippines, and particularly Chile liberalised interest rates within a short period of time. This approach resulted in sharp increases in real interest rates which in turn contributed to exacerbate the moral hazard problems. Indeed, Mckinnon (1988) one of the founders of the "liberalisationist" school of thought on financial markets conceded that the failure of financial liberalisation in Latin America can be partly explained by the failure of interest rate deregulation. He supported the view on policy-stance that governments should have imposed a ceiling on interest rates to avoid banks' moral hazard.

In general, one could argue that factors such as bank holding companay structure and bank concentration, the availability of a fixed price deposit insurance scheme or the expectation of a free deposit guarantee by the state, a weak prudential regulation and supervision, and a rapid deregulation of interest rates will encourage excessive risk-taking (moral hazard) by both bankers and depositors. Moral hazard will in turn raise the likelihood of bank failures. These four factors are policy-induced and hence external to the banks, but the banks' reaction to these incentives in the form of excessive-risk taking are internal to the management.

As we will see in chapter 8, the evidence from developed and developing countries has given more ground to the role played by moral hazard in different episodes of bank failures, and undoubtedly it will explain the collapse of banking institutions in Chile during 1982-83.

(4.5) The Importance of Bank Failures.

As we have seen in early sections of this chapter, banks have been subject to several mechanisms to regulate and supervise financial institutions. Most of this regulation has been designed in order to prevent bank failures. There is a widespread consensus that bank failures produces a significant social cost and hence the necessity to protect the public. Specifically, the social costs of bank failures are borne by third parties rather than banks' owners and creditors. In the event of bank failures, people unconnected with the banks will be facing credit rationing, termination of productive investment, loss of employment, and the overall effect of a reduction in economic activity and increasing uncertainty.

Most of the theoretical framework developed for the study of financial crisis (bank failures) postulates links between banking system instability and output fluctuations. That is, they recognise a direction of causation running from bank failures to real economic activity. Their efforts have been concentrated in identifying the transmission mechanism between banking failures and panics to economic activity.

According to the monetarist model and its interpretation of the Great Depression of the early 1930's the wave of bank failures was responsible for the collapse of economic activity. Friedman and Schwartz (1963) maintained that bank failures led to deflation via a reduction in the money stock, as the currency/deposit and currency/reserve ratios rose unexpectedly. In this model, the transmission mechanism was viewed through the narrow channel of changes in the money supply and the effect on output under the implicit assumption of sticky prices (i.e. the IS/LM paradigm and the shift inwards of the LM).

It was argued that the impact of bank failures on output via money supply reductions seems quantitatively insufficient to explain a large fall in output. Moreover, the monetary model has to rely on ad hoc sticky price assumption to produce real output effect unless we introduce the Lucas' supply curve and/or Barro's unanticipated monetary change.

Bernanke (1983) demostrates that the impact of money on output does not come only through the conventional channel of shortage in liquidity and high ex ante real interest rates but also and more importantly through the effect of the disruption of the real services provided by financial intermediaries (banks). The model departs from the Neo-classical assumption of perfect competitive capital market by assuming the existence of asymmetrical information between lenders and borrowers. Thus, a bank performs a service of differentiating good from bad risk borrowers by incurring administrative, screening, and monitoring costs. The minimisation of these intermediation costs are achieved as a result of the benefits from continous trading between the bank and the lenders. Among them we include the accumulation of information on qualities and characteristic of borrowers from a long term financial relationship, accumulated expertise at evaluating potential borrowers, and the use of collateral and net worth requirements.

The essence of Bernanke's model is that bank failures and bankruptcies disrupt the allocation property of the banking system by destroying and distorting the value of past information and henceforth raising the intermediation cost. Although there would be borrowers willing to pay high intermediation costs in order to secure funds, a profit maximising bank will prefer to ration the limited availability of loanable funds. Thus, even though some class of borrowers were able to borrow funds under a more sound economic environment, under an adverse economic climate they will be rationed. Thus, the reduction in the availability of credit via credit rationing, and recalling loans will affect production and the economy's output as much as it will be affected by the money supply.

In consequence, this modern approach which introduces asymmetrical information has provided a theoretical and empirical framework to understand how the disruption of financial markets can cause a downturn in output without resorting only to the money supply narrow transmission mechanism.[32]

Apart from the social costs from bank failures, there are also private costs from failure which are those borne by bank shareholders and by individuals and firms with contractual financial interests. When there is a failure of a financial institution there are legal procedures, including the appointment of a receiver to liquidate the bank which involves costly legal expenses. This direct bankruptcy cost is bear by the bank's creditors and shareholders since they receive what is left of undervalued assets after the receiver's and lawyer's fees have been paid.

There are also indirect bankruptcy costs, as depositors will need to incur search costs to find another deposit taking institution. Moreover, insured and particularly uninsured depositors will need to bear a long delay before the bank is liquidated and they can get their money back. It should be said that direct and especially indirect costs are extremely difficult to quantify empirically.

(4.6) <u>Two Testable Hypotheses for the Chilean Bank Failures</u>

From the examination of the proximate factors of bank failures in the earlier sections of this chapter, there are two general hypotheses which can be empirically tested. Firstly, the effect of an adverse change in the general economic environment due to international disturbances and/or policy inconsistencies which produce severe misalignment in some key macroeconomic prices (e.g. real exchange rate, real interest rate, and real stock prices), and a bust in output on the likelihood of bank failure. These factors are considered to be external to the banks' management.

Secondly, the likelihood of bank failure can be affected by the banks' willingness to undertake excessive risk-taking as a response to structural changes, increase in competition and remaining incentives from financial liberalisation. The existence of free deposit insurance, powerful bank holding company structure, weak prudential regulation and supervision, and a rapid deregulation of interest rate will induce banks' moral hazard, excessive-risk taking , and thus a higher probability of bank failure. Although those changes coming from liberalisation reforms are external to the banks (industry), the managers' attitude is an internal factor to the bank (firm-specific)

In my view it seems that the banks' vulnerability to the type of financial crisis which affected the banking systems during the 1930's as a result of panics and illiquidity is an unlikely event today. According to the evidence from different financial episodes, the banking system remains vulnerable to the type of crisis which will result from the internal response by banks to undertake more risks. The effect from changes in the external environment is merely a detonator of a banking system already weakened by less conservative banking practices.

The study of the banking crisis in Chile during the early 1980's emerges as an interesting and unique episode not only due to its magnitude but also from the concurrence of two factors namely adverse macroeconomy, and banks' excessive risk-taking from liberalisation reforms.

There are several issues relating to the Chilean bank failures which remain to be answered from an empirical point of view. Firstly, how important was the deterioration of the banks' external environment, particularly the misalignment of key macroeconomic prices, and the collapse of aggregate output on bank failures ? This issue will be addressed in chapter 7.

Secondly, is there any significant evidence to suggest that banks' increasing vulnerability and subsequent debacle can be attributed to moral hazard (excessive-risk taking)? Chapter 8 will provide the answer to this question.

Finally, given the fact that the process of financial liberalisation started several years before the collapse of banks, is there any early warning signs which may suggest that the banks' increasing vulnerability started before the deterioration of the banks' external environment ? Chapter 6 and 9 discusses the result of an early warning model for Chile, and evaluates the two competing hypotheses

Endnotes.

(1) Chant (1992) have also maintained that models should also be able to explain the characteristics of financial intermediaries, particularly the types of claims they issue and hold. In the case of banks, they issue liquid liabilities with a fixed value and payable on demand and hold mainly non-marketable securities (loans and advances).

(2) In this economy households know their intertemporal income and consumption as much as firms know the technology, the supply of both capital and labour, and the future demand. Different rate of time preference among households will enable firms to borrow from surplus units and use this divisible productive capital in an amount different to what their own initial physical capital would permitted. This contractual agreement can be monitor and enforced at no cost if necessary. Or we can assume that every transactor is honest about this intertemporal exchange.

(3) Specifically, Myers and Majluf (1984) introduced a model where a firm has an asset in place and a valuable real investment (I) whose expected value depends on a random variable. The project realisable values are denoted as a and b respectively. The investor only knows the distribution of the random variable in contrast with the manager who knows a and b. The model also assumes that the management act in the interest of existing and passive shareholders by maximising Vo(a,b,E). They demostrate that under these assumptions a rational expectation equilibrium indicate that a firm may passed-up a positive present value project if it has to issue new shares to finance it. The firm has insufficient internal resources or financial slack (i.e S=cash+marketable securities so that S<I then E=I-S), and the price of equity after the issue P` is less than the price P if no equity has been issued. That is, the market value of the firm if no issue is Vo=[P/P](S+a) > Vo=[P`/P`+E](E+S+a+b) when it has issued. This can be interpreted as the share of existing assets and financial slack going to new shareholders is greater than the share is more than the share of the increment in the firms` value obtained by the old stockholders. It is proven that P`< P since the decision to issue equities is interpreted by a rational individual as bad news on the project prospect and hence the firm`s value. However, once the assumption of passive shareholder is dropped and they are compelled to buy and hold new issues this loss is avoided.

(4) Apart from perquisites, managers have the incentive to divert resources towards the acquisition of skills and technical knowledge in order to improve its market value and makes himself indispensable to the firm. This type of activity is known in the literature as managerial entrenchment.

(5) Stiglitz (1985) maintained that in a modern capitalist firm (i.e. many small number of shareholders and a manager controlling a large amount of resources) a manager does not act in the interest of the stockholders and the market mechanism fail to provide the necessary incentives. Shareholders' meeting and voting are mechanism which attempt to control managers and replace them in the case of bad performance. However, small shareholders hold the belief that their vote has a neglible effect on the outcome. Moreover, the cost of information in evaluating a manager and alternative teams is forbbiden for individual shareholders and the information obtained is by nature a public good. These two factor will preclude shareholders to vote intelligently if any. The market discipline is also undermined by the failure of take-overs to provide limits on managers. As we know if a manager fail to maximise the firm's profits and market value then there is a risk of take-over from outsiders and the likelihood of management restructuring. Insiders have more information that outsiders so that when an existing shareholder is willing to sell signal that the take-over firm is actually paying in excess. Thus, under the existence of asymmetrical information, a take-over bid will be successful when the bidding firm is paying an over-valued market price for shares. This may put off any attempt of buying-off a firm. Moreover, information is costly and a public good so that any firm spending on information search to identified under-valued firms will make negative profits as new bidders which are free riding from information will rise the cost of bidding. At the same time, if the take-over bid succeed then the firm's market value increases such that small shareholders will prefer to free ride and internalised additional gains unless the market value is reduced.

(6) Given that $g(Y)<Y$ (entrepreneur's payment to the intermediary depends on Y) then the total payment from monitoring n entrepreneurs is $Gn=Eg(Y)$. But Gn is a random variable bounded as $\{0,Gn<\Phi\}$. Moreover, the intermediary must pay to the lender (depositor) at least r or a total payment $Zn=(n*r)$. It follows that $Zn<Gn$. Therefore, a deadweight non-pecuniary penalty must be impose so that the intermediary pays at least $(n*r)$. The optimal contract is given by $\Phi(Zn)=\max[Hn-Zn,0]$ where Hn is the smallest solution to $P(Gn<Hn)E[Gn|Gn<Hn]+[(1-P)(Gn<Hn)]Hn>n*r$. The expected return to the intermediary is $E[Gn]-Hn$ so that he has an incentive to monitor and to $\max E(Gn)$.

(7) The optimal insurance contract (consumption) satisfies $C12=C21=0$ which states that type 1 and type 2 agent derives no utility from consumption in $T=2$ and $T=1$ respectively. Moreover, $u'(C11)=pRu'(C22)$ and $tC11+[(1-t)C22/R]=1$ where p is the rate of time preference means that the marginal utility is equal to the marginal productivity, and the

resource constraint is satisfied. Given that $pR>1$ and the relative risk-aversion always exceed unity then the optimal consumption from the insurance contract satisfy $C11>1$ and $C22<R$ and $C11<C22$.

(8) The model demostrate that this equilibrium destroyed the optimal risk sharing between agents affecting detrimentally production efficiency as production is stop at $T=1$. Moreover, they demostrate that a bank run equilibrium is inferior than the competitive claims market.

(9) It is assumed in the model that investors both short and long run have no initial endownment so that avery investment opportunity has to be financed by bonds. Specifically, a long term investor faces an investment opportunity I at $T=0$ with a yield $F(I)$ at $T=2$. At the same time, a short term investor has two consecutive short term investment opportunity X1 and X2 at $T=0$ and $T=1$ with a yield of $f(X1)$ and $f(X2)$ at $T=1$ and $T=2$. These investments are financed with long term bonds B and short term bonds Y at a given interest rate.

(10) As we have seen in the Diamond and Dybvig's model, a bank insures savers against the risk of a consumption shock and hence a liquidity needs by offering a deposit. In contrast, the role of bank is Waldo's model is to provide indirect access to market for primary securities. At the same time, it is shown that savers shifts from deposits to storage in the anticipation of a run, and hence explaining the decline in the deposit-currency ratio. Moreover, it explains the rise on interest rates as the bank sell long term securities before maturity and purchasers have to be compensated for the forgone return of existing investment opportunities. These two observations were present during the financial crisis of the 1930's.

(11) Dowd (1992) provide a summary of Jacklin's model. It is shown that agents can invest in a mutual fund which in turn invest in production and issue equities at $T=0$ with a promised and fixed dividend announced at $T=0$ and paid at $T=1$. At $T=1$ equity holders receive a dividend D and as they learned their type, type 1 agent sells its equity to type 2 with a return which is greater than its market price, that is $R(1-D)=R(1-tR1)>R1(1-t)$. Type 1 sells its equity as future dividend at $T=2$ does not matter to him after the consumption shock at $T=1$. The return to type 1 is equal to the dividend D at $T=1$ which is equal to $tR1$ plus what he gets from selling its equity stake at $T=1$, $(1-t)R1$. It is demostrated that an equity contract satified the same condition as the Diamond and Dybvig's contract.

(12) Lewis (1992) argues that a collateral is mortgage, and its disposal will be slow as it requires legal consent. With

reference to the role of collateral and interbank loans, it is argued that this market is rationed and subject to asymmetrical information. In addition, there is evidence that interbank lending encouraged excessive risk-taking as reflected by the collapse in the US of the Franklin National and Continental Illinois in 1975 and 1984 respectively. On the value of the collateral, I should add that if the assets are subject to a bubble and hence valued above its fundamentals then it follows that when the bubble burst then the collateral's value should fall and hence offering no sufficient guarantee to depositors.

(13) Although the number of bank suspensions during most of 1930 remained similar to the average number of failures in the previous nine years it picked up in November and December of that year. According to them, although farm-belt banks failures were unusual during these two months and led to bank runs from currency and postal savings without geographical limits, the role played by the Bank of the United States was paramount in affecting depositors' confidence. Although Wicker (1980) supports the panic nature of bank failures and the importance of the failure of the Bank of the United States, he lent more importance to the collapse of the Caldwell and Coy. in November 1930. This company based in Tenneesse was the largest investment house in the south of the US. It controlled the largest chain of banks, insurance coys.,industrial enterprises, and even newspaper businesses totalling more than U$ 1.5 billions worth of assets. He found evidence that the bankrupcy of Caldwell was attributable to financial weakness from inadequate capital, its rapid expansion, lack of liquidity, poor quality of loans and investment as a result of excessive portfolio concentration by bank affiliates with the "parent" company. This reckless and risky managerial performance of Caldwell led to the suspension of more than 120 banks in four states which were directly or indirectly affiliated to Caldwell Coy.

(14) Lewis (1994) compares the balance sheet composition of the US and the UK. In both cases, loans and advances represent around 65% of total assets followed by 33% of securities, and between 1% and 2% in cash. Similarly, deposits exhibited the largest share of total liabilities with approximately 80% followed by 14% in other liabilities, and the difference being equity capital. These figures are not different for a bank in a less developed economy.

(15) Eichengreen and Portes (1986), Kindleberger (1986), and Keran (1986) provide a thorough account of the effect of macroeconomic instability on bank failures of the 1930's and the 1980's.

(16) Basically, the model shows an investment with an stochastic return R with a cummulative distribution F(R,w) where w is the diversification of project-specific risk. The probability of loss is given by $Pr[R<L(1+i)-K]=F[L(1+i)-K,w]$ where L and i is the loans and the rate of interest respectively. Higher indebtness, lower capital, and riskier project-specific the higher Pr. However, there are uncertain events where nature draws investment returns from a disastrous distribution with R=0. The subjective probability of loss when nature draw from this distribution ($\pi>0$) is $Pr[R<L(1+i)-K]=(1-\pi)F[L(1+i)-K,w]+\pi$. That is, a weighted sum of the objective probability of an adverse outcome from the project-specific distribution and the subjective probability of nature draws investment return from a disastrous distribution π. While frequent shocks affecting the specific-project distribution are priced as risk-premium loan or forcing quantity rationing, the distribution of disastrous returns are unknown even from past history. This imply that subjective and objective probabilities may differ leading to a disaster myopia. Subjective probabilities are considered as determined by psychological mechanisms. For instance, the probability of an event depend on the time elapsed since the last occurrence and its intensity (availability heuristic). After some point of the occurrence of the event, the probability is considered as zero (threshold heuristic). When new information contradict previous information and suggest that there is a probability of disaster, such information is ignored or rejected (cognitive dissonance). This expectation formation which leads to mistakes are reinforced by the lack of supervision, and the principal-agent problem between managers and shareholders due to asymmetrical information and agency costs.

(17) Meltzer (1982) argues that there are events which are not susceptible to be measured by means of an objective and stationary probability distribution. These events then need to be excluded altogether from rational expectation models. The existence of uncertainty as opposed to risk is another facto which could be relevant in financial disorders and instability However, there is no theory of how decisions are made under uncertainty. In general, people tend to watch others and do not deviate from the pattern already set by the rest. Although there is no way of knowing ex ante if people are right or wrong this in it self may contribute to a possibility of banking instability. For instance, innovation increases uncertainty via destructive creation process which may trigger a shift in confidence and provoke a bank run.

(18) White compares the dissimilar configurations of the banking system in Canada and in the US and the different responses to the problem of the 1920's. The US operated with 30.291 banks during 1920 whereas Canada had 8 chartered

banks with 4.676 branches. Between 1920-29 there were 6,008 suspensions and voluntary liquidations and 3,963 absorptions and mergers in the US. In contrast, in Canada only one bank failed and nearly 14% of branches were closed. Between 1929-33 there were no failures in Canada and a fall in branches by 10%. Nationwide branching in Canada permitted a quick mobilisation of funds to meet localised runs. A similar argument is made by Wheelock (1995) for bank failures in the Great Depression.

(19) Sinkey (1979) provide a thorough account of the failure of the US National of San Diego and the Hamilton National Bank. The US National was the second largest failure in the US after the Franklin National. Loss classification of loans exceeded the bank's capital, involving principally extensions to persons and entities related to the bank. Similarly, The Hamilton National become the third largest failure in the US. It involved illegal loans to speculative real estate operations by the affiliate Hamilton Mortgage Corp. After the recession of 1974 heavy losses emerged from the bank's loan portfolio which forced him into insolvency.

(20) Undoubtedly, the existence of economies of scale in banking can explain partly bank concentration. However, it should be also pointed out that there are potential benefits available from market concentration. For instance, given the nature of banks as they are highly gear (i.e. high liabilities/capital ratio) they should benefit from horizontal integration.

(21) A basic oligopolistic model with no bank holding company structure predicts that whenever collusion is plausible financial intermediaries would widen the spread between asset and liability interest rates. However, the oligopolistic profits which arise from a positive spread is passed onto the affiliates caompanies in the form of a subsidised credit. According to Galbis (1986), the bank's choice of the size of the interest rate spread respond to the tolerance and effectiveness of the supervisory authorities with respect to abnormally high profits. The possibility of examining bank's balance-sheet in looking for implicit subsidies will encourage a low spread by oligopolistic banks related to bank holding companies.

(22) Like credit markets, the insurance market is also subject to adverse selection and moral hazard problems which arise from information asymmetries between the insurer and the insured. Rothchild and Stiglitz (1976) identified two market equilibrium: pooling equilibria where bad and good risk individuals buy the same insurance contract, and a separated equilibria in which a different contract is offered to each particular risk. It is shown that an average actuarial premium of Ka will be offered to both type of risk affecting adversely the mix of applicants if Ka is greater

that marginal benefit of low risk individuals and viceversa (adverse selection). With respect to moral hazard, Arrow (1963) and Pauly (1968) identify two problems faced by insurers, particularly in relation to medical insurance. Firstly, the insurer is unable to assess the extent of the insured's losses in the case of an adverse state of nature unless he incurrs into costly monitoring. Secondly, the probability of an adverse state of nature is under the control of the insured. The introduction of deductibles, coinsurance, limited coverage, flexible risk premiums, and information gathering to encourage the insured to signalling their risk-characteristic as well as its actions to reduce risk are important steps to reduce the moral hazard and adverse selection problem.

(23) Benston (1983), Eisenbeis and Gilbert (1985), White (1989), Calomiris (1990), and Karaken (1983) among others not only have shown the perversive incentive created by deposit insurance, but also provide alternative ways to reform the system. White (1989) believe that the command-control regulation approach (i.e. regulation of banks asset portfolios, entry controls, bank ownership etc.) have been inefficacious. Instead he proposes the introduction of tools applied by insurance companies to protect themselves against risk. Among them favour the implementation of deductibles (minimum net worth at market value), coinsurance, reinsurance, limits on insurance coverage, the preference for market value accounting information, and risk-based premiums. On the opposite extreme, Calomiris (1990) advocate a greater role for incentive-compatible self-regulation. Self-imposed regulation and mutual monitoring will keep members from privately established coalitions away from taken undue risks and from free riding. Kareken (1983) prefer a middle road solution where the government can provide information about banks' asset quality in a digestible and comprehensible form. Given that there is no secondary market for loans, a practical rule for valuation will be required to provide information as part of the public domain.

(24) Calomiris (1990) have shown that deposit guarantees were established in New York (1828), Vermont (1831), Indiana (1834), Ohio (1845), and Iowa (1858). Except for the first two which were state run, the others operated successfully largely because they empowered the agencies to monitor bank risk-taking. In contrast, a second wave of deposit guarantee plans , particularly the compulsory plans of Oklahoma (1908), Nebraska (1909), and South Dakota (1916), as well as the voluntary arrangements of Kansas (1909), Texas (1910), and Washington (1917) resulted in failures as these plans did not include supervision.

(25) This does not mean that the regulatory framework which was in operation during the state of financial repression is useful in a more liberal order. On the contrary, it could be argued that the old regulatory institutional structure is obsolete, ineffective, and expensive. While a regulator in a financially repressed market was concern with following government directives, to day they are enhancing the role of the market and competition along the lines which ensures efficiency and stability.

(26) The unregulated efficiency frontier contain portfolios with minimum standard deviation for a given expected return. A risk-averse bank maximised its utility by choosing a portfolio at the point of tangency between the efficiency frontier and the upward sloping indifference curve. That is, at a point where the marginal rate of substitution (MRS) between expected return and risk is equal to the marginal rate of transformation (MRT) along the derived efficent frontier. This portfolio equilibrium is consistent with portfolio's insolvency risk shown by a ray along which the probability of failure is constant. The introduction of portfolio restriction shifts the efficient frontier downwards so that the new equilibrium will entail a lower indifference curve (i.e. lower expected utility) and a higher probability of failure as the ray pivot downwards. In this model, any point on the unregulated efficient frontier should cointain portfolios with a higher expected utility (i.e. higher indifference curve) and a lower probability of failure (i.e. a ray pivoting upwards). This model can also capture changes in capital requirements by means of a shift downwards in the ray if capital is increased. Or the introduction of a global efficency frontier which is an envelop of efficient frontiers with all values of capital. The same conclusions as before follows from the analysis.

(27) The evidence from Sinkey and Walker (1975) lend support to importance of banks' asset condition for the classification of problem banks. They found that that from the FDIC's list of 318 problem banks in 1973, 210 (64.8%) presented poor asset condition measured by the adversely classified loans relative to capital and reserves. Similarly, Sinkey (1978) found that NCR was the most significant variable separating problem banks from non-problem banks. The list of problem banks analysed corresponded to 143 commercial bank from the FDIC sample of 1973 and compared with a random sample of 163 non-problem banks draw from a total sample of 9065. By applying discriminant technique which test for groups mean and the dispersion-matrix difference indicates any significance mean difference between groups and any overlapping between groups. Out of 21 examination variables, NCR was the most important discriminator between the two groups with a type-I error of only 4.9% (7 banks).

(28) For all projects Θ such that $\Theta>\Theta c$ where Θc is the critical value which satisfy the condition that the borrower's expected profits $\Phi[\hat{\imath},\Theta c]=0$ for a given $\hat{\imath}$, the borrower undertakes the project. Any increase in $\hat{\imath}$ rises Θc so that below this critical value individuals do not apply for loans. These two results indicates that if there is a discrete number of potential borrowers each of them with a different Θ (risk) then the bank's average expected return $\Phi(\hat{\imath})$ will not be monotonically increasing with $\hat{\imath}$ as good risk (i.e. $\Theta<\Theta c$) leave the market. There will be then a discrete fall in Φ.

(29) If two projects A and B with returns $Ra>Rb$ and probabilities $Pa<Pb$ then at a given $\hat{\imath}$ the firm would be indifferent between the two projects (i.e. $[Ra-(1+\hat{\imath})B]Pa=[Rb-(1+\hat{\imath})B]Pb$). It is demostrated that in the event of an increase in $\hat{\imath}$ will lower the expected return of a project with highest probability of success by more than it lowers the return from the riskier project. It follows from this result that the bank's average expected return Φ is lowered by a rise in $\hat{\imath}$ if the firm at a given $\hat{\imath}$ is indifferent between projects A and B. Again, i this case Φ is not monotonically increasing with respect to $\hat{\imath}$.

(30) According to Feldstein (1991) the root of the problem of thrift banks was the rapid inflation of the 70's and the authorities respond to solve the problem. Congress permited managers to grow fast into mortgages for real investment and to take substantial risk in higher yield assets like "junk bonds". At the same time, it was agreed to increase the banks' liability insurance to U$ 100.000 per account, and relax the minimum capital standard for thrifts enable them to increase their size without adding to their equity capital. The differential between high interest rate paid on junk bonds and the low cost of insured deposits made this a very profitable solution. At the same time, Saving and Loans had little of their own resources invested and at risk. The process of excessive risk-taking came to an end when mortgage borrowers for many commercial real estate investment were unable to service their debt. The magnitude of the problem was so large that the insurer's agency had insufficient assets to deal with all of the insolvent thrifts. Therefore, the government guarantee those losses.

(31) For instance, Cho and Khatkhate (1989) have described the Korean interest rate deregulation as flexible by noting that lending interest rates were adjusted downwards in the event of a reduce profitability by the corporate sector as a result of shocks. Moreover, prudential regulation and supervision was enhanced to restraint banks' risk-taking. After macroeconomic stability was ensure and an effective prudential regulation introduced, the authorities fully liberalised interest rates.

(32) Bernanke (1983) in his Lucas-Barro model formulation found that monetary variables were statistically significant on the output equation. The dynamic simulation of the path of output captured less than half of the total output decline during the Great Depression. The introduction of non-monetary variables improved the fit of output for the period between the mid-1929 and March 1933 by showing smaller mean square simulation error. Hamilton (1987) have also confirmed these results for the 1930's Great Depression. Similarly, Calomiris and Hubbard (1989) arrived to similar results for the pre-World War I gold standard era and support the importance of the credit hypothesis over the role of money.

Chapter 5. Banking Failures: Some Empirical Studies and the Econometric Methodology

(5.1) Introduction.

The purpose of this chapter is to discuss the econometric methodology applied to the study of the banking crisis in Chile. This includes an analysis of some previous empirical studies carried out mainly in the US and the application of logit estimation technique. The chapter is divided into two main sections. The first one is a self-contained review of some of the early studies in explaining the failure/problem of financial institutions. Most of the studies employ specific econometric methods, in particular binary choice models. Much of the literature available is related to the US financial institutions and their failures and/or problems during the 1930's as well as the early 1970's and 1980's.

The second section presents a discussion of a univariate logit model with which I estimate the probability of bank failure given the set of the chosen explanatory variables using maximum-likelihood estimation for logit models. Moreover, there is a discussion of the criterion for hypothesis testing and model selection applicable for logit models.

(5.2) Previous Empirical Studies on Banks' Failures.

The economic environment and some policy reforms have introduced significant changes in the banking environment during the 1970's and early 1980's in both developed and developing countries. The pace of globalisation and integration of financial markets has generated a rapid increase in competition and marked shift in banks' attitude towards a greater exposure to risk. According to Short, O'Driscoll,and Berger (1985), the rate of annual bank failures in the US from 1975-81 has doubled compared with the average of the post war period and continued at this higher trend from 1982 onwards in spite of economic recovery. The same pattern is true with regard to the Saving and Loans financial institutions. Barth, Brumbaugh, Sauerhaft, and Wang (1985) calculated that since the establishment of Federal Savings and Loan Insurance Corporation (FSLIC) there have been 627 thrift-institution failures where at least 500 of them took place in the early 1980's. This financial instability and some of the difficulties in developed economies have also been experienced by the banking system in some developing countries. In many cases these were economies which took decisive steps towards market liberalisation and the collapse of their banking system brought to an end the deregulation of their financial system. This is true for Turkey, Mexico, Argentina, Uruguay, and especially Chile during the early 1980's.

As a result, there has been a proliferation of research directed towards the study of financial liberalisation and the causes of bank failures. In the US much of the effort has been concentrated on comparing the characteristics of failed/problem banks and non-failed/non-problem institutions. The aim has been to develop sophisticated methods to identify a bank's risk exposure and construct an early warning system to evaluate ex ante the weakness of financial institutions. Such bank failure prediction models not only can help test those factors (i.e asset quality, and capital adequacy) which contribute to bank failures/problems but also to an earlier detection of any financial weakness. This may also be critical for the improvement of the allocation of the scarce resources available for supervision and to minimise any costs from financial instability.

The bulk of the research on the US has been conducted by US Federal Banking Agencies such as Federal Deposit Insurance Corporation (FDIC), and Federal Reserve Bank of New York. In addition, the National Bank Surveillance System (Comptroller of the Currency) and the Board of Governors (FED System) had also carried out important research into the development early warning system and bank failure prediction models.[1]

Traditionally, the banking authorities have carried out their supervisory duties by relying on the on- site examination of a bank asset portfolio and capital adequacy.

For instance, the bank-examination process in the US has been the primary supervisory technique for identifying banks with financial difficulties although it has been complemented with statistical model using banks' balance-sheet data. Sinkey (1975) and Martin (1977) pointed out that financial and accounting information from a bank balance sheet and income statement have proven to be very efficient in showing specific bank characteristics as well as good discriminators between failed/problem banks and sound financial institutions. The accounting and financial information is used as a ratio analysis.

Those ratios have been included into different categories such as liquidity, asset quality and risk, capital adequacy, profitability, efficiency, and liability quality and risk. It was expected by researchers that the average problem bank will be less efficient, and less liquid, with riskier assets and liability structure, and with inadequate capital. This difference between problem and non-problem banks will tend to increase as we approach the failure status defined as negative net worth or by the liquidation, merging, and/or any other support from those responsible to ensure confidence and stability in the financial system.

The modern use of financial and accounting information in studying and developing models to assess the characteristics and to predict the problems and/or failures of financial and non-financial institutions was first applied by Secrist (1938). He used a simple tabular and graphics comparison of one or two balance sheet ratios at a time for failing banks and non-failing ones for the period of 1921-33. Although this study concluded that the univariate analysis did not discriminate well, Secrist maintained that a more elaborate approach using multivariate techniques should produce more satisfactory results.

The application of financial information from balance sheet to predict bankruptcies was first introduced by Beaver (1966). He developed a model to predict financial failure in a broader sense. In the firms' failure group he included bankruptcies, bond default, overdrawn bank accounts, and firms that omitted preferred dividends. Of the 30 ratios estimated by Beaver, only three of them best predict failures and with at least 2 of them with 5 years before failure.[2]

The other early path-breaking work was by Altman (1968) who studied the problem of failure prediction of firms in the manufacturing sector. Apart from using accounting information, he was the first to apply multivariate discriminant statistical technique to failure prediction models. He concluded that his model was an accurate predictor of firm bankruptcy up to two years prior to failure. From his initial 22 financial variables just 5 were included with good predictive ability.[3]

The subsequent literature has expanded in several directions. This was translated in the introduction of different new approaches, estimation techniques, and the study of different institutions under distint episodes, in particular banks and non-banks financial institutions.

One of the most common approaches in the literature of financial failure has been the ex post empirical approach. This approach included a wide range of estimation techniques and different criterias to identify a failure.[4] The essence of this approach consists in taking the actual classification made by the regulators in terms of failure and non failure groups as a discrete dependent variable. The second step is to identify and explain the classification as a function of a set of explanatory variables, mostly from information estimated from a balance sheet and income statement. An alternative and equally applied treatment for the discrete dependent variable is to categorise banks in terms of problem and non-problem institutions using examiners' reports. However, the bank failure prediction model has important advantages over a problem prediction model. Firstly, it eliminates the supervisory judgment regarding the problem status. Thus, failed and non-failed groups should be more discrete and identifiable than problem and non-problem banks.

Secondly, it should eliminates somewhat the problem of overlapping among groups. This advantage is important for classification purposes.

The advantage of bank problem prediction model lies in the fact that most failed banks are normally classified as problem with a substantial lead before failure. However, it should be pointed out that the converse is not true in the sense that not all problem banks actually failed.

The result is a model relating the probability of failure in period t to the set of independent variables as of period t-i. The evaluation of the estimated model depends on the significance of the variables, the goodness of fit and prediction ability as well as the stability of the coefficients over time. The methods employed to test the estimated model depends basically on the specific estimation technique being used. As we will see in the next section discriminant, logit, probit, and linear probability are the most common techniques applied in the study of bank failure/problem.[5]

Table 1 gives a chronological account of the most important studies using the ex post empirical approach. It shows that a number of studies have succesfully tested those financial variables which discriminate well between failed/problem and nonfailed/non-problem banks and can be used as early warning of banks' financial difficulties. The independent variables are organised in six categories which include capital adequacy, profitability, credit risk, liability risk, liquidity risk, and others. In each category the variables are not the same for each study. A more detailed description of the use of these accounting and financal ratios is provided in table 2.

The sampling methods and the definitions of the discrete dependent variable have involved pairing samples of failed/problem banks with nonfailed/non-problems banks. They have used a controlled sample by size, geographical location, and number of branches or alternatively with a random sample of sound institutions. As examples of the former procedure one may include Sinkey and Walker (1975), and Sinkey (1975) whereas with respect to the latter we have Sinkey (1978), Bovenzi, Marino, and Mcfadden (1983), and Nelson White (1984). In addition, those studies have used diverse and more sophisticated statistical techniques since the pioneer work of Secrist, Beaver, and Altman. For instance, Meyer and Pifer (1970) have applied a linear probability model to estimate the likelihood of bank failures. Following Altman's work in 1968 and the use of Multi-Discriminant Analysis (MDA) on the bankruptcy of non-financial firms and later in 1974 applying the same technique to the failure of the Saving and Loan Associations, Stuhr and Van Wicklen (1974) and Sinkey (1975,1978) extended its application to commercial banks.

Table 5.1 Analysis of Selected Empirical Studies on Banks.

Author Year	Number Type	Time Period	Est. Tech.	Dep.Vr. Class.	Independent Var. KA	PR	CrR	LbR	Lq	Ot
Meyer& Pifer (1970)	39FB	1948-65	Linear Prob.	1=FB 0=NFB	+	+	+		+	+
Sinkey& Walker (1975)	210PB 210NPB control	1972-73	ANOVA	Two-Way Class.	+	+	+		+	
Sinkey (1975)	110PB 110NPB control	1969-72	Discrim. Analysis	Two-Way Class.	+	+	+		+	+
Martin (1977)	58FB 5642NFB	1970-76	Logit	1=FB 1=NFB	+	+	+		+	
Sinkey (1978)	163PB 163NPB control	1973-74	Discrim. Analysis	Two-Way Class.	+	+	+			
Bovenzi, Marino,& McFadden (1983)	70FB 150NFB Random	1980-83	Probit	1=FB 0=NFB	+		+	+	+	+
Avery& Hanweck (1984)	100FB 588NFB	1978-83	Logit	1=FB 0=NFB	+	+	+		+	+
Nelson White (1984)	152FB 253NFB random	1927-30	Logit	1=FB 0=NFB	+		+		+	
Short, O'Driscoll &Berger (1985)	81FB 13820NFB	1962-83	Probit	1=FB 0=NFB	+		+	+	+	
West (1985)	PB NPB		Logit	1=PB 0=NPB	+	+	+		+	+
Rodriguez Fernandez (1990)	31FB 49NFB	1978-83	Logit	1=FB 0=NFB	+	+	+	+	+	

FB=Failed Bank NFB=NonFailed Bank
PB=Problem Bank NPB=NonProblem Bank

KA= Capital Adequacy PR=Profitability
CrR=Credit Risk LbR=Liability Risk
Lq=Liquidity Ot= Others

The probit and logit analysis have also been applied very widely in different case studies of bank failures. Following the first logit application to bank failure by Martin (1977) several studies have appeared in the literature ever since. For example, Avery and Hanweck (1984) and Nelson White (1984) applied the logit technique whereas Bovenzi, Marino, and Mcfadden (1983), Short, O'Driscoll and Berger (1985), West (1985), and Rodriguez Fernandez (1990) had applied probit analysis for bank failures.

With respect to the independent variables used in the literature, most of the financial ratios computed from balance sheet and income statement and tested in banking studies have been grouped in 6 categories, namely capital adequacy, profitability, credit risk, liability risk, liquidity, and others. A number of key financial ratios were associated with an increasing incidence on bank failures/problems, in particular during the last full year of operation before failure. In Martin's model the best regressors included net income/total asset ratio (NI/TA) as a indicator of profitability, gross charge-off/net income ratio (CGO/NI) and commercial loans/total asset ratio (CL/TA) as indicator of asset quality, and an indicator of capital adequacy measured by capital/risky asset ratio (K/RA). As we see from table 2, similar variables are used by Short, O'Driscoll, Berger (1985), Avery and Hanweck (1984), but with different success.

More recent studies have attempted to include also bank stock prices. Among these studies we include Pettway and Sinkey (1980) and Shick and Sherman (1980). Given the efficient market hypothesis, stock prices represent the bank's market value at all time since news and additional information on a bank performance will be instantaneously reflected in the stock price. Thus market information should complement the accounting information in bank failures predicting models if available and so long as stock prices does not respond to accounting data. In addition, it represents a quicker warning on a bank financial health if stock market have complete information.

The ex post empirical approach has thrown up considerable evidence on the usefulness of using accounting data to discriminate between financial firms that go bankrupt and those which remain solvent and to predict financial failures or problems.

Table 5.2 Synthesis of Selected Empirical Studies on Banks.

Author	Objectives	Estimates
Meyer& Pifer (1970)	To discriminate between FB & NFB using financial data as proxies for managerial ability and employee honesty.	The 9 variables regression model where 8 are trend and lag variables which correctly discriminate and classified 80% of the banks sample. Beyond two years lead time type-I error increases and financial ratios are unable to discriminate effectively.
Sinkey (1975)	To discriminate between PB and NPB by using financial ratios and MDA technique. He aimed at testing group mean differences and group overlapping.	Using a 10 variable model the null hypothesis of equal covariance and mean was rejected. Loan volume and quality were important as was efficiency in 1969-71. The mis-classification rate improved from 36% in 1969 to 24.8% in 1972. Type-I error fell from 46% in 1969 to 28% in 1972.
Martin (1977)	To analyse FB & NFB using logit and a wider definition of failure. To compare the results of logit and MDA.	The regressors were selected from 25 financial ratios.The best model was choosen by the Akaike's criterion. The best model of bank failures in 1975-76 estimated with data of 1974 had 4 variables, NI/TA,CGO/NI,CL/TL and K/RA. The model perdicted 20 failures out of 23 although the predicted accuracy declined with time.
Sinkey (1978)	Although is similar to Sinkey (1975) it includes net capital ratio estimated by using examination data on loans class. NCR is used to assess PB and to spot failures for large banks	Bank capital and examiners' substandard loans proved to be important. On average,the latter accounted for 80% of PB loans' classification. FB showed a large vol. of bad loans 16 to 20 months before failure. However, most with low NCR did not fail.

Table 5.2 (continued)

Bovenzi, Marino,& McFadden (1983)	To develop an early warning model using financial data and to compare with early models in terms of relative performance. To use CAMEL to test and predict failures.	They estimate 3 models: Call A included OOE/TA,GSp/K,TL/K CGO/TL ratios. Exam A is an extension of Call A as includes credit risk based on loan examination data. Exam B included also TOL/TA. All coefficients were significant and with correct expected sign. Examination data improves classification accuracy although efficiency falls relative to call data as the interval between data & failure increases. The result from using CAMEL classification is consistent although does not do better than the ratios.
Avery& Hanweck (1984)	To examine factors associated with FB. It focus on local market condition and the dynamic leading to failures unlike earlier studies.	The model contain 9 ratios where 5 were significant among them NI/TA,NL/TA,K/TA, CIL/TA and log TA-LLR.Lagged financial ratios did not add much to the model after 6 months and a year.
Nelson White (1984)	To study bank failures in the 1920's and the banking crisis of 1930 By analysing financial ratios he ascertained the empirical meaning of managerial factors on FB. Also, to test between real and money factors of the crisis.	For failures occurring in 1930 capital adequacy was insignificant unlike loan losses.Liquidity measured as CR/TD did affect the probability of bank failure. The Temin & Friedman/Schwartz hypotheses were found both significant. The evidence from the model shows the characteristics of FB in the 1930's were similar to those who had failed some years earlier where there was no liquidity problems.

Table 5.2 (continued)

Short, O`Driscoll & Berger (1985)	Similar to White`s paper. To assess the determinants of bank failures by comparing asset and liability portfolios of FB&NFB. To establish whether the explanatory power of risk variables have changed over time.	They estimated 5 ratios as proxies for the conduct of management.It includes K/TA TL/TA,CoD/TL and PuF/TL.The loan-asset ratio was significant during 3 years unlike PuF/TL. The probit estimates for FB indicates that the quality of banks` assets and the risk of outflows were important determinants of bank failure.
West (1985)	It introduces a new approach to early warning system by means of factor analysis.	The model includes 19 ratios most of them successfully used in earlier studies. By factor analysis 4 ratios are included in the model which is similar to the CAMEL components. They are successful in the estimation of the prob. of failure.
Rodriguez Fernandez (1990)	To provide an ex post empirical analysis of the Spanish banking system. To identify a set of financial ratios to explain bank failures.	Ratios NI/TA, K/TL, and FA/TA were significant. In terms of the accuracy, the model perform well only 1 and two year before the failures.

NI= Net Income RA= Risk Assets LLR=Loan Loss Res.
TA= Total Assets OOE= Other Oper. Exp. CR= Cash and Res.
CGO= Gross Chargeoff GSp= Gross Spread TD= Total Deposits
CL= Commercial Loans TOL= Overdue Loans CoD=Core Deposit
TL= Total Loans CIL= Commercial&Ind.Loans PuF=Purchased Funds
K= Capital NL= Net Loans
FA=Fixed Assets

As evidenced by the selected number of studies reviewed in table 1 and 2, the empirical models have been developed and applied for different periods of time. They have evolved from a basic classification problem to the construction of failure prediction models and early-warning systems. The building up of the ex post empirical model has involved a sampling process for sound and unsound banks (failed and problem banks). By making comparisons on the bank characteristics over time ,it was possible to find out systematic differences between the two groups and from there on to proceed in the calculation of the probability of failure and make predictions.

Most of the studies analysed have used data derived from balance-sheet and income statements to construct financial ratios and apply multivariate estimation techniques ranging from MDA to logit analysis. The results from these models have been very encouraging particularly with reference to the ability to assess the banks` characteristics, to test statistically the importance of explanatory factors (e.g asset quality), and to provide early signals about approaching bank failure/problem one and more years in advance.

However, the empirical approach have been questioned on several grounds. Rodriguez Fernandez (1990) maintains that although the explanatory power of model development for bank failures exhibits a good record, the predictive accuracy is less conclusive from those models. Furthermore, Scott (1981) also introduces some criticisms to this approach. He stresses the lack of theoretical underpinnings as most of the findings and conclusions have been derived by a statistical search through a number of plausible financial indicators. Table 3 gives an assessment of the most important contribution and shortcomings from the selected cases of study.

Table 5.3 Overview of the Contributions and Shortcoming from the Selected Banks` Studies.

Author	Contributions	Shortcomings
Meyer& Pifer (1970)	It represent one of the first attempt to use financial information on bank failures in the form of ratios,trends& lags.	A narrow definition of failure, the lack of predicting ability beyond 2 years, and the use of linear prob.model
Sinkey (1975)	It is the first study using MDA technique on commercial banks.	The use of examiners` determined groups& the use of MDA itself.
Martin (1977)	It is the first attempt to use LOGIT on banking studies. It compares the the results between MDA and LOGIT.	Small sample size and exclude nonmember bank failures.
Sinkey (1978)	One important contribution is the use of NCR and its ability to discriminate between PB and NPB.	The estimation of NCR is based on information of loans`classification implemented by banks` examiners.
Bovenzi, Marino,& McFadden (1983)	Compares the results of models using call data, examiners`data, and with early models (Martin 1977) Also, it test the usefulness of CAMEL ratings on failures. (a)	Small sample size for some subperiod leading to lack of efficiency in the estimators.
Avery& Hanweck (1984)	By using pooled cross-section data rather than average for independent variables the model has the advantage of providing dynamic prediction of the prob. of failure.	The sample was including small size institutions and the data was elaborated from examiners` report.

Table 5.3 (continued)

Nelson White (1984)	The application of LOGIT to US bank failures during the 1920's and 1930. It tested the Temin&Friedman/Schwartz competing hypothesis.	It included data on National Banks only. The highset failure rate was concentrated on State-Chartered banks.
Short, O'Driscoll, & Berger (1985)	It represent a fresh attempt to test the portfolio risks decision of commercial banks using PROBIT.	It assumes that macro-factors (general economic conditions) remain constant.It treats financial ratios as proximate determinants rather than casual factors.
West (1985)	Its contribution lies on the use of factorial analysis.	The groups in which the logit analysis was based was determined by the opinion of supervisers.
Rodriguez Fernandez (1990)	The application of LOGIT the case of the Spanish Banking System.	The use of financial ratios as proximate determinants.

(a) The CAMEL rating system based on capital adequacy, asset quality, management, earnings and liquidity. Each indicator is rated from 1 to 5 with 1 being the highest score.

The shortcomings stated in table 3 and the lack of a totally objective and exact criterion for identifying bank failures have prompted the researchers to introduce other methodologies in the study of bank failures.

A second approach defines bank failure as the event whereby the net worth of a bank is negative. This a priori methodology attempts to estimate and test the a priori probability of a negative net worth by incorporating the observed probability distribution of factors such as earnings, loan losses, and other factors affecting the value of a bank's net worth. For instance, Santomero and Vinso (1977) and Nelson (1979) had followed this approach. Santomero and Vinso estimate the probability of a negative net worth by considering period to period changes in the bank's capital as random variable. The parameters of this stationary distribution for each bank were estimated using weekly time series data reported by banks and transated into a probability of failure. Factors such as profitability, loan losses, liquidity , and other relevant financial information were implictly treated in the determination of the distribution.[6]

In contrast, Nelson estimated a very similar model of the role of capital in relation to the likelihood of failure that disaggregates the effect of loans losses and other elements affecting the variability of a bank's net worth.

Santomero and Vinso's model performed poorly as their estimated probability of failure based in the sample 1965-74 was very low. This result was highly inconsistent as the US banking system witnessed the collapse of the Franklin National Bank and the Security National Bank in 1974-75.

A third approach may be identified from the banking literature. The a priori undefined approach introduces the concept of bank vulnerability as a more general concept. For instance, Korobow and Stuhr (1975) and Korobow, Stuhr, and Martin (1976) distinguish vulnerable banks from resistant ones. They constructed a ranking of banks by weighting a set of financial variables as proxies of financial weakness or strength. Those banks which were above the arbitrary cut-off point were considered as resistant to failure and viceversa.[7]

One important criticism is that the a priori undefined models and the concept of vulnerability bears no relation to the issue of banks failure. In a later articule Korobow, Stuhr, and Martin used the score as an independent variable to estimate the probability of bank problems using an arctangent regression equation.[8] According to Martin (1977), this new version is merely a variant of the ex post empirical approach but with a poorer fit as they used a single explanatory variable based on the rank scores.

One important criticism to the banking studies carried out in particular for the case of the US banking system is related to the use of financial ratios and in some cases market data as independent explanatory variables. Clearly, financial ratios point to symptoms rather than causes. In other words, it identifies proximate determinants of bank failures but not more fundamental causal factors. For instance, increasing in asset and liability risk, reduction in profitability, and low capital adequacy may be affected by general factors such as a downturn in economic activity and/or more specific issues relating to bank management and risk taking. Thus, one could visualise two interesting competing hypothesis, namely macroeconomic and firm-specific factors.[9]

The approach to be followed in the present study will consist in the modelling and estimating of the probability of bank failure/problem in Chile. We will test those two competing hypotheses using the logit model. At the same time, we will use the ex post empirical approach based on accounting and financial information to classify banks into the two groups as it will be seen in the next chapter. Before that we will discuss the econometric methodology involve in the binary-choice model with specific reference to the logit model.

(5.3) Binary-Choice and the Logit Model.

Usually we are dealing in economics with models in which the dependent variable is continuous. However, bank failures/problems can be in general considered as an event. Since we are estimating the probability of occurrence of an event the dependent variable takes a discrete value. Thus, the econometrician is faced with the modelling of a pattern of behaviour which involves a decision on a finite set of alternatives. Models which are used for such purposes are called qualitative response models (QR). QR models have been extensively used in biometrics applications for much longer than they have been applied in social science and in particular in economics. These dicrete or QR models however have had numerous applications in social science in more recent times. Their topics range over a great variety of discrete economic decisions such as labour force participation, education and schooling, legislation and voting, choice of occupation, and jobs and firm location among others.[10] As we have seen in the review of previous studies these models have also been used successfully in banking and finance.

(5.3.1) The Logit Model.

Suppose we want to consider the occurrence or non-occurrence of an event,in our study we define this event as a failure/problem bank (PB) and non-failure/non-problem bank (NPB). We define a dichotomous random dependent variable Yi which takes the value of Yi=1 if PB and Yi=0 if NPB. We assume that Pi is the probability that Yi takes the value of 1 and hence (1-Pi) is the probability that Yi=0. Therefore the probability function for Yi can be expressed as (1).

$$(1)\quad f(Y_i) = P_i^{Y_i}\,(1-P_i)^{1-Y_i}$$

It is argued that the outcome of the random variable Yi is determined by factors which can be grouped in terms of microeconomic variables including banks' characteristics and management as well as general economic conditions. Then we have

$$(2)\quad Yi = (Zi_1 - Zi_0)'\delta + Wi'(\tau_1 - \tau_0) + (ei_1 - ei_0)$$

$$(2a)\quad Yi = [(Zi_1 - Zi_0)', Wi'] \begin{bmatrix} \delta \\ \tau_1 - \tau_0 \end{bmatrix} + e^*_i$$

where Zi` are vectors of microeconomic variables and/or bank characteristic of the ith bank.

Wi` is a vector of general economic conditions and/or macroeconomic variables.

Therefore, we may express the linear model in terms of (2b)

$$(2b)\quad Yi = Xi'\beta + e^*_i \qquad \text{for} \qquad i = 1,2,\ldots,n.$$

where Xi = K-vector of known explanatory variables

ß = K-vector of unknown parameters

e^*_i = random error term

One of the earliest functional form used was the linear probability model (LP). The LP model can be interpreted as the probability that the event will occur given the value of Xi. The estimated probability can lie outside the admissible range 0,1. In other words, the distribution of F is not limited to be between 0 and 1. In addition, because of the heteroscedasticity problem, the OLS estimates of ß will not be efficient. Its wide usage can be explained as a result of computational simplicity and its usefulness today remains in determining quick estimates at a preliminary stage only.

Given the shortcomings associated with the LP model we need an alternative specification concerning the distribution assumptions so that all predictions lie within the interval [0,1]. Since our main concern is to interpret the dependent variable Yi as the likelihood of an event then the notion of probability can be regarded as a suitable basis for a transformation. There are two important requirements which need to be met: Firstly, for all real X the probability must fall between 0 and 1. Secondly, such transformation has to be monotonic, that is increases in X are associated with increases (decreases) in Yi for all X.

Probability distribution theory shows that the cummulative distribution function (c.d.f.) for a continuous random variable X is given by

$$(3)\quad F(x) = \int_{-\infty}^{x} f(t)\, dt \qquad -\infty < x < \infty$$

where f(t)=probability density function

Notice that $F(-\infty)=0$ and $F(\infty)=1$ and if $a<b$ it follows that $F(a) < F(b)$.

Therefore, given the p.d.f. the LP model in (2a) becomes

(4) $P(Yi=1) = F(X'\beta)$ for $i= 1,2,...,n.$

where F= c.d.f.

The two most common choices of distribution are the standard normal and the logistic distributions. The c.d.f. for the former is defined as

$$(5) \quad F(t) = \int_{-\infty}^{t} (2\pi)^{-1/2} \exp\{-X^2/2\}\, dX \qquad \text{(Probit)}$$

and for the latter we have

$$(5a) \quad F(t) = 1 / 1 + \exp(-t) \qquad \text{(logit)}$$

where exp≡e= 2.718

The probit model (PM) may be justified by reference to a central limit theorem and so it is the case for the logit model given that the logistic distribution is similar to the normal distribution. In fact, both distributions are bounded between 0 and 1 as well as being monotonic. Also, they are symmetric around zero means and have a variance equal to 1 and $\pi/3$ respectively. The standardised logistic has slightly heavier tails than the standard normal distribution. Because of the close similarity between two distributions, it is difficult to distinguish statistically between them unless we have a large sample. Thus in a univariate dichotomous model it does not matter whether we use probit or logit model. In consequence, both transformations are suitable in modelling bank failure/problem models, choice which is made on the basis of convenience and the availability of computer software.

From now on we will concentrate on the formulation, estimation, testing, and selection of a logit model. Thus, by recalling expression (4), the model can be expressed as

$$(6) \quad F(Xiß) = \int_{-\infty}^{Xiß} f(Z)\, dZ$$

where $f(Z) = 1 / 1 + \exp(-X)$ standard logistic density function.

Then the problem bank or bankruptcy is determined by a logit probability model as shown in (6). The interpretation of the estimated coefficient in the logit model reflects the effect of a change in an independent variable on the odds ratio given by the expression $Ln[Pi / (1- Pi)]$.

The next question we need to look at is relating to the parameter estimation of the logit model.

(5.3.2) Estimation of a Logit Model.

The object of estimation of this model is the vector of unknown parameter ß. How the estimation is carried out depends on the type of data being used. In some cases, we may have repeated observations on a particular decision maker (case). In this context we may apply the min x^2 method for QR models also known as the "Berkson-Theil approach". It is only useful when there are repeated draws on the dependent variable Yi having the same value of the vector of the independent variable X. Then F(X'ß) for the specific value of X can be estimated by the relative frequency of Y being equal 1. (Amemiya 1981,1985)

This restriction is satisfied in the case of the physical science where the data are generated in an experimental setting. They normally consist of repeated trials holding the discrete independent variable as constant. In contrast, most social science data are often continous where observations differ both in the dependent and the independent variable. Moreover, it would be very difficult having natural repeated trials with the X's held constant.

If sufficient repeated observations are not available we must resort to the use of the maximum likelihood estimator for ß. The likelihood function of the logit model is given by

$$(7)\quad ML = \sum_{i=1}^{n} F(Xiß)^{Yi} \; [1-F(Xiß)]^{(1-Yi)}$$

By taking natural log we get

$$(7a)\quad \ln ML = \sum_{i=1}^{n} Yi \ln F(Xiß) + \sum_{i=1}^{n} (1-Yi) \ln [1-F(Xiß)]$$

The ML estimator for ß, say ß˜ is obtained by maximising (7a) with respect to ß.

$$(7b)\quad d\ln ML/dß = \{\sum_{i=1}^{n} Yi-F(Xiß) \; / \; \sum_{i=1}^{n} F(Xiß)[1-F(Xiß)]\} \; f(Xiß)Xi$$

By setting the first order condition given by (7b) equal to zero we obtain an estimate for ß. The lnML is globally concave as the Hessian matrix of second partial derivatives is negative definite. This implies that the solution corresponds to a single local maximum and hence a solution to (7a) which is unique if it is bounded.

Notice that the expression (7b) is a non-linear first order condition in terms of ß so that the ML estimator must be obtained by mean of an iterative method. In order to define the iterative method and to obtain the asymptotic variance-covariance matrix we calculate the second order condition from lnML in (7b).

$$(8) \quad d^2 \ln ML/d\beta d\beta' = -\sum_{i=1}^{n} \{[Yi/F^2(Xi\beta)] + 1-Yi/[1-F(1-Xi\beta)]\} f^2(Xi\beta)XiXi + \sum_{i=1}^{n} \{Yi-F(Xi\beta)/F(Xi\beta)[1-F(Xi\beta)]\} f'(Xi\beta)XiXi$$

where f'is the derivative of f.

Taking expected values we are left with

$$(8a) \quad Ed^2 \ln ML/d\beta d\beta' = -\sum_{i=1}^{n} \{f^2(Xi\beta)/F(Xi\beta)[1-F(Xi\beta)]\}XiXi$$

Amemiya (1985) has shown that under very general conditions the ML estimator is consistent and asymptotically normal with the asymptotic variance-covariance matrix as

$$(9) \quad -(Ed^2 \ln ML/d\beta d\beta')^{-1} \equiv Var(\tilde{\beta}) = \sum_{i=1}^{n} \{\{f^2(Xi\beta)/F(Xi\beta)[1-F(Xi\beta)]\}XiXi\}^{-1}$$

By substituting F by the logistic distribution defined in expression (5a) we obtain the formulas for the logit model.

The non-linear equation can be solved by a variety of iterative techniques.[11] One the most common method to calculate the ML estimator is the Newton-Rapshon. This is an iterative procedure where the (t+1)st round estimate of $ß^{\sim}_{t+1}$ is

$$(10)\quad ß^{\sim}_{t+1} = ß^{\sim}_{t} - \left[\, d^2 lnML/dßdß`\Big|_{ß^{\sim}_t} \right]^{-1} \left[\, dlnML/dß\Big|_{ß^{\sim}_t} \right]$$

where $[\, d^2 lnML/dßdß`| \,]$ is a (K*K) matrix of second partial derivatives of lnML function evaluated at the th round estimate $ß^{\sim}_t$.

This procedure is to be repeated until the iteration converges to a global maximum bound on any set of starting values $ß^{\sim}$.

(5.3.3) Hypothesis Testing.

There is a full menu of procedures available for hypothesis testing. The simplest testing for a single restriction is based on the normal and/or t-student test.

Suppose we are interested to test a general linear hypothesis of the form given by expression (11).

$$(11)\quad Rß = r$$

where R=(JxK) known hypothesis design matrix with rank $J \le K$

r= (Jx1) known vector

Thus the null hypothesis Ho is defined as

(11a) Ho: $R\beta = r$

If we test specifically $R_1\beta=[1\ 0\ 0\ 0...0]\beta= r_1$ where r_1 is any scalar including the value of 0 then a test of (11) can be performed on the basis of the following asymptotic results.

(11b) $$R_1\tilde{\beta} - r_1 \,/\, \tilde{\sigma}\sqrt{R_1(X'X)^{-1}R_1'} \approx N(0,1)$$

where $\tilde{\sigma}\sqrt{R_1(X'X)^{-1}R_1'}$ is an scalar and a variance estimate of $R_1\tilde{\beta} - r_1$

Therefore, the null hypothesis Ho is rejected when the absolute value of (11b) is bigger than the theoretical value given by the normal distribution (Z value) corresponding to a particular level of significance. This test is suitable for large samples and a known variance.

Alternatively, for small samples (11b) possess a t-student distribution. For instance, if we test the null hypothesis that the coefficient is 0 and the sample size is small then (11b) is reduced to

$$(11c)\quad \beta^{\sim} / \sqrt{\sigma^{2\sim}(X'X)^{-1}} \approx t_{(n-k,\ \alpha/2)}$$

where $(n-k)$ degrees of freedom
$\alpha/2$ level of significance two-tail

As before the null hypothesis is rejected as long as the absolute value exceed a defined critical region of the t-distribution at n-k degrees of freedom and $\alpha/2$ level of significance. Notice that (11b) and (11c) are both correct and equivalent since a t-distribution is asymptotically equal to a normal distribution, that is $t_{(n-k,\alpha/2)} \overset{A}{\approx} N(0,1)$.

We may also wish to test the significance of all or a subset of the coefficient of the logit model when the ML estimator is used for ß. A test using the chi-squared distribution replaces the usual F-test applied to ordinary regression. The null hypothesis is defined as $Ho{:}\beta_1=\beta_2=..=\beta_K=0$.

The likelihood ratio test (LRT) reflects the comparability between a sample of data and the null hypothesis through a comparison of the constrained and unconstrained likelihood functions. Thus, the LRT is defined as

$$(12)\quad LRT = 2[\ln ML(\beta^{\sim})-\ln ML(\beta^{\sim}_c)] \overset{A}{\approx} x^2_q \text{ (chi-square dist.)}$$

where $\ln ML(\beta^{\sim})$ = unconstrained likelihood function
$\ln ML(\beta^{\sim}_c)$ = constrained likelihood function
q= degrees of freedom

The $ML(\tilde{\beta}_c)$ is obtained by maximising the ML function given by expression (7b) with respect to ß subject to the linear constraint Rß=r where as we already know R is (JxK) known design hypothesis matrix and r is (Jx1) vector of given values.

The null hypothesis Ho as defined by (11a) is rejected if the value of the statistics exceed a given critical value of chi-square distribution with q degrees of freedom.[12]

(5.3.4) Model Selection.

Finally, we need to develop a simple criterion for model selection to choose alternative specifications in terms of explanatory variables and/or general distribution functions. There are a number of criteria for selecting among alternative QR models. The use of a single scalar may be treated with caution since it may be suitable only for some instances. This means that it is extremely difficult to make a definite evaluation concerning the relative merits of various criteria independently. As a result, one should select at least two or more scalar criteria for selection purposes and compare the results. Another important remark is that whatever criteria one decides to apply it is necessary to make adjustment for degrees of freedom.

For the purpose of this study we have chosen two scalar criteria from the menu, namely the prediction accuracy and the Akaike Information Criterion (AIC) which follows the discussion.[13]

- Prediction Accuracy.

Suppose we have

$$(13) \quad \sum_{i=1}^{n} (Yi-Yi^{\sim}) \qquad \text{where } Yi^{\sim}= 1 \text{ if } Fi^{\sim} \geq ½ \quad \text{and } Yi^{\sim}= 0 \text{ if } Fi^{\sim} < ½$$

Expression (13) gives the number of wrong predictions as $(Yi-Yi^{\sim})=1$ if and only if Yi and $Yi^{\sim}$ are not equal. This criterion is appropiate when one has an all or nothing loss function. Thus, if an individual who estimated its probability to be 0.40 and another individual who estimated its probability equal to 0 then both are equally penalised. However, under this criteria most models will do relatively well even if the probabilities differ greatly within the interval $0 \leq Yi^{\sim} < ½$.

- The Akaike Information Criterion (AIC).

According to Judge, Carter, Griffith, and others (1988) the information criterion seeks to incorporate in model selection the divergent consideration of accuracy of estimation and the best approximation to reality. Thus use of this criterion introduces a statistic that gives a measure of the precision of the estimate and a measure of the parameterisation of the model. Then the AIC is defined as

$$(14) \quad AIC = -\ln ML + K$$

where lnML= likelihood function
K= number of parameters

Clearly, from (13) we see a trade -off between precision and parameterisation where increases in K involves a penalty in the value of the AIC. According to this criteria one chooses the model with smallest AIC.

So far the discussion has centered on the specification and estimation of a univariate logit model using cross-section data. There are other alternative specifications for a logit model such as a univariate multinomial model which specifies the discrete dependent variable with more than two alternatives. For instance, in a model of transport modal choice we might specify the model with three alternatives, say car, bus, and train. We may extend this model by making such choice sequentially. That is, any particular choice or state is determined by a previous choice or state. Suppose that Yi=2 and Yi=3 where the first choice correspond to problem bank and the second one to a non-problem bank. Then if Yi=3 then Yi=1 which is defined as failed bank.

A second large group correspond to the multivariate models. This type of QR model specifies the joint probability distribution of two or more discrete dependent variable.(For a thorough review of these models see Maddala 1983 and Amemiya 1985)

Finally, we have to consider the question of a specification and estimation of a logit model using panel data. The panel data consist of observations made on individuals over time. In other words, it is a combination of cross-section and time series data. This approach is very useful in case of limited number of individual observations in the cross-section data.

If the observations are independent between individuals and overtime, then a logit model using panel data does not introduce additional complications. In fact, it becomes only a larger model with more observations. However, if there is heterogeneity across units, the estimated parameters from the logit model will be inconsistent.

The logit estimation with panel data and some of the potential problems and shortcomings will be discuss in chapters 7 and 8.

Endnotes.

(1) At the same time but in less quantities, academics from universities and institutes have also contributed to the development of this topic. For an exhaustive review and assessment of early warning system developed by these agencies and others for the US see Altman E., Avery R., Einsenbeis R., and J.Sinkey Jr. (1981) Chapter VIII.

(2) Of the 30 ratios reported by Beaver cash flows/total assets,net income/total debt, and cash flows/total debt best predicted financial failures.

(3) The 5 variables are the following: working capital/total assets, retained earnings/total assets, earnings before interest and taxes/total assets, market value of equity/book value of total debt, and sales/total assets. For a thorough account on the pioneer work of Beaver (1966), Altman (1968) and the more recent development of failure-prediction models for non-financial firms see Altman, Avery, Eisenbeis, and Sinkey Jr. (1981).

(4) As argued by Martin (1977), it is commonly agreed that a financial firm fails as any other enterprise when its net worth becomes negative or incurr losses that would result in a negative net worth. However, actual insolvency and receivership are infrequent relative to some form of intervention by the monetary and banking authorities. Among them we find mergers with a healthy institution, the purchases of bad loans and risky assets. In spite of this, he argues that no serious problems will be present in empirical research.

(5) For an excellent and thorough review of the econometrics for binary choice models see Amemiya (1981) and Judge, Carter, Griffiths, Lutkepohl, and Chao-Lee (1988). For a more advance treatment see Maddala (1983) and Amemiya (1985)

(6) Santomero and Vinso studied 224 large US banks between 1965 to 1974. Those banks who have not reported continuously over this relevant period were excluded. United State National Bank, Franklin National Bank, and Security National Bank felt into this category.

(7) They employed a linear combination of 12 financial ratios to measure vulnerability. Each variable is weighted by either 1 or minus 1 depending whether this financial ratio is a priori favorable or unfavorable. After dividing it by the standard deviation, the weighted sum represent the rank score. Positive score implies resistance and negative score vulnerability.

(8) The arctangent procedure differ only slightly from the logit analysis. The regression estimate the relationship between the bank scores and the observed probability of receiving low rating over the estimation period subsequent to the base year. This realtionship was assumed to be continuous, approaching zero for large positive scores and approaching one for negative score, and monotonic. The arctangent distribution has indeed these properties.

(9) This point have been raised by Nelson White (1984) and Short, O'Driscoll, and Berger (1985). Nelson White test two competing hypothesis for the banking crisis of 1930, the effect of real and monetary factors and the ability of the banking system to withstand those shocks.

(10) For an exhaustive review of QR models and its applications see Amemiya (1981) and Pindyck and Rubinfelt (1984)

(11) Normal equations for non-linear models are in general non-linear with respect to the parameters so we require some specific algorithms to solve them. We should mention the Newton-Raphson, method of scoring, the Berndt, Hall, Hall, and Hausman algorithm, and Davison, Fletcher, and Powell algorithm among the most common.

(12) For more involved restrictions we may also test the model by means of the Wald test. As the LRT, this test has a chi-square distribution and both are asymptotically equivalent.(See Judge, Carter, Griffith, and others 1988).

(13) Amemiya (1981) gives a more thorough review of the list of scalar criterias for QR models. In addition, Judge, Carter, Griffiths, and others (1988) discuss problems of specification in econometrics models.

Chapter 6. The Discrete Dependent Variable: Predictions from an Early Warning Model.

(6.1) Introduction.

This chapter seek to develop an appropriate banks'classification method using financial information from balance-sheets and income statements. In the absence of ex post information on the state of health of the chilean financial institutions prior to the failure date of 1983, we have constructed an early warning system to predict the ex ante probability of bank problem/failure based on the statistically significant determinants of the likelihood of those events. The empirical results were obtained by the use of univariate and multivariate statistical techniques. At the same time, the model provides evidence as to whether the bank failures could have been anticipated by the authorities.

This chapter has been structured into three main sections. Section 2 contains a description of the model in terms of the definition of bank failure/problem and the relative advantages and disadvantages of alternative definitions used in the literature. Section 3 discusses the set of independent variables and its classification in seven broad categories. Finally, the last section reports and assesses the empirical results from univariate and multivariate statitical models. The evidence is complemented with a set of appendices to compare the results.

(6.2) Development of a Failure/Problem-Prediction Model.

(6.2.1) Failure/Problem Model: The Dependent Variable.

As we have seen in the previous chapter, there are several approaches to the construction of a problem and/or failure prediction models in the empirical literature of banking. The lack of an objective criterion for identifying bank failures in the real world has led to researchers to deal with this ambiguity by taking the ex post classification of bank failures or alternatively, they have also adopted a more abstract and subjective definition based on the judgment from the banking authorities about what constitutes a sound and healthy financial institution. This acceptable variant of the ex post empirical approach rests on the existence of a bank "problem" list elaborated by the banking authorities. This classification is elaborated with information from on-site bank examinations, and in particular, from the evaluation of asset portfolios and the quality and riskiness of bank loans.[1]

However, given that a failure is a more objective indication of a bank's ability to continue its operation, then this approach results in a more convenient and less subjective approach than the definition of a problem bank. On the other hand, if bank problems precede actual failures, then a problem prediction model may provide a longer lead time for identifying and classifying financial institutions than would a failure prediction model. Also, the authorities may encourage corrective actions which can prevents bank failure. Thus, as the failure path tends to be a decaying one rather than an explosive one, then identifying those banks with financial difficulties would be the first step towards achieving the failure prevention goal.

The evidence from other empirical studies and from the banking crisis in Chile show that all failed banks were identified as problem banks although it did not follow that all problem banks failed. Bearing in mind the pros and cons discussed above, this study accepts as a more convenient approach to study the banking crisis in Chile a definition of the discrete and dichotomous dependent variable as failed/problem and nonfailed/nonproblem banks. At the same time, this definition maximises the number of observations unlike the case where the dependent variable is failure and non-failure banks. The data limitation for this empirical study became a powerful reason to choose failure/problem prediction model instead of a failure-prediction model.

The development of this model aims at replicating the ex post list of problem banks of 1983. At the same time and equally important, the model is used to construct a classification list for financial institutions prior to 1983. Given that such ex post information is not available we then predict quarterly estimates of the ex ante probability of problem as a proxy in order to classify financial institutions into the two groups. The estimating coefficients of the logit models will generate a set of probability estimates so that those institutions classified as problem are assigned a high ex ante probability of problem and a low probability to non-problem banks.

Initially, two models were considered for comparison purposes conveniently labeled as models A1B1 and A1B2. Both correspond to problem-prediction models where in the first case A1 includes all those financial institutions which have sold bad loans to the Central Bank and/or were liquidated, merged, and capitalised in 1983. From table 1 and appendix 1 we see that for 1983 a total of 17 commercial and development banks were classified into the list of A1 from a total of 27. The only two institutions which remained healthy and hence did not have to sell bad debts to the banking authorities were the state bank Banco del Estado and the private commercial bank Banco Industrial y de Comercio Exterior.[2]

The chosen samples did not include those financial intermediaries which were subject to regulatory intervention during 1981, despite that the fact that this year marked the beginning of the severe banking crisis of 1983. This arbitrary selection was justified on the grounds that most financial failure were concentrated in non-bank financial institutions and it would have reduced the sample size for the empirical study. Moreover, the period of 1981 can be seen as one with a buoyant macroeconomic environment and hence no comparison between two macroeconomic states would have been possible for those institutions.

Table 6.1 List of Problem and Failed Banks in Chile During 1983.

Bank	Code	Problem	Failed
Chile	001	SBD	Rk & Rp
O'Higgins	008	SBd	
Internacional	009	SBD	Rk & Rp
Continental	011	SBD	
Sud Americano	014	SBD	
Credito	016	SBD	
Trabajo	022	SBD	
Pacifico	025	SBD	
Nacional(a)	026	SBD	
Concepcion	027	SBD	Rk & Rp
Edwards(b)	029	SBD	
Santiago	035	SBD	Rk & Rp
MorganFinansa(c)	047	SBD	
Unido Fomento	502	--	Liquidated
Hipotecario F.	504	SBD	Rk & Rp
Hipotecario Ch.	505	--	Liquidated
Colocadora Nac.	506	SBD	Merged

Source: SIBF, Informacion Financiera, Various Issues.

(a) Former Banco de Curico
(b) Former Banco Constitucion
(c) Former Financiera Finansa

Rk= Capitalised
Rp= Privatise
SBD= Bad Debt Sold to Central Bank.

An important observation is the fact that foreign banks did not fail and/or sold bad debts to the Central Bank, although there were two exceptions namely Banco Español and Banco Talca which in 1981 were bought by the Santander Bank and the Central Bank both from Spain. Later on, they became Banco de Santander and Centro Banco.

The group of non-problem banks was constructed using two classifications. For the case of B1, this sample includes the two healthy commercial banks, a group of foreign banks which opened after 1980 and the remaining development bank but excluded non-bank financial institutions. B2 differs from B1 only in terms of the replacement of foreign banks by non-bank financial institutions.

The inclusion of foreign banks in the sample B1 is justified on the grounds that they outperformed domestic banks during and after the crisis. Marshall (1990) reported that foreign banks performed better than domestic banks measured in terms of a performance index.[3] The same conclusion was obtained by the author by looking at the rate of growth of total deposits, loans, financial investment measured in real terms. Therefore, their inclusion as sound banks was expected to give some light on the specific differences with respect to the unhealthy ones. The same objective was sought when we include non-bank financial institutions and exclude foreign banks in the sample B2. However, the sample size of B2 was smaller than B1. Therefore, A1B2 contained a total of only 25 observations as compared with A1B1 with 36 observations.

There are two final points to be stressed about problem-prediction models. Firstly, apart from the arguments for and against one or other model suggested earlier on, the number of observations included in the model also should be given a considerable weight in our choice. Given that the size of the Chilean financial system is rather small as compared with, say, the USA, where normally the sample size is in excess of 1000 observation for each period, it is necessary to maximise our sample size.

Secondly, and also related to the data limitations, we attempted to work with a controlled sample model labeled as A1B3. The B3 contained a controlled sample by bank size to incorporate such differences in the model. However, the sample of non-problem banks was insufficient to construct a paired observations with problems banks having the same size category. Therefore, such model was dropped from the empirical analysis.

(6.2.2) Variables Categories and Financial Ratios as Regressors.

Once we have chosen and defined the problem-prediction models, the next step is to discuss the selection and use of variables as regressors. In this study, we have included a large number of financial ratios properly calculated from bank balance sheets and income statements.[4] Unfortunately, we were unable to include market data to be used as regressors in the estimated models. Although the "market-efficiency hypothesis" suggest that markets contain all relevant information on the future performance and hence provide the earliest warning signal, the lack of market data for Chilean banks left this option unavailable.

The list of selected explanatory variables is similar to those used successfully in other previous studies as discussed in chapter 5.

In selecting variables for its inclusion we identified the potential risks and problems inherent in financial institutions. Thus, the list of variable in each category serving as reasonable proxies for banks' risks and financial problems were considered in terms of its theoretical plausibility.

Appendix 3 contains a list of the 49 financial ratios classified into 7 broad groups: capital adequacy, liquidity, profitability, asset risk and quality, efficiency, liability risk and quality, and mismatchings.

Each of these general characteristics could in theory and in practice as proved by the empirical literature affect the prospects of bank problem and failure. For instance, a bank may become a problem and be threatened with the possibility of failure as a result of large and unsustainable losses from its asset portfolios, in particular, bad loans. Capital adequacy, profitability, efficiency, and liquidity will measure the ability of banks to remain in business in the face of unexpected losses.

As pointed out by Sinkey (1979) and Barth, Brumbaugh and others (1985), capital adequacy or net worth represents a cushion against future unanticipated losses. Moreover, it is argued that stringent capital regulation reduces the incentive to increase asset risk and the likelihood of bank failure in the case of fixed price deposit insurance.

On the other hand, profitability measures the ability of a bank to maintain its net worth and hence its current performance. On this aspect it was also considered a variable which measures efficiency which indirectly will affect the financial result concerning the bank gross utility.

Asset risk and quality measures the potential erosion of a bank's net worth and the subsequent reduction in profitabilty from loan loss provisions and chargeoffs.

The model also includes a category which measures the bank's liquidity. According to Sinkey (1979) banking firms need liquid assets as a buffer or cushion for meeting any excess in cash outflows. Thus, most liquidity ratios attempt to measure the size of this buffer.

There are two additional measurements included in this study which are worthy of consideration. The first one concerns the risk associated with a mismatch of maturities between assets and liabilities, both in domestic and foreign currency. Here, fluctuations in interest rates and unexpected devaluations can introduce a significant risk for the financial position of a bank. Finally, I also included a category which accounted for the riskiness and quality of the liability structure of a bank.

Admittedly, financial ratios identify symptoms rather than causes. This means that these financial ratios employed as regressors are proximate determinants of bank problem/failure but not the more fundamental causal factors. For instance, the profitability and the asset quality can be equally affected by both bank management in terms of risk taking, and the general condition of the economy.[5]

The model is estimated using financial data with different time lags between the ex post data of bank problem and the financial statement, that is with data between 1979 and 1983.

(6.3) The Empirical Results from the Failure/Problem Prediction Model for Chile.

The main objective was to estimate the quarterly ex ante probability of failure/problem for the period between 1979 and 1983. We started by taking an ex post definition from the classification available for 1983 to construct the dichotomous dependent variable. We modelled the ex post classification as a function of several independent variables using the data available from the balance-sheets and income statements.

From several tentative specifications I chose the estimated equation with the lowest Akaike's value, and maximise the overall accuracy in terms of type-error I and II at a given cut-off point.

Then we proceded with the evaluation of the ex ante probability based on the prediction from the estimated equation using quarterly financial data prior 1983. This procedure will enable us to calculate the quarterly ex ante probability that a financial institution had problems before 1983.

The analysis consisted of two major steps. Firstly, we applied one way analysis of mean and variance techniques to examine the extensive list of financial ratios of problem and non- problem financial institutions. The importance of this first step rests on the need to reduce the list to more manageable proportions and selected numbers of independent variables.

The second step consisted in the application of a multivariate technique using a logit model to identify those financial variables from the remaining list as significant determinants of the likelihood of bank problems and to be followed by the prediction of the likelihood of financial difficulties.

(6.3.1) Univariate Results.

The univariate results are shown in table 2 which contain the mean and the mean differences for each financial ratio as well as each group and year. In addition appendix 4 provides a review of the testing procedure for the difference between means.

We tested the mean difference for the specifications for the A1B1 and A1B2 at the critical time of failure/problems, that is 1983, and for each of the 4 years before the critical year.

Table 6.2 Mean Differences between Nonfailed/Nonproblem and Failed/Problem Banks and the t-Statistics for 1983.(a)

Category	Var.	B1-A1	t(b)	Var.	B2-A1	t(b)
Capital Adequacy (1)	13	-8.73	-5.69	15	0.12	3.58
	14	-0.83	-4.81	16	0.11	3.55
	15	0.19	3.55	14	-0.84	-3.42
Liquidity (2)	23	0.19	6.50	24	0.21	2.65
	26	0.43	5.48	21	0.09	2.60
	21	0.15	5.32	26	0.22	2.53
	24	0.34	4.88	23	0.09	2.40
Profits (3)	31	0.72	3.69	32	0.06	3.97
	35	0.33	2.74	31	0.18	2.81
Asset Risk (4)	41	-0.19	-6.18	423	-0.20	-5.30
	42	0.15	5.32	41	-0.10	-2.60
	44	0.92	5.13	42	0.09	2.60
	43	10.19	5.07	416	-0.04	-2.19
	423	-0.10	2.98	415	-0.05	-2.07
Efficiency (5)	--	--	--	--	--	--
Liability Risk(6)	61	0.26	2.56	63	0.26	3.76
	62	-0.01	-2.54	66	-0.19	-3.61
	67	0.10	2.39	67	-0.20	-3.55
	611	0.03	2.55	65	-0.14	-3.46
Mismatching (7)	74	0.33	4.88	71	-0.19	-5.22
	73	0.07	4.31	74	0.15	2.64
	75	0.89	2.91	--	--	--
	72	0.22	2.87			

(a) The table include the most significant variables and they are ranked in terms of the relative significance. The definition of each variable is found in appendix 3
(b) Evaluated at 5% significance level.

One important finding from the data is that the sign in the mean difference values are consistent with the a priori expectations and statistically significant at 5% level in most cases. Moreover, the average values for capital adequacy are significantly greater for non-problem banks than problem banks. For instance, in the model A1B1 the mean difference for the variable total loans/capital (variable category 1-13) is -8.73 which is consistent with the a priori expected sign and statistically significant. This means that failed/problem banks exhibited a lower capital ratios than sound banks.

At the same time, liquidity ratios for the former group are, as expected a priori, higher than the latter group. This is evident by examining financial investment plus cash/total assetl ratio (variable 2-23).

Another interesting result from table 2 is that the measurement of asset risk also shows a significant difference between the two groups of banks. For instance, variable 43 defined as provision for bad loans/operating expenses shows a statistically significant difference of 10.19 between A1-B1. This means that non-problem/non-failed banks have chosen a less risky portfolio than problem/failed banks. It is not surprising then to find that B1 group is relatively more profitable than A1 group judging from the profitability ratio operating earnings/operating expenses (variable 3-31). With reference to the risks involved from banks' liability structure the evidence from the ratio analysis suggests that failed/problem banks did not show lower and inferior quality in its liability structure than nonfailed/nonproblem banks. Indeed, the mean difference of the deposit(less than a year)/total liabilities1 ratio (variable 6-61) between nonfailed/nonproblem and failed/problem banks is positive and significant.

Finally, we expect a priori that group B1 should exhibit a lower risk of mismatching than group A1. In effect, the evidence from mismatching ratios supports this view.

In general, the evidence from the ratio analysis for the critical year of 1983 indicates that nonproblem banks exhibit significant differences in terms of each selected category. On average and as expected, they carried relatively less risk in terms of the asset structure. At the same time, the data on capital adequacy and profitability suggest that they have a greater ability to respond in a case of unexpected losses and/or risks.

A second important finding from the data is the fact that the variable assessing any difference in efficiency between the two groups was not significant for both models A1-B1 and A1-B2 at least for 1983.

Thirdly, it appears that the differences in the mean values are larger for A1-B1 than A1-B2. In the former we had included foreign banks and excluded non-bank financial institutions. This evidence may indicate that for comparison purposes it is more convenient to consider a larger sample which includes foreign banks.

Finally, the difference in mean values tends to change as the time before failure lengthens. These changes over time occur in both the significance of the ratio and its relative ranking within its category. These comparison can be seen in table 3 and 4 respectively.

From table 3 we see that over-time mean differences diminish for the variables in the category of capital adequacy and asset risk in contrast with profitability which tends to increase as we go back from the critical time. Also, we observe that over-time significance of the variable changes from year to year with the exception of total loans/capital (13), and net capital/asset1 (15) both measuring capital adequacy and the financial ratio total loans/asset1 (41) which assess the rikiness of the portfolios.

These findings tend to suggest that variables relating to capital adequacy and asset risk consistently spotted significant differences between the two groups. These early data may lead to the assertion that managerial differences could be important in the likelihood of financial difficulties.[6] However, it must be pointed out that capital adequacy, unlike the quality of banks' portfolios, is not completely within the control of bank managers. This variable is set by the bank legislation which inforce certain minimum limits. Nevertheless, some discretion is still left to banks in this respect.

Table 6.3 Over-time Mean Differences and its t-Statistics for A1B1.

Category	Var.	82	t	81	t	80	t	79	t
Capital	13	-7.08	-7.22	-7.57	-5.93	-5.44	-4.10	-4.98	-3.38
Adequacy	14	--	--	-0.09	-2.39	--	--	--	--
(1)	15	0.15	2.70	0.25	3.26	0.15	2.93	0.24	2.69
Liquidity	23	0.10	4.16	0.09	2.40	0.09	2.87	0.11	2.58
(2)	26	0.19	3.23	--	--	0.27	2.11	--	--
	21	0.07	3.32	0.06	1.99	--	--	--	--
	24	0.13	2.60	--	--	--	--	--	--
Profits	31	1.14	2.21	--	--	1.41	1.97	--	--
(3)	35	--	--	--	--	-0.09	-3.43	-0.07	-3.36
AssetRisk	41	-0.12	-4.48	-0.09	-2.77	-0.09	-2.82	-0.10	-2.41
(4)	42	0.07	3.32	0.06	1.99	--	--	--	--
	44	0.18	2.78	--	--	--	--	--	--
	43	--	--	--	--	--	--	--	--
	423	-0.08	-1.94	--	--	--	--	--	--
Efficiency (5)	--	--	--	--	--	--	--	--	--
Liability	61	--	--	--	--	0.11	2.39	0.15	2.64
Risk(6)	611	0.10	2.03	0.06	2.10	--	--	--	--
	62	-0.01	-2.20	--	--	--	--	--	--
	67	--	--	--	--	--	--	--	--
Mismatch	74	0.17	3.43	--	--	0.20	2.02	--	--
(7)	73	0.05	3.60	0.07	2.05	0.06	2.70	0.11	2.79
	75	0.46	3.71	--	--	--	--	--	--
	72	0.15	2.83	0.14	2.09	0.09	2.38	--	--

(a) The table include the most significant variables and they are ranked in terms of the relative significance.

From table 4 we observe that the relative rankings of the financial ratios within each categories changes overtime, although some of them still remain among the most significant.

Table 6.4 Overtime Rankings for Financial Ratios in Model A1B1.

Categories	Rankings(a)	1983	1982	1981	1980	1979
Capital Adequacy (1)	1	13	13	13	12	13
	2	14	12	12	13	12
	3	15	11	11	15	11
	4	16	16	15	11	15
Liquidity (2)	1	23	21	23	23	22
	2	26	25	21	25	23
	3	21	23	--	--	25
	4	25	26	--	--	--
Profits (3)	1	31	31	32	35	35
	2	35	--	--	33	--
	3	--	--	--	34	--
Asset Risk (4)	1	41	41	411	41	413
	2	42	412	41	45	41
	3	44	411	45	46	411
	4	43	42	46	412	--
	5	423	44	421	411	--
	6	412	415	42	--	--
Efficiency (5)	1	--	51	51	51	52
Liability Risk (6)	1	61	64	611	61	61
	2	611	62	--	63	63
	3	62	611	--	--	66
	4	67	--	--	--	--
	5	63	--	--	--	--
Mismatching (7)	1	74	75	72	72	73
	2	73	73	73	73	--
	3	75	74	--	--	--

(a) Rankings are established according to the value of the t-statistics.

Given these difficulties we have included the most significant financial variables during 1983 and those which consistently appeared in the group of significant variable overtime.

(6.3.2) Multivariate Results.

Based upon the univariate results, we use a logit model to identify those financial variables belonging to a specific category which are significant determinants of the likelihood of failure/problem. Then we proceded to use the estimated equation to assess the predictions from the model during the critical time of 1983 and before the crisis.

In tables 5-9 I present the logit results for alternative specifications at the time of failure/problem, and years before the critical date. Among the alternative specifications presented in table 5, equation E1 is preferred to the others on the basis of the Akaike's information criterion (AIC) and the likelihood ratio test as discussed in the previous chapter. Unlike E1, the alternative specifications E2 and E5 were statistically insignificant at 1% as the chi-square with 6 degrees of freedom is 16.81. Similarly, although E3 and E4 nearly rejects the null hypothesis their Akaike's value are quite large in comparision to E1. (x^2=9.2 with 2 d.f.)

The specification E1 includes the constant and the explanatory variables total loans/capital and provision/operating expenses. A negative (positive) sign means that if the variable increases the probability of problem/failure declines (increases).

Table 6.5 Logit Analysis of Selected Financial Variables at the Time of Failure/Problem in 1983.(a)

Financial Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-6.22	127.81	7.05	7.17	23.45
	(-1.14)	(1.00)	(1.42)	(1.43)	(1.58)
Capital Adequacy					
13	1.15				
	(1.64)				
14		-2.74	1.25	1.10	-3.29
		(-0.70)	(0.34)	(0.27)	(-0.76)
Liquidity					
24		-87.05	-27.07	-29.9	-7.98
		(-1.09)	(-1.28)	(-0.82)	(-0.31)
Profits					
35		-15.45	-14.83	-14.67	-4.32
		(-0.88)	(-0.93)	(-0.91)	(-0.35)
Asset Risk					
41		-114.95			
		(-0.92)			
43	-1.28				-1.43
	(-1.79)				(-1.42)
412			-52.18	-49.98	
			(-1.42)	(-1.26)	
Liability Risk					
61		-31.24			-32.88
		(-1.36)			(-1.52)
62			18.47	19.65	
			(0.31)	(0.30)	
Mismatching					
72		-45.98	2.30		-21.67
		(-1.10)	(0.18)		(-0.82)
75				0.92	
				(0.13)	
Ln(Lklhd)	-4.71	-6.37	-5.77	-5.77	-5.46
Lklhd Ratio(b)	48.14	12.61	17.87	17.55	14.76
AIC(-)(c)	7.71	13.37	12.76	12.77	12.46

(a) t-statistics are in parentheses.
(b) The likelihood ratio is calculated as -2[lnLklhdr-lnLklhdu] and is has a chi-square distribution with k-1 degrees of freedom
(c) The Akaike's information criterion is -ln(Lklhd)+k where k is a number of estimated parameters.

Thus, the signs of the coefficients with respect to total loans/capital and provision/operating expenses are consistent with hypothesised role of capital adequacy and asset risk. The first of the regressors suggest that an increase in total loans relative to capital increases the probability of problem/failure. In constrast, the increase of provision relative to operating expenses reduces the likelihood of financial difficulties.

With respect to the significance of the estimated coefficients, we found that provision/operating expenses is significant at 10% of significance. However, as we increase the degree of statistical significance, say 5%, the estimated coefficients are insignificant. We suspect the existence of multicollinearity among the explanatory variables. On this issue, Judge, Griffiths and others (1980) and Johnston (1988) show that the near multicollinearity produces three effects, namely very large sampling variances, large covariances, and unstable coefficients. In this case the correlation coefficient of the two explanatory variables is nearly 64%. Furthermore, by dropping one of the regressors in the equation the t-statistic of the remaining variable left improves considerable and becomes significant.[7] In spite that both of the regressors together are insignificant, the overall equation is still statistically significant in terms of the likelihood ratio test and as we will see the overall prediction accuracy of the model is exceptionally good and comparable with other studies in this area. This indicator should be the overwhelming criterion to choose the best specification together with the AIC.

Table 6.6 Logit Analysis of Selected Financial Variables One Year Before the Critical Time.(1982)

Financial Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-3.22	-32.09	21.36	25.95	13.30
	(-0.79)	(-1.16)	(1.68)	(1.57)	(2.03)
Capital Adequacy					
13	0.67				
	(2.04)				
14		-0.30	-3.68	-4.32	1.99
		(-0.16)	(-1.26)	(-1.29)	(0.65)
Liquidity					
24		-6.07	-44.85	-31.13	-31.47
		(-0.28)	(-1.56)	(-0.89)	(-1.53)
Profits					
35		9.45	-1.77	-0.36	21.33
		(1.18)	(-0.17)	(-0.03)	(1.82)
Asset Risk					
41		41.71			
		(1.41)			
43	-2.92				-6.02
	(-1.65)				(-1.83)
412			-205.1	-243.1	
			(-1.48)	(-1.43)	
Liability Risk					
61		-6.76			-10.51
		(-1.02)			(-1.31)
62			-12.43	-21.37	
			(-0.50)	(-0.72)	
Mismatching					
72		-2.90	-2.70		1.16
		(-0.70)	(-2.11)		(0.11)
75				-8.34	
				(-0.65)	
Ln(Lklhd)	-8.90	-12.13	-12.13	-6.16	-6.4
Lklhd Ratio	27.62	6.34	19.85	19.80	20.95
AIC	11.90	19.13	19.13	13.16	13.43

(a) t-statistics are in parentheses.

The results for one and more years before the problem/failure date are presented in tables 6-10. The evidence shows that specification E1 is preferable to the others for every year prior to 1983 with the exception of 1980 based on the Akaike's information criterion.

There are several interesting findings from this estimation. Firstly, the variable of capital adequacy is significant at 10% for every single year prior to 1983.

Table 6.7 Logit Analysis of Selected Financial Variables Two Years Before the Critical Time.(1981)

Financial Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-4.30	-9.55	-0.13	0.33	5.16
	(-3.06)	(-1.42)	(-1.42)	(0.29)	(1.86)
Capital Adequacy					
13	0.39				
	(3.30)				
14		6.14	5.40	4.09	8.83
		(1.48)	(1.46)	(1.08)	(1.57)
Liquidity					
24		-0.008	2.33	2.76	-5.95
		(-0.02)	(1.20)	(1.23)	(-0.61)
Profits					
35		8.54	5.92	6.98	4.31
		(1.24)	(0.88)	(1.02)	(0.61)
Asset Risk					
41		12.64			
		(1.65)			
43	-0.008				-3.47
	(-0.17)				(-2.04)
412			-7.18	-8.01	
			(-1.21)	(-1.18)	
Liability Risk					
61		-4.57			-6.95
		(-1.29)			(-1.71)
62			-0.59	0.85	
			(-0.08)	(0.12)	
Mismatching					
72		-2.34	-2.38		1.74
		(-0.89)	(-0.96)		(0.42)
75				-2.21	
				(-1.49)	
Ln(Lklhd)	-16.22	-19.21	-21.49	-20.57	-14.6
Lklhd Ratio	11.73	2.41	1.51	1.84	4.72
AIC	19.22	26.21	28.49	27.57	21.64

(a) t-statistics are in parentheses.

Secondly, the overall significance of the equation the likelihood ratio is significant for every single year, although its value felt as we approached 1979 and 1980.

Table 6.8 Logit Analysis of Selected Financial Variables Three Years Before the Critical Time.(1980)

Financial Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-2.89 (-2.13)	161.55 (1.92)	-2.29 (-0.89)	-1.48 (-0.56)	6.01 (1.50)
Capital Adequacy					
13	0.31 (2.61)				
14		0.04 (0.03)	-0.95 (-0.26)	0.14 (0.02)	-0.14 (-0.06)
Liquidity					
24		-140.50 (-1.74)	-41.53 (-1.61)	-49.41 (-1.41)	-11.20 (-1.27)
Profits					
35		30.93 (2.15)	52.09 (2.06)	41.71 (2.09)	18.78 (1.85)
Asset Risk					
41		-154.32 (-1.88)			
43	-0.02 (-0.10)				0.10 (0.14)
412			-22.54 (-1.57)	-19.09 (-1.41)	
Liability Risk					
61		-40.47 (-1.29)			-9.38 (-1.61)
62			106.04 (1.93)	88.89 (1.86)	
Mismatching					
72		-47.65 (-1.92)	12.67 (1.27)		-7.64 (-1.02)
75				8.33 (1.03)	
Ln(Lklhd)	-17.14	-9.31	-10.01	-10.27	-13.28
Lklhd Ratio	5.46	6.72	5.99	5.80	3.53
AIC	20.14	16.31	17.01	17.27	20.28

(a) t-statistics are in parentheses.

Thirdly, the negative value of the likelihood function gets larger for E1 over-time meaning that the predictive power of the model tend to fall as the time before failure/problem lengthens.

Table 6.9 Logit Analysis of Selected Financial Variables Four Years Before the Critical Time.(1979)

Financial Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-4.35 (-1.70)	16.42 (0.79)	0.89 (0.36)	-1.29 (-0.52)	3.59 (1.03)
Capital Adequacy					
13	0.31 (2.25)				
14		-0.02 (-0.02)	-0.02 (-0.02)	-2.02 (-0.83)	-0.06 (-0.05)
Liquidity					
24		-9.76 (-0.54)	-12.74 (-0.83)	-33.93 (-1.35)	-2.84 (-0.24)
Profits					
35		23.95 (1.55)	24.54 (1.61)	32.32 (1.63)	19.65 (1.56)
Asset Risk					
41		-14.27 (-0.62)			
43	-0.008 (-0.06)				-0.26 (-0.32)
412			-15.23 (-1.08)	-24.98 (-1.39)	
Liability Risk					
61		-4.86 (-0.82)			-6.30 (-0.88)
62			124.85 (0.98)	238.64 (1.21)	
Mismatching					
72		-17.81 (-1.08)	-2.41 (-0.22)		-2.97 (-0.15)
75				7.22 (1.05)	
Ln(Lklhd)	-12.82	-10.56	-9.72	-9.11	-10.63
Lklhd Ratio	3.71	1.94	2.11	2.47	1.87
AIC(-)	15.82	17.56	16.72	16.11	17.63

(a) t-statistics are in parentheses.

Now we turn to the classification accuracy of E1 where we aimed at minimising misclassification errors. One could make type-I error which occurs when one classifies a problem bank as non-problem and vice versa for type-II error.

Table 6.10 Prediction Accuracy of the E1 Logit Model for 1983.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	6.6(1)	6.6(1)	13.3(2)	20.0(3)
Problem Accuracy	93.4	93.4	86.7	80.0
Type-II Error	4.7(1)	9.5(2)	9.5(2)	14.2(3)
Non-problem Accuracy	95.3	90.5	90.5	85.8
Overall Accuracy	94.4	91.6	88.8	83.3
Predicted Number Prob.	14	14	13	12
Actual Number Prob.	15	15	15	15
Predicted Number NonProb.	20	19	19	18
Actual Number NonProb.	21	21	21	21

Table 6.11 Prediction Accuracy of the E1 Logit Model for 1982.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	5.8(1)	11.7(2)	17.6(3)	23.5(4)
Problem Accuracy	94.2	88.3	82.4	76.5
Type-II Error	13.6(3)	13.6(3)	22.7(5)	22.7(5)
Non-problem Accuracy	86.4	86.4	77.3	77.3
Overall Accuracy	89.7	87.1	79.4	76.9
Predicted Number Prob .	16	15	14	13
Actual Number Prob.	17	17	17	17
Predicted Number NonProb.	19	19	17	17
Actual Number Non-Prob.	22	22	22	22

Table 6.12 Prediction Accuracy of the E1 Logit Model for 1981.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	23.5(4)	29.4(5)	35.2(6)	58.8(10)
Problem Accuracy	76.5	70.6	64.8	41.2
Type-II Error	16.6(4)	20.8(5)	20.8(5)	29.1(7)
Non-problem Accuracy	83.4	79.2	79.2	70.9
Overall Accuracy	80.4	75.6	73.1	58.5
Predicted Number Prob.	13	12	11	7
Actual Number Prob.	17	17	17	17
Predicted Number NonProb.	20	19	19	17
Actual Number	24	24	24	24

Table 6.13 Prediction Accuracy of the E1 Logit Model for 1980.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	25.0(4)	31.2(5)	43.7(7)	75.0(12)
Problem Accuracy	75.0	68.8	56.3	25.0
Type-II Error	16.6(3)	22.2(4)	38.8(7)	50.0(9)
Non-problem Accuracy	83.4	77.8	61.2	50.0
Overall Accuracy	79.4	73.5	58.8	38.2
Predicted Number Prob.	12	11	9	4
Actual Number Prob.	16	16	16	16
Predicted Number NonProb.	15	14	11	9
Actual Number	18	18	18	18

Table 6.14 Prediction Accuracy of the E1 Logit Model for 1979.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	21.4(3)	28.5(4)	35.7(5)	50.0(7)
Problem Accuracy	78.6	71.5	64.3	50.0
Type-II Error	27.2(3)	36.3(4)	45.4(5)	63.6(7)
Non-problem Accuracy	72.8	63.7	54.6	36.4
Overall Accuracy	76.0	68.0	60.0	44.0
Predicted Number Prob.	11	10	9	7
Actual Number Prob.	14	14	14	14
Predicted Number NonProb.	8	7	6	4
Actual Number	11	11	11	11

These results are based on specification E1 and are reported in tables 10-14. Most previous studies assign a cut-off point of 0.5 for the likelihood of failure/problem. Nevertheless, in the present study, we have estimated the classification accuracy for different cut-off points. There are several interesting findings which is worth to be mentioned.

Firstly, the overall accuracy of E1 is superior to the other specifications at different cut-off points. For instance, at the 0.5 (50%) cut-off point conventionally used in most studies, the type-I error for the E1 logit estimation for 1983 is 6.6% which is equivalent to a failure/ problem accuracy of 93.4%. Moreover, type-II error is 4.7% so that the nonfailure/nonproblem accuracy is 95.3%. Thus, the overall accuracy of this model is 94.4% which it is quite acceptable.

Secondly, we observed that the overall accuracy decreases as we increase the cut-off point from 0.5 to higher restrictions. For instance, the overall accuracy for E1 for 1983 at 0.6,0.7, and 0.8 cut-off value is 91.6%, 88.8%, and 83,8% respectively.

Thirdly, we observe that the overall accuracy of the model decreases as we attempted to predict problems with data before the critical time. The overall accuracy at 0.5 fall to 89.7% in 1982, 80.4% in 1981, 79.4% in 1980, and 76% in 1979. Indeed, type-1 errors have risen from 6.6% in 1983 to 21.4% in 1979. Similar deterioration is observed with respect to type-II errors as they went from 4.7% in 1983 to 27.2% in 1979.

In view of the overall prediction accuracy of specification E1 over the years under examination and in comparison with other empirical studies on the subject, these results should be considered as highly satisfactory.[8]

These econometrics results confirm the view that the failure of some financial institutions in Chile would have been anticipated before its critical time in 1983 with an acceptable degree of confidence. Indeed, it was seen that the model was predicting these failures with a lead time of four years.

We can estimate the E1 equation using quarterly data for each year and from there to obtain the ex ante quarterly probability estimates to construct a quarterly classification of financial institutions. These estimates will be used as the dependent variable of the macromodel and the moral hazard model in chapters 7 and 8 respectively.

Once the financial institutions have been classified either into a failed/problem and nonfailed/nonproblem group in each quarter for the five year period we can proceed to test two competing hypothesis which may explain the financial difficulties experienced by Chilean banks. In chapter 7 and 8 we will estimate a logit model with quarterly macroeconomic and microeconomic data.

Endnotes.

(1) After the banking crisis of 1983, the chilean banking authorities improved the mechanism of loan classification in terms of risk and the classification and related risk for different financial institution was agreed in 1987 to be in the public domain.

(2) Appendix 1 provide an exhaustive list of the chilean financial institutions and its classification.

(3) This index was calculated by the magazine estrategia. It is a general index composed by four financial ratios: profitability, capital adequacy, liquidity, and asset quality. The index was 70, 68, 60, and 59 for foreign banks during 1980, 81, 82, and 83 respectively. Whereas domestic banks showed an index values of 69, 66, 58, and 40.3 for the same period of time.

(4) The data have been taken from the monthly reports of the Superintendencia de Bancos de Chile. This reports include bank balance sheets and income statements as well as information of the health of the financial system. The data quality and reports improves considerable from 1982 onwards.

(5) The testing of macroeconomic and microeconomic as determinants of problem/failure will be carried out and reported in chapter 7 and 8.

(6) However, capital adequacy is not completely within the control of bank managers. This variable is determined by the bank legislation which tend to inforce certain minimum limits. Nevertheless, still some discretion is left to banks in this respect.

(7) The result of separate regressions for variables 13 and 43 are reported in appendix 5.

(8) Similar results in terms of overall prediction are obtained from other empirical studies. For example, Barth, Brumbaugh, and others (1985) reported an overall prediction accuracy of 87% at cut-off point of 0.5 for Thrift Institution failures. Also, Martin (1977) reported accuracies around 90% for failure and non-failure bank. Although his result assumes a cut-off point of 0.0041, the sample proportion failure. That is the cut-off point assumes a priori probability of group membership equal to the sample frequencies and equal misclassification cost.

Chapter 7 The Bank Failures in Chile: The Role of Macroeconomic Factors.

(7.1) Introduction.

The purpose of this chapter is to re-assess and to examine the issues related to the bank failures/problems of 1982-83 and to evaluate the importance of the economic recession and the role played by some key macroeconomic prices which exhibited severe misalignment and could have affected the performance of the banking system. It is shown the inconsistency of macroeconomic policy and external shocks produced a boom-bust economic cycle and coincided with the rise and fall of the Chilean banking system. In effect, bank failures/ problems were preceded by a sharp fall in output. Although the evidence on the link between the general economic climate and the collapse of the banking system is irrefutable as a first approximation, its empirical validity need to be assess.

This chapter will provide a discussion of the boom-bust cycle hypothesis and its evaluation for the case of Chile during the period 1977-81 and 1982-83 as part of sections I and II. In addition, it will be shown that performance of the banking sector was correlated with the macroeconomic environment. Finally, section III provides a thorough discussion of the model specification and estimation. At the same time, I report the econometric results and its interpretation.

(7.2) Macroeconomic Instability and Banking Crisis.

The central tenet of the hypothesis to be tested in this chapter relates the banking crisis with changes in the general economic conditions and the misalignment of some key macroeconomic prices. In general, it could be argued that macroeconomic shocks, including external exogenous disturbances (deterioration of the terms of trade, and rising world interest rates) and policy inconsistencies (a fixed exchange rate regime with backward-looking wage indexation scheme, and/or significant fiscal deficit, trade and financial liberalisation with no supportive macroeconomic policies) can generate significant misalignment of key macroeconomic prices (overvaluation of the real exchange rate, high real interest rates, overvaluation of stock prices, rising real wages) which may increase the proportion of non-performing loans and lead to bank failures. Similarly, serious output downturns can equally affect the values of bank assets and the likelihood of bank failure.

There are several episodes described in the literature which fit this hypothesis. For instance, Kindleberger (1986) and Keran (1986) subscribed to this hypothesis when comparing bank failures in the 1930's with the 1980's for the US banking system. Indeed, the evidence from the US indicates that 6.704 (9.2% of total banks) of the banks failed during the period between 1930-33. Although the number of failures fell in the years 1934-1978 to only 689, the evidence for the 1980's suggests a significant increase in the number of failed banks from 10 in 1981 to 120 in 1985. Although most of these financial institutions were concentrated among small farm and energy banks, the failures of the Continental Illinois in 1984 (8th largest bank in the US), The First Pennsylvania in 1980 (23rd largest), and the Seafirst in 1983 (29th largest) were a matter of concern in the banking system as a result of their significant size.

According to Kindleberger and Keran major shocks to relative prices produced a deflationary impact in both periods. They found that during the 1980's there was a major decline in the relative price of farm land as much as in the 1920's and the 1930's. The collapse of land prices during the 1980's was accompanied by the effects of major oil shocks during the late 1970's. Similarly, they show that these two periods exhibited a substantial increase in real interest rates and noted that they stayed high longer in the 1980's than in the 1930's. It was certainly a major reason behind rising non-performing loans and subsequent bank failures.

Finally, a major dollar appreciation analogous to the one of the 1980's was present during the 1930's. A real appreciation was bound to generate distortions in both production and consumption as well as wealth effects by turning domestic relative prices in favour of non-tradables and away from tradables. Those financial institutions with a high share of their capital in loans to those companies in the tradable sector will be at risk. However, even if the banks' portfolio is weighted towards profitable activities at the given relative prices, still there is the danger of a time bomb if the real appreciation is not sustainable in the long-run and the adjustment take place initially via output deflation. Thus, Kindleberger and Keran attached a great importance to relative price shocks on the banks solvency.

Similarly, Sundararajan and Baliño (1990) examines the recent experiences with banking crisis in seven countries (Argentina, Malaysia, Phillipines, Spain, Thailand, Uruguay, and Chile) with a focus on the linkages between macroeconomic conditions, financial liberalisation, and banking failures. In spite of the cross-country differences they found common causes to explain the episodes of banking crisis (failures). Their study demostrated that the episodes of banking crisis (defined as a generalised solvency problems among banks due to an increase in non-perfroming loans, and losses due to foreign exchange exposure, interest mismatch, contingent liabilities, and decrease in the value of investment) occurred following a shock to the macroeconomy, and reinforced the subsequent decline in output. In most countries in the sample, the banking failures took place after a sustained period of rapid expansion in output following major fluctuations in relative prices and general business conditions. After major external shocks, and gross policy inconsistencies, sharp adjustments in real exchange rate, real interest rates, and stock prices affected the economy's performance, ouput growth, and the soundness of financial institutions. Although the effect of macroeconomic instability appears to be central in their argument, it was equally accepted that a more gradual financial liberalisation, vigilant bank supervision, and a well designed prudential regulation would limit the magnitude of bank failures (crisis) and help to reduce the vulnerability of the banking system to the shocks from the macroeconomy.

With specific reference to the Chilean banking crisis, Moreno and Perez (1983) have also provided a testimony to the importance of macroeconomic instability on bank failures. On this account, they argued that the collapse of the banking system had little to do with financial liberalisation and inadequate bank legislation. Moreover, they maintained that no banking system would be able to withstand a fall in GDP and the level of interest rates as the one observed during 1982-83. External shocks combined with inadequate macroeconomic policies, in particular the exchange rate policy, tended to amplify the economic cycle in the open economy. In effect, sharp increases in lending interest rates after a long history of negative rates, the introduction and later on the abandonment of a fixed exchange regime, and the burst of the stock exchange bubble all contributed to major variations in the overall economic environment and consequently the solvency of the banking system. In their own words, they blame the authorities for inadequate management of macroeconomic variables, particularly the exchange rate, and interest rates, misalignments which amplified the economic cycles and hence the financial condition of several financial institutions.

As we will see in section 3, although this description fit extremely well to what happen in Chile during the period of 1977-83, this in itself represents no direct empirical test on the influence of these set of variables on likelihood of bank failure/problem.

There are two interesting papers which attempted to evaluate the influence of macroeconomic variables on bank failures. Bovenzi and Nejezchleb (1985), for instance, studied the relationship between the rate of bank failures and macroeconomic conditions in the US using quarterly data from 1970 through the first quarter of 1984. They maintained that during an economic downturn, fixed loan commitments established previously under more auspicious economic circumstances become difficult to fulfil so that an increasing number of borrowers will be forced to default. Thus, after some specific time lag an increasing share of non-performing loans and falling bank profits would result in higher bank failures.

They studied bank failures by using alternative proxies for overall macroeconomic conditions among them real GNP growth, real interest rates, unemployment rate, and the corporate debt burden. The evidence indicates that although the relationship between real GDP and the bank failure rate was significant it explained only 10% of the variation of the failure rates.

With reference to the unemployment rate, this proxy accounted for 56% of the total variation in bank failures. At the same time, given that unemployment rate tend to lag general economic conditions, it lead the failure rate by one to three quarters which is shorter than the GDP regressor. Similar results are found for the interest rate on the failure rate with 50% prediction accuracy after about a five-quarter lag. On this account, high business failure rates and loan losses seem to be correlated with real interest rate movements.

The regressor measuring the corporate debt burden represented a more direct measure of the ability to repay debt measured by the ratio "after-tax nonfinancial corporate debt service to nonfinancial corporate cash flow. It exhibited a better fit with 62% of the variation of bank failure rates. Although these variables were statistically significant, macroeconomic conditions explained only a part of the increase in the rate of bank failures. The estimated equations did in fact overestimate bank failures during 1981, but underestimated failures from that point on.

Similarly, Amos (1992) found that for periods with high rates of bank closings were characterised by the economy growing below its historical trend. The evidence from his time series regression analysis using sample data for the US bank closing between 1934 and 1988 tend to support his assertion. The effect of current real GNP on the number of closing banks was statistically significant and with a positive sign as expected. The effect of lagged GNP on the dependent variable was insignificant. The regression also included the money supply as an additional explanatory variable. The money supply with one year lag was significant although with a positive sign. The overall goodness of fit of the regression was 0.95.

Although this empirical approach is useful for a large sample with aggregate data, there are certain limitations for the study of the Chilean bank failures. Firstly, bank failures in Chile were mostly concentrated in a single year, that is 1983. Secondly, the purpose of this study is to estimate the ex ante probability of bank failure during the period of liberalisation. In other words, the likelihood previous to the critical year of 1983.

With this purpose in mind, I have constructed and estimated a logit model for panel-data in order to directly test the explanatory power of macroeconomic variables on the likelihood of bank failure/problem. Partly, I expect that some of these systematic factors could explain the collapse of the banking system in Chile.

(7.3) The Boom-Bust Economic Cycle: The Macroeconomy in Chile.

(7.3.1) The Chilean Economy and the Main Policy Reforms.

Before we proceed to assess the performance of the economy it is necessary to give a brief account of the main reforms introduced prior to the deterioration of the macroeconomy and the crisis of financial institutions in 1982-83 period.

As we have seen in Chapter 1 and 2, previous to the reform period which started in September 1973 inmediately after the military coup which overthrew Allende's socialist government, the economy was pursuing an inward-looking strategy for development which relied exclusively on intensive and extensive government intervention in all the spheres of the economy. The trade bias was towards the import substitution sector by means of tariff and non-tariff barriers across sectors , export taxes, and an over-valued exchange rate. In addition, the financial system was subject to a wide range of instruments to direct credit towards the priviledged industries and to finance the fiscal deficit. The imposition of high reserve requirements, ceilings on interest rates, selective credit controls and rationing was conducive to the repression of the financial system. The economy was immersed in a large macroeconomic disequilibrium and a modest growth as compared with its historical standard and with those economies pursuing outward looking strategies. This became even more acute during Allende's populist government in 1970-73.

Stabilisation and liberalisation policies were implemented from late 1973 onwards in order to correct the large macroeconomic disequilibrium and to enhance the rate of economic growth. The economic reforms contained three main principles. Firstly, the transformation toward an outward-looking economy fully integrated with international capital and goods markets with a dominant role assigned to the private sector in a competitive market economy was regarded to be conducive to higher growth rates.

Secondly, the credibility and success of trade and financial liberalisation required that they were preceded by macroeconomic stabilisation, particularly in view of the high inflation rate.

Thirdly, the question of the dynamics of liberalisation suggested that the sequence and timing should follow a specific order. As I have shown in chapter 2, there was a consensus among the experts that trade and domestic financial liberalisation should come before the opening of the capital account of the balance of payments.

According to these principles, the reforms started with an orthodox stabilisation strategy which emphasised the control of the money supply and a consistent reduction in the fiscal deficit.[1] The fiscal shock included large cuts in government expenditures, temporary increases in income taxation and the replacement of sales tax for a 20% VAT, full indexation of the tax system, integration of personal and business income tax, and the elimination of the remaining tax exemption and subsidies. The shock treatment also included a tight monetary policy although some monetarist like Harberger (1982) and a critic such as Foxley (1983) do not accept the view of a nominal monetary crunch. Specifically, the evidence indicates that the percentage increase in M2 was still high at 257%, 166%, and 130% in 1975, 1976, and 1977 respectively. Whereas the percentage increase in the GDP deflator was 328%, 252%, and 103% for each three successive years. Similar results are obtained between the period of 1977 and 1980 but with the added query that the nominal growth of M2 was still above the inflation rate. Therefore, there was no genuine nominal monetary crunch during the second half of the 1970's but it certainly was one in real terms between 1975 and 1976. This apparent closed economy monetarism was pursued with some relative success until early 1978.[2]

Given the greater openess of the economy, the modest progress made on inflation, the contractionary effect of the orthodox measures in particular during 1975, and the increasing role played by exchange rates in expectations formation of tradable prices the authorities advocated an exchange rate stabilisation approach as an anti-inflation policy. The academic and practical acceptance of the monetary approach to the balance of payments made readily acceptable two important tenets of this approach. Firstly, the law of one price will hold so that domestic inflation will rapidly converge towards world inflation plus the expected rate of devaluation. And secondly, under a fixed or preannounced exchange rate monetary policy will be endogenous. That is changes in the quantity of money will only affect the composition of the base money as the increase in domestic credit will be offset by a fall in international reserves.[3]

In theory the exchange rate stabilisation approach involves the public announcement of a fixed schedule of the future nominal exchange rate over a specified period which is credible by the rational agents. Moreover, this anti-inflationary policy has been part of an overall stabilisation and growth strategy comprising both trade and financial liberalisation. According to Blejer and Mathieson (1981) the potential stabilising effects of preannouncing the exchange rate will have two fundamental effects on the rate of inflation: a direct impact on expectations, and an indirect effect via product and financial markets.

With reference to the former, a credible announcement of the future path of the nominal exchange rate in an open economy consistent with lower inflation should help to reduce the public's expectations concerning future inflation. In this scenario nominal claims between firms and managers should be in line with lower expected inflation. Moreover, if nominal yields on financial assets are market determined and reflect the expected rate of inflation, then lower inflationary expectations should raise the demand for money (currency holdings), and hence lower price increases for a given monetary expansion and income growth.

With respect to the indirect effect, the elimination of trade restrictions (tariffs) will produce both a price differential, and a potential profits which will not be arbitraged away unless they persist over time to recover the high initial cost of entry. Thus, a predictable future path of the exchange rate will help to curb inflation by enhancing price arbitrage.

A formal "tablita" was introduced in February 1978 consisting in a preannounced future rate of devaluation set below the domestic inflation rate and at a decreasing rate. In June of 1979, this active crawling peg exchange rate was transformed into a fixed exchange rate regime as the US dollar was fixed at $39 Chilean pesos. However, it was abandoned three years later with the forced devaluation of June 1982 because of increasing overvaluation of the exchange rate.

On the liberalisation front, the first step was the deregulation of nearly 3000 prices and the privatisation of state-owned firms, including financial institutions. The liberalisation also included trade reforms with the removal of quotas and the reduction of the average and range of nominal tariffs. From early 1976 onwards, a new set proposal for tariff reduction was proposed and by late 1977 a gradual attainment of a uniform tariff of 10% was agreed. This schedule was completed in June of 1979.

With respect to financial liberalisation, interest rate controls were removed for non-bank financial institutions and banks in May and October 1974 respectively. In addition, entry barriers to new financial institutions including those applicable to foreign banks were lifted.

On the external side of the financial market, in September 1977 commercial banks were allowed to borrow from international markets under article 14 of the exchange law although with a monthly flow limit of 5% of capital and reserves. A stock limit of 25% under articule 14 was introduced in January 1978 and raised two months later to 160% of capital and reserves. The relaxation of controls on capital inflows went further and by 1980 all monthly limits were lifted. In May 1982 banks were allowed to obtain external credit with maturities below 2 years and a reserve requirement of 20%.

In general and as also argued by Mckinnon (1982), the stabilisation and liberalisation strategy followed what was accepted at that time as the optimal sequence and timing of reforms. However, the economic collapse of 1982 meant that the liberalisation reforms were reversed by the rise in trade tariffs from 10% to 18% and the intervention of financial institutions as part of the rescue package of the financial system in Chile. At the same time, the crisis of 1982 and the emergency measures taken by the authorities meant increases in the fiscal deficit and inflation rate.[4]

(7.3.2) The Boom-Bust Economic Cycle of the Chilean Economy: The Appraisal.

The central idea is that the introduction of exchange rate management, in particular the active preannounced crawling peg and which ultimately ended in a fixed exchange rate regime as an anti-inflationary tool during trade and financial liberalisation was likely to generate a boom-bust cycle as some key relative prices became misaligned and then return to their long run equilibrium.[5] It could be argued that the path from the economic and banking boom in 1977-81 to the economic and banking bust in 1982-83 had its sources in what happened to key relative prices specially the real exchange rate, the real interest rate, and the real wage rate.

Let's first examine the data for the economic boom between 1977-81 from table 1. The evidence portrays some impressive results from the reforms undertaken, in particular in terms of export volumes at least up to 1980 and capital inflows, the improvement of overall balance of payments and the surplus in the fiscal budget. At the same time, we observe important gains in the control of the rate of inflation although achieved gradually and at a very high cost in terms of unemployment. Indeed the evidence indicates that the percentage inflation rate (as measured by the CPI) went from nearly 500% in 1974 to less than 10% in 1982, consistent with the astonishing figure of 22% unemployment rate during 1982 and 1983.

Table 7.1 Indicators of the Economic Boom, 1977-81.

	77	78	79	80	81
GDP Growth(a)	9.8	8.2	8.3	7.8	5.5
GDP Tradables(b)	7.8	4.5	7.0	5.2	2.9
Non-Tradables(c)	9.4	9.6	9.9	9.7	5.4
Absorption(d)	14.2	9.7	10.9	9.3	10.9
Fiscal Deficit/GDP	1.8	0.8	-1.7	-3.1	-1.7
Unemployment Rate(Nac.)	13.2	14.0	13.6	11.8	11.1
Overall Balance Payments(US$)	118	712	1047	1244	67
Trade Balance	4	-426	-355	-764	-2677
Exports(FOB)	2186	2460	3845	4705	3837
Imports	2151	2886	4191	5469	6513
Capital Inflows(e)	607	1959	2255	3242	4768
Number of Bankruptcies	224	312	344	415	431

Source: Banco Central Chile, Monthly Bulletin, Various Issues
Banco Central Chile, National Accounts 1974-85.
ECLA, Statistical Yearbook, Various Issues.

(a) All GDP data at 1977 prices.
(b) Includes agriculture, forestry, fishing, mining, and manufacturing.
(c) Includes construction and services.
(d) Absorption includes private and public consumption plus total investment.
(e) Long and short term flows.

With respect to GDP growth, the data shows that the average annual rate of GDP growth was nearly 8% between 1977 and 1981. Although this figure exceeded Chile's historical standard it is below the growth rate of 1928 which was 24.3%.[7] Surprisingly, the sectoral GDP growth shows that non-tradables grew at a much faster rate than the tradable sector contrary to the intention of trade reforms. In fact, for the period of exchange rate stabilisation strategy, non-tradables grew at an annual average of 8.8% as compared to 5.4% for the case of tradables. It is remarkable that growth of GDP took place under a significant overvaluation of the peso. This performance and the relative boom between the two sectors can be explained by the pattern of some key prices in the Chilean economy, in particular the appreciation of the real exchange rate, the increases in real wages, the transitory reduction in real interest rates, and the unsustainable rate of capital inflows which made possible both rising expenditures to sustain the economy's growth rate given the relative prices, and to masked the sustained deterioration of the trade balance particularly in 1981.

The data from table 2 shows the movements in three macroeconomic prices during the period of preannounced exchange rate.

Table 7.2 Key Prices in Chile between 1977-1983.

	77	78	79	80	81	82	83
Nominal InterestR(a)	98.1	63.3	49.2	39.0	42.5	49.6	35.7
Real Interest RT(b)	90.0	52.7	39.4	10.7	18.3	54.5	46.1
Real Interest R(c)	43.9	34.1	16.2	11.0	31.7	31.2	14.3
Real Wages(d)	72.5	82.9	92.0	100.0	108.9	108.6	97.1
Real Exchange Rate(e)	83.6	100.0	93.8	80.1	70.2	76.7	82.3
Real Value Stock(f)	--	46.9	54.2	100.0	80.4	61.2	39.2

Sources:Banco Central Chile,Monthly Bulletin,Various Issues
Edwards (1986) for effective real exchange rate.

(a) Nominal lending rate on 30-89 days loans.
(b) Ex post real lending rate was estimated as {[(1+i)/(1+PTI)]-1}*100 where i and PTI are nominal lending rate and changes in tradable price index.
(c) Ex post real lending rate estimated from nominal rate deflated by the CPI which includes non-tradables.
(d) Nominal index of wages and salaries deflated by CPI. 1980=100
(e) This index was constructed as the ratio of a weighted average of WPI of Chile's 10 main partners in $ to Chile's CPI.1978=100
(f) Stock price index at constant price, IGPA. (1980=100)

Although the appreciation of the real exchange rate is seen as a major factor in most of the interpretation of the crisis of 1982-83, there is no consensus on what caused the systematic appreciation of the real exchange rate of more than 30% between 1978 and 1981. The most obvious factor in the appreciation of the real exchange rate was the introduction between February 1978 to May 1979 of a preannounced declining rate of monthly devaluation set below the previous month's domestic inflation rate and the subsequent fixing of the nominal rate at $ 39 pesos per dollar until June 1982.

The data on domestic and international inflation plus devaluation from table 3 indicates two things: Firstly, the introduction of the "tablita" and fixed exchange regime coincided with a significant difference between domestic and US inflation rate. Under every definition of a real exchange rate this would have meant beyond any doubt an initial although transitory declining value for the real exchange rate under the law of one price.[8]

Secondly, the data also show however that between 1978-81 domestic inflation failed to converge rapidly enough and avoid a permanent overvaluation.

Table 7.3 Indicators of Convergence (%)

	77	78	79	80	81	82
Real LIBOR(a)	- 0.7	1.6	-10.6	1.7	8.7	26.2
LIBOR(b)	6.1	8.8	12.1	14.2	16.8	13.2
Spread lending-LIBOR(c)	50.6	40.4	25.9	28.5	30.4	-23.7
Spread deposit-LIBOR(d)	13.9	23.3	12.7	20.1	20.8	-30.8
Devaluation	60.5	21.4	14.9	0.0	0.0	88.3
US Inflation (CPI)	--	9.1	13.3	12.4	8.9	3.9
Chile Inflation(CPI)	91.1	40.4	33.0	35.0	19.6	9.9

Source:IMF,International Financial Statistics,Various Issues

(a) Nominal LIBOR deflacted by the variation of dollar price of Chilean tradables
(b) Nominal LIBOR is the three months Eurodollar rate.
(c) Calculated as {[(1+i)/(1+I)(1+e)]-1}*100 where i,I, and e are nominal domestic lending, nominal LIBOR and the expected devaluation rate respectively.
(d) Calculated as {[(1+i)/(1+I)(1+e)]-1}*100 where i nominal deposit rate.

Therefore the real exchange rate appreciation was not transitory and became even worse after the exchange rate was fixed. The existence of full wage indexation to compensate lagged changes in CPI introduced as part of the labour law in late 1979, and the fact that many non-tradables prices were fully indexed backward made the dynamic path of tradables and non-tradables prices inconsistent. In effect, as a first approximation and according to the real wage index in table 2, wages increased by 26% in real terms between 1978 and 1981 and coincided with the 30% real appreciation. Thus, the exchange rate regime became inconsistent with a wage indexation.

However, as we have seen from tables 1 and 2, the real appreciation of the exchange rate also coincided with significant increases in private sector expenditures averaging 11% per annum, exports rising from U$ 2.186 millions in 1977 to U$ 4.705 millions in 1980, falling unemployment rates, and substantial increases in the stock price index by 53% in real terms between 1978 and 1980.

Although many proponents among them Corbo (1985, 1987), Edwards (1986,1989), Harberger (1985a,1985b, 1987), and Dornbusch (1985) accepted the inconsistency argument, they viewed the appreciation of the real exchange as a consequence of the increase in private sector expenditures on both tradable and non-tradables financed by large and unsustainable capital inflows as well as domestic borrowing but for different reasons.[9]

According to Corbo (1985,1987), the active crawling peg and fixed exchange rate mechanism combined with the gradual lifting of restriction on foreign indebtness encouraged a significant rise in the rate of capital inflows as a result of the increasing spread between domestic and foreign interest rates. This differential made it quite attractive for foreigners to bring capital into the economy and for nationals to borrow from abroad. These spreads were large even in the period where the exchange rate devaluation was pre-announced and fixed later on. The data from table 1 and 3 shows that the spread between nominal peso lending rate and the nominal LIBOR in 1977 was 50.6 and remain high even in 1979 at 28.5, and capital inflow went from U$ 607 millions in 1977 to U$ 2.255 millions in 1979. Similar observations can be drawn from the spread between nominal peso deposit rates and the LIBOR.

Further relaxation of controls on capital inflows and the portfolio disequilibrium encouraged even more the inflow of capital and hence pushing the nominal domestic interest rate further down. According to the evidence the nominal lending rate fell from 63.3% in 1978 to 49% and 39% in 1979 and 1980. But even more significant was the reduction in real interest rates which according to table 2 (lending rate deflated by changes in CPI) came down from 34% in 1978 to 16% and 11% in 1979 and 1980 respectively. Similar results were obtained when using the change in the tradable price index as a deflator.

It could be argued that the fall in real interest rates partly reflected increasing arbitrage between nominal domestic and foreign rates, although it remain fairly high as a result of Central Bank sterilisation and imperfect asset substitution. Similarly, the evidence also show that international influences were also important in the drop in real lending interest rates, in particular the dollar depreciation in world markets and the effect on the dollar price of chilean tradables.

Table 7.4 US Exchange Rates and Tradable Prices for Chile. (a)

	77	78	79	80	81	82
NEFF EXR	124.0	111.2	108.3	108.0	121.1	135.2
REFF EXR(b)	117.6	108.6	108.9	110.0	125.2	134.7
Tradable Prices(c)	183.5	196.4	246.5	296.8	297.3	266.7

Source: IMF, International Financial Statistics, Various Issues
ECLA, Statistical Yearbook, Various Issues

(a) Indices were constructed with 1970=100
(b) Nominal effective exchange rate, NEFF EXR, is deflated by WPI
(c) The average dollar price of tradables are calculated as follows 0.5 Px + 0.5 Pm where Px=unit value of exports and Pm=unit value of imports.

According to the theory an appreciation of the US dollar with respect to other major currencies clearly will cause the dollar price of homogeneous traded goods to fall. It follows that for a small economy pegging to the dollar an appreciation of this currency will be subject to a deflationary pressures transmitted by changes in the dollar price of its tradables.[10]

If we compare the movements of the indices between the real and nominal exchange rate with the dollar price of tradables in table 4, we see that there was a dollar inflation between 1977 to 1979 as the accumulated appreciation in these 3 years was 7.4% in real terms. This coincided with sharp rise in tradables prices by 34.3% and thus the reduction in real interest rates over the same period.

Therefore, Corbo's portfolio disequilibrium triggered by the exchange rate regime and the subsequent massive inflows of capital responding to the lending-libor spread explained the fall in nominal and in particular real interest rates and hence increasing permanent income and expenditures. According to Dornbusch (1985), in an intertemporal model consumption and investment could also be determined by the appreciation of the exchange rate. He asserted that the temporary overvaluation induced an intertemporal substitution accelerating the purchasing of durable goods and generating a growing current account deficit.[11] Rising expectations that the overvaluation and the exchange regime will not last clearly provoked the import surge particularly in 1981 as shown in table 1.

The data from table 1 shows that the rate of absorption exceded the GDP growth and the current account deficit was getting larger. This demostrates the growing excess demand for non-tradables and tradables. For instance, in 1980 and

1981 private absorption increased at 9.3% and nearly 11% whereas GDP was growing much slower at 7.8% and 5.5% only. Thus, a market clearing appreciation was required to clear the excess demand for non-tradables (via nontradable prices) whereas the excess demand for tradables was reflected in a mounting external deficit. The real exchange rate reached its lowest value during 1981 with a nearly 30% overvaluation with respect to 1978 and the current account deficit was becoming too large with U$ 2.677 millions.

In 1981 the nominal peso lending rate was beginning to rise in spite of the massive inflows of capital during the last three years from 39% in 1980 to 42.5% as shown by table 2. At the same time, table 3 shows the lending-LIBOR spread was getting larger as it moved from it lowest value of 22.2 in 1979 to 25.5 in 1981.[12] However, the rise in real interest rates was even larger as it went from its lowest value of 11% in 1980 to 31.7% and 31.2% in 1981 and 1982 respectively. In those two years, the real lending rate for tradables also rose from 10.7% in 1980 to 18.3% and 54.5%.

In spite of the significant increases in real interest rates and the deterioration of the world economy in the form of a reduction in the terms of trade and increasing nominal LIBOR during 1981, private sector absorption continued growing well beyond GDP growth. This can be explained by the lasting effects of the stock market bubble which generated wealth effects and increasing consumption expenditures.

Moreover, the stock market bubble overpriced private sector gurantees and collaterals, enabled firms to borrow additional resources from banks, thus making banks more vulnerable to any change in market conditions.[13] At the same time, the expectations of the unsustainability of the exchange rate regime could have accelerated the purchase of durable goods and enlarged the current account deficit.

By 1982 the rate of capital inflows started to deccelerate so that the amount of external financing came down to U$ 2.327 millions in 1982 and only U$ 520 million in 1983 as shown in table 5. Morover, nominal and real lending rate was reaching in 1982 almost 50% and 32% respectively. Given that monetary policy was endogenous then the decline in capital inflows produced a decline in the monetary base via changes in international reserves and a rise in nominal interest rates to clear the money market.[14]

Equally the evidence from table 2 also indicates that the stock market price felt by more than 38% between 1980 and 1982. The decline in expenditures reduced the demand for both tradables and non-tradables. According to table 5, absorption felt by 23.4% in 1982, and the trade balance went from minus U$ 2.677 millions in 1981 to U$ 62 millions in 1982.

Table 7.5 Indicators of the Economic Bust of 1982-83.

	1982	1983
Real GDP Growth	-14.1	-0.7
GDP Tradables	-12.4	1.6
GDP Non-tradables	-15.1	-7.2
Absorption	-23.5	--
Fiscal Deficit/GDP	2.3	3.8
Inflation Rate	10.0	27.1
Unemployment Rate	22.1	22.1
Overall Balance Payments(US$)	-1165	-541
Trade Balance	62	986
Exports	3706	3831
Imports	3643	2845
Capital Inflows	2327	520
Number of Bankruptcies	810	375

Source: Banco Central Chile,Monthly Bulletin,Various Issues
ECLA, Statistical Yearbook, Various Issues.

Clearly, the decline in expenditures reduced the demand for traded goods improving the trade balance. At the same time, the reduction in expenditures and thus the demand for non-traded goods created now an excess supply. Unlike the opposite case of 1978-81, now the market for non-tradables needed a rise in the real exchange rate to restore the equilibrium with a lower level of expenditures and external financing. As a result of the Chilean labour law which introduced full backward wage indexation non-tradable prices were inflexible downwards. As we have seen already from table 2, real wage were in 1981 nearly 9% above the wage rate of 1980 and remain so in 1982. At the same time, the continous dollar deflation of tradable prices as a result of the dollar appreciation and the fixed exchange rate regime imposed a severe adjustment in the nominal price of non-traded goods to restore the real exchange rate to equilibrium consistent with the new level of expenditures. As Sjaastad (1982) correctly put it these two features were like imposing two inconsistent numeraires in the economy so relative prices did not adjust and the adjustment was in quantities. In consequence, the adjustment to lower expenditures was in terms of a severe output decline and increases in unemployment.

As Corbo (1985,1987) and other commentators of the Chilean economy, in particular Edwards (1986) and Harberger (1985,1987), agreed on the elimination of wage inflexibility and a devaluation in late 1981 should have been the appropriate response to the fall in capital inflows and expenditures rather than relying on the governments' belief in the economy automatic adjustment.[15]

According to table 5 output felt in two successive years. In 1982 and 1983, the GDP growth rate was negative with -14.1% and -0.7% respectively.[16] Unemployment rate and the number of bankruptcies also shows a marked increase reflecting the magnitude of the economic crisis. The rate of unemployment went from 11.1% in 1981 to 22.1% in 1982 and the number of bankruptcies almost doubled between 1981 to 1982. Moreover, as we have seen in chapter 3, the collapse of the economy was accompanied this time by the bust of the banking system.

All in all, the evidence presented tends to support the view that the introduction of the exchange rate regime as an anti-inflationary policy in the context of trade and financial liberalisation was not a mistake per se if the rate of crawl would have been much higher so as to avoid the initial appreciation of the real exchange rate, and wages were not indexed fully to past inflation. In effect, Mckinnon (1981) and Blejer and Mathieson (1981) have shown in their models that real domestic interest rates would have been lower and the spread between domestic and world interest rates consequently lower. Accordingly, the real peso lending rate in Chile in 1979 and 1980 would have been much lower and the spread smaller, capital inflows and banks' asset expansion lower, absorption and hence the demand pressure on traded and non-traded goods much lower. At the same time, the equilibrating appreciation of the real exchange rate in the face of excess demand for non-traded goods would have been smaller so the loss of competitiveness and profitability of Chilean tradables and the current account deficit. Probably the path of output would have been dominated by the expansion of tradables financed by a greater reliance on domestic than foreign borrowing.

Although these general observations are part of an acceptable description of the issues, the factors which explain the appreciation of the real exchange rate are not clear and remain a contentious issue. If we accept the Edwards and Harberger contention that the appreciation of the real exchange rate was due to an exogenous increases in capital inflows then it follows that the hypothesis which suggest a wrong exchange rate policy is not sustainable and the external financial liberalisation was far too aggressive within the gradual approach followed between 1978 to 1981.

Regardless of the debate in the determinants of the large appreciation of the real exchange rate, the stock exchange bubble and the fluctuating interest rates, the facts tend to corroborate the notion that the expansion in output was not going to last given the long and large misalignment of some key relative prices. Given the inconsistencies and rigidities of the numeraire, the adjustment was going to take place via output, employment, and increasing numbers of bankruptcies both in industrial firms and banks.

(7.3.3) The Boom-Bust Economic Cycle and the Increase Vulnerability of the Chilean Banking System.

There is an apparent connection between the performance of the macroeconomy and the financial system. The 1977-81 economic boom was accompanied by a significant expansion of the financial system just as the 1982-83 economic bust coincided with the collapse of the banking system.

As we have seen in chapter 3, the growth rate between 1977-81 of both the sectoral GDP (GDPfin) and bank assets was 20.3% and 34.5% per annum respectively. At the same time, the data showed that bank liabilities exhibited an annual average growth rate of more than 36% over the same period. These spectacular growth rates not only coincided with an equally impressive growth in the economy's GDP but also they remained above the overall growth of the economy throughout the period in question. However, this financial boom ended in 1982 and 1983 as the sectoral GDP felt by 4.4% and 40.5%. This turning point was preceded by the downturn of the economy's GDP which fell by 14.1% and 0.7% in 1982 and 1983. Although the growth rate of bank assets slowed down slightly, it continued climbing at a faster rate than GDP reflecting perhaps some distress borrowing and the banks' willingness to take a fair-bet against the government. At the same time, we do not observe a run from the banks since the growth of bank liabilities still exhibited positive growth rates. These observations can be seen from figure 1 which was constructed with data from chapter 3 and from the previous section.

Figure 7.1
BANK EXPANSION

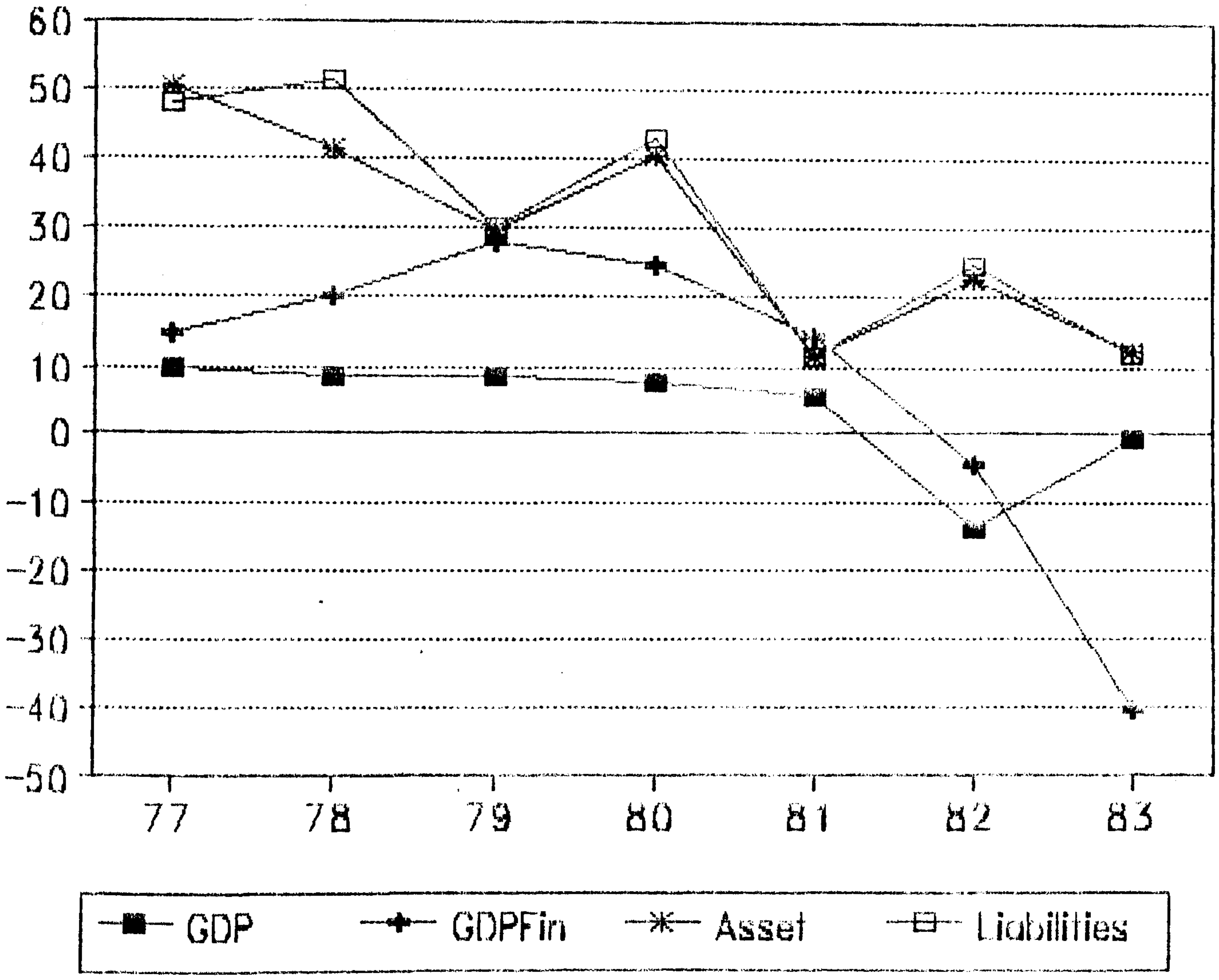
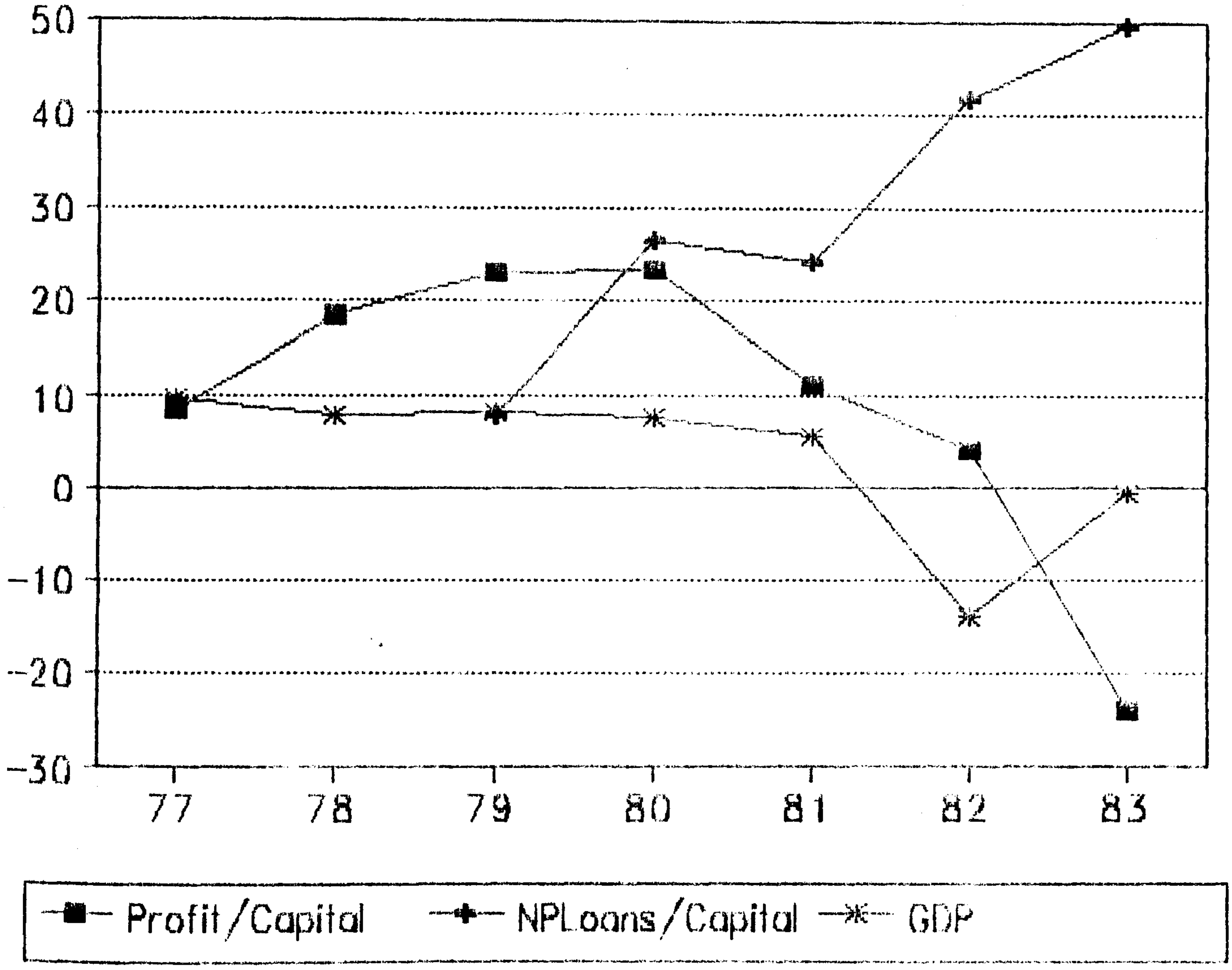


Figure 7.2
PROFITS, ASSET QUALITY, AND GDP



Banks' profitability measured by the gross profits/capital ratio (Profit/K) also shows the influence from the changes in the economic cycle. The average rate of return for the boom period was 17% with a peak of 23.5% in 1980. In contrast, by 1982 and 1983 the rate of return did fall to 4.1% and -24% respectively. At the same time, the data on risky and nonperforming loans also show a marked increment. For instance, the nonperforming loans/capital ratio (NPloans/K) was almost 42% and 50% during 1982 and 1983. Moreover, the amount of risky and nonperforming loans purchased by the Central Bank was 60% larger than the total capital and reserves of the financial sector. Graph 2 pictures the cycle of these ratios with the economy's GDP.

Another interesting observation from the available data is the expansion of bank assets not only reflected the tendencies of the economy's output growth but also the changes in the composition of output. Table 6 contain information about the composition of output and the share of bank loans. We observe a large increase in the share of nontradables by nearly 9% between 1977 and 1981. The largest share in this group corresponds to commerce and financial services with an average share between 1978-81 of 18.2% and 8.9% respectively. In contrast, the share of tradable output was reduced by more than 3% during the same period.

The composition of bank loans also reflected the change in output composition as the tradables share of loans dropped from 73% in 1977 to almost 35% in 1981. In contrast, the share of loans received by the nontradable sector went from 9.4% to 44.7% in 1977 and 1983 respectively. In effect, between 1980 and 1982 the construction sector received on average nearly 11% of loans.

Table 7.6 Composition of GDP and Bank Loans. (%)(a)

	77	78	79	80	81	82	83
GDP Traded	40.3	39.2	38.5	37.5	37.2	37.7	38.7
GDP Nontraded(b)	34.1	36.8	38.9	41.5	42.7	41.3	38.7
Loans Traded	73.1	62.8	56.4	44.3	34.9	37.6	36.4
Loans Nontraded	16.5	24.6	28.0	36.6	40.8	41.1	44.7

Source: Banco Central Chile,Boletin Mensual, Various Issues.
SIBF, Informacion Financiera, Various Issues.

(a) The data is express at constant 1977 pesos.
(b) Includes the three most important items: retail and wholesale trade, financial services, and construction. The difference between traded and nontraded GDP correspond to final nontraded GDP which remained around 20%.

It could be argued that the larger share of loans to the nontradable sector could be explained by a superior performance. Galvez and Tybout (1985) and Tybout (1986) found that the appreciation of the real exchange rate affected in a detrimental way the performance of the tradable sector, in particular exportable firms, by reducing significantly the price-cost margin.[18] For instance, the exportables' relatively lower and falling operating earnings coincided with large reduction in gross margins and stable asset turnover but significantly small overhead costs. In contrast, while exportables' gross margins and operating earnings were rapidly and continuously falling, nontradables margins were rising and remained high from 1978 onwards. One interesting performance which is worthty of comment is that of importables (low protection). This sector's performance was as good as nontradable sector in terms of gross margins and operating earnings although the latter exhibited high overheads cost. This explains the relatively superior performance of importables in spite of the currency appreciation and the reduction in nominal tariffs.[19] While exporters' financial costs remained relatively low and offset a poor operating earnings, they managed to survive. The opposite was true for nontradables and importables which had larger financial costs at least at the beginning.[20] However, rising real interest during 1981 and 1982 was making credit far more expensive reducing the excess of earning rates over financial costs. Firms in both nontradable and importable sector acquired debt with a real interest rate which exceeded their operating earnings. This was even more acute for those in the exportable sector.

Thus the evidence from Galvez and Tybout's paper and graph 3 support the intuition that the appreciation of the real exchange rate (IREXR) and the subsequent rapid increases in absorption coincided with both increasing nontradable GDP as well as rising nontradables' output share (ISGDPNT), and smaller GDP growth and output share in the case of tradables (ISGDPT).[21] Similarly, the share of bank loans was clearly concentrated in the nontradable sector.

Figure 7.3
REAL EXCHANGE RATE, GDP TRADED&NONTRADED

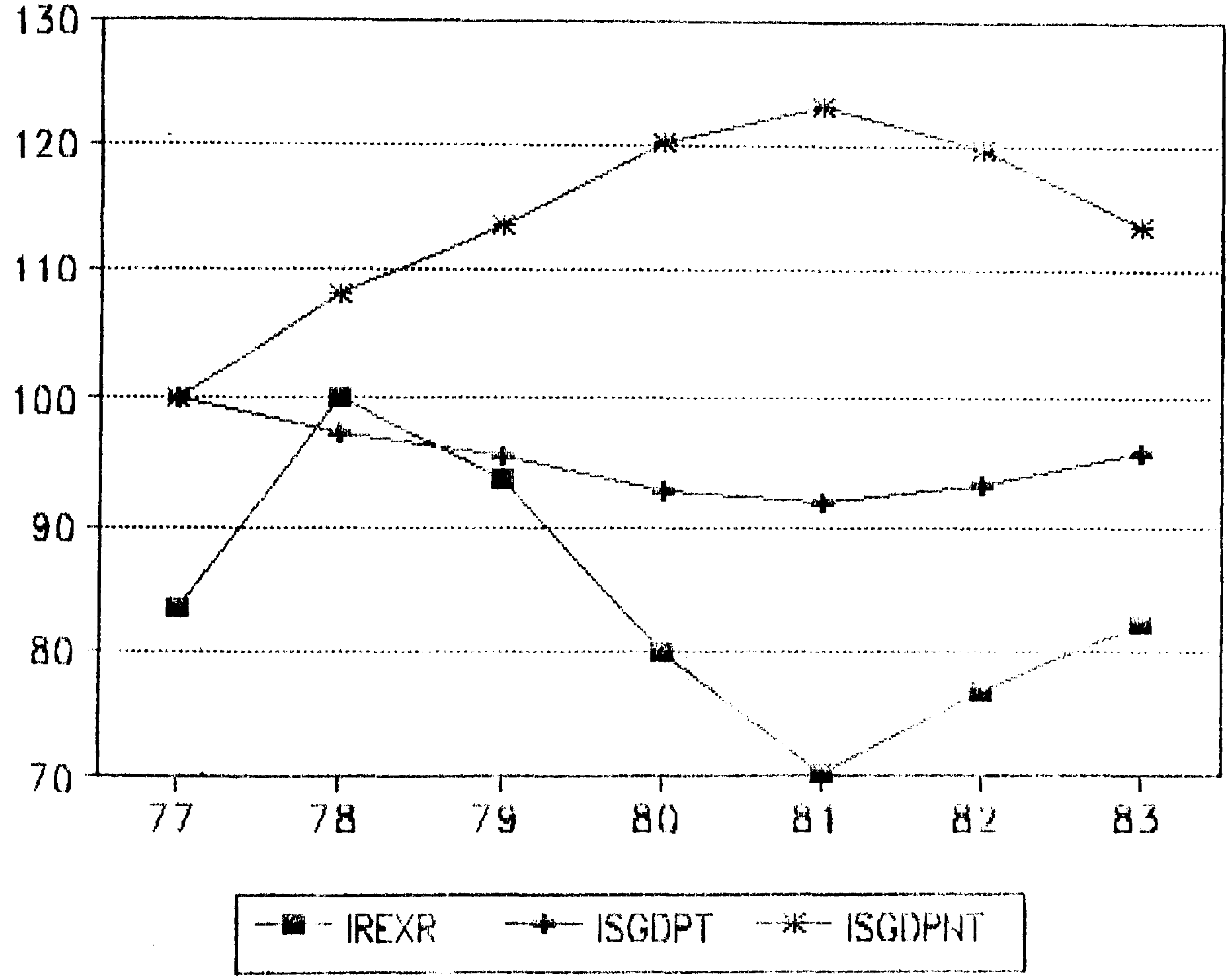
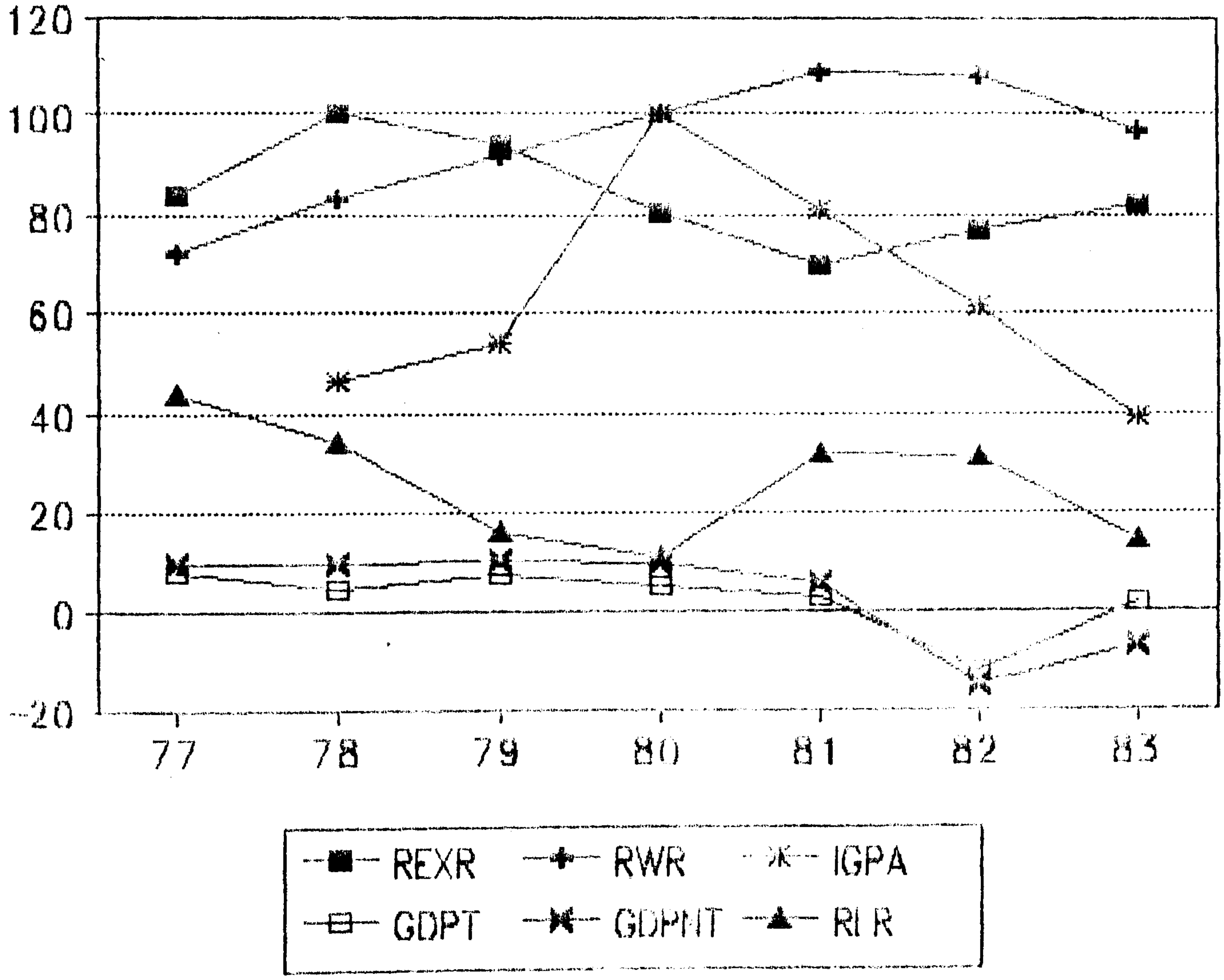


Figure 7.4
MACROPRICES, GDP TRADED&NONTRADED



As we can see from graph 4, this process was more pronnounced between 1978 to 1981 when the peso was rapidly appreciating (REXR), real interest rates were falling (RLR), real wages (RWR) and real stock prices rising (IGPA), and capital inflows were at an all-time high. However, the relative price at 1981 was not sustainable as the current deficit was too large, nearly 16% of GDP, capital inflows started to decline very rapidly, real interest rates were rising again, and the stock exchange bubble were beginning to burst. Given the backward wage indexation the adjustment was in terms of output, employment, and bankruptcies including the banking system.

After 5 years of sustained GDP growth, an increasing share of GDP output and bank loans, the nontradable sector experienced the collapse of output. By 1982 and 1983 GDP of nontradables fell by 15.1% and 7.2% respectively. The collapse in output growth coincided with both sharp increases in nonperforming loans/capital ratio and a substantial fall in the profit/capital ratio as shown by graphic 5a.

Figure 7.5a

GDP NONTRADED AND LOAN QUALITY

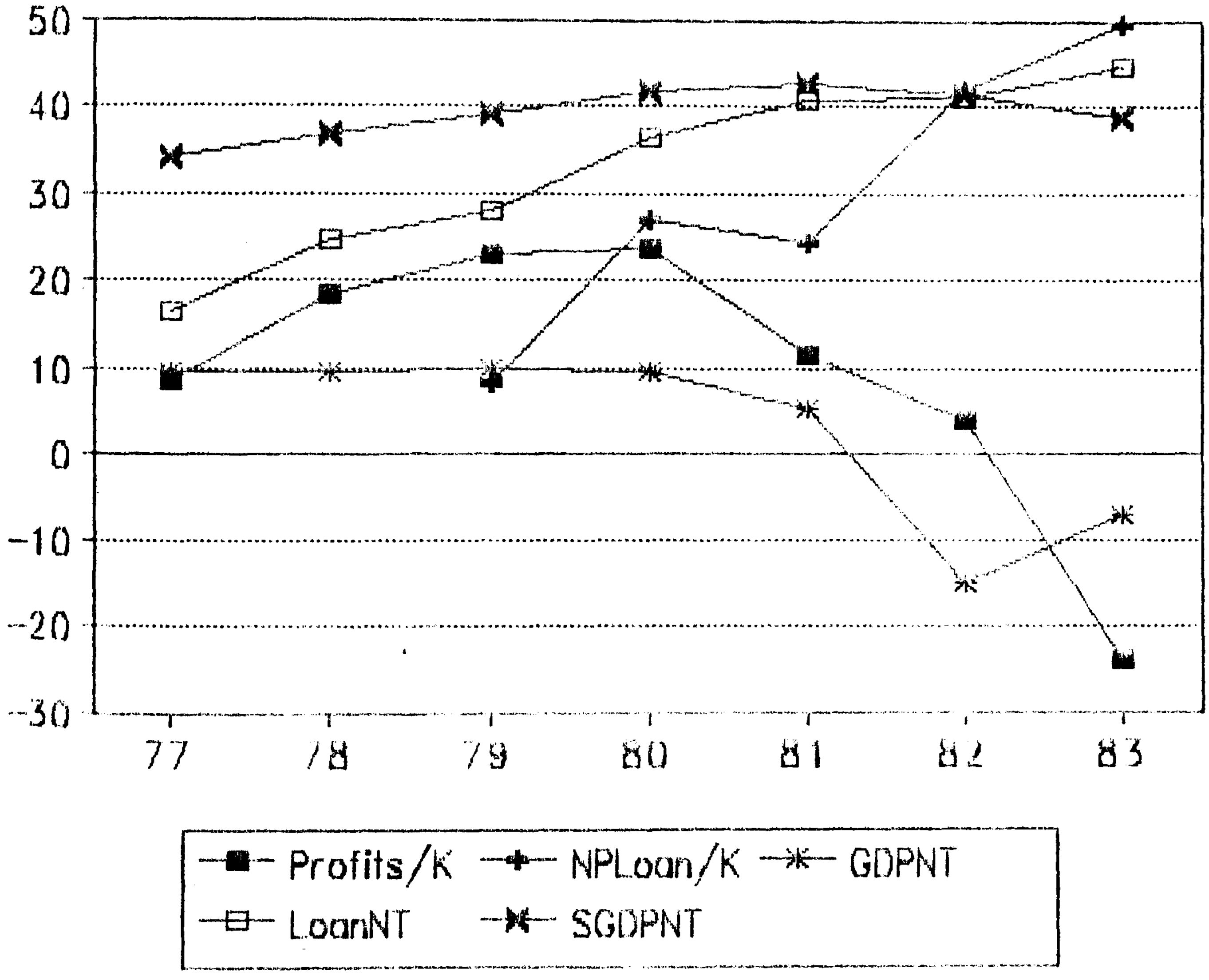
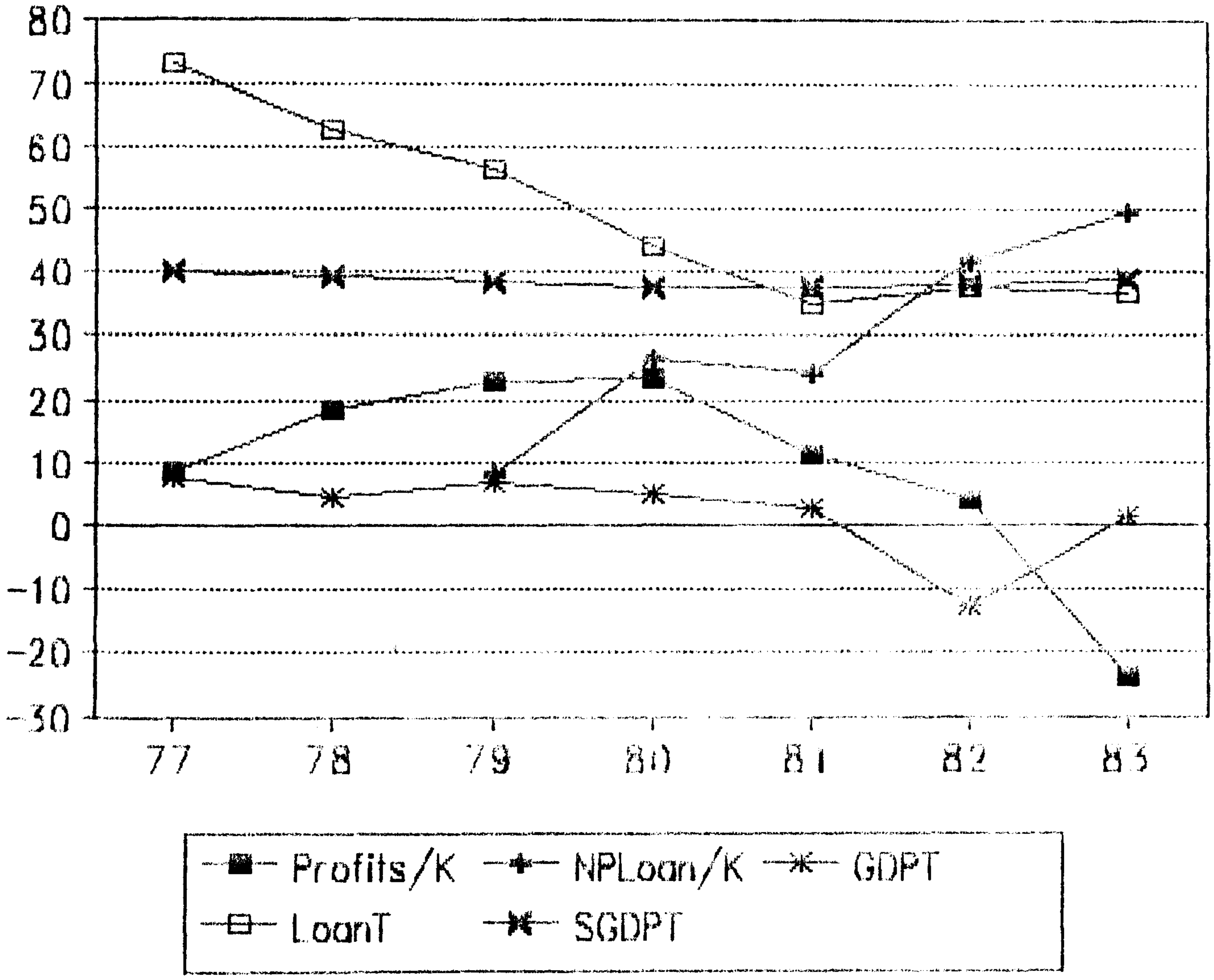


Figure 7.5b
GDP TRADED AND LOAN QUALITY



A similar conclusion is derived from graphic 5b when we plot the GDP for tradables with the two ratios as proxies for profitability and vulnerability. However, the turning point of the cycle for tradables does not exactly match the path of the two ratios. In effect, the increases in nonperforming loans coincided with the slowdown of tradable GDP growth in 1979-80 while output growth of nontradables were at its peak. Also, we observed that while output growth of tradables was growing at 1.6%, GDP for nontradables were still falling at 7.2%. This means that given the larger share of loans in nontradable firms and the two consecutive years of falling output the ratios were more affected at least between 1982-83 by the performance of the nontradable sector.

It is clear that the change in the composition of bank assets between 1977-82 which reflected changes in the composition of output may have produced a greater vulnerability in the banking system in the sense that increasingly large allocation of loans in the nontradable sector were producing an increasing vulnerability in particular in the case of falling output, wages, and asset prices, and rising real interest rates and real exchange rates. These observations are displayed by graphs 6a and 6b.

Figure 7.6a

BANKS VULNERABILITY AND MACROPRICES

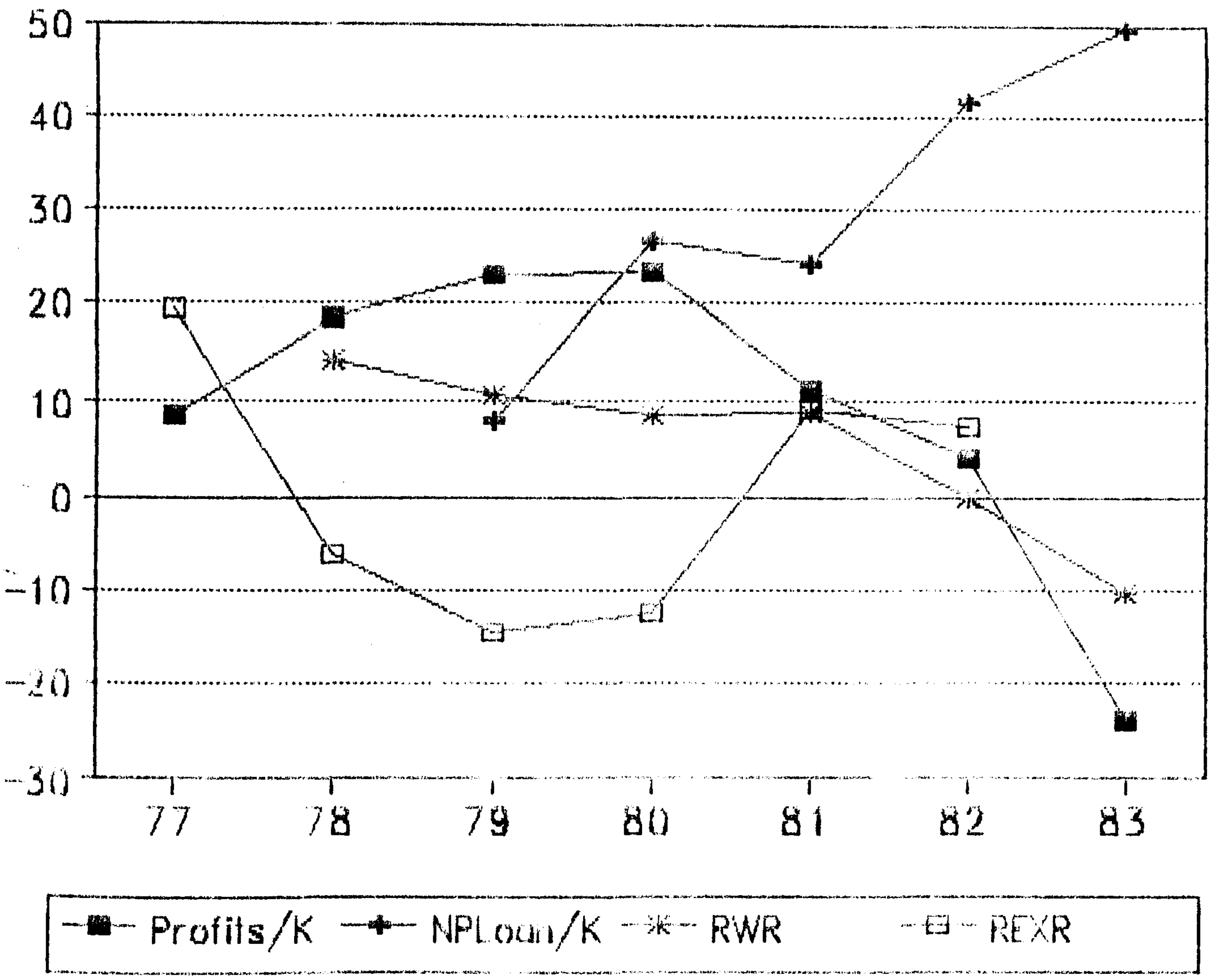


Figure 7.6b
BANKS VULNERABILITY AND MACROPRICES

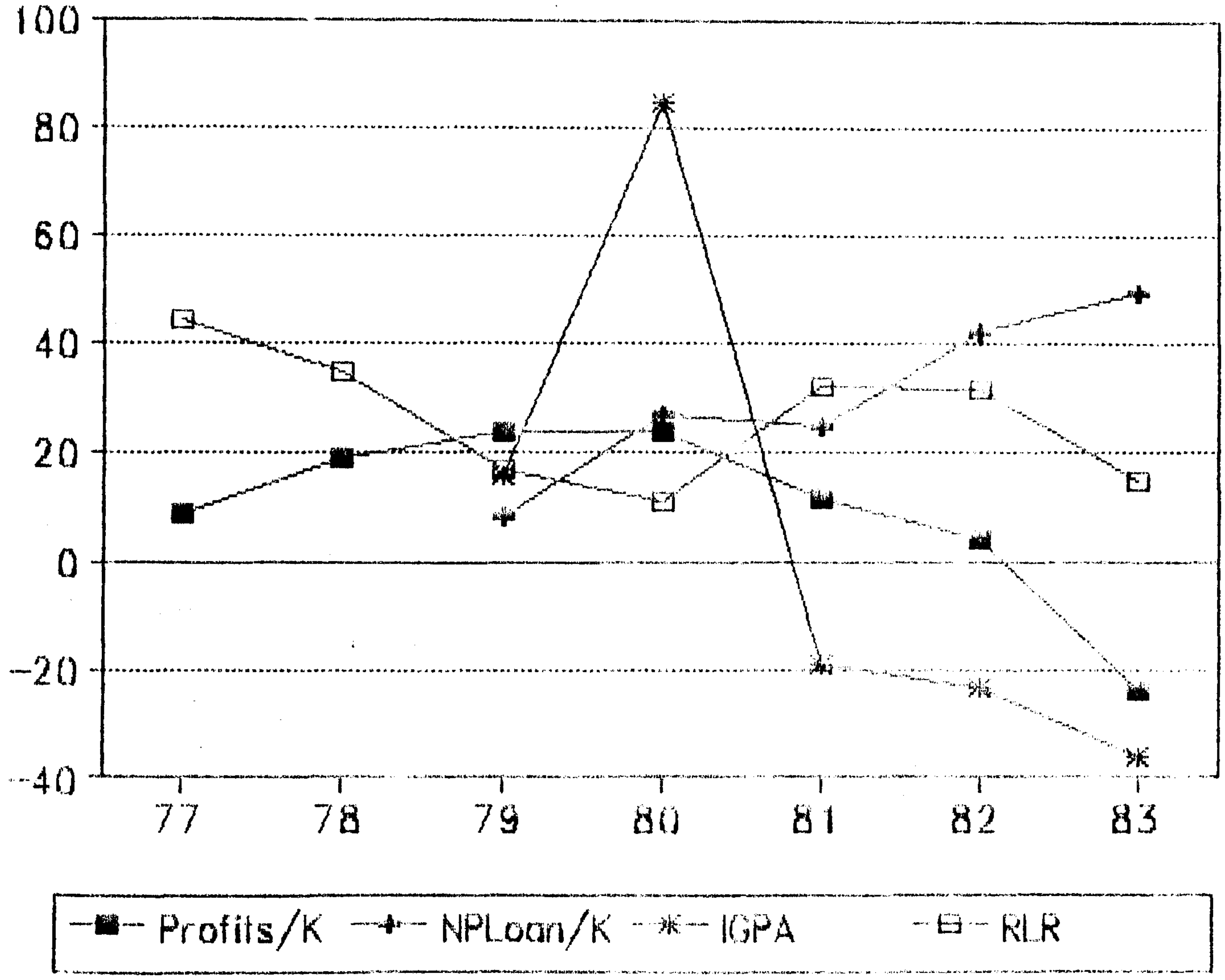
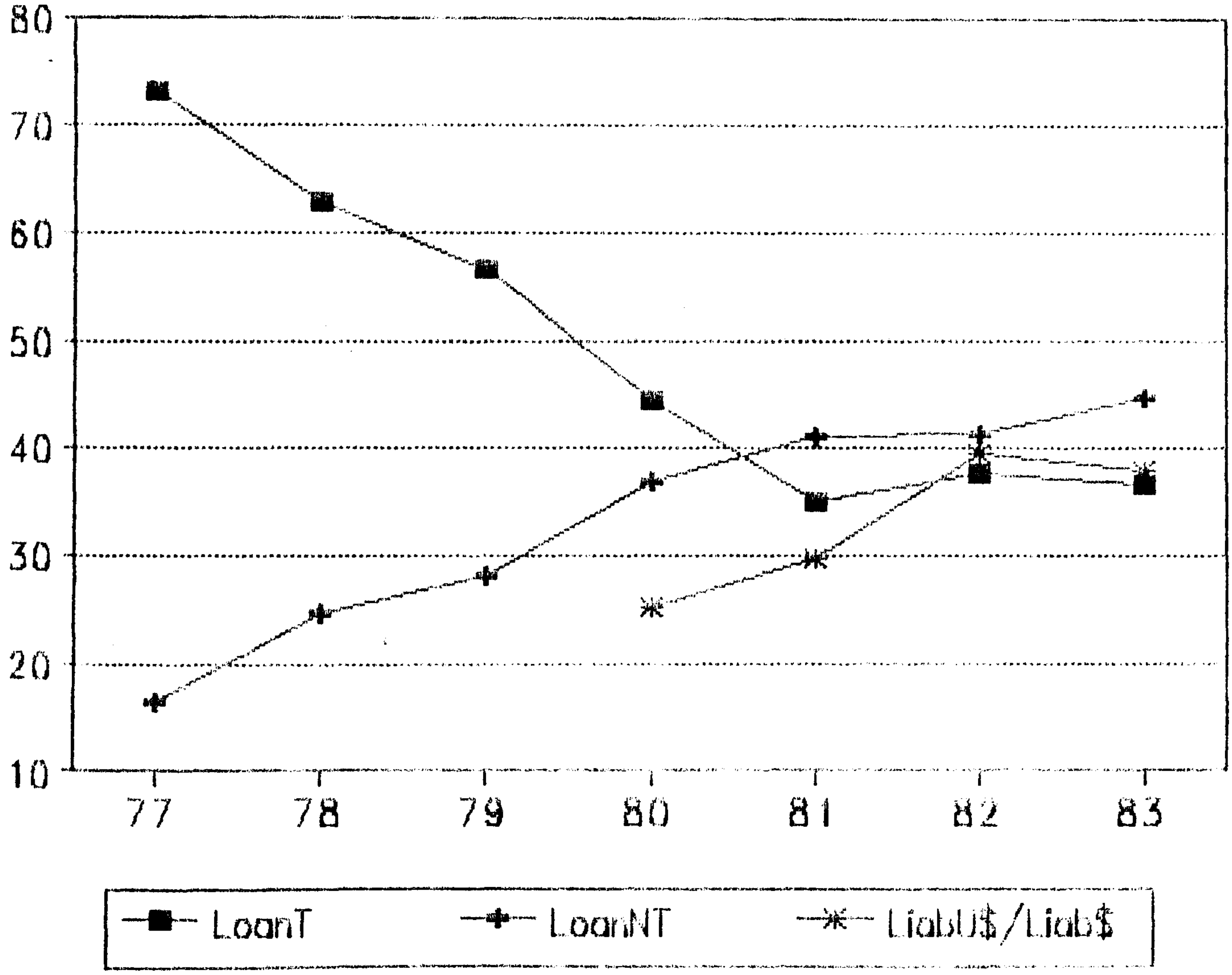


Figure 7.7
LOANS' SHARE AND LIABILITY RATIO



In addition, as I have reported in chapter 3, bank liabilities exhibited a significant rise in foreign currency. In effect, we estimated that the ratio of liabilities in foreign currency relative to domestic currency went from nearly 24% in 1980 to almost 40% in 1982.[22] This means that the shift in resources to the nontradable sector was financed by an increasing ratio of liabilities in foreign currency relative to domestic currency and this in turn meant an increasing vulnerability of firms and the banking sector to exchange rate collapse (devaluation). Graph 7 shows the tendency of loans' share and the liability ratio.

The evidence from the graphics had permitted us to interrelate banking performance with the overall economic environment, at least as a first approximation, and explictly formulate conjectures about bank problem/failures and the role played by factors external to the bank in the likelihood of bank problem/failure. These conjectures can be listed as follows: Firstly, the abrupt change in the performance of the banking system was consistent with the turning point of the expansionary economic cycle which started just before 1977. If this is true then the spectacular growth and profitability and the subsequent downfall of the banking system has its explanation on the boom-bust economic cycle which took place between 1977 to 1983. Therefore, we ought to be looking empirical links between the rate of GDP growth and the probability of bank failure/problem.

Secondly, if the boom-bust economic cycle can be explained by the misalignment of some key macroeconomic prices then it follows that the drastic changes in profitability and vulnerability could be explained by the disequilibrium of the key relative prices. Therefore, we should be looking for econometric evidence to sustain the relationship between real exchange rate, real interest rate, the stock prices, and the probability of bank failure/problem.

Thirdly, if conjecture 1 and 2 are empirically valid then it is possible to estimate ex ante probability and to test the prediction accuracy as we did in chapter 6.

(7.4) Econometric Analysis of Bank Failures: The Macro Aspect.

In order to answer these conjectures I had developed a logit model for quarterly panel data following the methodology and estimation procedures described in chapters 5 and 6. However, there are two main modifications with respect to the binary choice model introduced and estimated earlier.

Firstly, the present model is estimated using quarterly panel data. As will be shown, it should not pose, under certain assumptions, any additional difficulties except for the handling of a larger number of observations.

Secondly, we regress the dichotomous dependent variable against macroeconomic factors. Given that macroconomic variables will be identical for each bank in a given quarter of a given year, the estimation of the logit model will introduce some difficulties.

The attempt to relate banks' failure/problem with systematic factors such us real exchange rates, real interest rates, and stock prices and above all growth of GDP reflect indirectly the ability of businesses and individuals to meet their debt obligations under changing economic environment. This empirical model is the counterpart of Galvez and Tybout's model as we study the problem from the banks' perspective rather than the firm.

(7.4.1) The Econometric Model.

(7.4.1.1) Description of the Data.

The model was estimated using quarterly panel data for the period between 1979 to 1983. Thus, the sample contain 20 quarterly observations and 27 banks. Just as for the model of chapter 6, the bank sample was divided into two groups, A1 and B1.

The former correspond to the problem/failure group which includes all those institutions which were liquidated, merged, capitalised, and/or sold nonperforming and risky loans to the Central Bank during 1982-83. The latter group corresponds to the non-problem/no-failed banks which include Banco del Estado the only existing state bank, and Banco Industrial y de Comercio Exterior (BICE). As we have seen in chapter 3 both institutions were the only two domestic banks which remained financially healthy. Also B1 group includes foreign banks on the grounds that they also remained financially sound and as we saw in chapter 2 were subject to similar legislation as domestic banks.

Group A1 and B1 contain 16 and 11 banks respectively as listed in table 2.

Table 7.7 Bank List of A1 and B1 .

A1 Banks	Code	B1 Banks	Code
Chile*	001	Osorno	010
O'Higgins**	008	Estado***	012
Internacional*	009	Do Brasil	017
Continental**	011	BICE	028
Sudamericano**	014	Republic Nat. N.Y.	031
Credito**	016	America	032
Trabajo**	022	CityBank	033
Pacifico**	025	Real	034
Nacional**	026	Sao Paulo	036
Concepcion*	027	Santander	037
Edwards**	029	Exterior	038
Santiago*	035		
Unido Fomento*	502		
Hipotecario Fomento*	504		
Hipotecario Chile*	505		
Colocadora Nacional*	506		

Source: SIBF, Informacion Financiera, Various Issues.

* Failed Banks (liquidated, intervined, or merged)
** Problem Banks (sold nonperforming and risky loans)
*** State Bank.

The sample did exclude two groups of financial institutions. The first one corresponds to banks which failed during 1981 such us Español(002), Talca(006), Austral(024), and Linares(030). The second one, the non-bank financial institutions (financieras) including those which failed in 1981 among them Cash(705), General Financiera(715), De Capitales(725), and Del Sur (713). The exclusion of these two groups was justified as argued in chapter 3 by their small size in relation to the rest of the banks. In addition, as a general principle, we accepted all those banks which had 16 or more consecutive quarterly observations in order to compare their performance in the boom period of 1979-81 with the economic debacle of 1982-83.

In consequence, the panel data of 20 quarters and 21 banks gives a total number of 521 observations which represent a sufficiently large statistical sample to draw logistic inferences.[23] As argued in chapter 6, it would have been desirable to have had a controlled sample in particular by size, number of branches, or any other characteristic. However, data limitations and the small size of the Chilean banking system ruled out this possibility.

With respect to the dichotomous dependent variable, we used the quarterly ex ante probability of problem/failure estimated by the problem/failure prediction model in chapter 6. As we saw the overall prediction accuracy was extremely good at a 0.5 cut-off value. I stress the point that quarterly evaluation of banks was not available from SIBF nor annual classification prior 1983. Therefore, we were forced to rely on the ex ante quarterly estimation of the problem/failure prediction model.

The explanatory variables in the model are divided into three set of regressors. The first set contains some key macroeconomic prices such as indices for the real exchange rate (TCR) and the stock prices in real terms (IPA). These variables are also expressed in terms of percentage change, that is VTCR and VIPA. I also considered in this data set both real lending and deposit interest rates. The annualised ex post lending rate (TIAA) and ex post deposit rate (TIPA) were estimated by using 30-90 days nominal rates deflated by the consumer price index. In addition I computed the gross spread between lending and deposit interest rates express as DIFAP.

The second set contains data on gross domestic product expressed at constant prices of 1977. The GDP data is displayed in millions of Chilean pesos (PGB) and in percentage change (VPGB). Unfortunately, data on GDP per sector on a quarterly basis, in particular for the tradable and nontradable sector, was unavailable for the period in question.

Finally, the third set incorporates monetary variables to assess the implications of monetary aggregates on the likelihood of banks' failure/problems. Among the most important aggregates the model included the narrow M1 define as notes and coins plus sight deposits and a broader measure such as M2, which includes M1 plus time deposits.

I have also allowed some dynamic implications by introducing two lags among the sets explanatory variables which is equivalent to two quarters of year.

(7.4.1.2) Model Specification and Estimation.

The binary choice model was specified for panel data which consisted of observations made on individual banks over time. In addition, the model was restricted by assuming that observations are independent for both individuals and over time. These simplifying restrictions were desirable since the approach to estimate the model was straightforward and similar to the cross-section model estimated in chapter 6 but with more observations.

As we have seen in chapter 3 the determination of the failure of a bank or its classification as a problem bank is made in practice by monetary and banking authorities following different criteria. However, technically speaking we can determine a bank as insolvent or treated as problem so long as the market value of liabilities exceeds the market value of assets. Indeed, this condition arises as a result of an extreme unexpected deposit withdrawls and hence a fall in assets' market value from force liquidation, and/or large banks' loan losses and reduction in current income that must be charged to capital and reserves.

I assume that a bank has a given amount of capital (K) at the beginning of the period, and accumulates earnings (R) and losses (L) over the period, and spend (E) on screening and monitoring bank loans. The stream of bank's cash flows (Y) (net bank income) is given by [(R1-L1-E1),(R2-L2-E2),...,(Ri-Li-Ei)]. Moreover, the bank may also pay dividends (S) and issue new capital (N) at the end of the period. For simplicity, I assume that banks' investment in securities is zero.

The bank has issued a mix of deposits on which it promises to make a stream of payments [D1,D2,...,Di] that has a total value of D. It should be pointed out that although all assets and liabilities should be marked to market values to be more accurate, in practice we apply historical cost accounting as an approximation of the true bank's worth.

Formally stated, in expression (1) the bank's net cash flows from its loan structure is insufficient to pay the depositors' claims (negative net worth).

$$(1) \quad X = Y + D < 0$$

In order to prevent a failure the bank may use funds from its initial capital and reserves. Therefore, in this context failure occurs if condition (2a) holds.

(2a) $X = Y + D + K < 0$

Expression (2a) suggest that a bank failure occurs if negative cash flow is greater than bank's capital. Or more generally as shown by (2b), if deposit outflows (D) exceed banks' capital and reserves (K) plus net income from banks' assets (Y) plus new issues (N) minus dividends (S).

(2b) $D > K + Y + N - S$

In consequence, the probability of bank failure (F) will depend on the likelihood that $D + Y < -K$. Specifically,

(3) $F = \text{Prob}(D + Y < -K)$

However, the model assumes that Y and D are unknown so that the condition for bank failure $Y + D < -K$ should be related to the bank's financial condition (FC). If the bank's financial condition is weak then the failure condition will hold.

(4) $Y - D + K = FC_{it} + e_{it}$ where $i= 1,2,\ldots,n$; $t= 1,2,\ldots,T$

Thus, the failure condition in (4) is related to FC for the ith bank in time t plus a random term e. FC can be taken as a composite measure of the bank's financial condition given the values of selected macroeconomic variables. In other words, the model assumes that a deterioration of the macroeconomic environment worsens the financial condition (FC) of a bank and viceversa. This is shown in expression (5).

(5) $FC = x_{it} \beta$ where x= K-vector of known macro variables

β= K-vector of unknown parameters.

With this deterministic process giving rise to bank failure as shown by expression (5) we are able to convert it to a model of the probability of failure.

To begin with, the model assumes that there is a theoretical (unknown) index Θ which is determined by macroeconomic variables. This index measures a bank's propensity to fail and is unobservable from the data. Given that Θ is a function of a well defined set of random and independent explanatory variables, the logit model should provide suitable estimates of this function and hence for the value of Θ.

If the dependent variable Y is equal to 1 when a bank fails and to zero otherwise, and each bank has a critical value for Θ (cutoff point) which translate the index Θ into a classification process then we have the following: if $\hat{\Theta} < \Theta$ the bank is classified as a failure and vice versa.

Given that the logit model assumes that $\hat{\Theta}$ is a random variable with a logistic distribution then it follows that the probability that $\hat{\Theta} < \Theta$ can be computed from the cumulative logistic probability distribution.

The logit model was specified for panel data which consisted of observations made on individual banks over a specified interval of time. In addition the model specification was restricted by assuming that observations were independent for both individual banks and over time. These simplifying restrictions were considered desirable on the ground that the approach followed here was more straightforward and similar to the one applied in chapter 6 with cross-section data but with more observations.

Thus the restricted univariate binary choice model for panel data is defined by:

$$(6) \quad P(Y_{it} = 1) = F(\mathbf{x}'_{it}\boldsymbol{\beta}) = F(\Theta_{it}) \qquad \begin{array}{l} i = 1,2,\ldots n \\ t = 1,2,\ldots T \end{array}$$

Expression (6) defines Y as a sequence of independent binary random variable taking the value of 1 if the ith bank failed/problem at time t, and 0 otherwise. Also **x** is a K-vector of known macroeconomic variables, and **ß** is a K-vector of unknown parameters. F is defined as a cumulative probability distribution.

The cumulative probability distribution function enables us to translate the values of the independent and stochastic explanatory variables which range in value over the entire real line to a probability which ranges from 0 to 1.

$$(7)\quad P(Y_{it} = 1) = F(\Theta) = F(\mathbf{x}_{it}'\,\boldsymbol{\beta}) = \int_{-\infty}^{\mathbf{x}'\boldsymbol{\beta}} f(\Theta)\,d\Theta$$

$$= 1 / 1 + e^{-\Theta} = 1 / 1 + e^{-(\mathbf{x}'\boldsymbol{\beta})}$$

In expression (7), F(x'ß) is equal to the cumulative standard logistic function so that it assigns to a number Θ the probability that any arbitrary $\hat{\Theta}$ will be less than Θ. It follows that since the probability is measured by the area under the standard logistic curve from $-\infty$ to Θ, the event will be more likely to occur the larger the value of the index Θ.

As it was shown in chapter 5, to estimate the vector of unknown parameter of **ß** I resorted to the use of the maximum likelihood estimator for ß. The maximum likelihood estimation was appealing since a unique maximum always exists for the logit model. At the same time, it is appropiate for non-linear estimation and yields consistent parameters estimates. Thus, the likelihood function of the logit model is given by

$$(8)\quad \ln ML = \sum^{n} \sum^{T} Y_{it} \ln F(\mathbf{x}_{it}\, \boldsymbol{\beta}) + \sum^{n} \sum^{T} (1 - Y_{it}) \ln [\, 1 - F(\mathbf{x}_{it}\, \boldsymbol{\beta})$$

The ML estimator for ß, say ß~, is obtained by maximising (8) with respect to ß and setting the first order condition (FOC) equal to zero. As was shown in chapter 4 the solution is a local maximum and hence unique. Also we saw that the FOC was non-linear and hence solved by the Newton-Rapshon iterative procedure.

However, a panel data specification such as (6) specifies only the marginal probability and leaves the joint probability $P(Y_{i1}, Y_{i2}, ..., Y_{iT})$ unspecified. One way to get around this problem is to introduce some restrictions. We assume independence so that the joint probability will be given by

$$(9)\quad P(Y_{i1}, Y_{i2}, ..., Y_{iT}) = \Sigma\, P(Y_{iT})$$

The independence assumption implies that $P(Y_{it} = 1 | Y_{i,t-1} = 1)$ so that previous year status does not affect the one this year. This means two things: Firstly, there is no true state dependency in the sense that the present status is not affected by the past status. In other words, the probability of bank failure/problem is not affected by yesterday's probability.

Secondly, there is no heterogeneity problem in the sense that there are no serious complications with unobservable variables which could affect banks differently with respect to their likelihood of failure/problem.

Before we concentrate on the analysis of the results from the model estimation there is one complication in the setting of the matrix with the exogenous variables. Given that the macroeconomic data were identical for each individual bank in each specific quarter, the matrix was near singular. So in order to eliminate this problem we modified the matrix structure of the model. Let's take a close look to the matrix specification of the model and its meaning.

$$
Y_{it}=\begin{bmatrix} A_{179.1} \\ A_{179.2} \\ \vdots \\ A_{n83.4} \\ B_{179.1} \\ B_{179.2} \\ \vdots \\ B_{n83.4} \end{bmatrix}
\qquad
x_{it}=\begin{bmatrix}
TCRA_{179.1} \ldots\ldots IPAA_{179.1} & 0 \ldots\ldots 0 \\
TCRA_{179.2} \ldots\ldots IPAA_{179.2} & 0 \qquad 0 \\
\vdots \qquad\qquad \vdots & \vdots \qquad \vdots \\
TCRA_{n83.4} \qquad IPAA_{n83.4} & 0 \qquad 0 \\
0 \qquad\qquad 0 & TCRB_{179.1} \quad IPAB_{179.1} \\
0 \qquad\qquad 0 & TCRB_{179.2} \quad IPAB_{179.2} \\
\vdots \qquad\qquad \vdots & \vdots \qquad \vdots \\
0 \qquad\qquad 0 & TCRB_{n83.4} \quad IPAB_{n83.4}
\end{bmatrix}
$$

where $i= 1,2,\ldots,n.$
$t= 1,2,\ldots,T.$

The column vector Y_{it} contains the endogeneous dichotomous variables for each bank i in a given quarter t for the ordered group A and B respectively.

The matrix x_{it} was contructed by separating the data for the group of banks A and B respectively. This enabled us to compare the performance of these two groups in relation to changes in the macroeconomy. At the same time, we eliminated the near singular problem in the estimation of the model.

(7.4.2) The Econometric Results and Its Interpretation.

In this section I report the main econometric results from the restricted logit model using macroeconomic variables. The model was estimated for the period between 1979 and 1983 which involves twenty quarters. This selected period, selection made in terms of the availability of information, includes a boom period between 1979 and 1981 and the bust period between 1982 and 1983. The problem of multicollinearity among the sets of explanatory variables forced us to estimate and test the regressors separately.

Before we proceded with those two issues concerning the importance of the economic cyle and the misalignment of some macroeconomic prices, we wanted to run the model to test the significance of monetary variables on the likelihood of bank failure/problem.

- Logit Model with Monetary Variables.

As showed in chapter 4, banking crisis are often associated with changes in the monetary conditions, in particular large shifts in the demand for money. As argued by monetarists, increasing uncertainty about the financial health of financial institutions would produce a substantial increase in currency deposit ratio and thus a fall in the money supply and widespread liquidity problem in the banking system. Table 8 report the results of the logit model with reference to the monetary aggregate M2 between 1982.1 to 1983.4.

Table 7.8 Logit Analysis of Selected Macroeconomic Variables for the Period 1982.1 to 1983.4

Macroeconomic Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	1.09	1.21	1.10	1.46	0.56
	(0.23)	(0.26)	(0.24)	(0.30)	(0.10)
M2A	3.18E-06	1.85E-06	2.97E-06	2.47E-06	5.66E-06
	(0.26)	(0.14)	(0.24)	(0.19)	(0.41)
VIPAA		-0.05			
		(0.68)			
VTCR1A			0.01		
			(0.45)		
VPGBA				0.05	
				(0.69)	
TIAA2A					-0.01
					(0.48)
M2B	-7.09E-05	-6.57E-06	-7.17E-06	-8.15E-06	-7.17E-06
	(0.57)	(0.53)	(0.58)	(0.63)	(0.52)
VIPAB		0.04			
		(0.63)			
VTCR1B			0.003		
			(0.11)		
VPGBB				-0.01	
				(0.25)	
TIAA2B					0.01
					(0.75)
ln Lklhd(-)	76.55	76.09	76.44	76.27	76.09

(a) t-statistics are in parentheses.

Given the high degree of collinearity in particular between M2 and the change in stock prices (VIPA) and real lending interest rate (TIAA) as shown in the covariance-correlation matrix in appendix 6, we tested alternative specifications. The overall conclusion from the logit model is that the explanatory power of the M2 in the likelihood of bank failure/problem was insignificant in every alternative specification at both 1% and 5% level of significance. Therefore, we can reject the monetary hypothesis for the Chilean banking crisis.[25,26]

-Conjecture 1: The Likelihood of Bank Failure/Problem and the Economic Cycle.

The first conjecture we observed from the data presented in the previous section and which had a significant intuitive appeal was the relationship between output growth and the performance of the banking system. In effect, a booming GDP between 1977 and 1981 coincided with a buoyant banking system. Similarly, the collapse of GDP in 1982-83 led to the debacle of the banking system.

Table 9 provides econometric evidence on the significance of GDP growth on the likelihood of bank failure/problem. Alternative specifications are also reported for this period to enquire the performance of GDP in a more general model. According to the correlation coefficient presented in appendix 6 there is no significant correlation among the explanatory variables tested in this model.

Specification E1 correspond to a general model which included all the selected macroeconomic variables as explanatory variables. These included variation of GDP (VPGB), variation in stock prices (VIPA), real lending interest rate (TIIA), and variation in the real exchange rate (VTCR). The parameters' estimates are reported for each group of banks, namely group A for failed/problem banks and group B for nonfailed/nonproblem banks.

Table 7.9 Logit Analysis for Selected Macroeconomic Variables for the Period 1979.1 and 1983.4.(a)

Macroeconomic Variables	Alternative Specifications E1	E2	E3	E4	E5
Constant	-0.38	0.18	-0.41	-0.31	0.18
	(1.24)	(2.02)	(1.52)	(1.06)	(2.06)
VPGBA	0.13	0.01	0.12	0.11	0.01
	(3.02)	(0.55)	(3.09)	(2.85)	(0.07)
VIPAA	-0.01	-0.01			
	(1.27)	(1.66)			
TIAA2A	0.09		0.09	0.08	
	(5.61)		(6.27)	(5.64)	
VTCR1A	-0.09			0.001	0.03
	(0.37)			(0.06)	(1.84)
VPGBb	-0.14	-0.06	-0.14	-0.15	-0.05
	(2.71)	(2.05)	(2.91)	(3.02)	(1.92)
VIPAB	-0.01	0.007			
	(0.07)	(0.75)			
TIAA2B	-0.06		-0.05	-0.06	
	(3.78)		(3.89)	(4.04)	
VTCR1B	0.04			0.04	-0.0008
	(1.44)			(1.63)	(0.04)
Ln Lklhd(-)	227.00	355.59	229.08	227.80	355.50
Lklhd Ratio(b)	264.36	7.18	260.20	262.76	7.36
LklhdR Index(c)	36.80	1.00	36.22	36.57	1.02
A.I.C.(-)(d)	236.00	360.59	234.08	234.80	340.50

(a) t-statistics are in parentheses.
(b) The ratio is calculated as -2[LnLklhdr-lnLklhdu] and it has a chi-square distribution with j degree of freedom.
(c) This index is a pseudo-R square defined as 1-[lnlklhdr/lnLklhdu]
(d) The Akaike's information criterion (AIC) is defined as -Ln(Lklhd)+ K where K is the number of estimated parameters.

Specification E1 exhibits the largest likelihood ratio (LR) and the highest goodness of fit measured by the likelihood ratio index. Indeed, it rejects the null hypothesis that all coefficient are zero as the value of the test statistic LR is larger than the critical value of a chi-square distribution at 0.5% of significance and eight degrees of freedom (i.e. 21.95). Similar conclusions are obtained from specifications E3 and E4 which exhibit a similar performance. In contrast, E2 and E5 are found insignificant according to the LR test.

From the results based on the those specification which were found statistically significant we can draw some useful observations with respect to the empirical incidence of VPGB on bank failure/problem.

To begin with, the growth rate of real GDP (VPGB) was significant for the group of failed/problem banks (A) at 1% significance. Similar results are found for the group of nonfailed/nonproblem banks (B). At the same time, the negative sign of the coefficient for group B is consistent with the a priori expectation. That is, a fall in GDP growth rate increased the probability of failure/problem.

However, we can observe that the effect of GDP changes on the group of banks in difficulties (A) was opposite to group B and inconsistent with the a priori expectations. This result is rather puzzling since it suggests that falling output is consistent with falling probability of failure/problem.

- Conjecture 2: The Likelihood of Bank Failure/Problem and the Misaligment of Key Macroeconomic Prices.

We also observed from the graphics that the performance of the banking system was somehow related to the changes in some key macroeconomic prices. Severe fluctuations in relative prices coincided with the changes in banks' fortunes. Table 10 report the econometric results of the logit model estimated in order to test the significance of price misalignment.

Again, we specified a general model e1 which included three macroeconomic prices, namely the changes in the real exchange rate (VTCR), real lending rate (TIIA), and real stock price (VIPA). Although the overall equation is statistically significant at 1% measured by the likelihood ratio (LR), and the goodness of fit is one of the highest among the alternative specifications with 45.5%, the estimated coefficients are insignificant as their t-statistics fell outside the critical region at both 1% and 5%. The only exception to this result corresponds to the real lending rate lagged by two quarters for both groups.

Table 7.10 Logit Analysis for Selected Macroeconomic Variables for the period 1979.1 and 1983.4.(a)

Macroeconomic Variables	Alternative Specifications e1	e2	e3	e4
Constant	-0.20	-0.21	-0.24	0.16
	(0.97)	(1.01)	(1.20)	(1.91)
VTCR1A	-0.0008	-0.001		0.02
	(0.036)	(0.04)		(1.51)
VIPAA	-7.217E-05		0.0002	-0.009
	(0.007)		(0.02)	(1.14)
TIAA2A	0.08	0.08	0.08	
	(6.46)	(6.48)	(6.80)	
VTCR1B	0.03	0.04		0.0006
	(1.28)	(1.74)		(0.03)
VIPAB	-0.01		-0.02	0.001
	(1.08)		(1.53)	(0.11)
TIAA2B	-0.06	-0.06	-0.06	
	(4.90)	(4.78)	(4.85)	
Ln Lklhd(-)	240.21	240.86	241.03	356.73
Lklhd Ratio(b)	237.94	236.64	236.30	4.90
LklhdR Index(c)	33.12	32.94	32.89	0.60
A.I.C.(-)(d)	247.21	245.86	246.03	361.73

(a) t-statistics are in parentheses.
(b) The ratio is calculated as -2[LnLklhdr-lnLklhdu] and it has a chi-square distribution with j degree of freedom.
(c) This index is a pseudo-R square defined as 1-[lnlklhdr/lnLklhdu]
(d) The Akaike's information criterion (AIC) is defined as -Ln(Lklhd)+ K where K is the number of estimated parameters.

Alternative specifications were tried by dropping some of the regressors in order to confirm this result. Model e2 and e3 performed as good as e1 in terms of their likelihood ratio and likelihood index. In contrast, e4 was found insignificant and hence meaningless.

Specifically, I found that for group A (failed/problem banks) real lending rate was the only significant factor which carried explanatory power in every alternative specification. The positive sign of the coefficient indicated that rising interest rates were consistent with a rise the likelihood of bank failure/problem after two quarter lag. This coefficient confirm the a priori expectation.

With respect to group B, real lending interest rates with two quarter lag (TIAA2B) is statistically significant. The negative sign suggest that increase in lending rates was reducing the likelihood of bank failure/problem.

There are some firm conclusions to be obtained from the model. The sustained appreciation of the real exchange rate by more than 30% between 1978 to 1982 and the subsequent real depreciation as the authorities abandonned the fixed exchange regime did not explain the likelihood of failure/problem for group A. Also a similar conclusion was obtained for group B during the period between 1979-83.

High and rising real lending interest rates were found important in the probability of failure/problem in group A indicated by the significant and positive sign of the lagged TIAA2A. If we recall the data on real interest rates suggest that during the period of study the lending rate never fell below 11%. Indeed, we see that during the period of 1979-80 interest rates came down from over 34% in 1978 to 16% and 11% during 1979 and 1980 respectively. Thereafter, real lending rate rose from 11% in 1980 to over 30% in 1982-83.

The estimated coefficient for real lending rates was also statistically significant for group B although its interpretation is more complicated since the coefficient of lagged interest rate is with a negative sign.

Finally, the evidence does not support the view that the abrupt fluctuations in stock prices during this period of study did affect adversely the likelihood of bank failure/problem for group A and group B. The data from table 2 showed a substantial increase in the stock price index by 53% between 1978-80 and a more severe drop between 1980 and 1983.(i.e. insignificant coefficient)

-Conjecture 3: Predicted Probabilities from the Logit Model with Macroeconomic Variables.

We have found so far some econometric evidence to support the hypothesis that the deterioration of the macroeconomic environment had some role to play in the failure/problem of banks. The most significant variables in explaining the likelihood of bank failure/problem were the change in GDP and the real lending interest rate.

The next step is to select the best equation for prediction purposes. This will enable us to assess and compare the prediction accuracy of the model which include macroeconomic variables instead of accounting ratios already evaluated in chapter 6. However, given that the macroeconomic variables were the same for each individual bank in each specific quarter, the model cannot predict the quarterly likelihood for each bank. In effect, the quarterly probability for a given year will be exactly the same for every single institution included in a given group. The best we can aim for is merely a comparison between the prediction for group A and B. Therefore, this approach does not have any practical application as an early warning model.

In selecting the best equation we will look at some of the scalar estimated for each specification. To start with, the likelihood ratio test found insignificant at 1% confidence level specifications E2,E5, and e4. The remaining specifications did explained the likelihood of bank failure/problem. In other words, reject the null hypothesis.

Among the remaining alternative equations, specification E3 from table 9 was preferred to the others on the basis of Akaike's information criterion (AIC). In addition, this equation display one of the highest likelihood ratio index and contain the two most significant macroeconomic variables. (i.e. GDP and lending interest rate)

Tables 11a, 11b and 11c displayed the estimated probabilities for each group between 1979.1 to 1983.4.

Table 7.11a Prediction Accuracy of the E3 Logit Model for Group A and B During 1983 and 1982.

	1983				1982			
	I	II	III	IV	I	II	III	IV
GROUP A	0.72	0.93	0.82	0.75	0.82	0.95	0.93	0.95
GROUP B	0.23	0.07	0.13	0.07	0.19	0.06	0.19	0.17

Table 7.11b Quarterly Prediction of the E3 Logit Model for Group A and B During 1981 and 1980.

	1980				1981			
	I	II	III	IV	I	II	III	IV
GROUP A	0.54	0.86	0.80	0.83	0.51	0.64	0.91	0.86
GROUP B	0.23	0.11	0.17	0.09	0.38	0.21	0.10	0.17

Table 7.11c Quarterly Prediction of the E3 Logit Model for Group A and B for 1979.

	I	II	III	IV
GROUP A	0.72	0.64	0.83	0.87
GROUP B	0.14	0.29	0.17	0.09

Although the model did not enable us to compare individual predictions it was useful in predicting the likelihood of failure between groups. At 0.50 cut-off point, the E3 equation showed a good prediction accuracy as it obtained very high ex ante probability of failure for group

A during 1983 and 1982. As we move further back to 1981 and 1979, the predicted likelihood is smaller. If we increase the cut-off point, say 0.8, the accuracy of the model started to decline and the number of type-I error start to emerge. Similar conclusion were reached for the case of group B.

All in all, although the logit model estimated with macroeconomic variables did not prove to be useful for individual prediction purposes, it did provide some interesting results with respect to the hypothesis testing on the role of macroeconomic variables on the likelihood of bank failure/model. The next step is to test empirically the role of management decision making in the probability of bank failure/problem. In Chapter 8, I will argue that bankers responding to changes in risk incentives as a result of financial liberalisation did affect above all the health of the banking system.

Endnotes

(1) Although the reduction in the inflation rate was one of the central objective a gradual anti-inflationary approach was followed at least until April 1975. It involved a gradual slow down in the monetary growth and a reduction in the fiscal deficit by means of the elimination of subsidies, employees, and the sale of publicly owned enterprises.

(2) The shock treatment soon delivered some positive results as the fiscal deficit was reduced from 10% of GDP in 1975 to 0.8% in 1978. A surplus was attained in the three subsequent years. Although the progress on inflation was also important as it felt from 343% in 1975 to just above 37% in 1978, it was still high relative to international standards and involved an extremely high cost. The fiscal shock was felt inmediately as the economy plunged into a recession with a fall in GDP by nearly 13% and unemployment rate almost at 20% towards the end of 1975.

(3) There are no complete concensus among the experts on whether the experience of the Southern Cone Countries is relevant in order to evaluate the predictions of the monetary approach as an operational instrument. As Blejer (1983) pointed out these episodes involved exchange rate policy for stabilisation in conjunction with liberalisation reforms for structural changes.

(4) A more thorough account and evaluation of stabilisation policies and liberalisation reforms is provided in chapter 2.

(5) For instance, Edwards (1988) showed if capital controls are gradually removed to allow an increase in capital inflows, then the increase in current expenditures in particular in nontraded goods will increase its price and by definition lead to an equilibrium real appreciation. However, if the rate of capital inflows cannot be sustain in the long run, the real exchange rate should return to its long-run equilibrium. Therefore, temporary changes in fundamental can result in significant divergences between actual and equilibrium real exchange rate or what is normally known as exchange rate misalignment. The same dynamic is true when we look at the determination of stock price bubbles. See note 13.

(6) This performance was also determined by the favorable economic environment of the world economy.

(7) Cortes Douglas (1989) found that the highest growth rate during the period of 1926-82 corresponded to 1928 with 24.3%. The long run trend between 1940-82 was 3%.

(8) If $P=\alpha Pnt+(1-\alpha)Pt$ then if the law of one price hold for tradables $Pt=e+Ptf+\tau$ then $P=(Ptf+e+\tau)+\alpha(Pnt-Pt)$. Thus if $Pt=Pnt$ then $P=(Ptf+e+\tau)$ where Pt=tradable prices, Pnt=nontradable prices Ptf=world tradable prices, e=expected devaluation, and τ=tariff. This condition is valid as long as the government budget is in surplus, and the labour markets works efficiently. The government was confident that the law of one price could hold as they achieved fiscal surplus unlike Argentina. (See Corbo, De Melo, and Tybout 1986)

(9) Although there is an overwhelming concensus on the importance of capital inflows on the determination of the real exchange rate, Harberger(1985a,b) and Edwards(1986) maintained that capital inflows were exogeneous responding to the investor perception in the domestic profitability of investment. This produced an increasing demand of Chile's capital stock. In addition, they found that capital flows were insensitive to interest rates. This finding was corroborated by Sjaastad(1982).In contrast, Corbo (1987) found empirical evidence to support the view that capital flows were endogenous, that is explained by a portfolio adjustment model, although the coefficient for interest rate was insignificant. In my view, although capital inflows were paramount, the increases in absorption was responding to the significant growth in domestic loans financed by the substantial expansion in peso deposits as shown in chapter 2. At the same time, wealth effects from the stock market should have also been important on expenditures.

(10) Sjaastad (1985,1989) and Cortes Douglas (1985) argued that the fluctuation in real interest rates between 1979 and 1982 can be explained by the fluctuation in the value of the dollar. They maintained that in a small open economy with fully integrated capital and goods markets to international markets, domestic nominal interest rates will be fairly well arbitraged with external rates, but real interest rates would be affected by fluctuations in the exchange rate of major currency countries, where such fluctuations will be transmitted by the external price of traded goods.

(11) The increases in real wage also contributed to the rise in expenditures.

(12) Although the spread exhibited a significant reduction, particularly between 1978 and 1979 which reflected among other things a growing financial integration due to the gradual removal of external restrictions, less uncertainty from the exchange rate regime, and a substantial increase in peso deposits, it remained stable around 2% a month between 1979 and 1981. In chapter 2, we offered a more detailed evaluation about interest rates and the hypothesis to explained their performance.

(13) Barandiaran (1983) and Meller and Solimano (1984) argued that substantial rise in stock prices will affect the behavior of economic agents as they feel richer and enable them to expand their demand for credit. Meller and Solimano found that the movement of stock prices which went from a situation of boom to crash followed a trajectory of an speculative bubble. That is stock prices exceeded the value determined by the "fundamentals".

(14) As we have seen in chapter 2, the rise in nominal and real interest rates can be explained by the incidence from country-specific risk and exchange rate risk, increasing world interest rates, dollar deflation.

(15) Instead the authorities subscribed themselves to the automatic adjustment predicted by the monetary approach via increases in interest rates. However, the banking system was behaving in a very non-conservative way rolling over bad debts, capitalising the interest, financing distress borrowing. Therefore, the demand for credit became interest inelastic and the banking system was exhibiting a type of conduct consistent with moral hazard. The same observation was true for international banks which lent resources with no apparent control and with a belief that the government was willing to bail-out the banking system if difficulties arises.

(16) According to Cortes Douglas (1989) the 1982-83 output performance was the second worse in Chile's economic history after the 1931-32 economic depression when output declined by 17.1% and 26.8% respectively.

(17) Edwards (1986) investigated the empirical relationship between the real exchange rate (REXR) and capital inflows. In addition he included the terms of trade and real output as determinants of their equilibrium. His results support the view that capital inflows were significant in explaining the REXR and the slow adjustment towards its new equilibrium. Morande (1988) not only confirmed these findings and but also found in his VAR model that capital inflows were close to being Granger-Causality prior to the real exchange rate as well as capital flows being exogenous.

(18) Galvez and Tybout (1985) explored empirically the issues relating the performance and failure of nonfinancial firms during the period of 1977-82. Longitudinal data base of industrial financial statements was used to document real side and financial changes in firms'performance. The Galvez-Tybout empirical work is in a sense the counterpart of the present study as we are looking at the performance and failure of financial institutions.

(19) Galvez and Tybout (1985) found that between 1977 and 1981 the ratio of exportables to nontradable prices fell by 25% as did the ratio of exportable to nontradable gross margins. The most significant change in gross margin occurred in 1979 when the adverse terms of trade compounded the efect of the sustained real appreciation. Importables improved its margin between 1977 and 1979 and by 1981 were higher than both exportables and nontradables. By 1981 importable gross margin continued rising while exportable and nontradable margins were falling from the overvaluation and increasing overhead costs.

(20) Galvez and Tybout reported that by 1978 exporters (grupo firms) showed a lower financial cost than nontradable and importable (independent firms). The former was paying 14% while the latter 22%. However, this difference started to come down as result of the liberalisation of capital flows. As long as operating earnings were above financial costs, nontradable and importable sector were able to operate. When the interest rate rose from 1981 onwards the financial situation worsen for those firms.

(21) According to Brock (1989), trade liberalisation produced an anticipated upward shift in the productivity of tradable production so that the large increase in the share of non-traded goods was a part of the transition period during which nontraded production was needed to restructure the economy. Lower copper prices and thus a substantial deterioration in the terms of trade in 1981 brought down the value of capital and land and thus relative price of non-tradables. In his representative agent model, there is no money and prices are flexible. Although the model introduces important features of the Chilean economy, it is unrepresentative by excluding the monetary sector and assuming that non-tradable prices were flexible. In fact, the collapse in output and the misalignment of relative prices can be explained by monetary factors and the downward inflexibility of nontraded goods prices.

(22) Although the ratio of liabilities in foreign currency relative to domestic currency rose during this period, it was found statistically insignificant as a discriminator between failed/problem banks and sound banks. See chapter 6.

(23) In group A1, Pacifico, Unido Fomento, Hipotecario Chile, and Colocadora Nacional de Valores have missing observations in 1979(3Q),1983(4Q), and 1979(1Q) respectively. In group B1, BICE, Republic, Santander, Exterior have missing observations in 79(3Q), 79(2Q), 79(1Q), and 79(1Q) respectively.

(24) Amemiya (1985) and Green (1991) discuss unrestricted models with heterogeneity and/or state dependency.

(25) This contradict the evidence available for Chile. For instance, Sundararajan and Baliño (1990) found significant evidence for a shift into currency and a rise in the interest elasticity of the demand for currency during the banking crisis. Also, they found that the demand for M2 showed an upward shift and their interest rate elasticity increased reflecting a portfolio shift from non-bank financial institutions to bank deposits.

(26) It should pointed out that this approach does not represent a formal empirical test for the Diamond-Dybvig effect. An alternative formulation would be to test the model for the correlation between the residuals, that is between e_{it} & e_{jt}, or between e_{it} & e_{it-1}.
A priori I expect that the liquidity effect from any run for safety was neglible as a result of the public belief of the existence of an implicit deposit insurance.

Chapter 8. The Bank Failures in Chile: The Role of Moral Hazard.

(8.1) Introduction.

It could be argued that bank failures may arise from macroeconomic instability produced from external shocks and/or gross policy inconsistencies during a process of liberalisation. Chapter 7 had provided empirical evidence to support the hypothesis that the episodes of bank failures in Chile reflected the incidence of macroeconomic variables on the likelihood of bank failures.

This chapter examines a competing hypothesis that the rise in bank failures reflected the bank's greater incentives to take undue risks. Indeed, as we have seen from chapter 3, moral hazard can be motivated and even aggravated by the specific steps taken by the authorities to deregulate the financial market. An ill-implemented privatisation which enhanced the formation of powerful "economic groups" and economic concentration, the abrupt deregulation of interest rates which resulted in stubbornly high rates of interest, the expectation of explicit government insurance on bank liabilities, and an ineffective prudential regulation and supervision all exacerbated moral hazard among financial institutions (bank management) and bank users (depositors). As we will see from the evidence these features were present during the liberlisation episode in Chile.

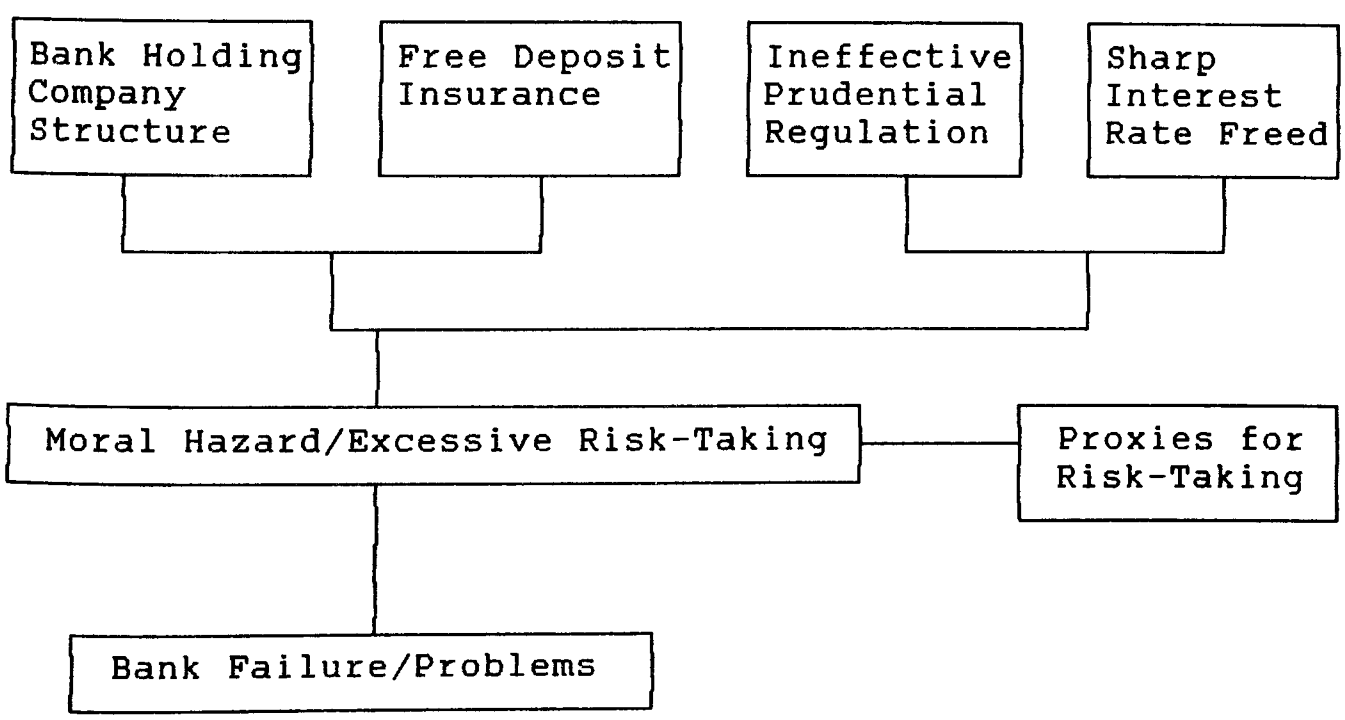
It is shown that the balance-sheet of Chilean banks reflected greater risk-taking as a result of moral hazard. At the same time, logit model estimates support the moral hazard hypothesis as an explanation of the bank failures in Chile.

(8.2) Financial Liberalisation and Moral Hazard.

Recalling the discussion in chapter 4, moral hazard was seen as the propensity to take excessive risk in the context of a bet against the government. It will be shown in the next section that the existence of certain specific features in the financial market as a result of ill-designed and implemented financial liberalisation could excerbate the moral hazard problems. On this point, Diaz-Alejandro (1984) maintained that the intrinsic imperfections in financial markets and the policy dilemmas they posed explain the collapse of financial institutions in the Southern Cone, particularly in Chile. Specifically, the development of bank holding company structure and a significant concentration of financial activities among few financial institutions, the existence of implicit or improperly priced explicit deposit insurance with respect to the bank's asset risks, a sharp deregulation of interest rates, and a weak prudential regulation either by design or enforcement would introduce incentives towards excessive risk-taking by banks and its customers and hence increase the probability of bank failures.

Diagram 1 describes the basic elements of the hypothesis of moral hazard on bank failures. The existence of policy-induced factors (financial liberalisation) exacerbates moral hazard and adverse selection type of behaviour which arise under information asymmetries. Specifically, the existence of a bankholding company structure combined with a fixed rate underpriced deposit insurance, rapid deregulation of domestic interest rates, and a weak and inefficient prudential regulation and supervision provided banks with a greater incentive to increase risk-taking (asset risk, higher leverage, lower capital and reserves requirements) hence increasing the likelihood of bank failures. Financial and accounting ratios constructed from banks' balance-sheet data should reflect the banks' incentive to take greater risks.

Diagram 8.1 Factors Affecting Moral Hazard and Bank Failures



(8.3) The Evidence from Chile.

The evidence from Chile's experience with financial liberalisation and the subsequent banking debacle in 1982-83 confirm the presence of those factors outlined in the previous sub-section and their likely effect on increasing risk-taking and the collapse of some banking firms. Although the role of an adverse macroeconomic environment (external factors to the banks) was tested and confirmed in chapter 7, the good predictive performance of the early warning model of chapter 6 suggest that the financial debacle would have been forseen a few years earlier. Indeed, the incidence of an ill-designed financial liberalisation was already inducing excessive risk-taking well before the deterioration of the macroeconomy. Therefore, the role of moral hazard in the debacle of the Chilean banking system should be considered as central in any explanation of bank failures.

Looking at the banking structure in Chile which arose during the liberalisation period indicates three distinct features: Firstly, three commercial banks controlled nearly 50% of the overall asset portfolio of the banking system.

Secondly, financial institutions were owned by few and powerful economic conglomerates.

And thirdly, the evidence shows that a large proportion of the banks' loan portfolio was allocated among their affiliates.

Table 8.1 Banks Ranking According to Total Loan Portfolio.(%)

Banks	1981	1983	Banks	1981	1983
Chile	20.5	22.0	O'Higgins	3.1	3.1
Estado	16.7	16.8	Osorno	3.0	2.1
Santiago	8.7	10.7	Unido de Fo.	2.5	---
Credito	6.7	5.5	Edwards	2.4	3.2
Sud Americano	5.5	5.5	Nacional	2.2	2.0
Concepcion	4.9	4.6	Colocadora Nac.	2.1	1.9
Hipotecario Fo.	3.8	3.6	Internacional	1.5	1.2
Hipotecario Ch.	3.4	---	Continental	1.3	1.1
Trabajo	3.4	3.3	BICE	1.2	1.4

Source: SIBF, Informacion Financiera, Various Issues.

The data from table 1 indicate that three commercial banks (Chile, Estado, and Santiago) controlled 49.5% of total loans of the banking system during 1983. For instance, Bank of Chile alone had a 22% control of the total loans of the system and this figure greatly exceeded the average participation of domestic commercial banks of 5.5% (2.7% excluding the three largest banks). Also, further evidence from SIBF suggests that the participation of foreign banks is even less important. For instance, the Citibank exhibits the highest share of total loans of the system with only 1.7%. while the rest of the foreign institutions were falling below 0.7%.

The banking system in Chile was owned and controlled by powerful economic groups organised in a tighly knit web of onwership links which included financial firms (banks, non-bank financial institutions, and insurance) and non-financial firms.

Table 2, which was taken from Dahse's research, shows the degree of concentration of economic groups. Dahse (1979) found that only five economic conglomerates controlled 36% of the 250 biggest firms and 53% of the total capital. For instance, "group" Cruzat-Larrain was the largest conglomerate with U$ 936 millions which was equivalent to nearly 25% of the total worth of the 250 firms valued at U$ 3.788 millions.

Table 8.2a The degree of Concentration of Chile's Economic Groups.

Conglomerate	(a) Firms	%	Ownership U$	%
Cruzat-Larrain (CL)	37	14.8	936.88	24.7
Vial J. (V)	25	10.0	477.30	12.6
Matte E.(M)	12	4.8	325.31	8.6
Angelini A. (A)	8	3.2	141.80	3.7
Luksic A. (L)	8	3.2	139.06	3.6
Galmez (G)	2	0.8	98.23	2.6
Edwards A. (E)	9	3.6	95.95	2.5
Yarur Banna (Y)	4	1.6	92.02	2.4

Source: Dahse (1979)
(a) Data for 1978.

There was no economic conglomerate which did not totally control (owned) or at least share joint ownership of one or more financial institutions. Indeed, Dahse (1979) maintained that private banking was owned by no more than fifty individuals.

Table 8.2b Banks' Ownership by Economic Groups in 1978.

Banks	CL	V	M	A	L	G	E	Y	Otro(o)
Chile	31	10	-	-	-	-	-	-	22 (a)
Santiago	100	--	-	-	-	-	-	-	---
Credito	---	--	-	-	-	-	-	77	6 (b)
SudAmericano	---	7.5	3	-	21	-	-	--	24 (c)
Concepcion	---	--	-	-	--	-	-	--	47 (d)
Hipotecario Fo.	55	--	-	-	--	-	-	--	45 (e)
Hipotecario Ch.	--	91	-	-	--	-	-	--	--
Trabajo	--	--	-	-	--	-	20	--	59 (f)
Unido Fomento	--	--	3	-	15	-	1	1	20 (g)
Colocadora Nac.	100	--	-	-	--	-	-	-	--
BICE	--	--	100	-	--	-	-	-	--

Source: Dahse (1979)

(a) It is composed by families Hirmas (9.5), Soza(4), Menendez(3), Andina(3), and Garcia Vela(2.5)
(b) The six percent is owned by Group Scheiss.
(c) It includes Molineros Ass. (18), and Scheiss (6)
(d) Ascui 9.8, Saenz Bros. 9.5, Martinez & Cueto 9.2, Giner 7.5, Ruiz 8.0, and Acosta & Cosmeli 3.0.
(e) 45% was owned by group Soza.
(f) 20% was under the control of the Said family and 39% corresponded to capital from Venezuela.
(g) Group Avalos & Gonzales hold 20% of the bank.

The evidence from table 2a and 2b clearly indicates that Cruzat-Larrain, the largest economic group, owned totally Colocadora Nacional and Banco de Santiago, and had a majority holding in Banco Hipotecario de Fomento. Moreover, they had a 10% ownership of Banco de Chile. Similarly, J. Vial, the second largest group, also controlled several financial institutions among them, Banco Hipotecario de Chile with 91%, Banco de Chile with 31%, and two "financieras" (Finasa, and Atlas) which controlled nearly 20% of the total credit of that segment.

What is clear from the evidence presented is that the two largest economic conglomerates controlled the two largest banks of the system (Chile and Santiago). Moreover, those banks associated with the economic conglomerates were liquidated or intervened in order to be merged or sold later. For instance, we saw in chapter 3 that Hipotecario de Chile and Unido de Fomento were liquidated, whilst Chile, Santiago, Colocadora Nacional, Concepcion, and Internacional were intervened in 1983. The list of problem banks was also larger as it included those financial entities which were forced to sell a mounting stock of non-performing loans.

The increasing concentration of credit among three large banks and the ownership and control of these institutions by large economic conglomerates meant a substantial concentration of loan portfolios among their own affiliates and a significant rise in the stock of nonperforming and risky loans. Table 2c shows the magnitude of the loan concentration and the problem of "related portfolios" in Chile.

Before we examine the evidence, it should be stressed that the identification and measurement of related portfolios is far from being a simple problem. In theory, a related portfolio problem may arise from an ownership or managerial interrelationship. In the former, a debtor can be a bank's stockholder and/or a partner/shareholder of a commercial firm which in turn ownes the bank's shares. In other words, the relationship can be direct or through third parties, whereas in the latter, the link relates directors, managers, and adviser with the bank itself.

In practice however, several possible links can be established by individuals, commercial firms, and other entities which will make a precise definition a difficult task. The Superintendency of Banks had introduced a more practical definition which considers the existence of a "pressumed" link between the bank and the debtor. They defined a pressumed link whenever there appears to be a bank's preferential treatment toward certain borrowers.

Once we have a working definition of those individuals and/or entities which are related to a specific banking firm, we are able to measure the magnitude of the related portfolio concentration.

There are three important observations from the data of table 2c. Firstly, the two largest banks in Chile exhibit the largest credit concentration among their affiliates. For instance, Banco de Santiago and Banco Chile had 42.3% and 18.6% of their total loans as related portfolios during December 1982 respectively. These figures are even higher and more meaningful with respect to capital and reserves, reaching four and three times the banks' capital. The stock of related portfolio worsened in 1983 as the authorities uncovered more information about the quality and structure of the banks' loan portfolios.

Table 8.2c Credit Concentration With Banks' Affilates.

	Related Portfolios(RP)/Loans			RP/Capital
Banks	December 82	February 83	April 83	Dec 82
Intervened Banks				
Santiago(CL)	42.3	45.8	47.8	413.5
Colocadora Nac(CL)	23.8	24.4	24.2	321.2
Chile(CL,V)	18.6	19.7	17.8	300.3
Hipotecario Fo(CL)	18.5	18.9	19.8	335.0
Internacional	22.8	25.9	20.5	164.6
Average	25.2	27.0	26.0	306.9
Non-Intervened Banks				
Nacional	25.7	30.1	27.5	252.6
Sud Americano(V,L)	14.8	16.2	18.1	226.3
Edwards	14.9	15.4	14.4	232.8
Credito(Y)	11.9	12.0	12.1	166.5
Concepcion(o)	12.2	12.0	12.0	146.7
O'Higgins	9.1	8.9	12.1	94.6
Osorno	5.6	5.9	9.4	56.3
BICE(M)	4.0	5.5	4.2	49.2
Trabajo(E)	1.6	1.9	3.3	22.3
Average	11.0	12.0	12.6	138.6

Source: SIBF, Informacion Financiera, Various Issues.

Secondly, banks with the largest credit concentrations were owned by single economic conglomerates. For example, Banco de Santiago and Colocadora Nacional de Valores were totally controlled by Cruzat-Larrain. Similarly, Banco de Chile was jointly controlled by Cruzat-Larrain and J. Vial with 31% and 10% each.

Thirdly, financial institutions rescued by the authorities were mainly owned by Cruzat-Larrain and exhibited a significantly larger credit concentration with respect to their total stock of loans and capital and reserves. For instance, the group of non-intervened banks presented an average credit concentration of 11% of total loans (138% of their capital and reserves) in December 1982. In contrast, for the group of intervened banks these numbers were more than doubled with 25% of total credit. (306% of capital and reserves).

Overall, the problem of related portfolios involved nearly 20% of the system's total stock of credit and nearly 2.5 times the capital and reserves. Undoubtedly, banks acted in a non-conservative way following their indifference about the concentration of their risk portfolio and the maximisation of the expected returns.

Apart from the influence of the banking structure in Chile, the belief that there was an implicit deposit insurance exacerbated the problem of moral hazard. Financial liberalisation reforms and the authorities sent the wrong signal to both the public and the bankers.

Right from the beginning of financial liberalisation the authorities stressed the point that financial institutions would be totally responsible, just like any other private commercial enterprise, for their financial losses and obligations with their liabilities' holders. This attempt to introduce a market mechanism into the banking system supposed that any losses incurred by financial institutions would be shared by banks and their customers. However, in spite of these continuous announcements, the authorities bailed out some banking institutions in two separate instances before the debacle of 1982-83. In January 1977, the Superintendency of Banks intervened in Banco Osorno and a day later introduced a free public deposit insurance to protect small savers up to a limit of U$ 2.789. Simultaneously, the Central Bank made explictly clear its willingness to provide financial support to Banco Osorno.

A second and even more powerful signal which reinforced this belief was the intervention and subsequent liquidation of four banks and four non-bank financial institutions (financieras) in December 1981. As presented in chapter 3, Banks Talca, Linares, Español, and Fomento de Valparaiso, followed by Financieras Cash, Capitales, Compañia General Financiera, and Finansur which accounted for no more than 10% of the total deposits and loans in the system received Central Bank's financial support.

The financial liberalisation reforms failed to introduce an efficient and credible explicit deposit insurance. Instead the banking system was left with the worst possible scenario, a deregulated system with an implicit deposit insurance. After the bank failures of 1981, the authorities made an attempt to establish an explicit voluntary deposit insurance which was expected to complement the existing deposit guarantee for small savers enacted after the collapse of Bank Osorno. This insurance was designed to be offered by banks to its customers for deposits equal to or less than U$ 5,100. The thrust of this initative was shortlived since it lacked the bankers' and depositors' support and the authorities failed to implemented it fully.

It is clear that the banking and monetary authorities sent conflicting signals to the market's participants and confirmed the belief in the existence of a de facto deposit insurance. Moreover, the liberalisation reforms did not include an explicit scheme to insure deposits. The public belief in the existence of a free public guarantee contributed towards a further relaxation of credit standards.

It could be argued that the widespread relaxation of bank practices and risk-taking would have been restrained if financial liberalisation had included an adequate and efficient supervision aided by an early prevention system. At the same time, the authorities were left with only two alternatives to regularise a bank subject to solvency problem: a specific time limit (two years) to comply with additions to capital, or liquidation.

For instance, bank legislation in Chile during the liberalisation period did state limits on credit concentration either among affiliates or non-affiliates. As we have seen already in more detail in chapter 2, banks were allowed to lend to a single borrower an equivalent of 5% of its own capital and reserves and 25% if the loan was secured by good quality collateral. The evidence from above clearly demostrates that these limits were surpassed several times.

The establishment of "paper firms" once the limits on individual firms were reached, the common practice of cross-credit allocation between "economic groups", and credit allocation via "off-shore" financial institutions owned by the conglomerates enabled them to exceed these limits unnoticed.

Similarly, the rolling-over of bad debts and the capitalisation of the interest was also a clear indication that regulation was ineffective. After 1976, the authorities set a 90 days' limit to recognise a bad debt and instructed the inmediate 100% individual provision. At the same time, there was an overall provision of 2% of total loans. However, the rapid growth of bank loans during 1979-80 encouraged a relaxation in the global provision to only 0.75% and 24 months' limit for the creation of an individual provision once a bad debt was recognised. The evidence presented in chapter 3 shows a significant increment in the ratio of non-performing and risky loans sold to the Central Bank relative to capital once the banking collapse unfolded and there was an explict recognition of the quality of loan portfolios. In fact, this ratio went from 78% in 1982 to 186% in 1984. These data coincided with an explosive growth in loans of nearly 35% average per annum between 1977 and 1981, and high real lending rate of more than 42% between 1975 and 1982.

By any standards, regulation and supervision was inadequate and ineffective in encouraging loan diversification, adequate provision for bad loans, and a more sustainable and conservative growth in bank assets. At the same time, the supervisors failed to provide the public with timely and reliable information about the financial condition (quality of loan portfolios, and profitability) of each bank. The authorities' fresh attempt to introduce a method of loan classification according to risk in 1980 was too modest and too late. At the same time, the fact that the information was not at the public disposal suggested the magnitude of the problem in hand. The increment of the minimum capital requirement for commercial banks from U$ 4 millions in 1978 to U$ 10.4 millions in 1980 was insufficient to cover to mounting expected losses in the system.

The new bank legislation which emerged after the banking debacle aimed at correcting the omissions and shortcomings of the existing regulation. The Banking Act of 1986 entitled the authorities with the responsability for ensuring the safety and stability of the financial system by providing elements for a continuous assessment of banks's financial conditions, providing information to the public, introducing an explicit deposit insurance, and a mechanism to deal with problem banks effectively.

It is clear that the prudential regulation and supervision framework which prevailed during the years of financial deregulation and growing competition failed to promote sound banking and prevent with a significant time lead the collapse of the banking system and the expensive rescue operation.

Finally, another related factor to financial liberalisation which enhanced the moral hazard problem and increased the probability of bank failure was the rapid deregulation of interest rates. As stated in the description of the Chilean financial reforms and discussed in chapter 2, the monetary authorities followed a sharp deregulation of domestic interest rates. It began in May 1974 with the elimination of interest rate controls impossed on non-bank financial institutions and was followed shortly by the freeing of interest rates for commercial banks in October of the same year. As we have seen from the evidence, the abrupt financial deregulation brought about an initial overshooting in nominal and real interest rates. The data from chapter 2 indicated that in 1975 nominal and real lending rates reached 498% and 114% respectively. Despite the gradual opening to capital inflows, these rates failed to converge to international levels and remained stubbornly high and volatile. Indeed, the lowest lending rate occurred in 1980 with nearly 47% in nominal terms and 11.3% in real terms. The evidence confirmed the coincidence of high interest rates with an explosive growth in banks' assets (loans) and subsequently with a significant deterioration in the quality of bank loan portfolios measured by the ratio of non-performing loans sold to the Central Bank (NPLSCB) relative to capital and reserves (K). The average asset growth rate per annum between 1977 and 1983 was 29.5% with a peak of 50.4% while the average real lending rate over the same period was 26.8% This explosive asset growth at an extremely high real cost of borrowing coincided with a spectacular rise in non-performing loans during 1982 and 1983 with 78.8% and 158.1% of capital and reserves respectively. In consequence, deregulation of interest rates and hence high domestic rates worsened the banks' moral hazard as they extended significant credits at high costs and with a low probability of repayment to their own affilates and non-affiliates.

In sum, the evidence from Chile confirms the existence of the dominance of a few banks which as a matter of fact were controlled by powerful "economic conglomerates". Moreover, the public believed in a de facto deposit guarantee which, combined with a weak prudential regulation and supervision, motivated a rapid expansion in bank loans and liabilities, and a significant loan concentration among their affiliates. This excessive risk-taking by market participants (bankers and depositors) should partly explain the bank failures of 1982-83.

(8.4) Bank Failures and the Role of Moral Hazard: A Testable Model For Chile.

Although there have been several studies supporting the hypothesis that the specific features which prevailed during the liberalisation of the financial market led to a moral hazard type of conduct by financial institutions and the subsequent collapse of the banking system, no empirical verification for the development of a bank failure predicting model has been conducted in the case of Chile.

The moral hazard hypothesis implies simply that banks would be willing to take greater risks (beyond the social optimum) which in turn should be reflected in terms of the banks' quality of loan portfolios, the banks' capability to absorb their losses via reserve and capital requirements, the liability structure, and the growth rates of banks' assets and liabilities. Therefore, any model testing the role of moral hazard (excessive risk-taking) on the likelihood of bank failure should include proxies which measure the quality of the banks' assets and liabilities. As we will see in the next sub-section, some of the empirical research in this area have followed this approach, although the list is very limited.

(8.4.1) General Framework.

There have been few attempts to model and test moral hazard in the literature of bank failures. In effect, most of the empirical work has been oriented towards testing the influence of deposit insurance on banks' risk-taking: particularly relevant are Clair (1984), Grossman (1992) and Wheelock (1992). For instance, Claire (1984) was one of the earliest attempts to test moral hazard in the context of the deposit insurance literature for the US. The hypothesis that the provision of federal deposit insurance resulted in greater risk-taking was tested using financial ratios of credit union institutions as dependent variables in the regressions. In his model financial ratios tend towards an optimal value so that any deviation from this optimum was an indication of moral hazard.[1] Any change in the secular trend resulting from the provision of deposit insurance was modelled by using a binary variable (dummy) which interacted with a time variable. If the coefficient of the dummy which separates the data in to two sub-periods (preinsurance and insurance periods) was significant, this indicated that the trend of the optimal ratio of the dependent variable had changed between the two periods. The regressions for the capital ratio (capital and reserves/total loans) and delinquency rate (loans with payment delinquent for two months or more/total loans) suggested an increment in risk following the provision of deposit insurance.

Similarly, Grossman (1992) also tested the moral hazard consequences of deposit insurance on the US thrift institutions during the 1930's using balance-sheet data from insured and uninsured entities. The foreclosures-asset ratio (non-performing loans) was taken as an appropiate proxy for thrifts' risk-taking and regressed against institution-specific characteristics, particularly the insurance status, and annual dummies measuring changes in economic conditions. Among the regressors, the insurance status was modelled also with a dummy variable and found positive and significant among the thrifts which were state-chartered and insured.

In the present study, I have relied also on banks' balance-sheet to test the significance of moral hazard on the likelihood of failure. Indeed, in order to assess the moral hazard consequences of these factors, an appropiate measure of bank risk-taking is needed which is sensitive, among other things, to changes in incentives facing bank managers. For instance, managers can choose the quality of their loan portfolios as well as having some discretion over capital adequacy and provisions.

The expected mean and variance of loan returns obtained from an efficient examination and classification of loan portfolios is an ideal measurement of risk-taking, if available. It follows that a risk-averse bank would make comparatively low-risk low-return loans with high quality collateral than a less risk-averse entity.

In the absence of such detailed information, as was the case of Chile during the period of study, I relied on some selected proxies estimated from banks' balance sheet information to assess the propensity for risk-taking. Unlike Clair and Grossman's papers, selected financial ratios in this study were included as the model's regressors in order to estimate a binary choice model. The dichotomous dependent variable was set equal to 1 for failed/problem banks and 0 otherwise.

Short, O'Driscoll, and Berger (1985) and Wheelock (1992) also tested a binary model with banks' balance-sheet data to ascertain the impact of risk-taking on the probability of failure. For instance, Short, O'Driscoll, and Berger's study focused on the microeconomic determinants of bank failures, particularly managerial decisions concerning risk-taking. They tested for the effect of changes in some selected financial ratios, including, capital-assets, loans-assets, US Treasury securities-assets, deposits-liabilities, and purchased funds-liabilities ratios, on the probability of bank failure. They hold the view that given that banks' managers can exert control over these ratios, their choices should reflect changes in the incentives towards risk-taking. The probit estimates indicated that the quality of banks' assets and the vulnerability to deposit outflows were important determinants of bank failures in the US, particularly for the period 1982-83.

Wheelock (1992) has also found empirical evidence for the 1920's using the same framework but also included a dummy for the insurance status.[2] In general, these models were successful in testing increasing risk-taking and its impact on the probability of bank failures.

However, I depart somewhat from this framework in two ways: Firstly, the model is estimated by assuming a logistic distribution of the random term as explained thoroughly in chapter 6.

Secondly, although the model included financial ratios estimated from the banks' balance-sheets, the moral hazard effect was captured by the ratio's deviation from its own trend. I assume that that the optimal value for the financial ratio is given by the time trend. Specifically, $r^*_t = a+bt$ where $t=1,2,...,n$ and t is the time trend. Thus, in the absence of moral hazard the management behaves as if it seeks to adjust for any difference between the actual and optimal ratio. However, the actual financial ratio r_t is affected by moral hazard so that any significant deviation of the ratio r_t over the optimal r^*_t indicates a bank's attitude to take greater risks beyond the optimal, ceteris paribus.

(8.4.2) The Model and the Econometric Specification.

(8.4.2.1) Model Specification and Estimation.

The descriptive and explanatory model of bank failure depicted below allow us to assess the influence of the features which emerged during financial liberalisation on risk-taking and the subsequent increase in the probability of bank failure.[3] Indeed, the interaction of bank management, government regulators, and depositors is seen to have a direct and indirect effect on the likelihood of failure.

The model implictly assumes that the economy is populated by rational optimising agents. In a two-period setting a risk-neutral bank attempts to maximise its book net worth[4] by choosing its loan portfolio, loan policy including the collateral (C), interest rate ($\hat{\imath}$), and the amount spent on screening and monitoring (E), minus the expected value of the bankruptcy penalty (c). That is, max BNW - cF(y+d<-k) where F( ) is the likelihood of bank failure as we shall see shortly.

The model assumes that the bank has a given amount of capital (K) at the beginning of the period, and accumulates earnings (R) and losses (L) over the period, and spends (E) on screening and monitoring bank loans. The stream of bank's cash flow Y (net bank income) is given by [(R1-L1-E1),(R2-L2-E2),...,(Ri-Li-Ei)]. Moreover, the bank may also pay dividends (S), and issues new capital (N) at the end of the period. For simplicity I assume that bank's investment in securities is zero.

The bank has issued a mix of deposits on which it promises to make a stream of payments [D1,D2,...,Di] that has a total value of D. Although all assets and liabilities should be marked to market values to be more accurate, in practice we apply historical cost accounting as an approximation of the true bank's worth.

$$(1) \quad X = Y + D \quad < 0$$

In expression (1) the asset's net cash flows from its loan structure is insufficient to pay the depositors' claims (negative net worth). In order to prevent a failure the bank may uses funds from its initial capital and reserves. Therefore, in this context failure occurs if condition (2a) holds.

$$(2a) \quad X = Y + D + K \quad < 0$$

Thus, expression (2a) suggests that a bank failure occurs if negative cash flow is greater than bank's capital, or more generally, as shown by expression (2b), if deposit outflows (D) exceed bank's capital and reserves (K) plus net income from bank's assets (Y) plus new issues (N) minus dividends (S).

$$(2b) \quad D > K + Y + N - S$$

Given that $D > K+Y+N-S$ implies that $S > K+Y-D+N > Y-D$ then $S=0$. Dividends must be zero since they cannot exceed the bank's net cash flows (X). Also, it is assumed that the bank issues capital only when the bank's net cash flow X is positive. Thus, if $S=0$ and $N=0$, and dividing expression (2a) by bank's total assets (A) we obtain

(3a) $x = d + y + k < 0$ where $d= D/A$

(3b) $x = d + y < -k$ $y= Y/A$

$k= K/A$

Thus, the probability of bank failure (F) will depend on the probability that $d+y<-k$. Specifically,

(4) $F = \text{Prob}(d+y<-k)$

or more generally

(4a) $F = \Phi(d,y,k)$

In this model, the quality (riskiness) of bank assets (loans) is captured by the parameter α and under the direct control of bank's management. For instance, if the bank manager chooses a riskier loan portfolio which entails a high loan concentration with its affiliates, or designs a loan contract with a high interest rate $\hat{\imath}$ and a low collateral requirement C, then the value of Y becomes riskier (variable). In consequence, a higher value of α, other things being equal, implies a higher F. Since α describes the riskiness of Y we can substitute α for Y in expression (4a). Similarly, F is also positively related to k, although the bank exercises less discretion over its value than α.

The model may also include an indirect effect on F via the value of d. If we assume that there is no prudential regulation and supervision, and deposits remain uninsured, then any change in the value of α and/or k will affect F and hence d. Specifically, as F rises the risk-return ratio facing uninsured depositors also increases producing in turn a rise in deposit withdrawals. Expression (4a) can be express as follows:

(4b) $F = \Phi[d(F),\alpha,k]$ where $\delta d/\delta F>0$ $\delta F/\delta\alpha>0$ $\delta F/\delta k>0$

By applying Taylor's expansion we separate the direct and indirect effects on F as shown by expression (4c).

(4c) $F = f(\alpha,k) + d(F)$ where f=direct effect of bank management on F
d= indirect effect from depositors on F

The next step is to model the impact of deposit insurance and prudential regulation on bank management (f) and depositors (d), and the value of F. I assume that depositors are fully insured with no cost (or de facto deposit insurance). The value of deposit insurance (I) is equal to the value of deposits (d). The term I can also be considered as the access to the discount window (lender of last resort) when $d+y<-k$. It follows that the bank failure condition in expression (3b) becomes $d+y+I<-k$ and then we have:

$$(5a) \quad F = f[\alpha(I),k(I),I(F)] + d(F)$$

By Taylor's expansion we separate the overall effects on F so we obtain (5b)

$$(5b) \quad F = f[\alpha(I),k(I)] + [d(F) - I(F)]$$

Expression (5b) shows that the existence of full deposit insurance (I) affects both α and k. Indeed, bank managers will be willing to take more risk (moral hazard) by choosing higher α and k and hence rising F. Also, the effect of deposit insurance will make depositors less sensitive to changes in F via the effect I(F) on the overall value of F. Notice that the value of I depends on F, that is I(F). This follows from the assumption that banks are entitled to deposit insurance and emergency loans, and the larger is the probability of failure F the more likely a bank will have to recourse on the deposit insurance and/or emergency loans.

Finally, the model introduces the effect of prudential regulation and supervision (G) on the likelihood of bank failure (F). I assume that there is direct impact on bank management. Specifically, banks with high α and k and hence f are likely to face supervision. Therefore, it should constrain the banks' choice over parameters α and k, hence reducing f. Moreover, the likelihood of supervision would depend on the value of F.

The effect of supervision and regulation can be seen by modifying expression (5b) so we obtain

(6a) $F = f[\alpha(I),k(I),G(F)] + d(F) - I(F)$

By Taylor's expansion we get an expression with separate components defined in (6b)

(6b) $F = f[\alpha(I),k(I)] + [d(F) - I(F)] - G(F)$

Expression (6b) is a general specification where the negative sign of G(F) indicates that regulatory intervention is likely to reduce the likelihood of bank failure (F). Moreover, it will offset the insurance effect on F as it constrain the value of parameter α and k. With respect to depositors confidence, the effect of G on the value of d is indirect via changes in F.

In general, expression (6b) describes the interactions among banks, depositors, and regulators in determining the probability of bank failure (F).

The next step is to estimate the model by assuming that the failure condition $y+d<-k$ and the value of F given by (6b). However, y and d are unknown with certainty so that the model should related $y+d<-k$ with the bank's financial condition (FC). If the bank's financial condition is weak then the failure condition will hold.

$$(7a)\quad y-d+k = FC_{it} + e_{it} \qquad \text{where } i= 1,2,...,n \quad t= 1,2,...,T$$

Thus, the failure condition in (7a) is related to FC for ith bank in time t plus a random term e. FC can be taken as a composite measure of the bank's financial condition of selected proxies as shown in (7b).

$$(7b)\quad FC_{it} = \mathbf{x}_{\mathbf{it}}\beta$$

where **x**=K-vector of selected proxies measuring risk-taking

taking.

ß= K-vector of unknown parameters

With this deterministic process described by expression (7b) we are able to convert it to a model of the probability of failure. This model is conditioned on well defined and selected proxies from banks' balance-sheet data which measure excessive risk-taking (moral hazard).

To begin with, the model assumes that there is a theoretical (unknown) index Θ which is determined by some selected proxies for risk-taking. This index measures a bank's propensity to fail and is unobservable from the data. Given that Θ is a function of well-defined random and independent explanatory variables (proxies) the logit model should provide suitable estimates of this function and hence for the value of Θ.

If the dependent variable Y is equal to 1 when a bank fails and Y equal 0 otherwise, and each bank has a critical cutoff point $\hat{\Theta}$ which reflects the index Θ classification process, then we have: if $\Theta > \hat{\Theta}$ the bank fails and vice versa.

Given that the logit model assumes that $\hat{\Theta}$ is a random variable with a logistic distribution then it follows that the probability that $\Theta > \hat{\Theta}$ can be computed from the cumulative logistic probability distribution.

The logit model was specified for panel data which consisted of observations made on individual banks over an specified interval of time. In addition the model was restricted by assuming that observations are independent for both individuals and over time. These simplifying restrictions were considered desirable since the approach to estimate the model was straightforward and similar to the cross-section model estimated in chapter V but with more observations.

Thus, the restricted univariate binary choice model for panel data is defined as follows:

$$(8) \quad P(Y_{it} = 1) = F(\mathbf{x}`_{it}\,\mathbf{ß}) = F(\Theta_{it}) \qquad \begin{array}{l} i = 1,2,\ldots,n \\ t = 1,2,\ldots,T \end{array}$$

Expression (8) defines Y as a sequence of independent binary random variable taking the value of 1 if the ith bank failed/problem at time t, and 0 otherwise. Also **x** is K-vector of known proxies measuring risk-taking, and **ß** is a K-vector of unknown parameters. F is defined as cumulative probability distribution.

The cumulative probability function enables us to translate the values of the independent and stochastic explanatory variables which range in value over the entire real line to a probability which ranges from 0 to 1.

$$(9) \quad P(Y_{it} = 1) = F(\Theta) = F(\mathbf{x}`_{it}\,\mathbf{ß}) = \int_{-\infty}^{\mathbf{x}`\mathbf{ß}} f(\Theta)\,d\Theta$$

$$= 1 / 1 + e^{-\Theta} = 1 / 1 + e^{-(\mathbf{x}`\mathbf{ß})}$$

In expression (9), F(**x**`**ß**) is equal to the cumulative standard logistic function so that it assigns to a number $\hat{\Theta}$ the probability that any arbitrary Θ will be less than Θ. It follows that since the probability is measured by the area under the standard logistic curve from $-\infty$ to Θ, the event will be more likely to occur the larger the value of the index Θ.

As was shown in chapter 5, in order to estimate the vector of unknown parameters of $\boldsymbol{\beta}$, I resorted to the use of the maximum lileklihood estimator for β. The maximum likelihood estimation was appealing since a unique maximum always exists for the logit model. At the same time, it is appropiate for non-linear estimation and yields consistent parameters estimates. Thus, the likelihood function of the model is given by expression (10).

$$(10)\quad LnML = \sum^{n}\sum^{T} Y_{it}\, Ln\, F(\mathbf{x}'_{\mathbf{it}}\boldsymbol{\beta}) + \sum^{n}\sum^{T} (1-Y_{it})\, Ln\, [1 - F(\mathbf{x}'_{\mathbf{it}}\boldsymbol{\beta})]$$

The ML estimator for β, say $\tilde{\beta}$, is obtained by maximising (10) with respect to β and setting the first order condition (FOC) equal to zero. As was shown in chapter 5, the solution is a unique local maximum. Also, the FOC was non-linear and hence solved by the Newton-Raphson interative procedure.

It should be pointed out that the specification given by (8) specifies only the marginal probability and leaves the joint probability $P(Y_{i1}, Y_{i2}, \ldots, Y_{iT})$ unspecified. One simple step to deal with this problem is to introduce some restrictions. We assume independence so that the joint probability will be given by

$$(11) \quad P(Y_{i1}, Y_{i2}, \ldots, Y_{iT}) = \Sigma\, P(Y_{iT})$$

The independence restriction implies that $P(Y_{it} = 1 | Y_{i,t-1} = 1)$ so that previous year status does not affects the status this year. This means two things: Firstly, there is no true state dependency in the sense that the present status is not affected by the past status. In other words, the probability of bank failure/problem today remains unaffected by yesterday's probability.

Secondly, there is no heterogeneity problem. This means that no serious complications with unobservable variables which could affect banks differently with respect to their likelihood of failure/problem would araise.

Given the difficulties in estimating the unrestricted version of the model for panel data with T=20 and n=21 we proceeded to estimate the restricted version of the logit model. The matrix specification of the model which is similar to the one in chapter 7 looks as follows

$$
Y_{it}=\begin{bmatrix} A_{179.1} \\ A_{179.2} \\ \vdots \\ \vdots \\ A_{n83.4} \\ B_{179.1} \\ B_{179.2} \\ \vdots \\ \vdots \\ B_{n83.4} \end{bmatrix}
\qquad
x_{it}=\begin{bmatrix}
RAT33A_{179.1}\ldots\ldots RAT63A_{179.1} & 0 \;\ldots\ldots\; 0 \\
RAT33A_{179.2}\ldots\ldots RAT63A_{179.2} & 0 \;\ldots\ldots\; 0 \\
\vdots \;\ldots\ldots\; \vdots & \vdots \;\ldots\ldots\; \vdots \\
\vdots \;\ldots\ldots\; \vdots & \vdots \;\ldots\ldots\; \vdots \\
RAT33A_{n83.4}\ldots\ldots RAT63A_{n83.4} & 0 \;\ldots\ldots\; 0 \\
0 \;\ldots\ldots\; 0 & RAT33B_{179.1}\ldots\ldots RAT63B_{179.1} \\
0 \;\ldots\ldots\; 0 & RAT63B_{179.2}\ldots\ldots RAT63B_{179.2} \\
\vdots \qquad\quad \vdots & \vdots \qquad\quad \vdots \\
\vdots \qquad\quad \vdots & \vdots \qquad\quad \vdots \\
\vdots \qquad\quad \vdots & \\
0 \qquad\quad 0 & RAT33B_{n83.4}\ldots\ldots RAT63B_{n83.4}
\end{bmatrix}
$$

where $i = 1,2,\ldots,n$
$t = 1,2,3,4,\ldots.T$

The column vector Y_{it} contains the endogeneous dichotomous variables for each bank i in a given quarter t for the ordered group A (failed/problem banks) and group B (nonfailed/nonproblem banks). The matrix x_{it} was constructed by separating the data for each group of banks A and B respectively. This procedure has enables us to assess and compare the hypothesis of excessive risk-taking for each individual group. This is in itself an important modification from the traditional literature bank failure modelling.

(8.4.2.2) Description of the Data and the Variables.

The model was estimated using quarterly panel data for the period between 1979 to 1983. Thus, the sample contained 20 quarterly observations for 27 banks. Like the model specification of chapter 6 and 7, the banks sample was divided into two groups, A1 and B1. A1 group corresponds to the problem/failure group which includes all those institutions which were liquidated, merged, capitalised, and/or allowed to sell non-performing and risky loans to the Central Bank during 1982-83. Group B1 includes non-problem/non-failed banks, among them Banco de Estado and Banco Industrial y de Comercio (BICE). As we have seen in chapter 3 both institutions were the only two domestic banks which remained financially healthy. In order to enlarge the B1 group, foreign banks were also included as they remained sound and as we saw in chapter 2 were subject to a similar legislation as domestic banks. Thus, A1 and B1 contain 16 and 11 banks respectively as they are listed in table 3.

Table 8.3 Bank List of A1 and B1.

A1		B1	
Banks	Code	Banks	Code
Chile*	001	Osorno	010
O'Higgins**	008	Estado***	012
Internacional*	009	Do Brasil	017
Continental**	011	BICE	028
Sudamericano**	014	Republic Nat. N.Y.	031
Credito**	016	Of America	032
Trabajo**	022	Citybank	033
Pacifico**	025	Real	034
Nacional**	026	Sao Paulo	036
Concepcion*	027	Santander	037
Edwards**	029	Exterior	038
Santiago*	035		
Unido Fomento*	502		
Hipotecario Fomento*	504		
Hipotecario Chile*	505		
Colocadora Nacional*	506		

Source: SIBF, Informacion Financiera, Various Issues.

* Failed Banks (liquidated,intervined,or merged)
** Problem Banks (allowed to sell nonperforming and risky loans)
*** State Bank

This sample excluded two sets of financial institutions which may appear relevant for this study. The first one corresponds to banks which failed during 1981 among them Español (002), Talca (006), Austral (024), and Linares (030). The second group correspond to non-bank financial institutions (financieras) which were left out all together, including those which failed during 1981 among them Cash (705), General Financiera (715), De Capitales (725), and Del Sur (713). Their exclusion was justified, as demostrated in chapter 3, as a result of their relatively small size. In addition, as a general principle, I have included all those financial institutions which had 16 or more consecutive quarterly observations. This was necessary for comparison purposes between the periods of 1979-81 (booming macroeconomy) and 1982-83 (economic debacle).

It should be pointed out that in group A1, banks Pacifico, Unido de Fomento, Hipotecario Chile, and Colocadora Nacional de Valores have missing observations in 1979(Q3), 1979(Q3), 1983(Q4), and 1979(Q1) respectively. In group B1, banks BICE, Republic, Santander, and Exterior also presented missing observations in 79(Q3), 79(Q2), 79(Q1), and 79(Q1) respectively. In consequence, the panel data of 20 quarters and 27 banks gives an adjusted total number of 521 observations which represent a sufficiently large statistical sample to draw logistic inferences.

As argued in chapter 6, it would have been desirable to have had a controlled sample, particularly by size, number of branches, and age. However, data limitations and the small size of the Chilean banking system ruled out this possibility.

With reference to the dependent variable (regressand) of the model, I have specified the dependent variable as dichotomous where it takes the value of 1 if the bank has been listed as failed/problem and 0 otherwise. It is assumed that in each year a financial institution either failed/problem or did not failed/problem. However, a list of quarterly classification of banks`s soundness was not available from the Superintendency of Banks (SIBF) nor an annual classification prior 1983. Instead, I was forced to rely on the predicted values estimated from quarterly bank failure predicting model presented in chapter 5. As we saw from there, the overall prediction accuracy evaluated at 0.5 cut-off point was judged as extremely good at different lead time.

With respect to the explanatory variables (regressors), I have selected a set of financial ratios estimated from banks' balance-sheet as proxies for changes in risk-taking by banks' managers. Like Short, O'Driscoll, and Berger (1985), the model used as regressors those ratios controlled by managers among them loans/asset ratio which serves as proxy for asset quality.[5] Indeed, loans are the riskiest assets for banks to hold so that the higher the loans/asset ratio the greater the risk exposure. Also, the study included profits/total assets, nonperforming loans/capital, and nonperforming loans/total loans as additional indicators of asset quality.

Also, there is a measure of capital adequacy which indicates the capacity of a bank to respond to asset losses. The capital/asset ratio and the provision/asset ratio are considered as two proxies for the banks' ability to absorb these losses. The expected sign of both ratios should be negative as increases in capital and provision relative to asset holding should lower the probability of failure. It should be said that these proxies are not entirely under the managerial control, but there is direct involvement by the banking authorities as part of their regulatory framework.

The risk associated with an unexpected outflow of deposit is captured by the deposit/liabilities ratio. The larger demand (sight) deposits and passbook savings relative to total liabilities, the higher banks' vulnerability to withdrawals. However, this ratio can also be interpreted as the cost of banks' indebtness. It is shown in the literature that the higher is the proportion of deposits (low cost) the lower is the probability of bank failure. Therefore, the interpretation of this ratio is ambiguous and hence treated with caution.

Finally, the model includes a measure of the asset and liability growth as proxy for banks' risk-taking. Indeed, in a regime of unregulated and stubbornly high deposit and lending interest rates high growth rates of assets (loans) and liabilities (deposits) rises the likelihood of bank failure.

It should be stressed that the ratios as proxies of banks' risk-taking (moral hazard) are expressed as the deviation from its own trend. They perform better in testing moral hazard than the financial ratios per se. The trend was estimated by regressing each monthly selected proxy for the ith bank against time. Its fitted value was applied to obtain the deviation from the its trend.

(8.4.3) Econometric Results and its Interpretation.

The first step in assessing the role of moral hazard in the Chilean banking system is to compare the arithmetic mean of selected financial ratios between the group of failed/problem banks (F) and nonfailed/nonproblem banks (NF) over the four-year period. The financial ratios are expressed as the deviation from its own trend for each financial institution and the group mean was estimated with monthly observations for each bank.

If moral hazard characterised the banking system, then failed/problem banks would have exhibited a riskier management than nonfailed/problem banks. A riskier bank management should be reflected in the quality of bank assets, capital and reserves adequacy, and bank leverage.

With respect to the quality of bank loans, we should expect a priori that the deviation from the trend for total loans/total assets ratio (TL/TA) and the nonperforming loans/capital (NPL/K) and nonperforming loans/total loans (NPL/TL) ratios of failed/problem banks should be larger than those of nonfailed/nonproblem banks. These results are reported in tables 4a and 4b.

For instance, the mean of nonperforming loans/capital mean ratio indicates sharp differences between the two groups particularly in 1980, 1981 and to a lesser extent in

1982. In 1981 and 1982 the difference between the mean ratios of the two groups (F-NF) is 0.8368 and 0.7182 respectively.

Table 8.4a Sample Mean for Failed/Problem and Nonfailed Nonproblem Banks for the Period 1979-1981.

	1979		1980		1981		Average 79-80	
	F	NF	F	NF	F	NF	F	NF
Pr/TA	.001	-.005	.001	-.005	.008	.006	.003	-.001
TL/TA	-.005	.046	.016	.034	.065	.104	.025	.061
NPL/K	-1.001	-.094	1.202	.365	1.154	.436	.451	.235
NPL/TL	-.018	.007	.014	-.015	-.026	-.013	-.010	-.007
Prv/TL	.017	.014	-.020	-.117	-.058	-.030	-.020	-.044
Dep/TL	-.017	.022	-.002	-.008	.100	.011	.027	.008
LACTOT	.088	.369	.253	.246	.305	.020	.215	.211
LPASCIR	.087	.394	.239	.255	.373	.080	.233	.243

Source: SIBF, Informacion Financiera, Various Issues.

Similarly, the evidence from the growth of bank assets and liabilities also confirms a propensity by failed/problem banks to undertake more risk than safe banks. For instance, the trend deviation of banks' assets for the former group not only widened during the period 1979-82 but also it was larger than the nonfailed/problem bank group. The average mean deviation for F-group and the NF-group for the whole period was 0.27 and 0.147 respectively. The same conclusions are drawn from the data on bank liabilities.

The provision/total loans ratio was included as measure of banks' capacity to respond to losses from banks assets.

The lower the ratio, the smaller the decline in asset values necessary to make a bank insolvent. The evidence does not indicate a marked difference between the means of these two groups. At the same time, the deviation from the trend is negative in almost every year which suggest a more risky stance by all financial institutions. However, this ratio is not solely the managers' choice but influenced by regulatory standards concerning capital and reserves requirements. In consequence, its meaning and interpretation should be treated with caution.

Table 8.4b Sample Mean for Failed/Problem and Nonfailed Nonproblem Banks for the Period 1982-83.

	1982		1983		Average 82-83	
	F	NF	F	NF	F	NF
Pr/TA	.007	.011	-.008	-.001	-.0005	.005
TL/TA	.032	.0002	-.175	-.183	-.071	-.091
NPL/K	-1.027	.113	-3.461	-1.832	-2.244	-.859
NPL/TL	-0.011	-.015	-.001	.066	-.006	.025
Prv/TL	.097	-.150	.108	.532	.102	.191
Dep/TL	-.091	-.169	-.065	-.053	-.078	-.111
LACTOT	.438	-.044	-.429	-.230	.005	-.137
LPASCIR	.426	-.040	-.468	.309	-.021	.134

Source: SIBF, Informacion Financiera, Various Issues.

Finally, the remaining ratio captures the banks' vulnerability to deposit withdrawals. One should expect the total deposits/total liabilities ratio to be lower for failed/problem banks. However, the data indicate the opposite result, with the exception of 1979. This ambiguity can be explained by the fact that sight deposits represent a cheaper source of liabilities. Therefore, a lower ratio implies a lower probability of failure.

Further evidence from selected individual banks of both groups are plotted in order to assess excessive risk-taking (moral hazard) for the period between 1979 and 1983. Among the group of failed/problem banks, Banco Chile, Banco Santiago, Banco Internacional, and Banco Concepcion were selected among 16 financial institutions classified in this category. With respect to the sample of nonproblem/nonfailed banks, Banco del Estado, Banco BICE, Banco Real, and Banco Sao Paulo were chosen from the list of 11 institutions for comparison purposes. As we have learned from chapter 3, Banco del Estado (the only remaining state bank after financial reforms) and Banco BICE were the only two domestic commercial banks which did not sell bad loans to the Central Bank. Also, Banco Real and Banco Sao Paulo were listed with the group of foreign banks operating in the Chilean banking system.

With reference to the banks' asset quality, the charts which plot the deviation and the trend of the total loans/total assets ratio shows that failed/problem banks exhibited an upward trend over the whole period and a large deviation of the ratio over its own trend, particularly between 1981 and the middle of 1983. For instance, the monthly ratio and its estimated trend plotted for 1979 to 1983 for Banco Chile, Banco Internacional, Banco Concepcion and Banco Santiago shows an upward trend indicating a greater exposure to credit risks. As was argued earlier, the trend should capture the influence of the overall economy and both technological and regulatory changes. However, the total loans/total assets ratio's deviation was largely positive indicating an over-exposure to credit risks. This is particularly the case during 1982 and part of 1983 during which the economy's output collapsed.

In contrast, nonfailed/nonproblem banks show a more steady upward trend especially Banco del Estado, and Banco Sao Paulo. Moreover, there are cases where the ratio trends downward as is the case of Banco Real. This evidence may suggest a more conservative banks' attitude to a buoyant macroeconomy. Although the ratio is above the trend and hence indicating some degree of over-exposure, the deviation began to fall rapidly during the beginning of 1982, period which witnessed the collapse of the economy's output.

Similar conclusions about loans quality can be drawn from other proxies. Particularly interesting is the comparision of the persistent positive deviation of nonperforming loans/capital ratio of failed banks (Banco Chile, Banco Internacional, and Banco Concepcion) in comparison to Banco del Estado and BICE which exhibit a smooth deviation. As it was seen in chapter 3, these two institutions did not sell bad loans to the Central Bank and thus suggesting a more conservative attitude towards the quality (riskiness) of their assets. Also noticeable is the significant fall in the ratio for the failed/problem banks towards the end of 1982 explained by the rescue package enacted by the monetary authorities. As it was explained at length in chapter 3, this included the possibility of selling nonperforming loans to the Central Bank and the capitalisation of these troubled institutions.

Figure 8.2a Banco Chile: Total Loan/Total Asset Ratio

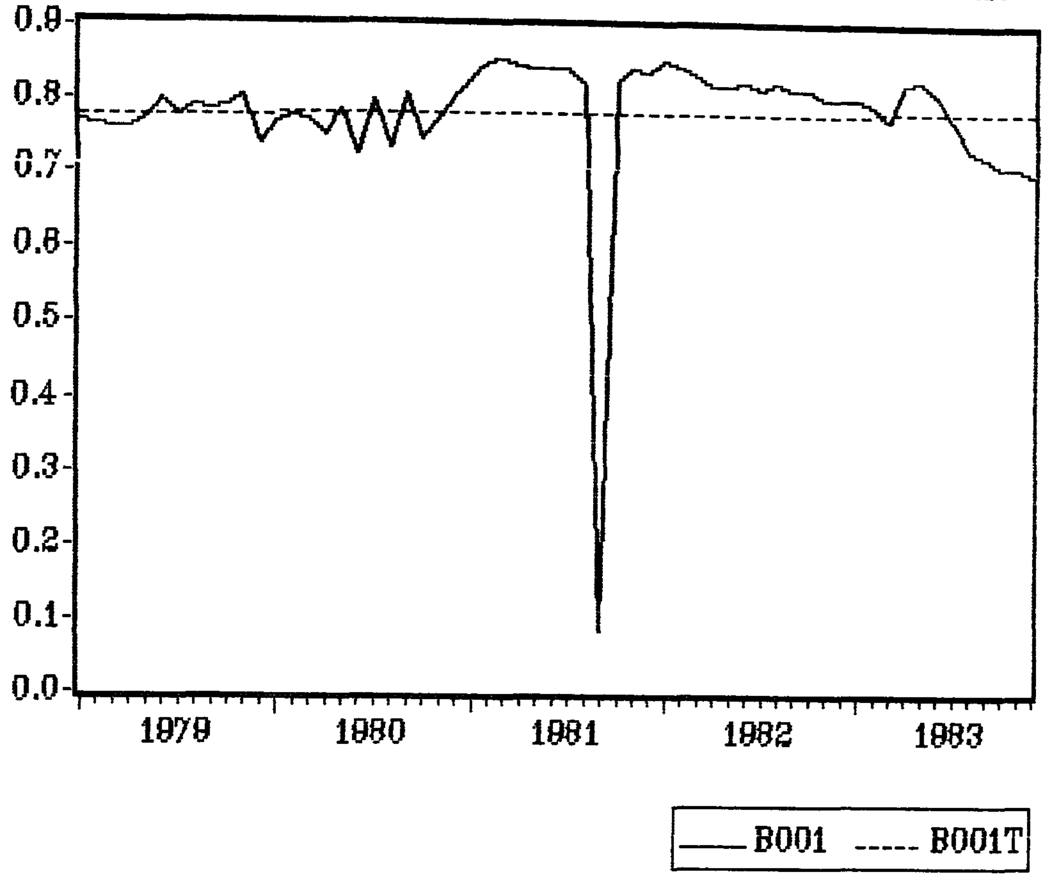


Figure 8.2b Banco Santiago: Total Loan/Total Asset Ratio

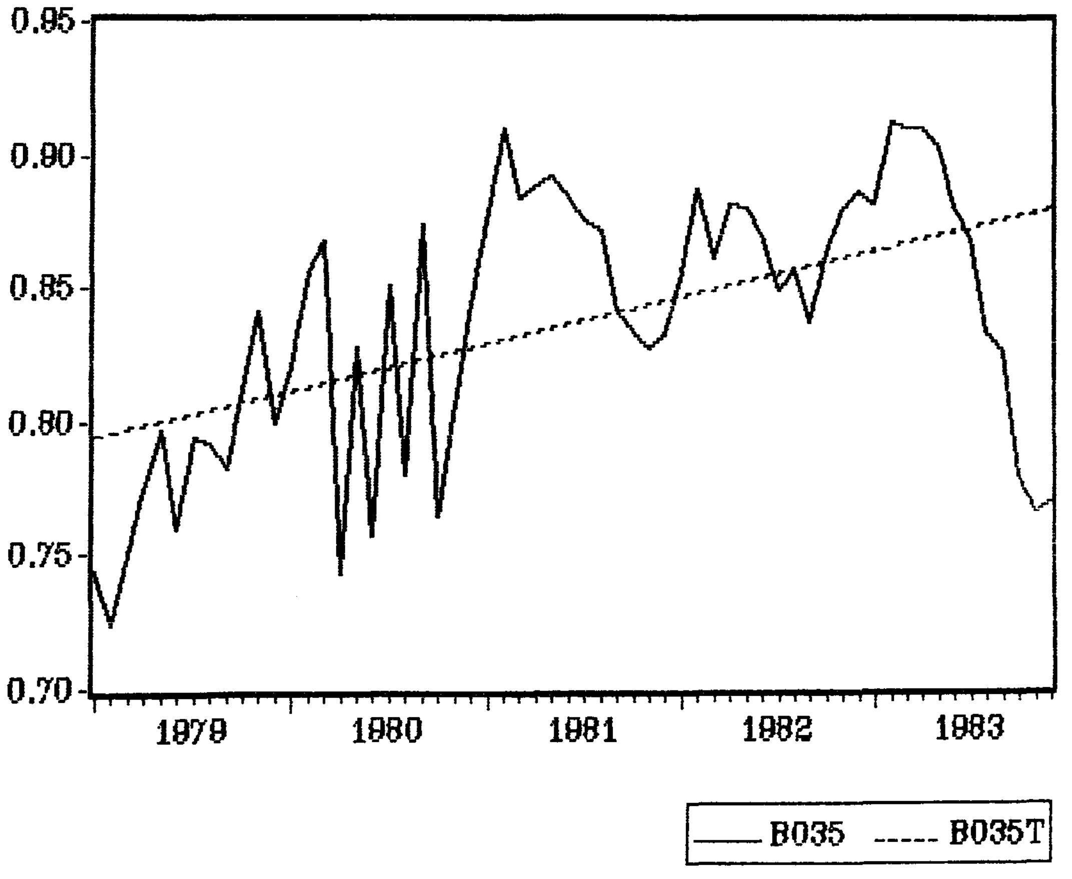


Figure 8.2c Banco Internacional: Total Loan/Total Asset Ratio

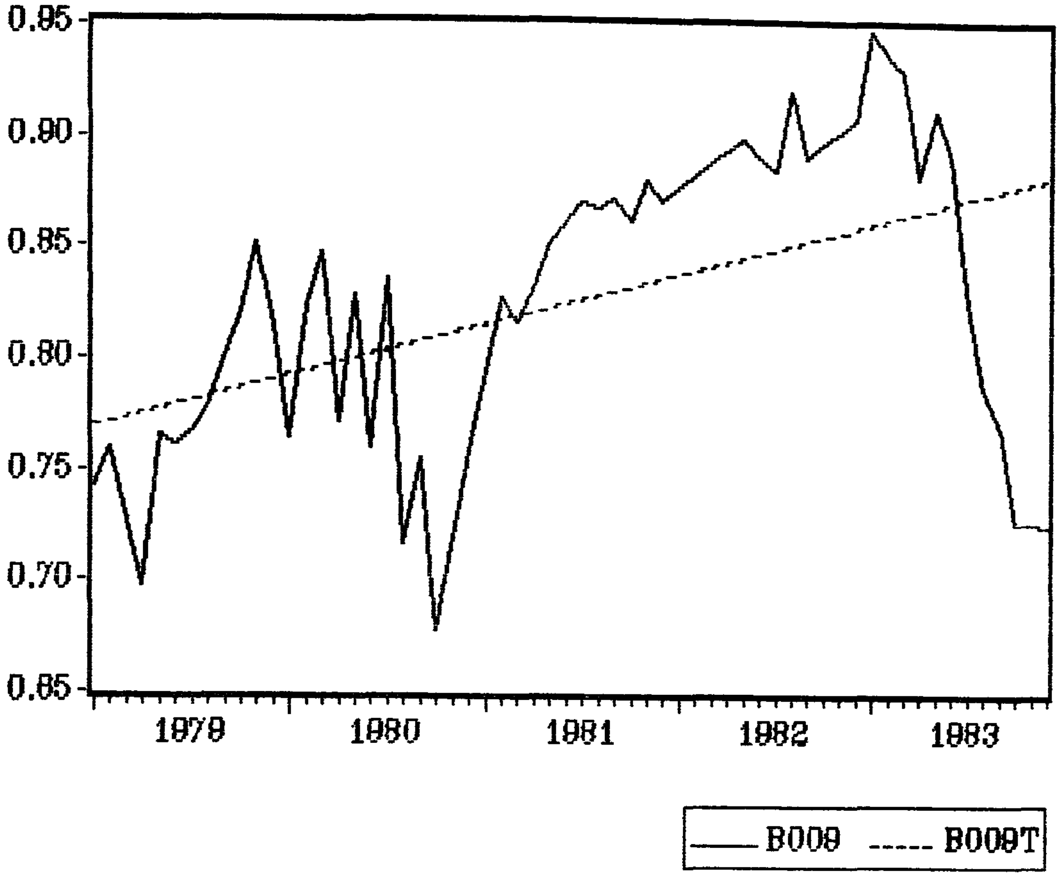


Figure 8.2d Banco Concepcion: Total Loan/Total Asset Ratio

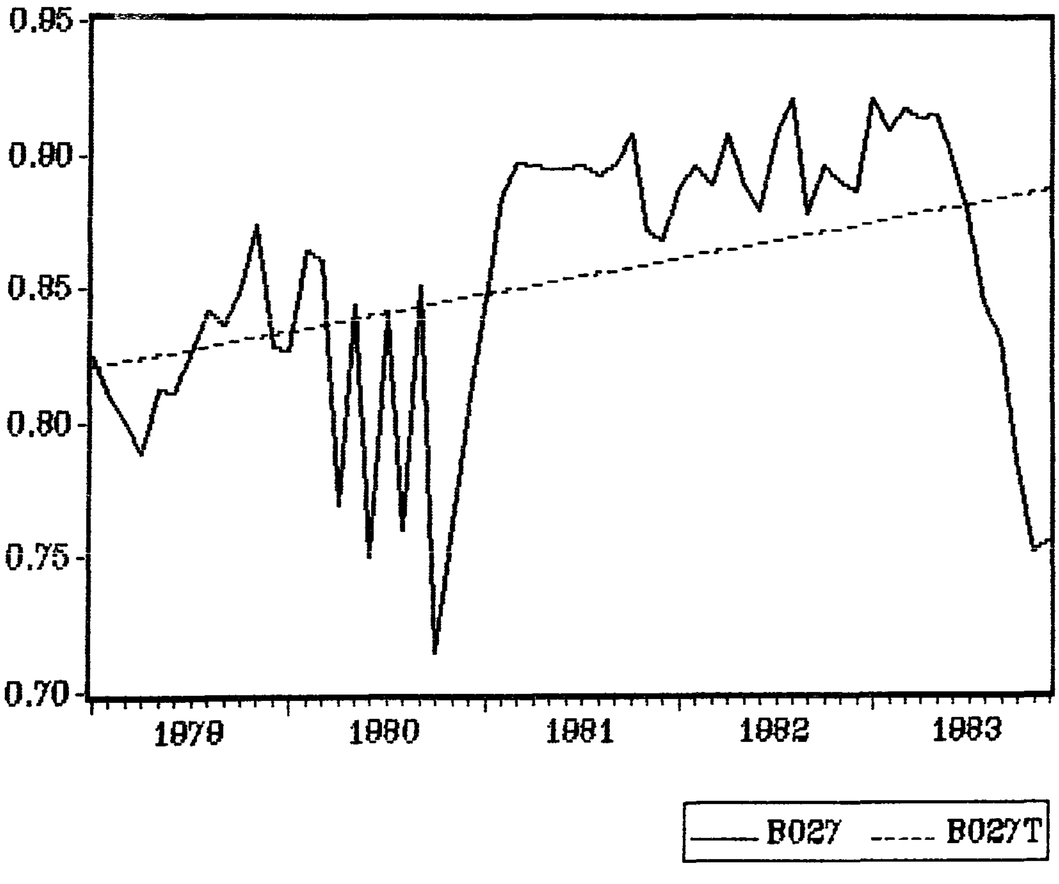


Figure 8.3a Banco del Estado: Total Loan/Total Asset Ratio

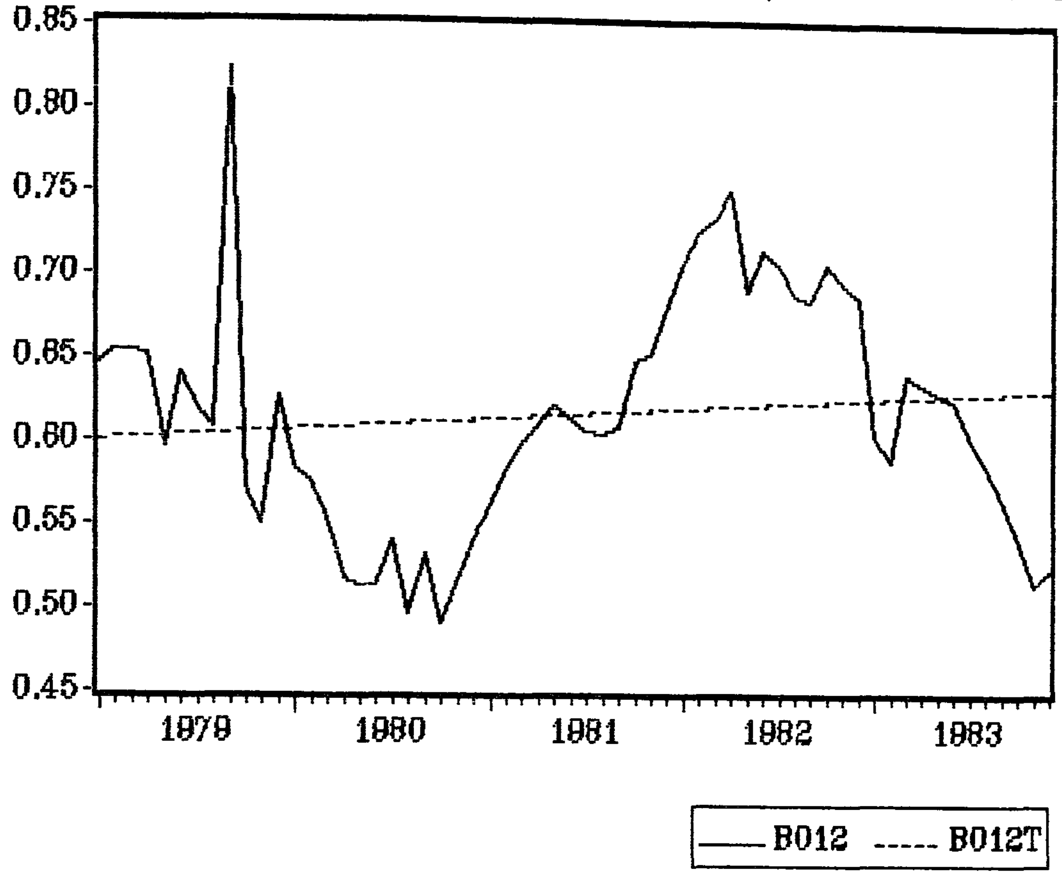


Figure 8.3b Banco BICE: Total Loan/Total Asset Ratio

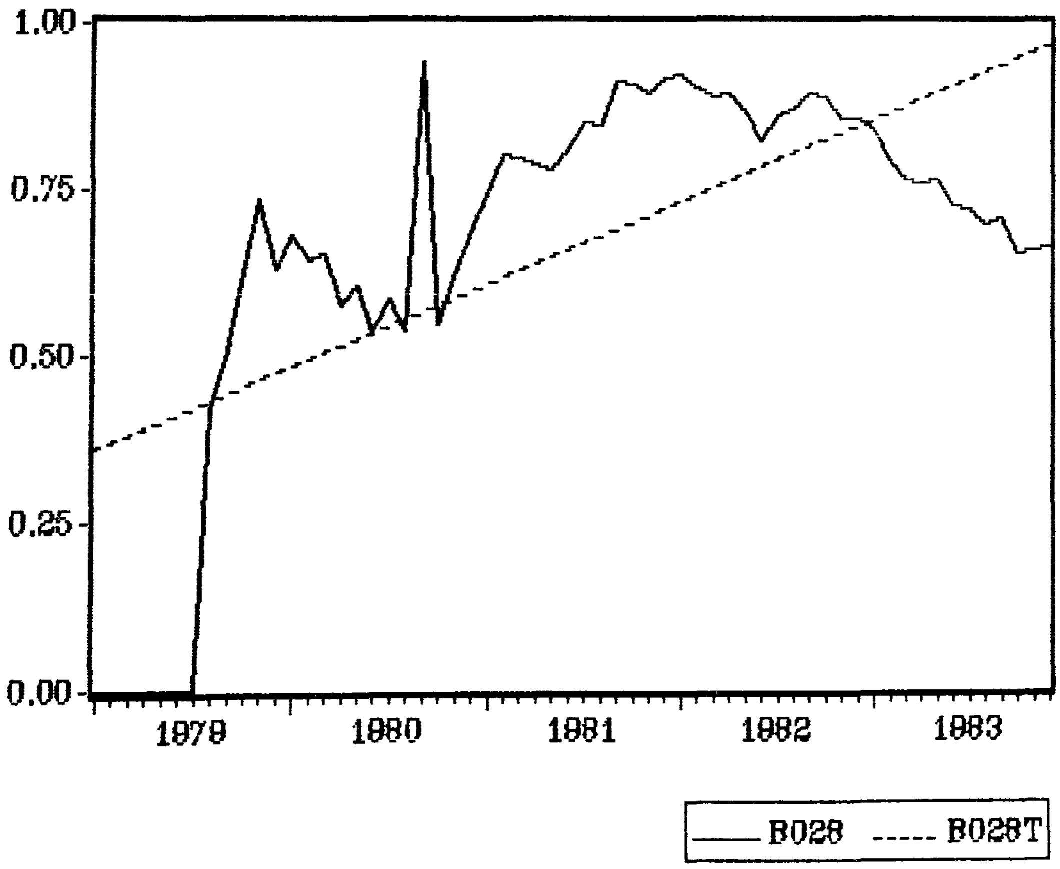


Figure 8.3c Banco Real: Total Loan/Total Asset Ratio

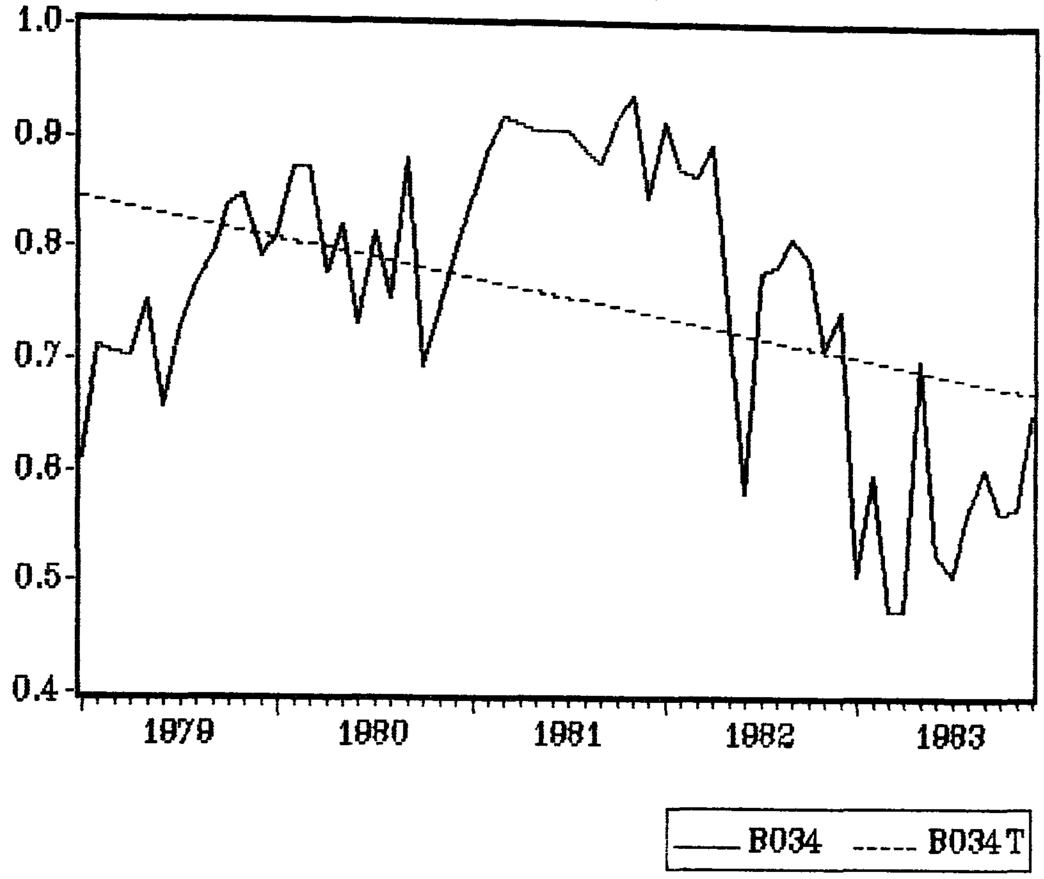


Figure 8.3d Banco de Sao Paulo: Total Loan/Total Asset Ratio

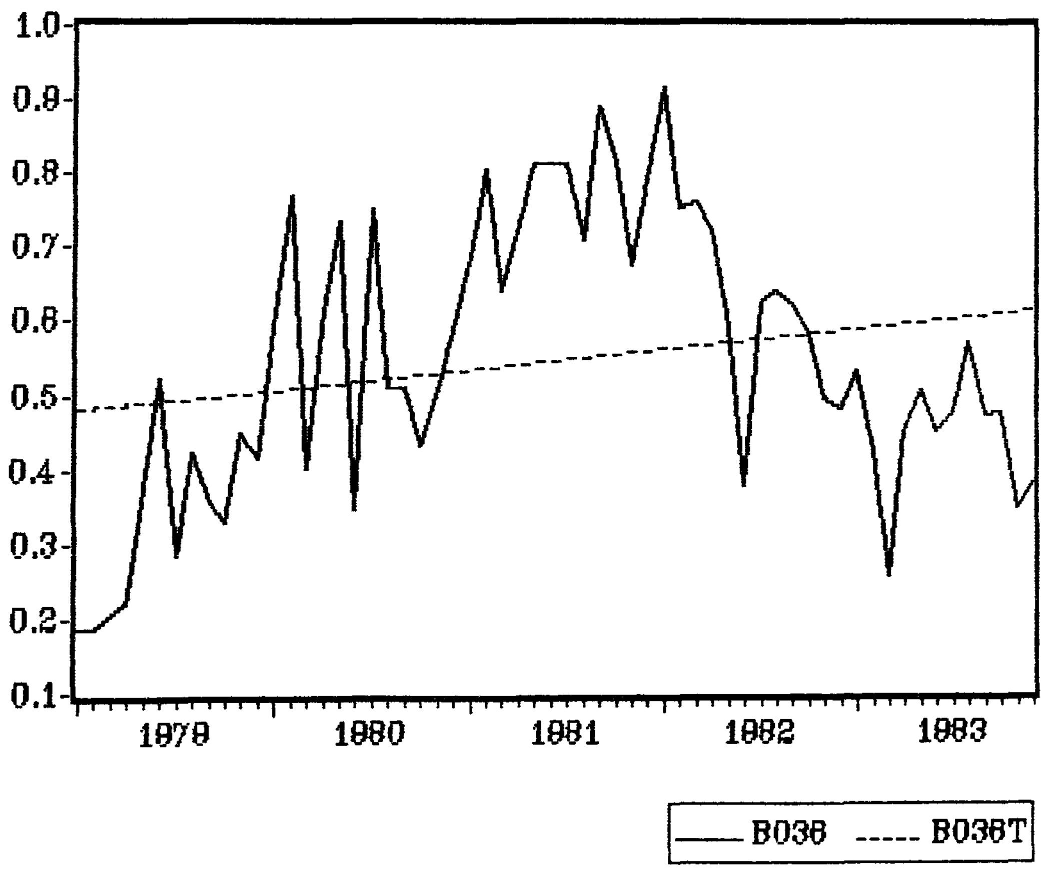


Figure 8.4a Banco Chile: NP Loans/Capital Ratio

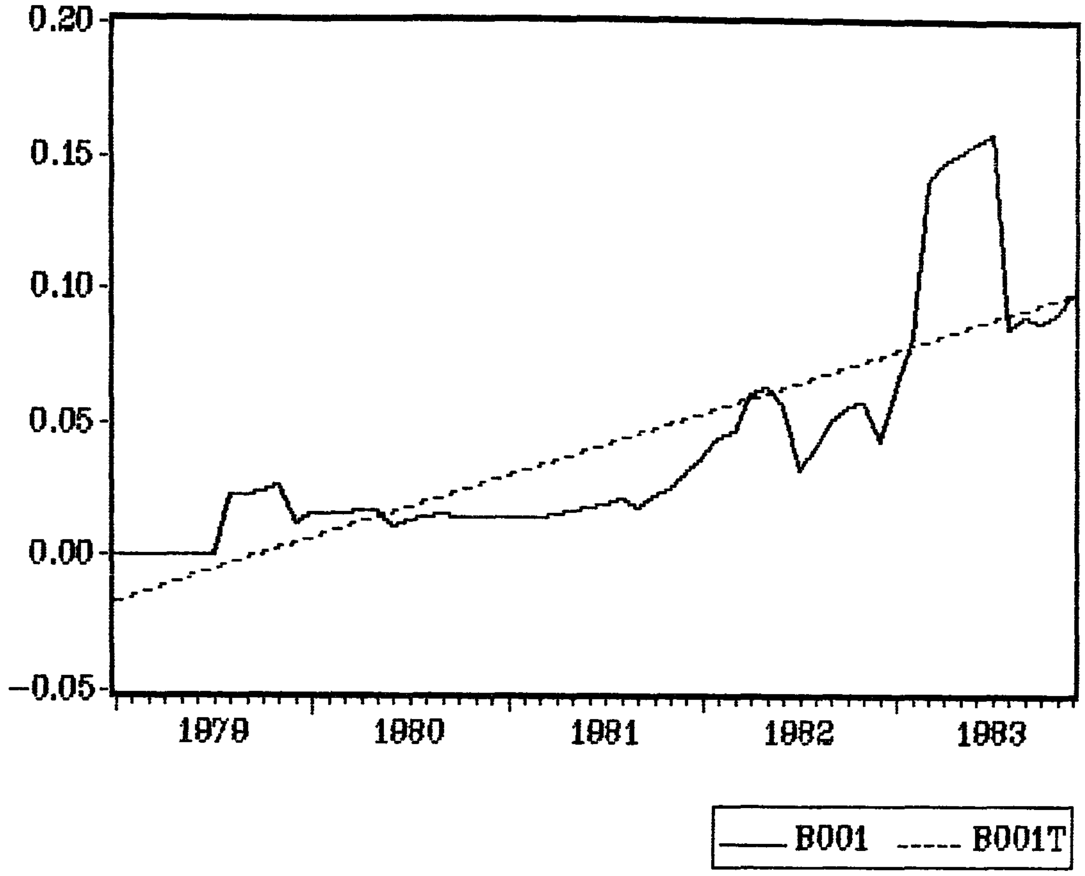


Figure 8.4b Banco Santiago: NP Loans/Capital Ratio

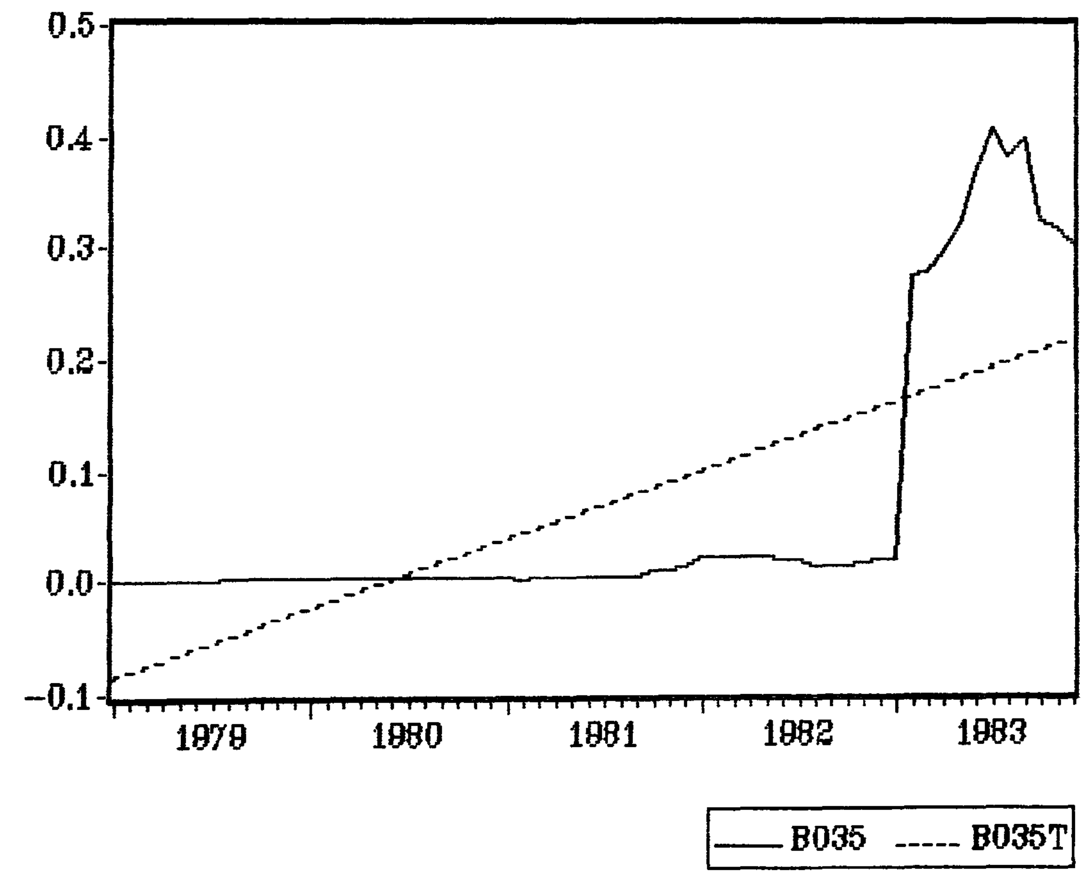


Figure 8.4c Banco Internacional: NP Loans/Capital Ratio

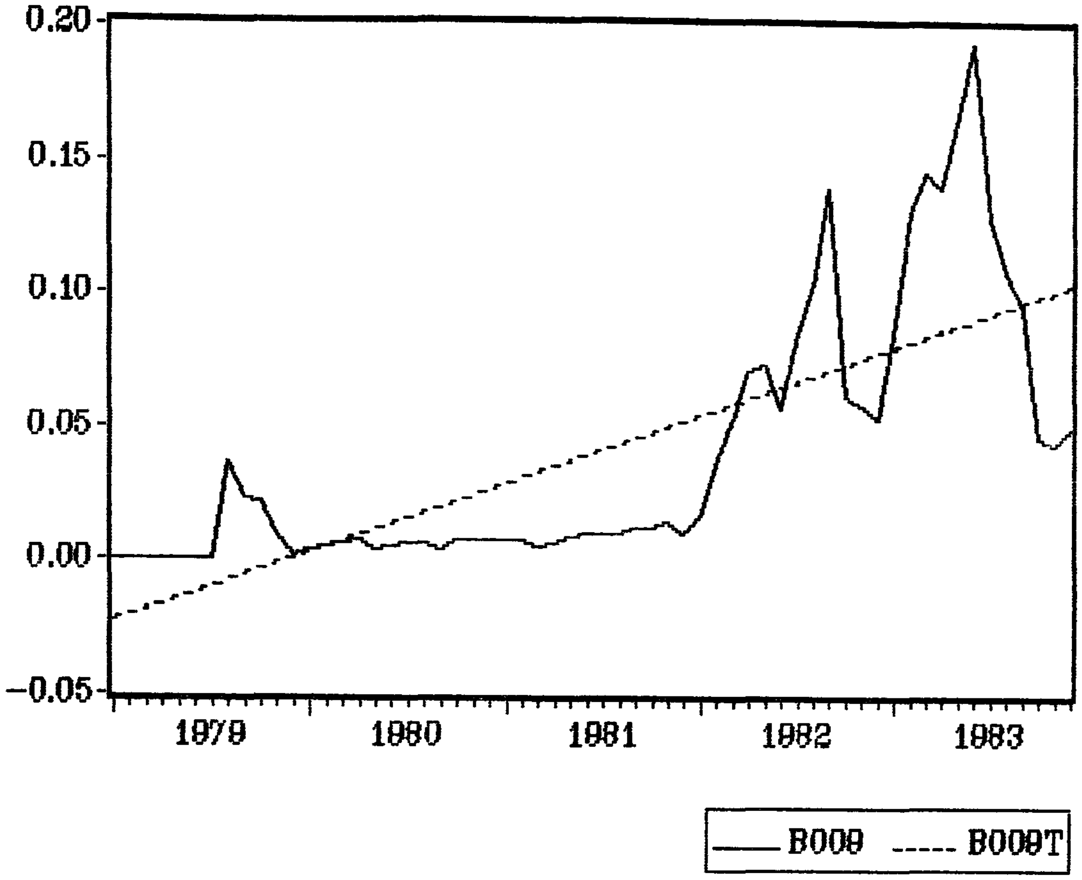


Figure 8.4d Banco Concepcion: NP Loans/Capital Ratio

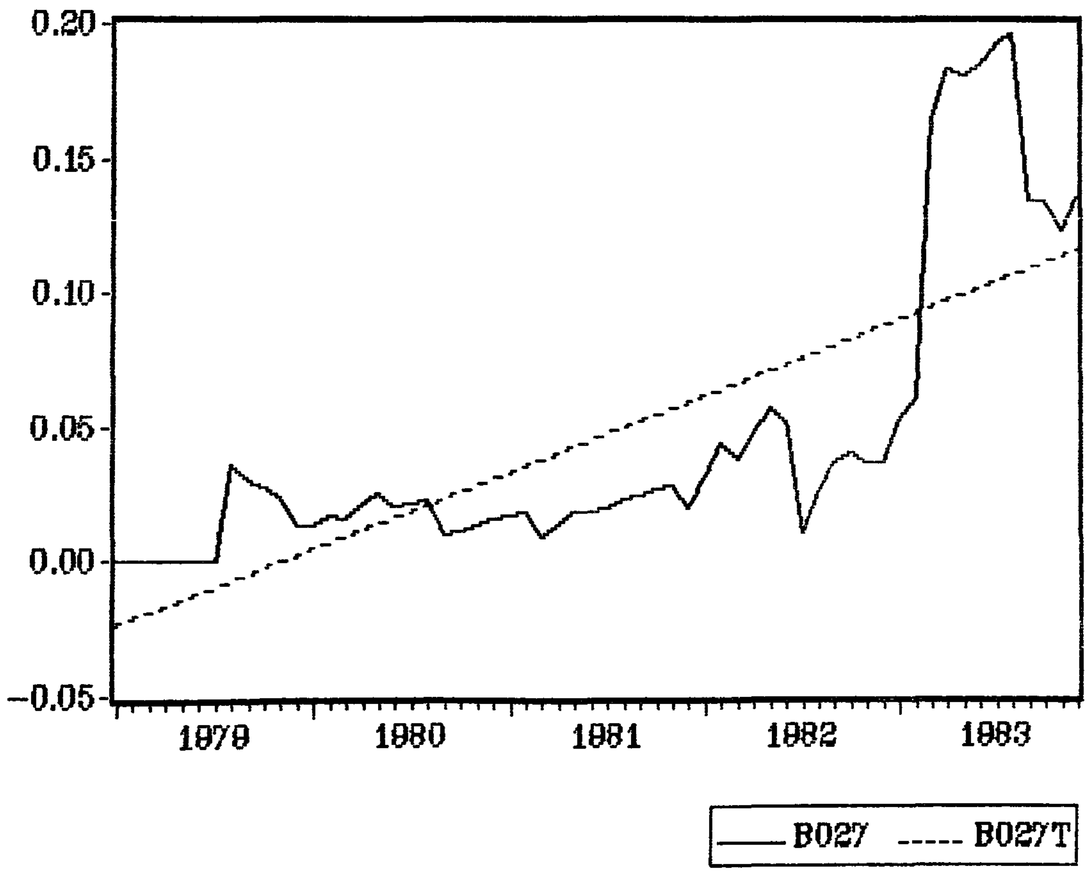


Figure 8.5a Banco del Estado: NP Loans/Capital Ratio

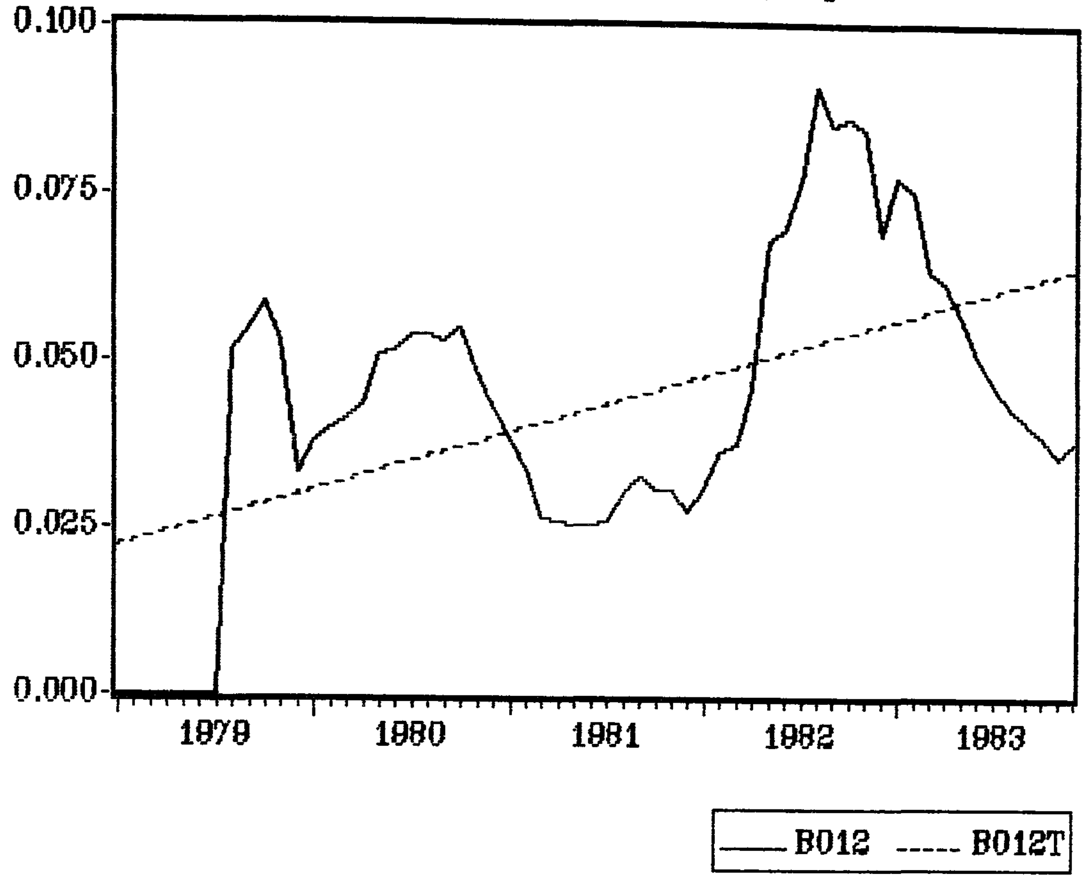


Figure 8.5b Banco BICE: NP Loans/Capital Ratio

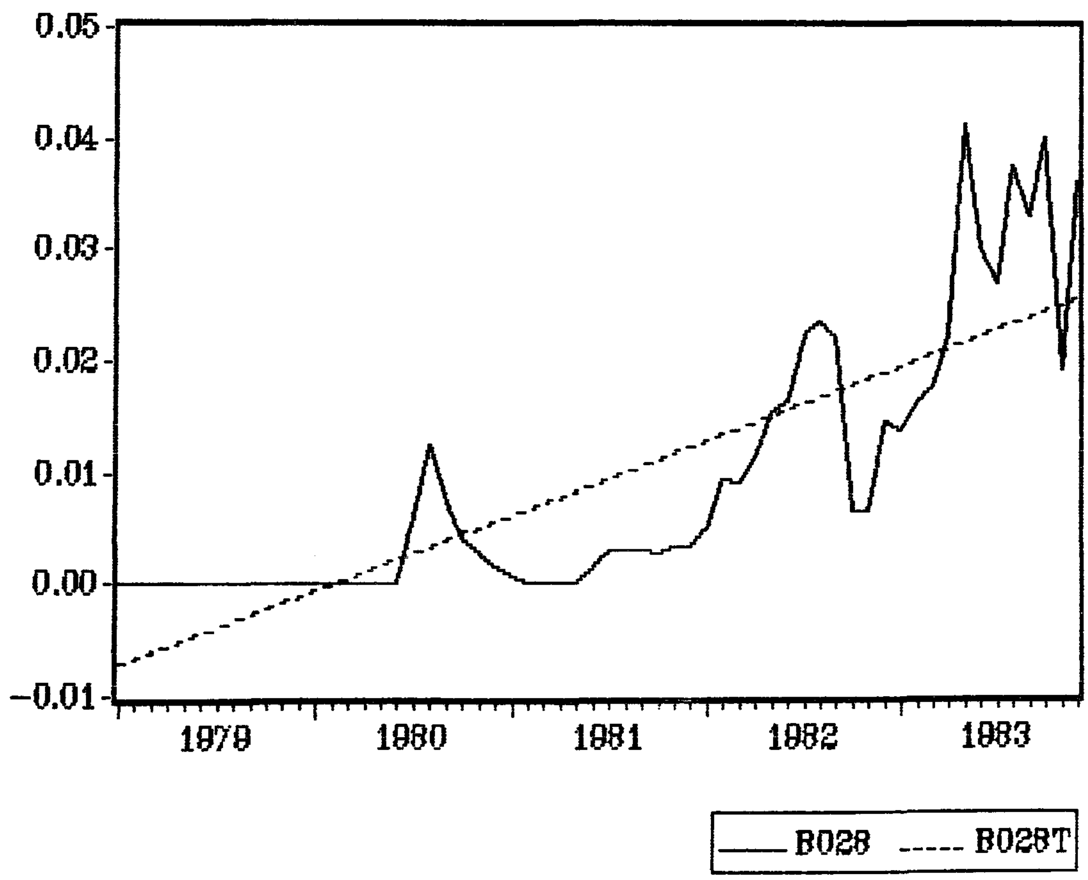


Figure 8.5c   Banco Real: NP Loans/Capital Ratio

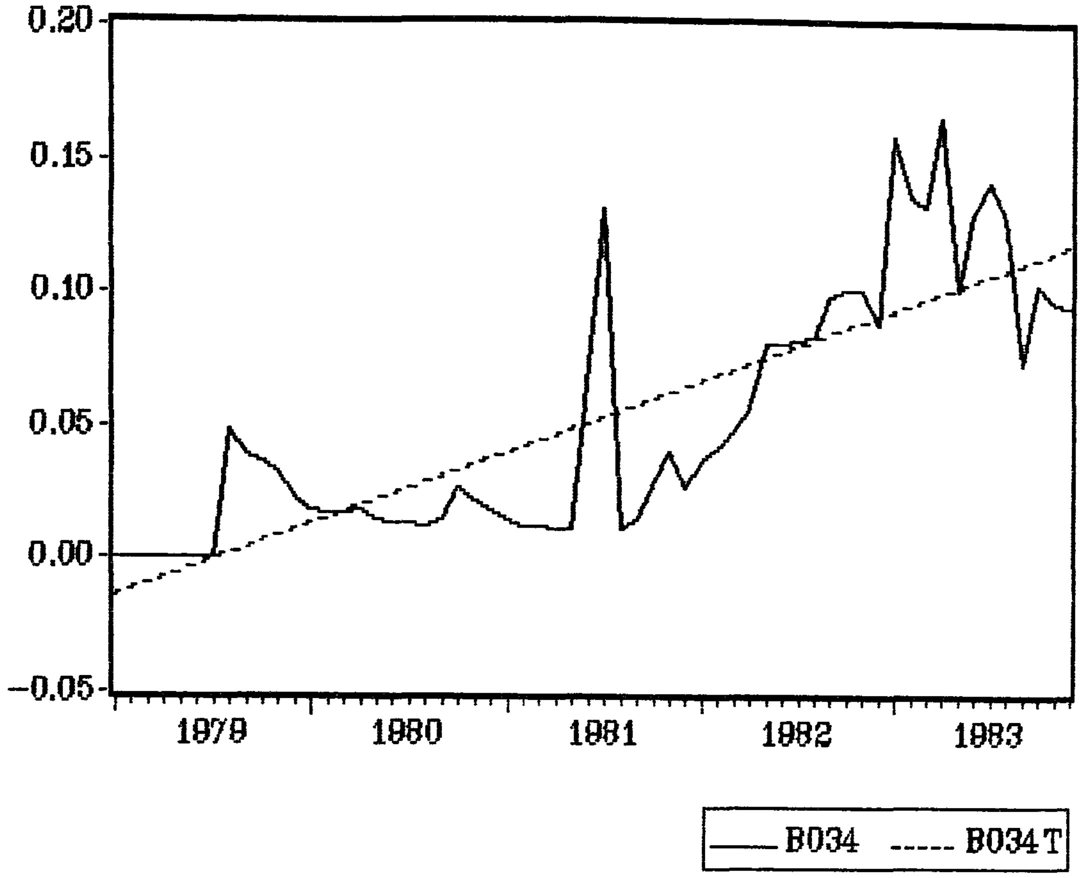


Figure 8.5d   Banco de Sao Paulo: NP Loans/Capital Ratio

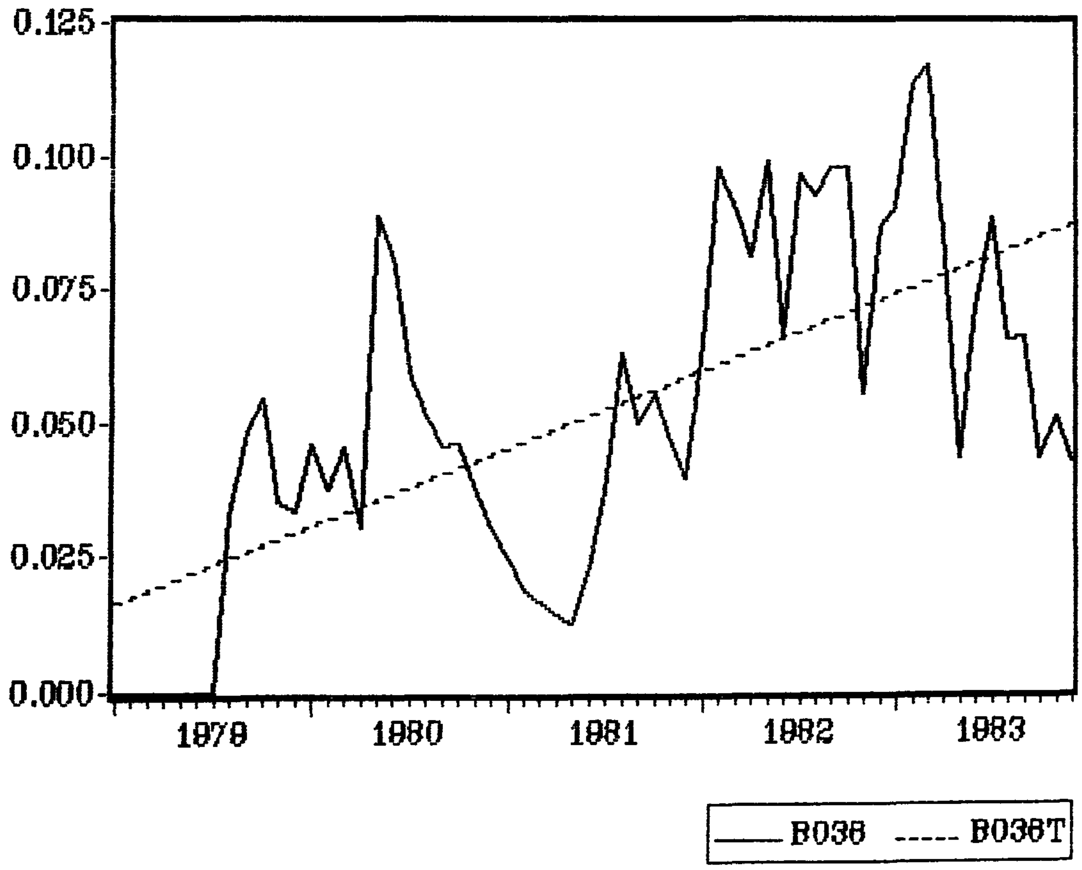


Figure 8.6a Banco Chile: Profits/Total Asset Ratio

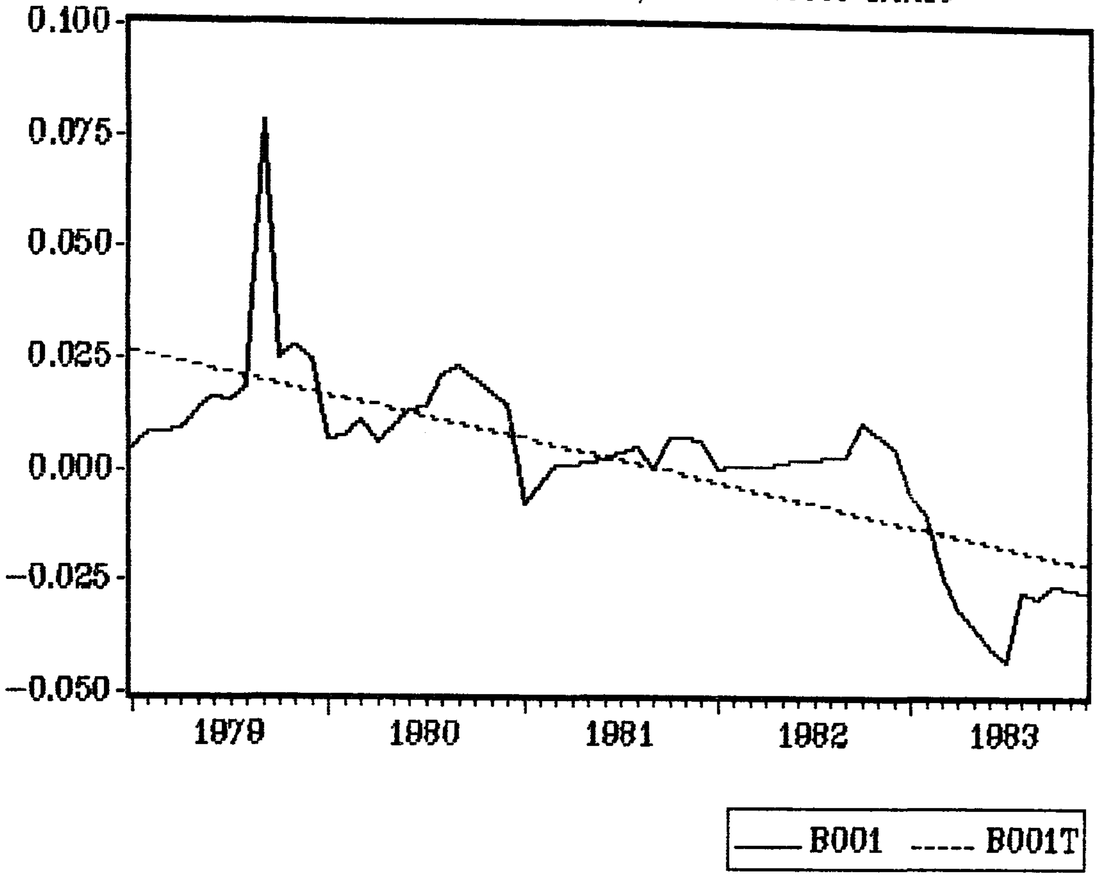


Figure 8.6b Banco Santiago: Profits/Total Asset Ratio

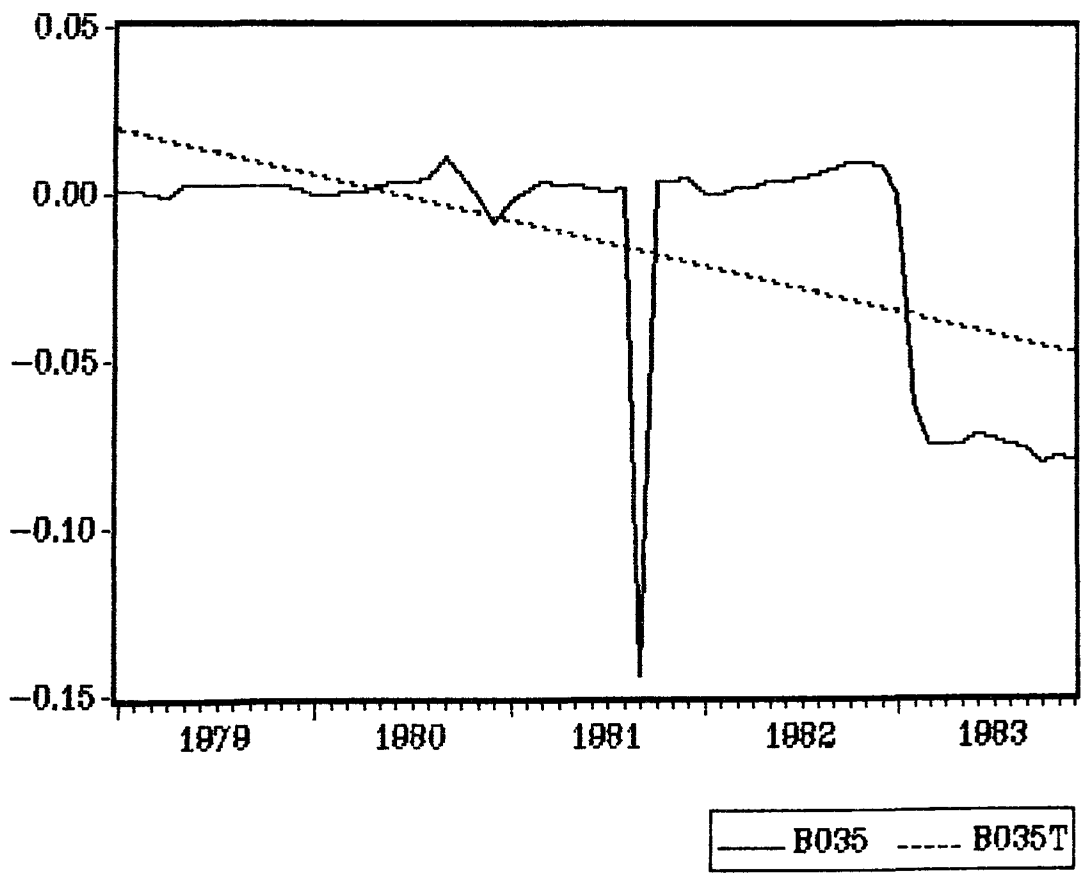


Figure 8.8c Banco Internacional: Profits/Total Assets Ratio

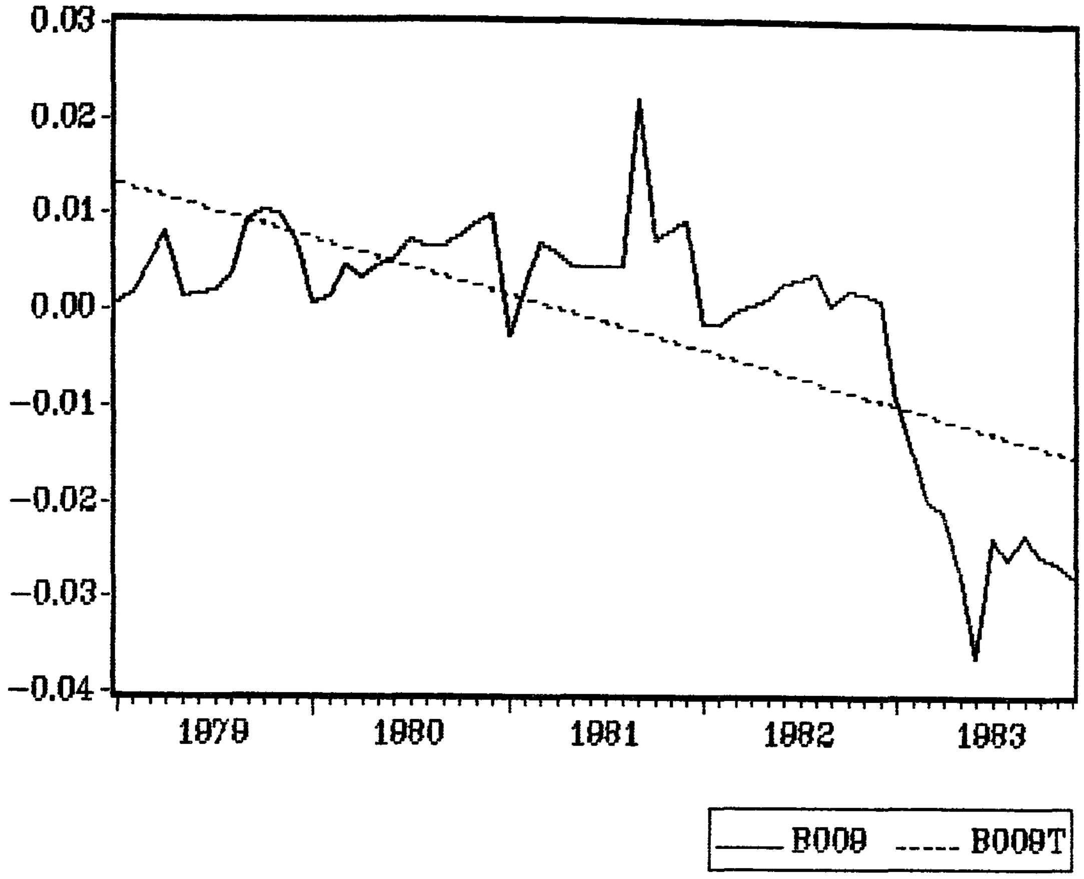


Figure 8.8d Banco Concepcion: Profits/Total Asset Ratio

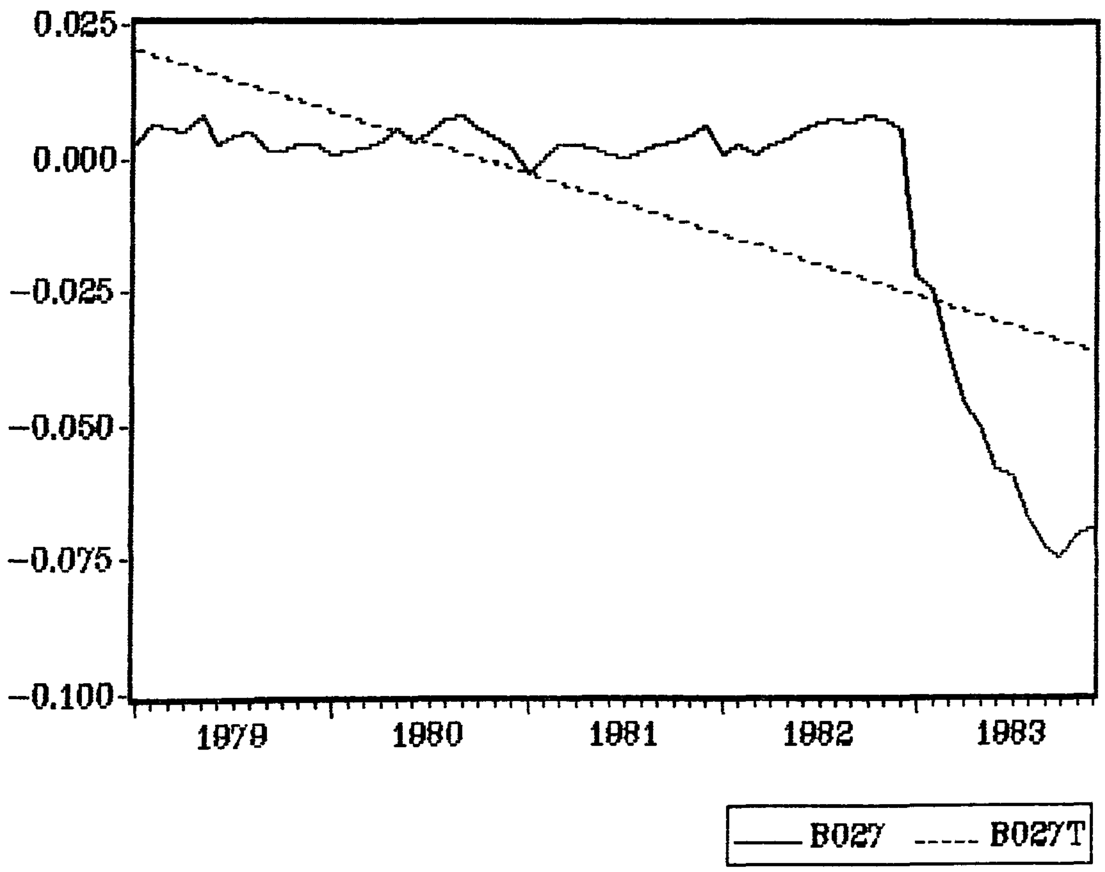


Figure 8.7a Banco del Estado: Profits/Total Asset Ratio

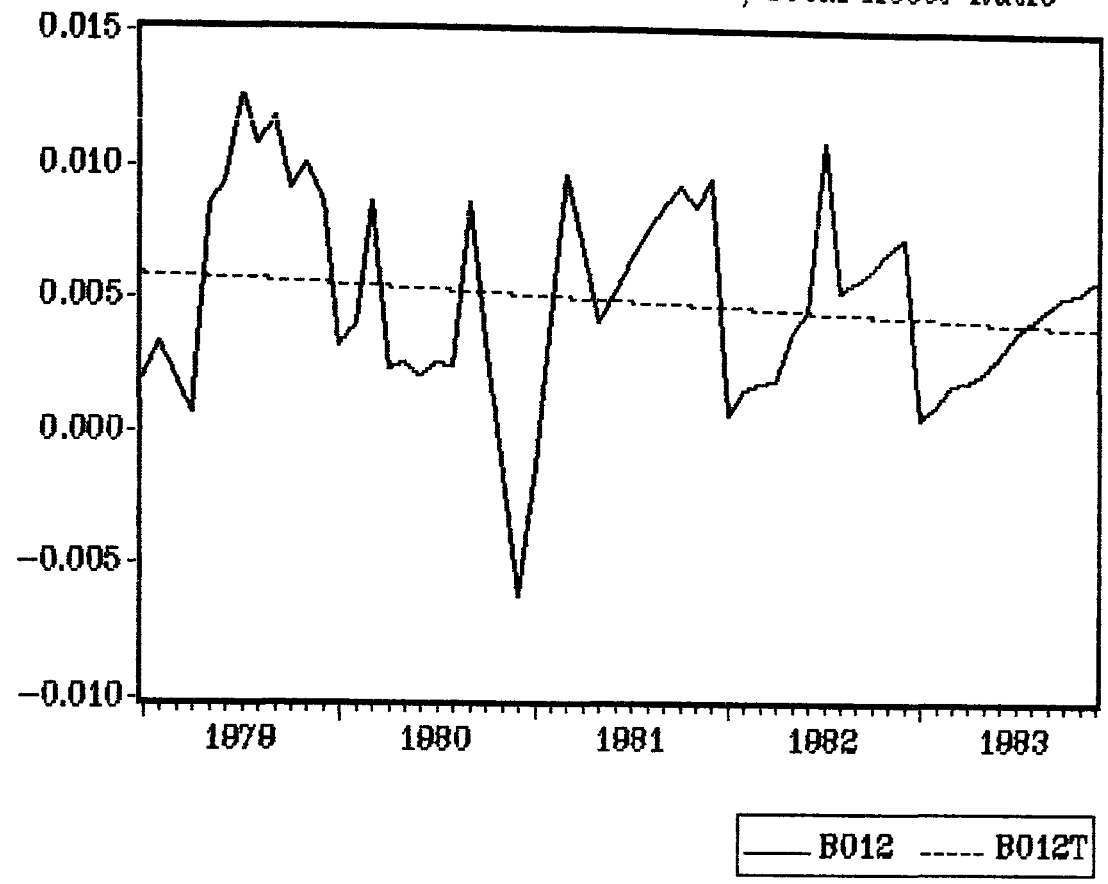


Figure 8.7b Banco BICE: Profits/Total Asset Ratio

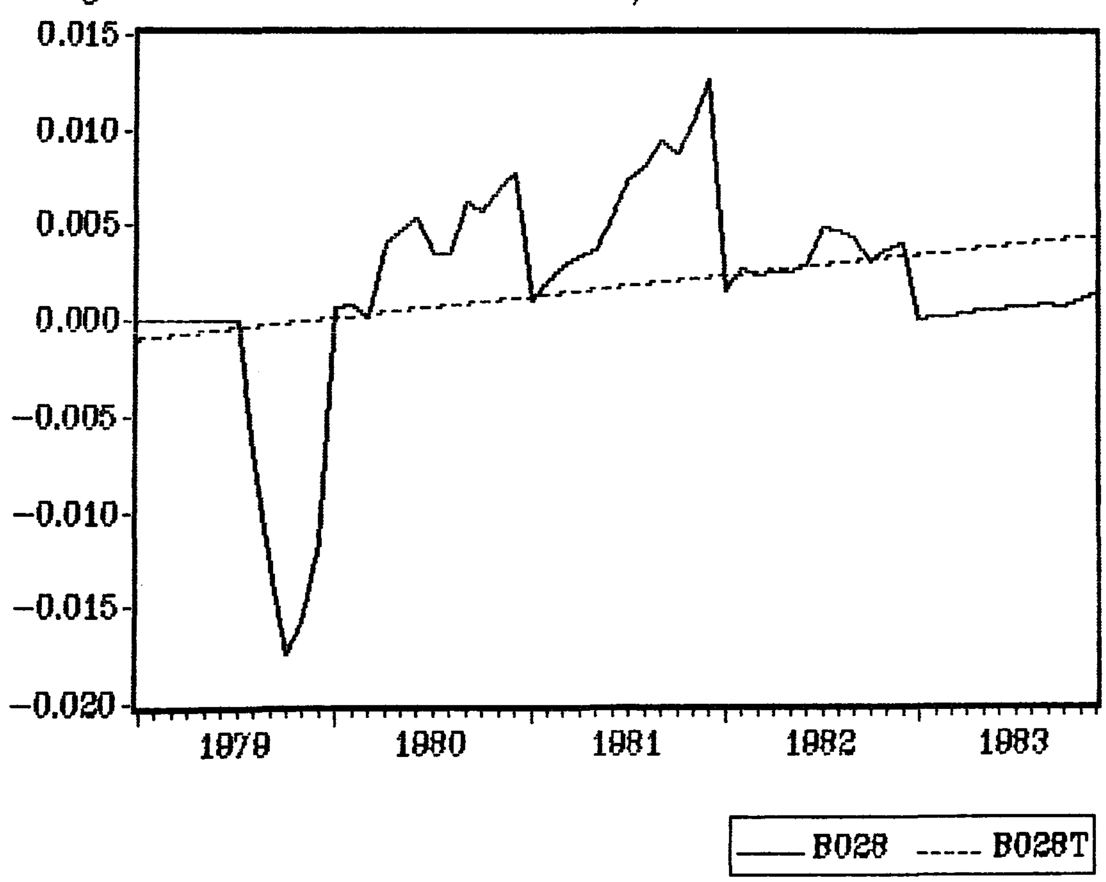


Figure 8.7c Banco Real: Profits/Total Asset Ratio

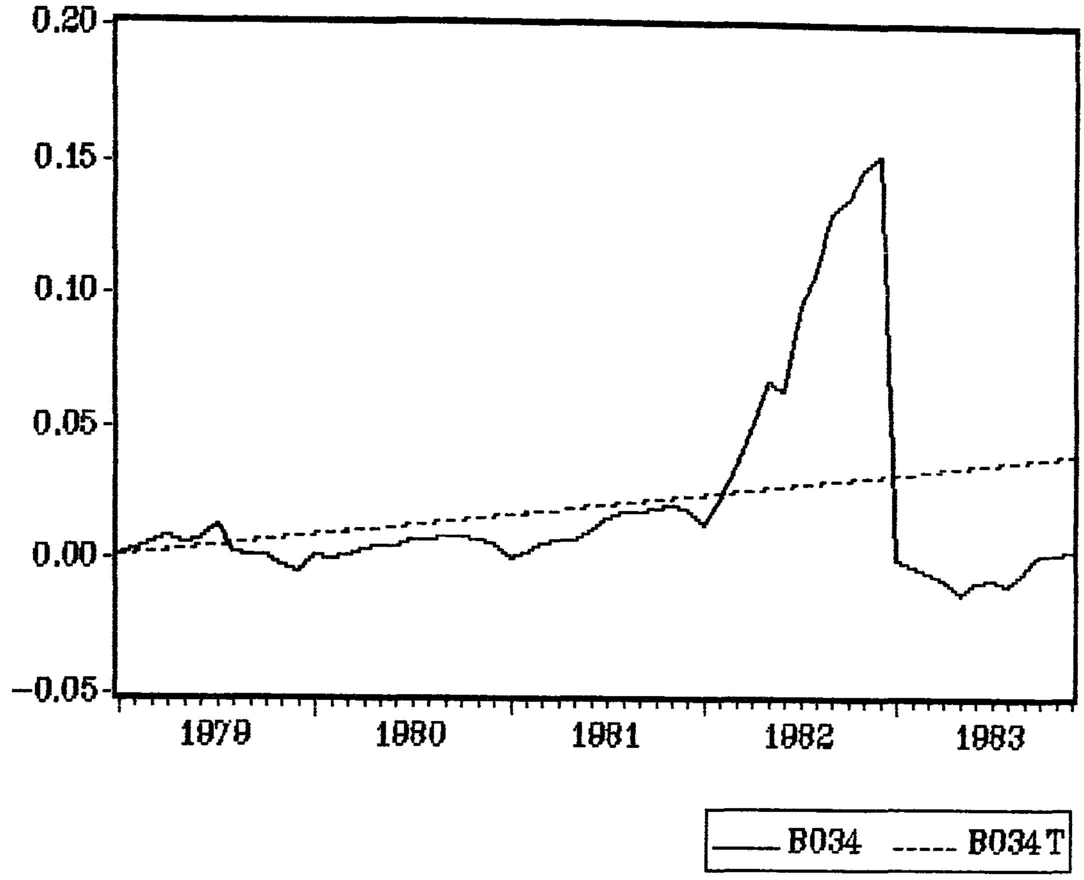
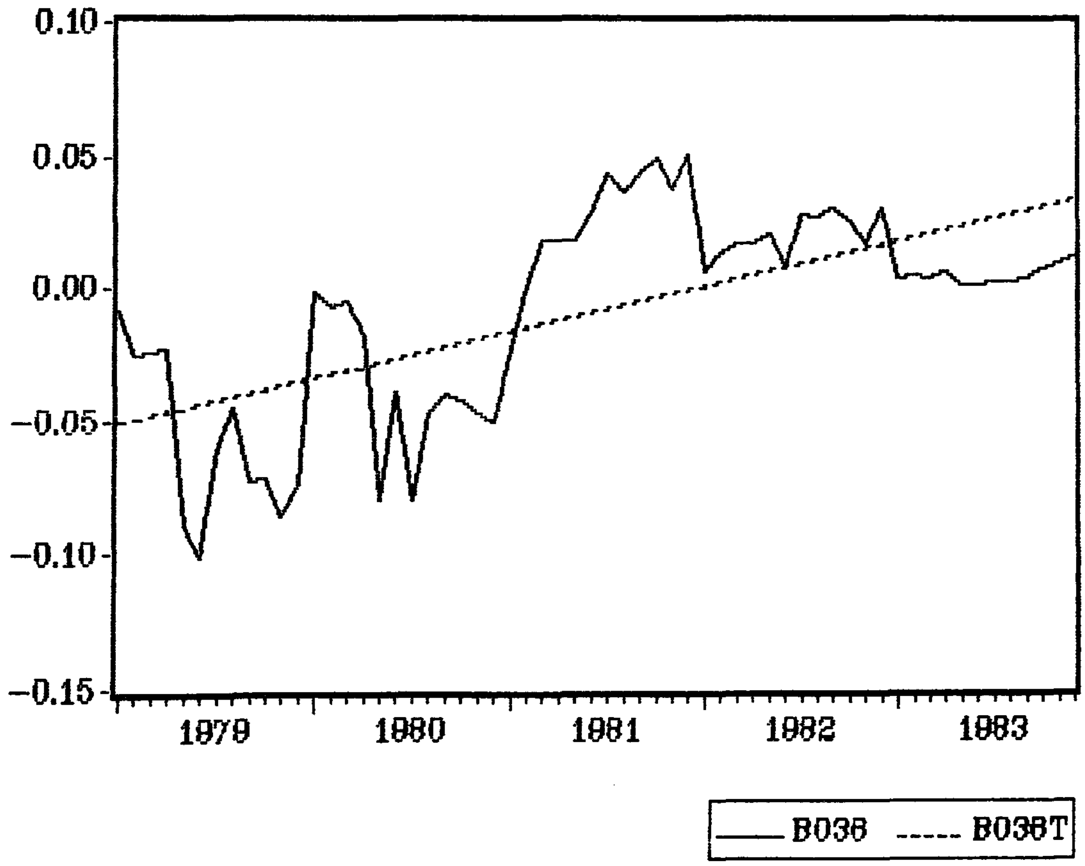


Figure 8.7d Banco de Sao Paulo: Profits/Total Asset Ratio



It is clear that a low quality of bank portfolios should be reflected in the profits/total assets ratio. Indeed, the examination of the trend for failed banks are clearly downwards as compared with healthy institutions. This again suggets that a secular deterioration in the banks' assets quality was underway during the overall period of examination. In addition, the former group exhibits a sharp fall in the value of the ratio relative to its trend towards the end of 1982 as compared with healthy banks. (see charts above)

Another proxy to assess the excesses on risk-taking is the provision/total loans ratio. It measures the banks' ability to absorb loan losses. Its value per se is partially determined by the regulators, although any deviation from its trend will capture the banks' flexibility and propensity to incur additional risk. Firstly, we can observe that the trend for the selected banks of the two groups is upward which may reflect the underlying increment in the phase of rapid expansion of banks' assets.

Secondly, the ratio fell below the trend between the 1980 and the end of 1982. Thereafter, it began to rise rapidly responding to the authorities' intervention and awareness concerning the difficulties of some banks. A less extreme result is true for healthy banks, Banks BICE, Real, and Sao Paulo which show smoother downward deviation from the tendency. This prompts me to suggest that the former group chose a greater credit exposure than the latter group.

Figure 8.8a Banco Chile: Provision/Total Loan Ratio

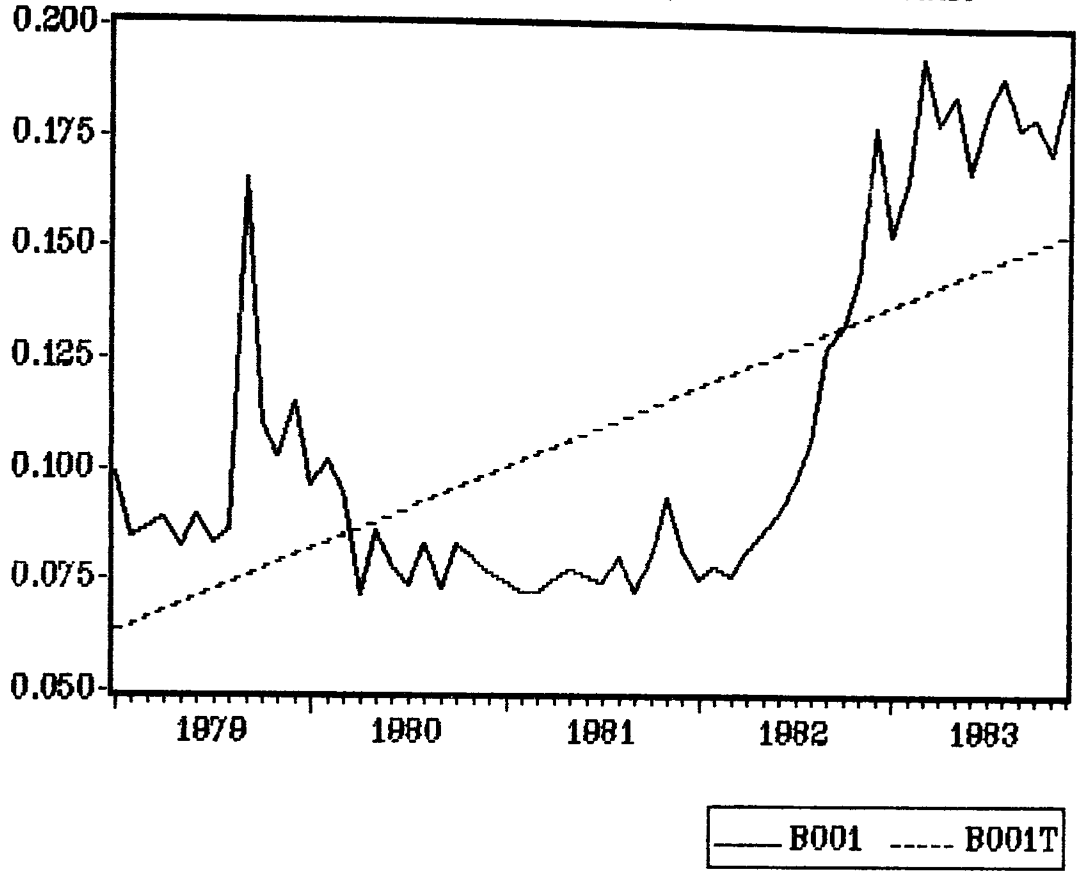


Figure 8.8b Banco Santiago: Provision/Total Loan Ratio

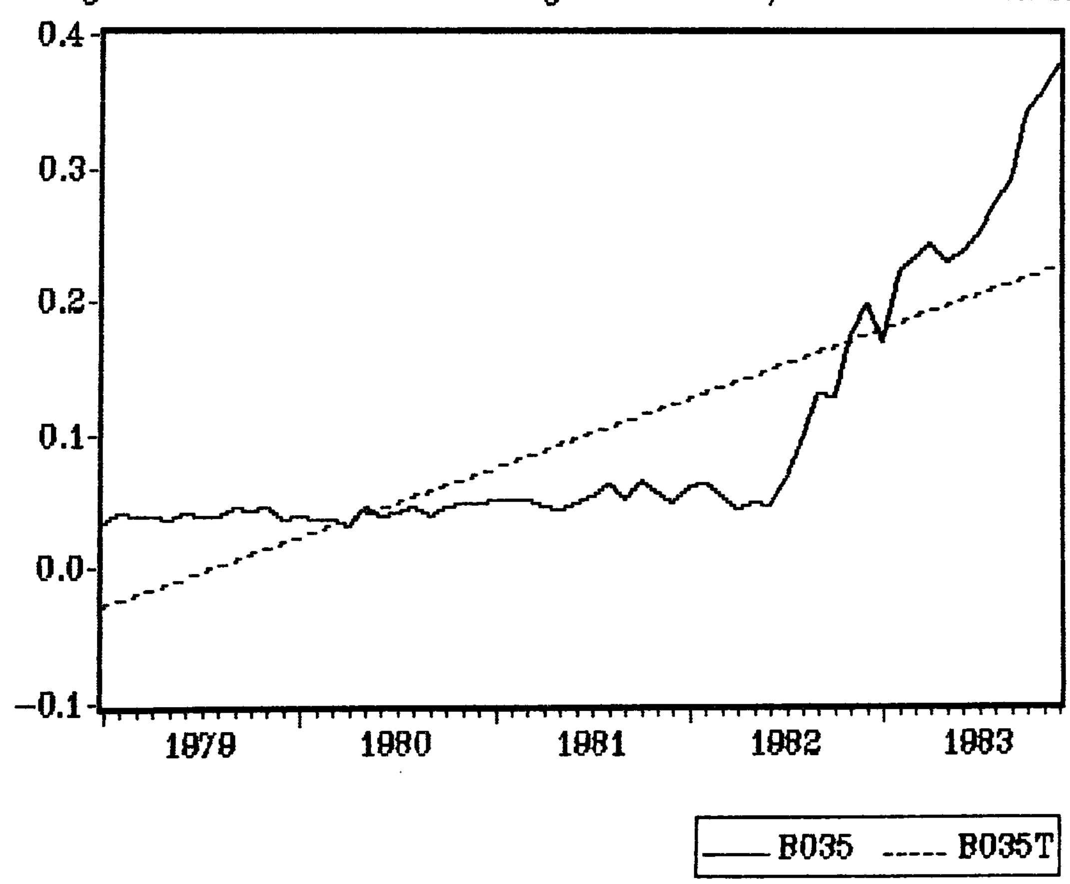


Figure 8.8c Banco Internacional: Provision/Total Loan Ratio

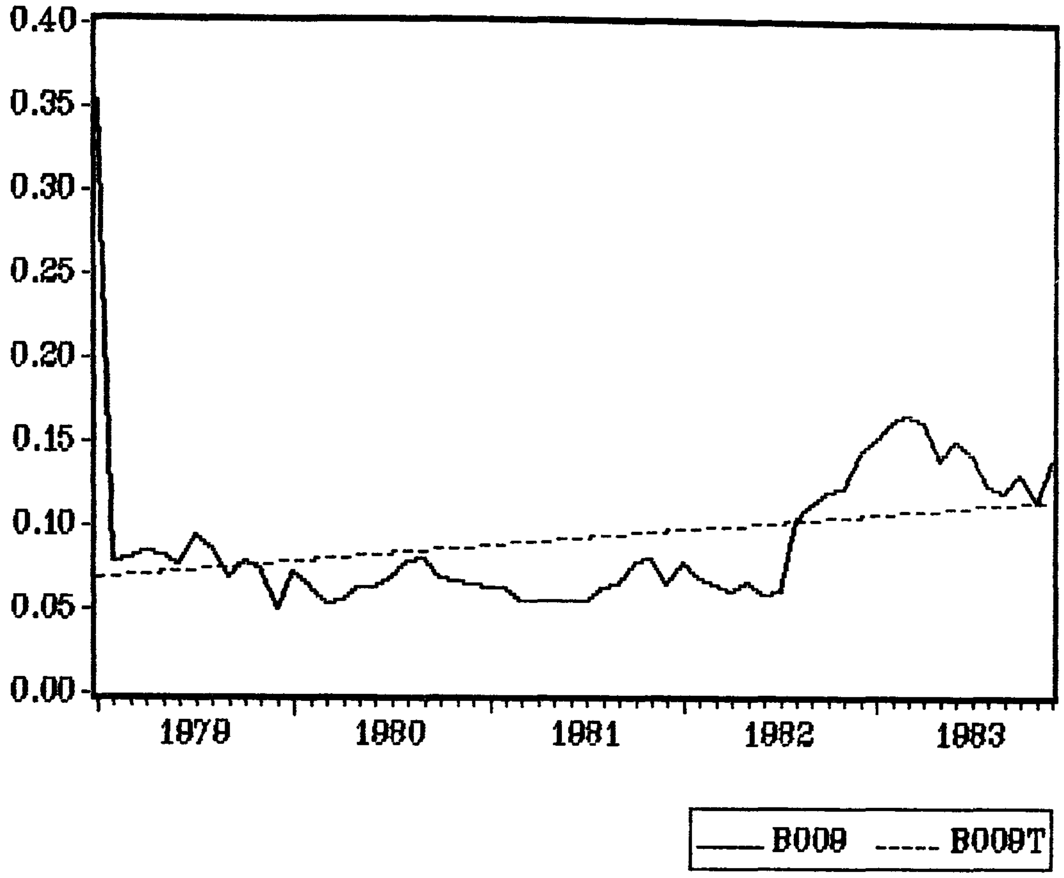


Figure 8.8d Banco Concepcion: Provision/Total Loan Ratio

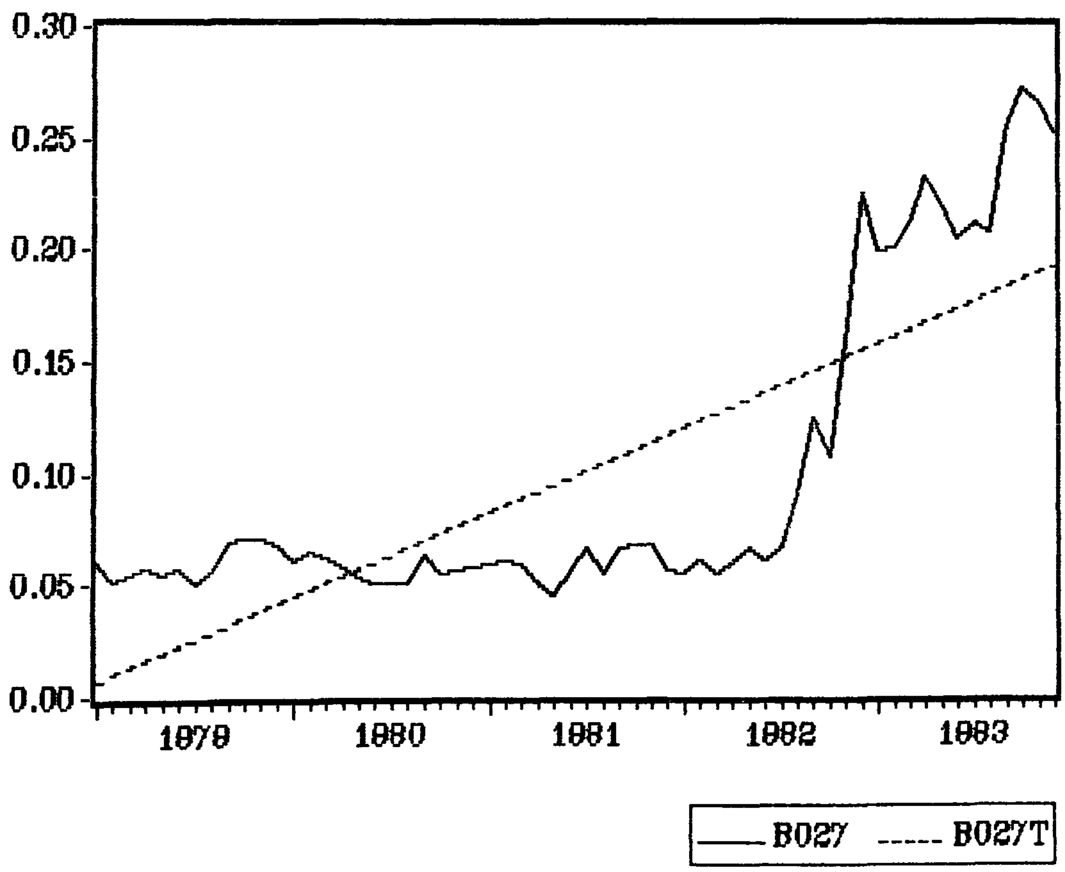


Figure 8.9a Banco del Estado: Provision/Total Loan Ratio

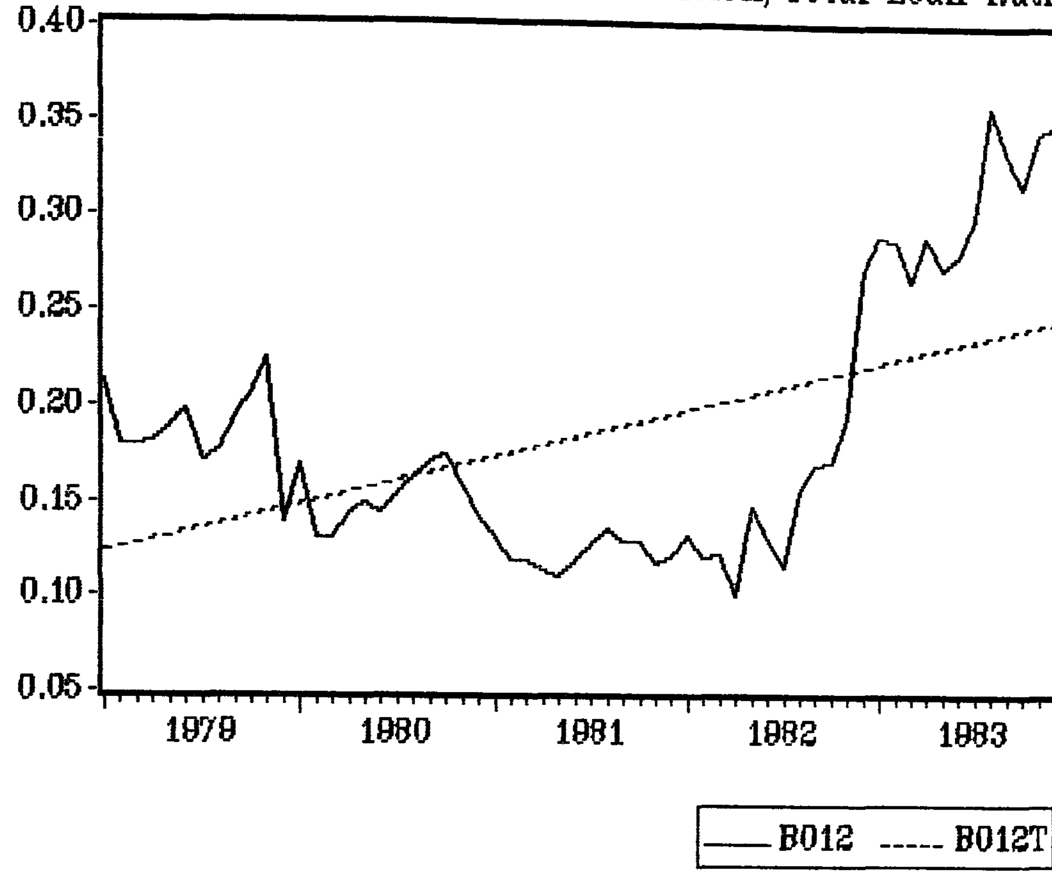


Figure 8.9b Banco BICE: Provision/Total Loan Ratio

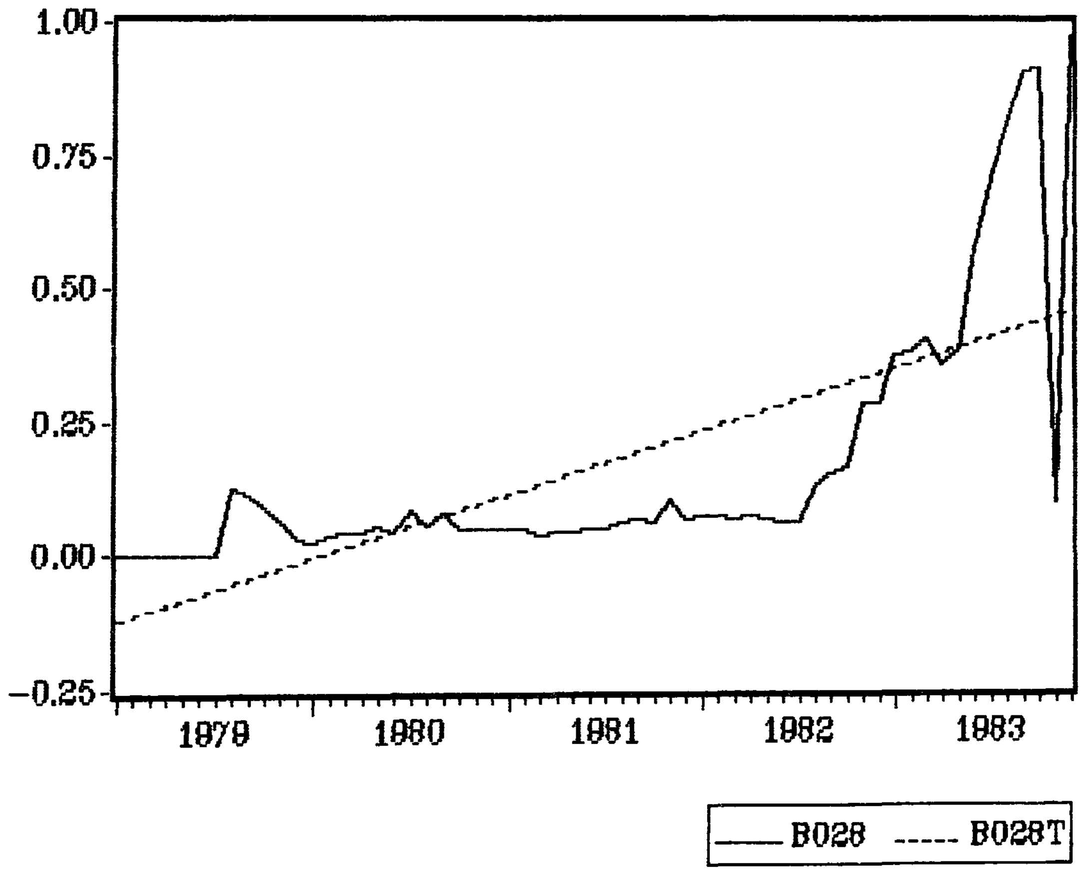


Figure 8.9c Banco Real: Provision/Total Loan Ratio

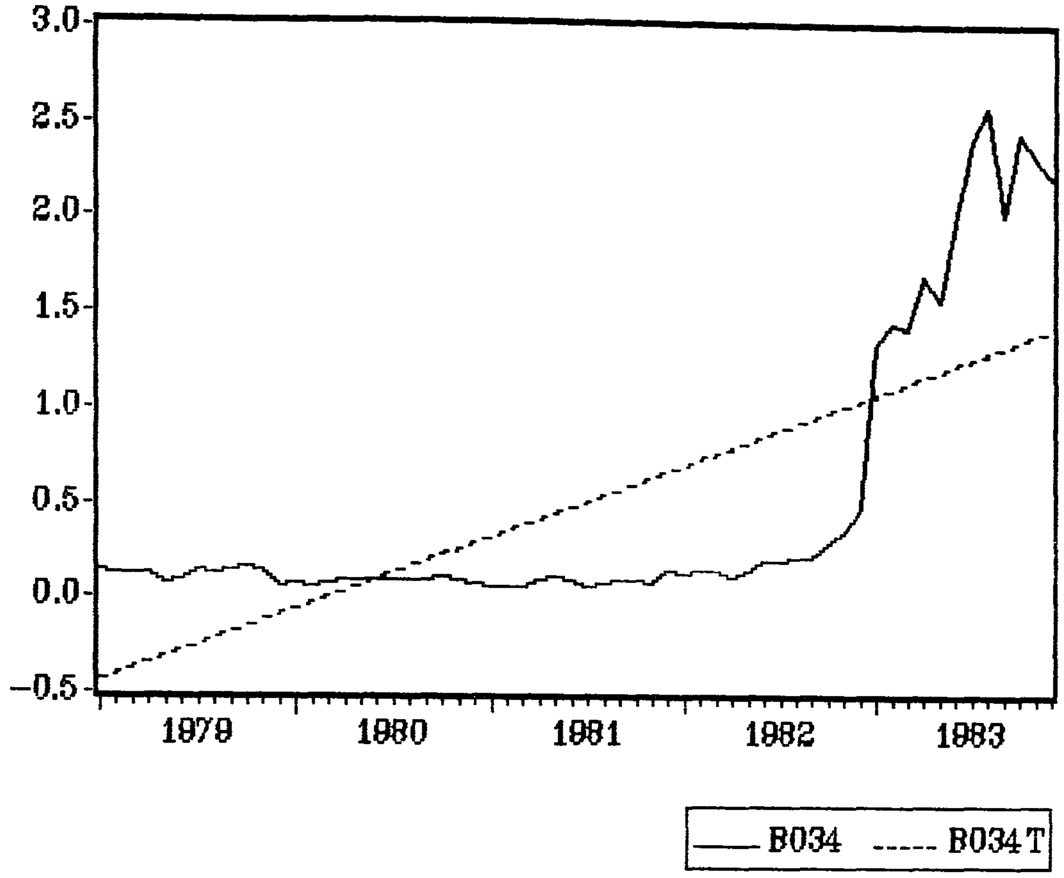
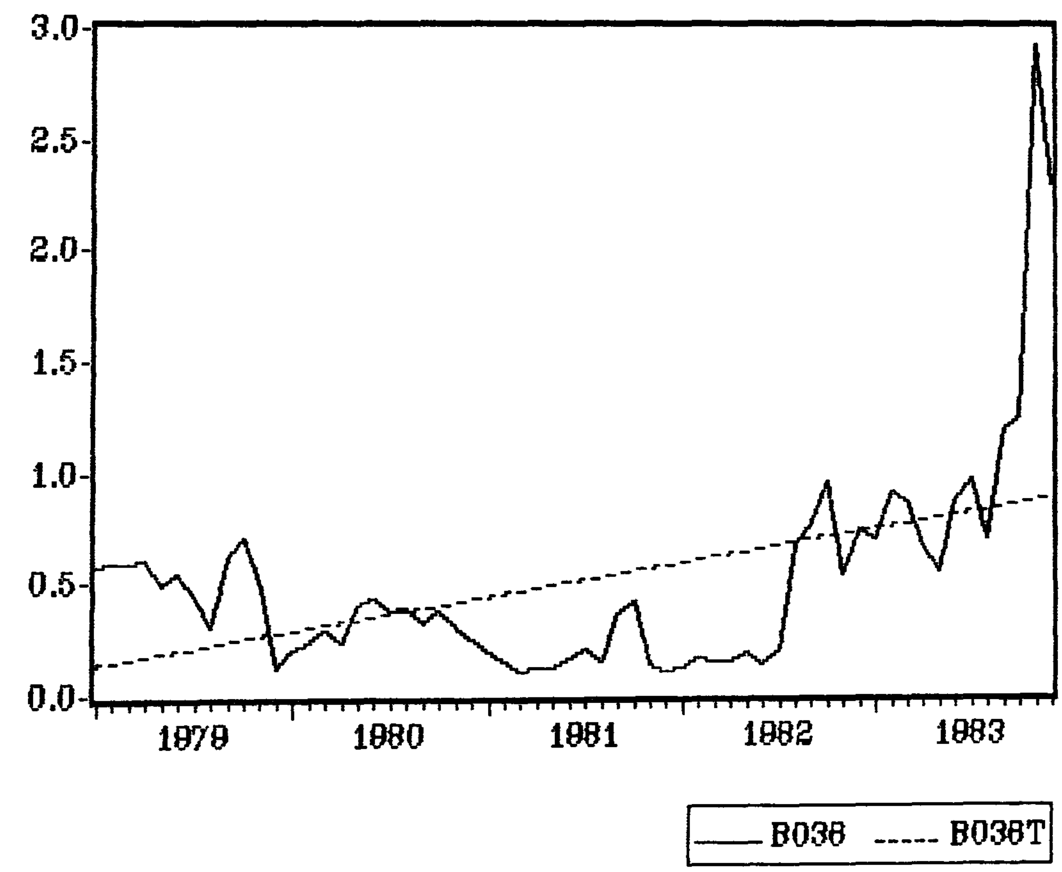


Figure 8.9d Banco de Sao Paulo: Provision/Total Loan Ratio



As was argued in a previous section, when a depositary financial institution becomes riskier the cost of deposits may not rise in proportion to the risk undertaken. This is certainly the case when there is an implict or explicit deposit insurance. Banks are able to increase their net interest margins by using low cost resources to fund loans with higher payoffs but riskier returns.

It is reasonable to expect that a positive deviation of the total deposit ratio/total liabilities ratio over its trend value should be relatively higher for failed banks. The evidence from the four selected failed banks and the group of nonfailed institutions clearly supports this assertion. For instance, Banco Chile and Banco Internacional show a sharp positive deviation over a downward trend. The downward trend is present in all the cases indicating how it was becoming more expensive to raise funds via banks' deposits. This is obvious if we examine the ex post short term real deposit rate which prevailed during the whole liberalisation reform.

In contrast, Banco BICE, Banco Real, and particularly Banco del Estado exhibit values close to the underlying trend, and in some instances below it. This suggests a more conservative approach by bankers to issuing deposit liabilities than failed financial institutions.(see charts below)

Figure 8.10a Banco Chile: Deposit/Total Liabilities Ratio

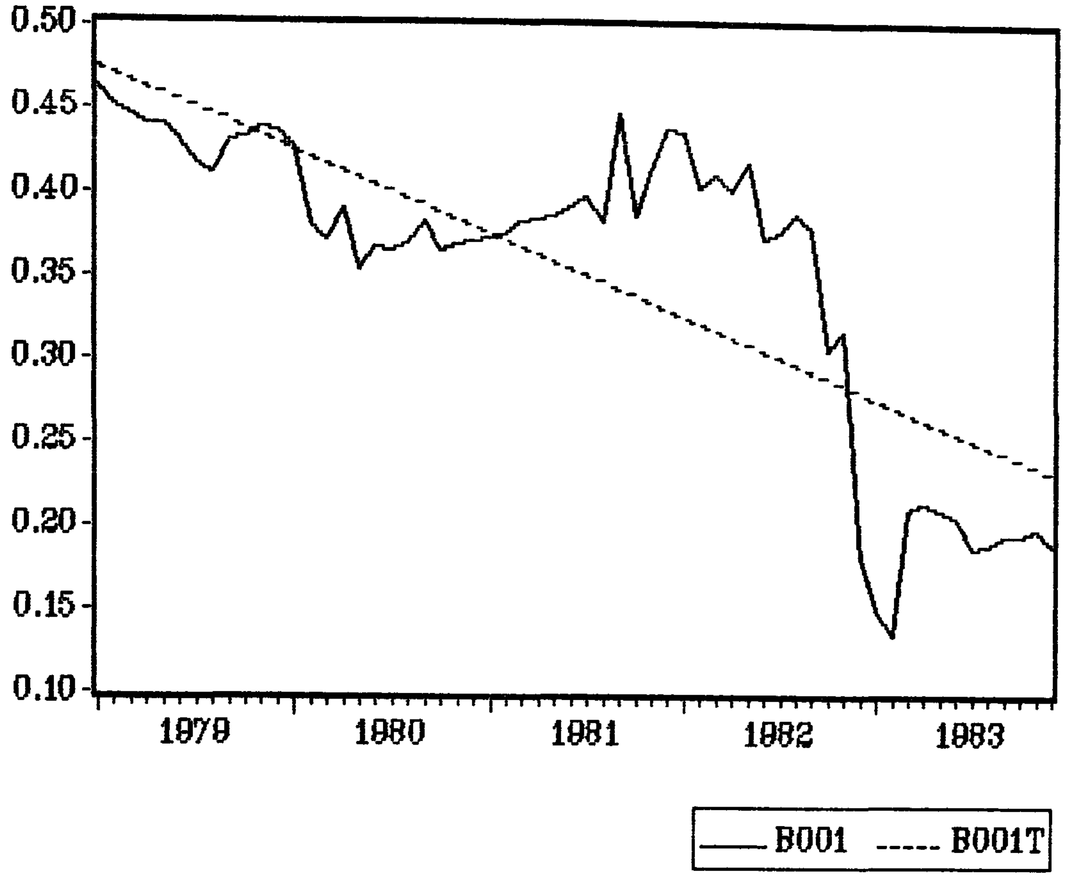


Figure 8.10b Banco Santiago: Deposit/Total Liabilities Ratio

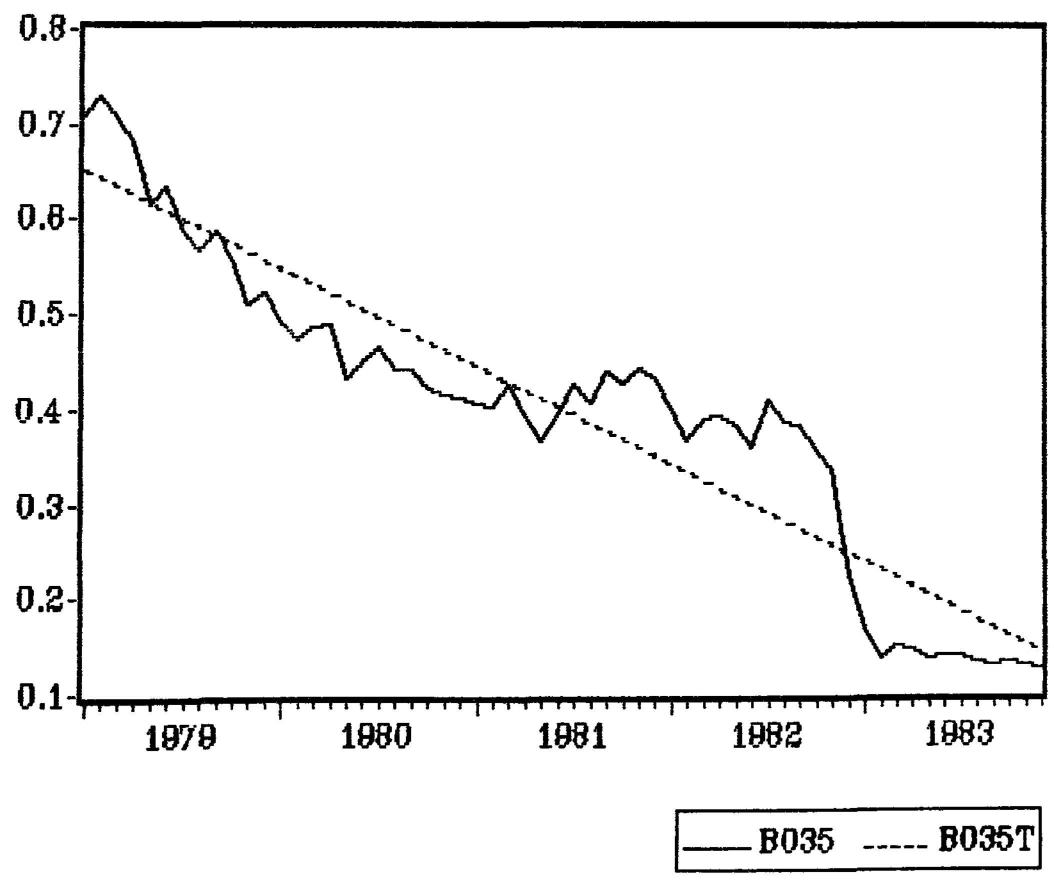


Figure 8.10c Banco Internacional: Deposit/Total Liabilities Ratio

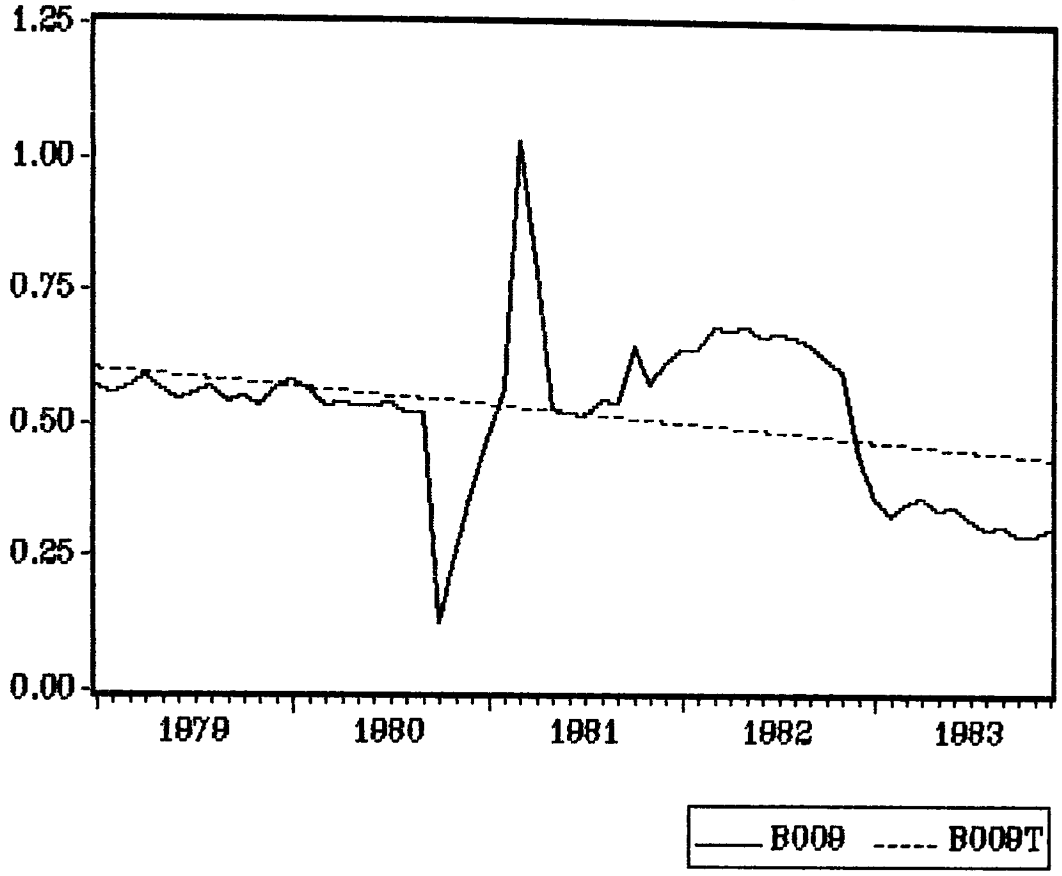


Figure 8.10d Banco Concepcion: Deposit/Total Liabilities Ratio

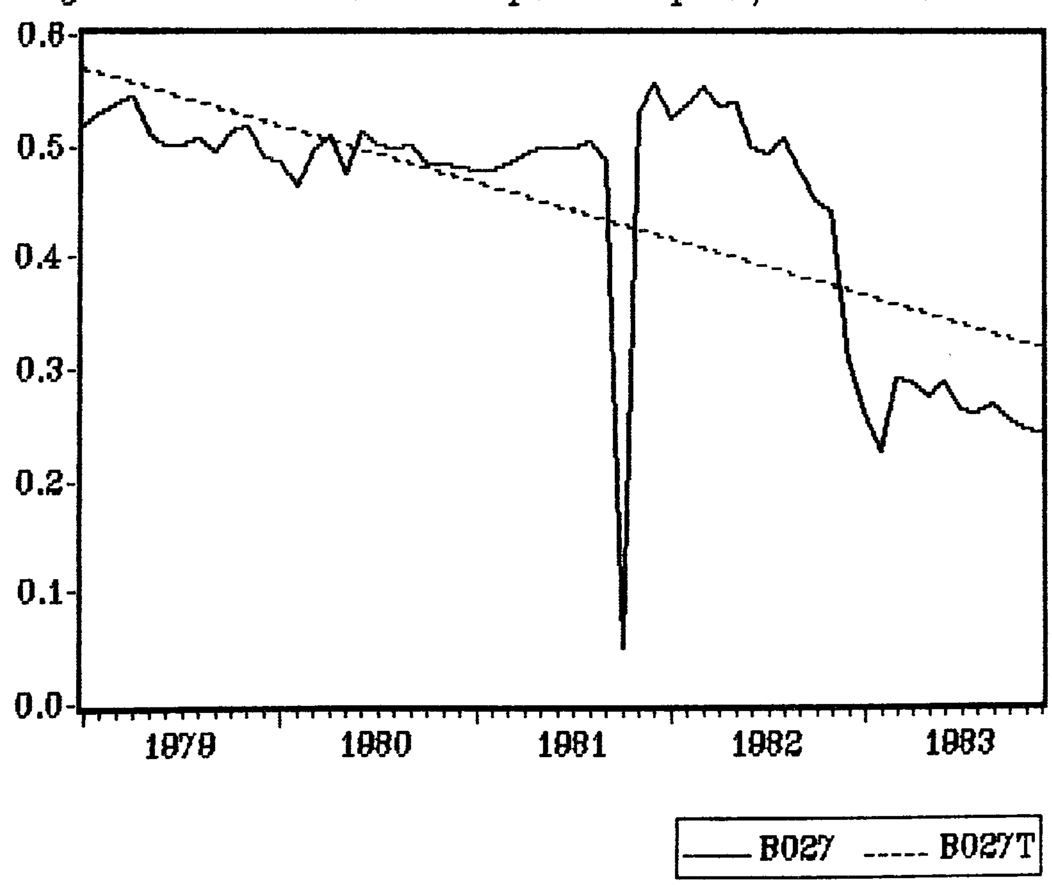


Figure 8.11a Banco del Estado: Deposit/Total Liabilities Ratio

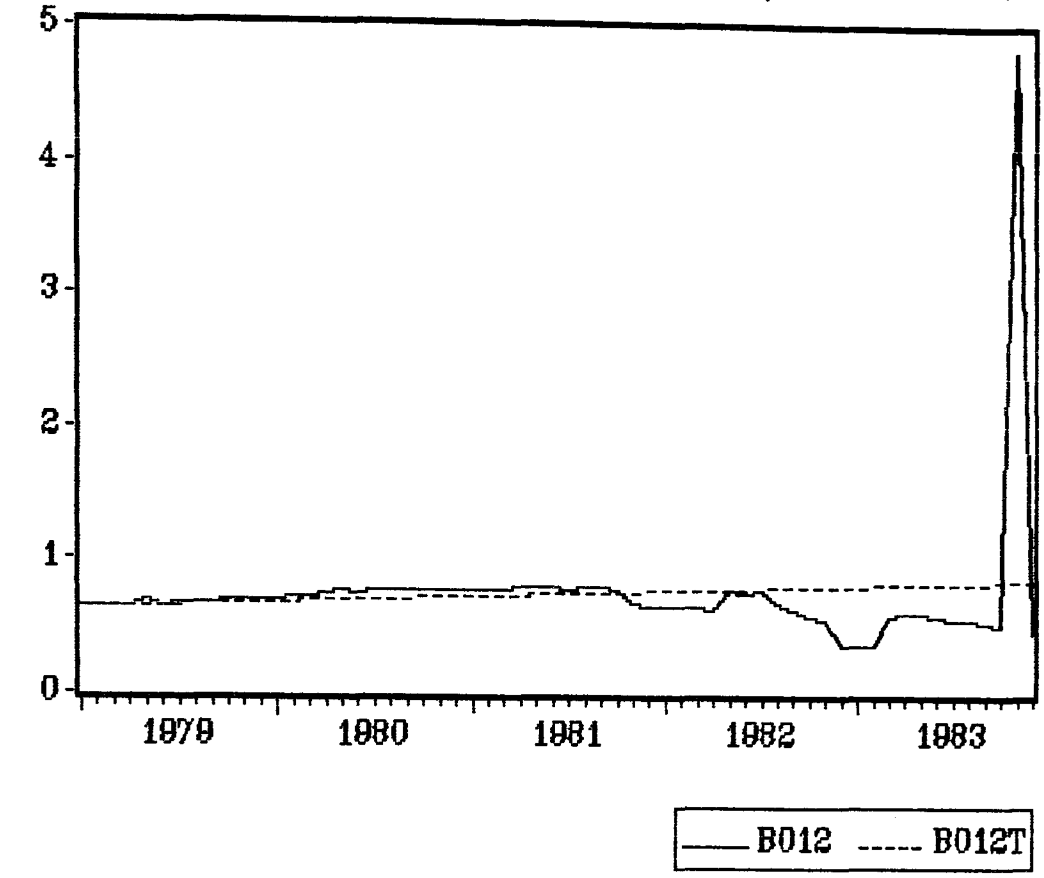


Figure 8.11b Banco BICE: Deposit/Total Liabilities Ratio

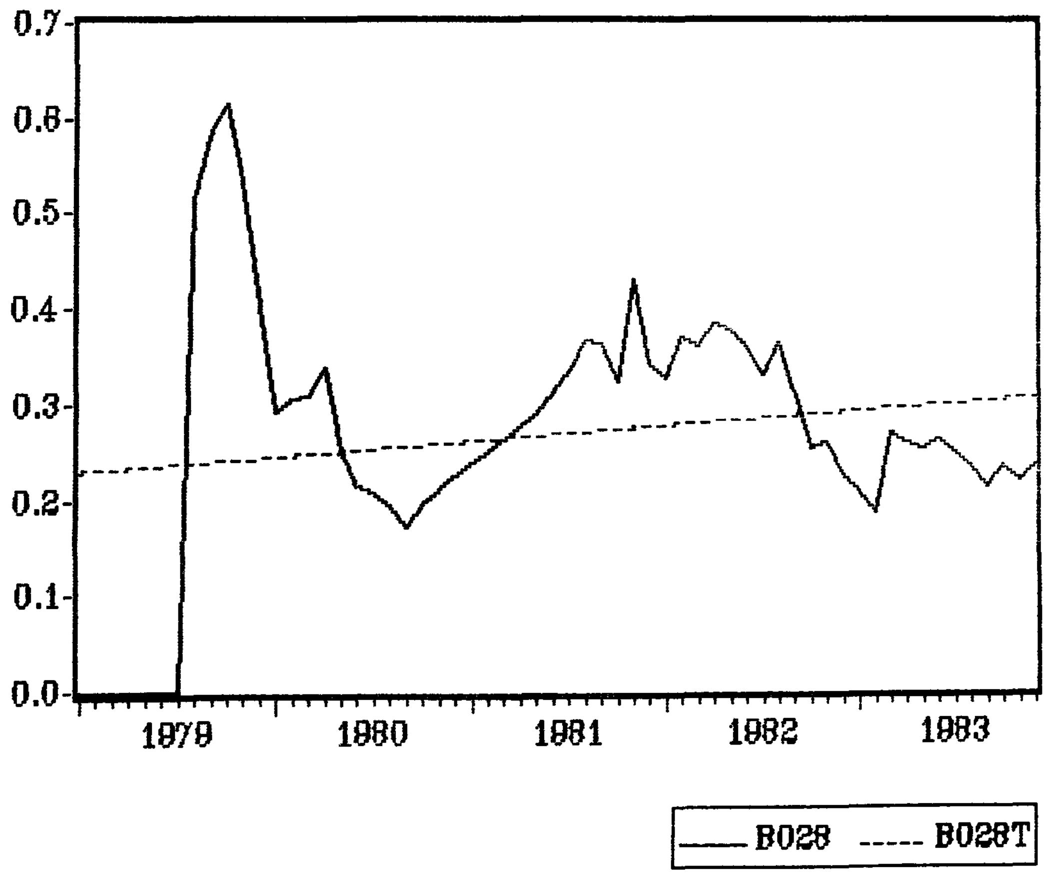


Figure 8.11c Banco Real: Deposit/Total Liabilities Ratio

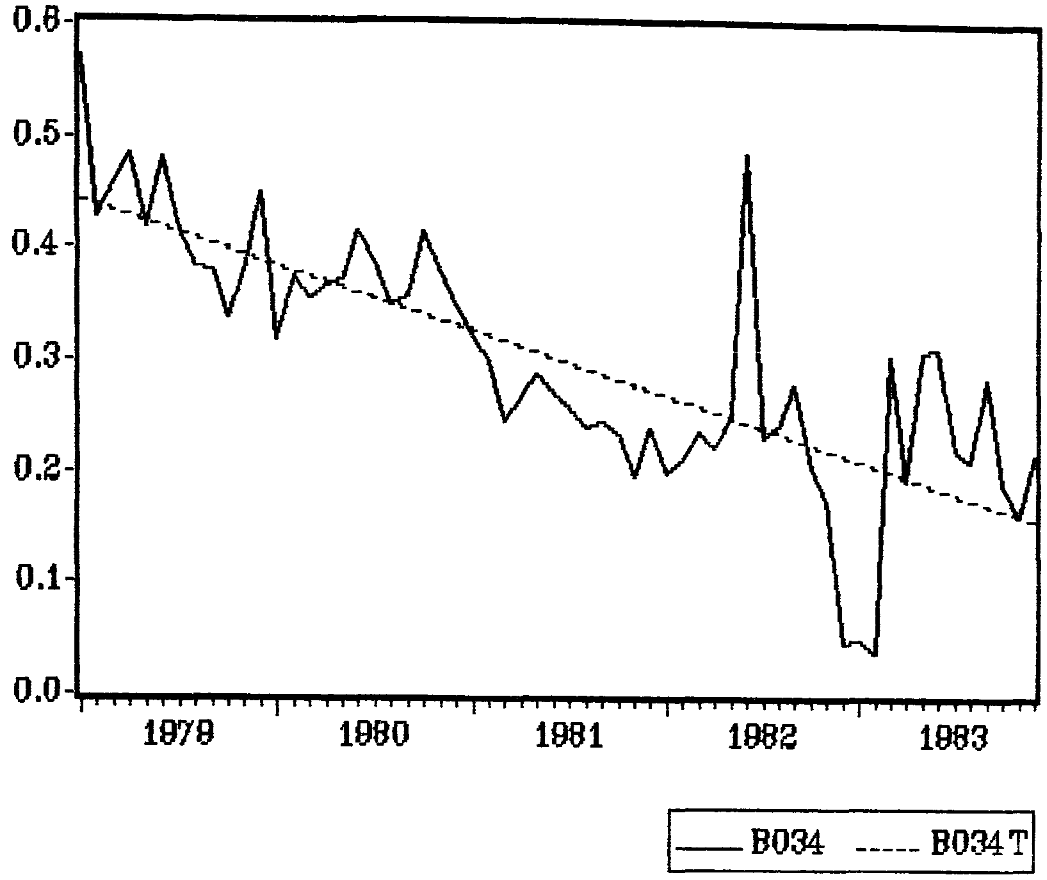
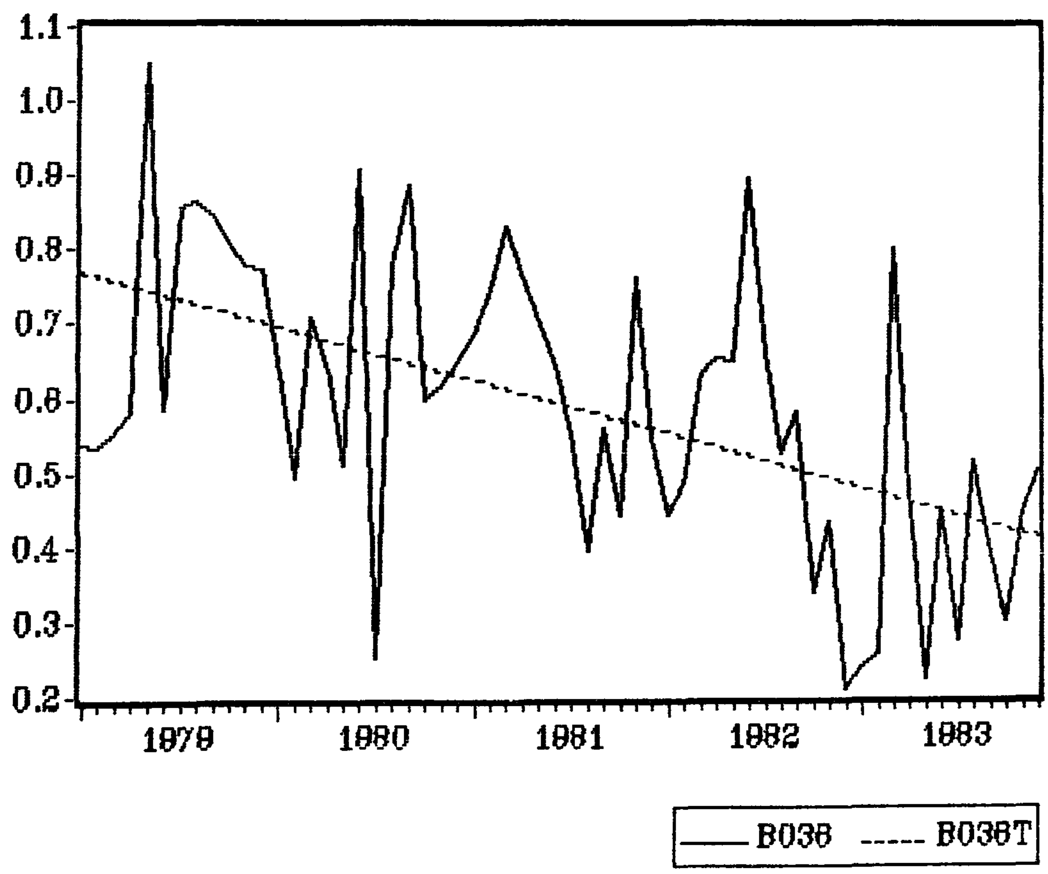


Figure 8.11d Banco de Sao Paulo: Deposit/Total Liabilities Ratio



Finally, one of the most noticeable aspects of financial liberalisation was the spectacular growth in bank assets. This took place in spite of stubbornly high real lending rates indicating a propensity to accept more risks. The evidence from the asset growth and its deviation from its trend confirms this point.

The plot of the ratio measuring the growth of bank assets for selected failed banks shows a positive deviation from its trend by almost the whole period of study, especially between 1980 and 1982. This contrast sharply with the observations from the cases of Banco Real and Banco Sao Paulo. Also, it can be seen that the asset growth began to fall towards the end of 1981, especially in the case of Banco del Estado.

The trend is upward in all cases indicating the response of the banking system to the rapid output growth experienced by the economy during most of the period. It is clear that those banks which exhibited a growth rate above their secular trend were willing to expand credit beyond an optimal point and hence to accept a greater risk-exposure. (see charts below)

Figure 8.12a Banco Chile: Asset Growth

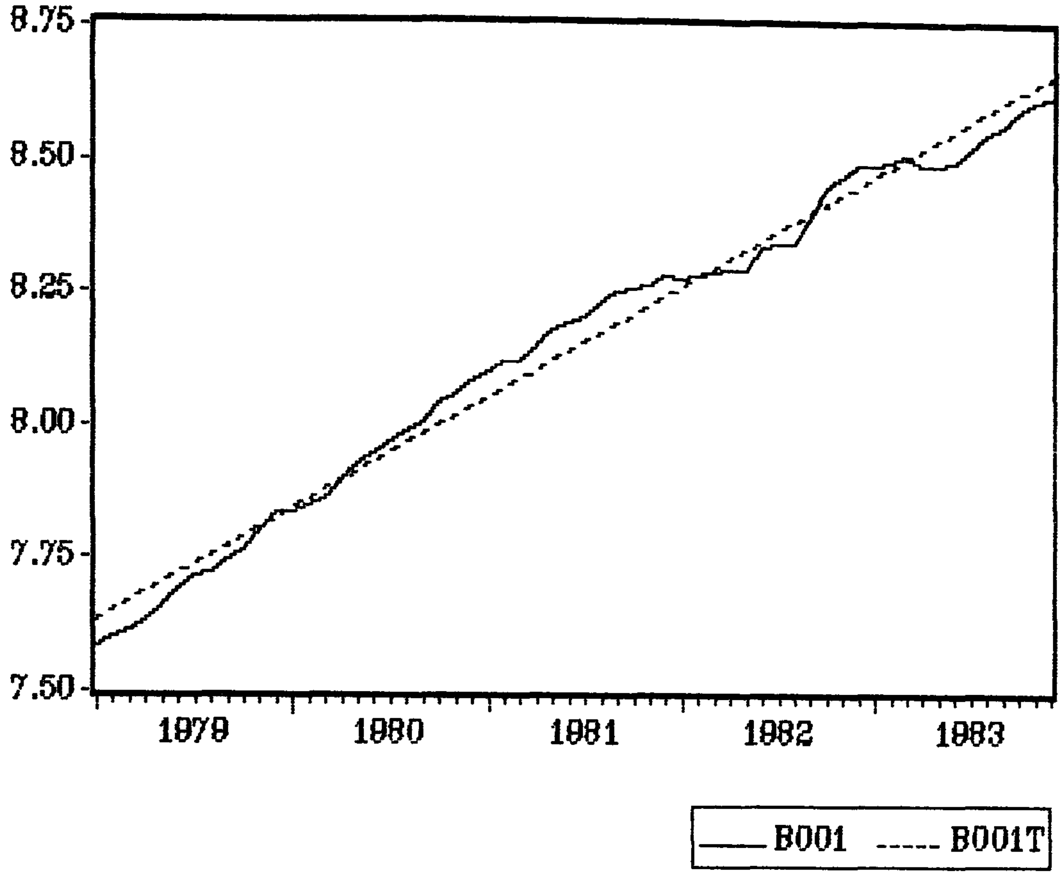


Figure 8.12b Banco Santiago: Asset Growth

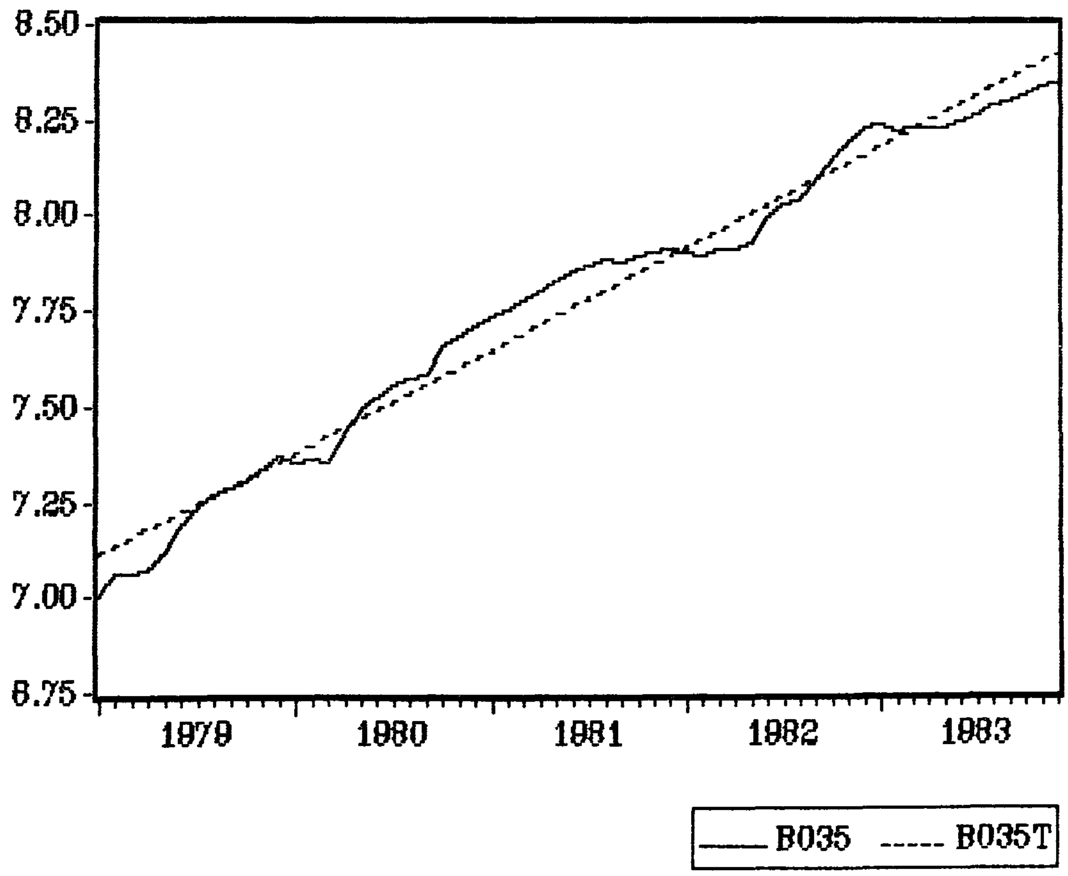


Figure 8.12c Banco Internacional: Asset Growth

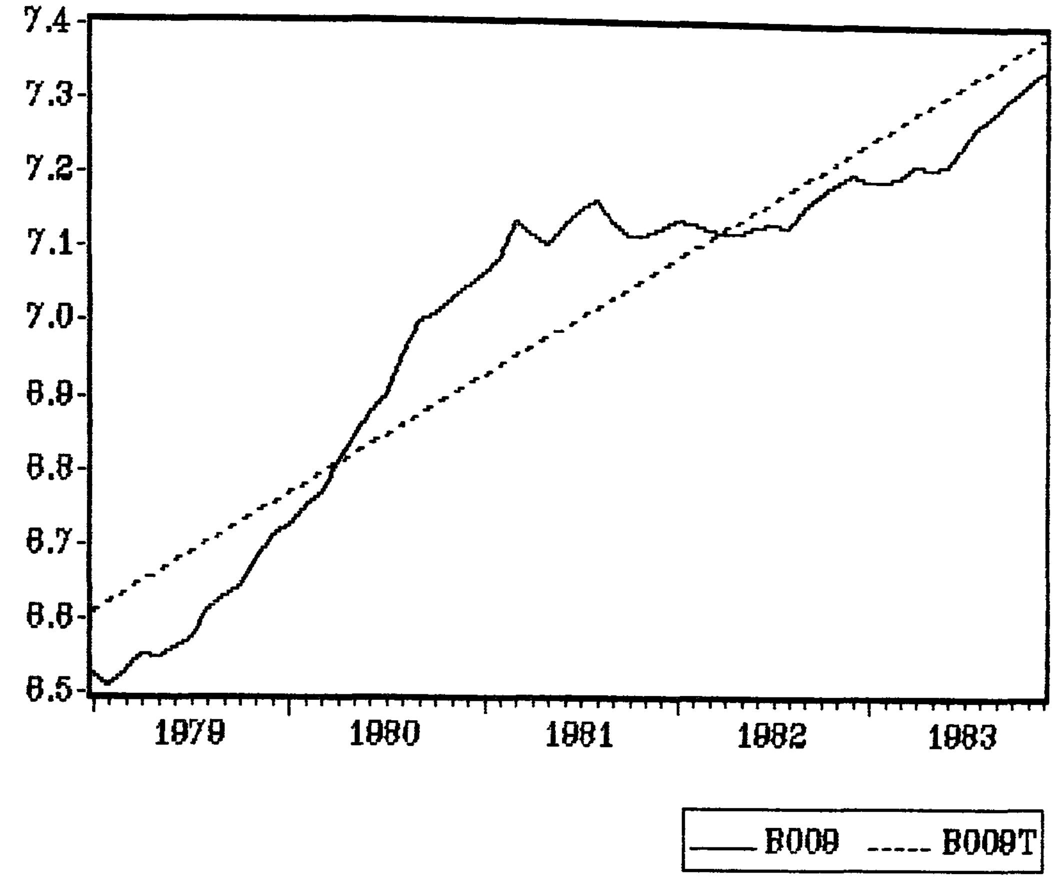


Figure 8.12d Banco Concepcion: Asset Growth

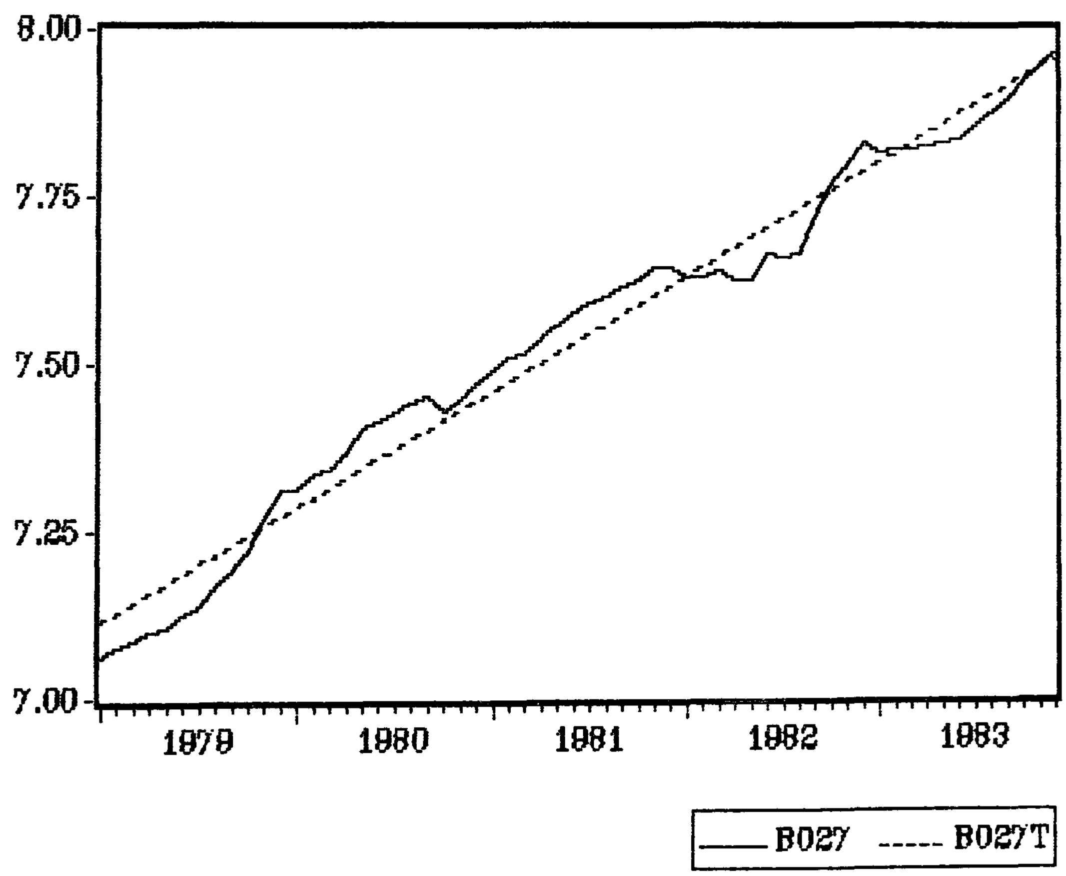


Figure 8.13a   Banco del Estado: Asset Growth

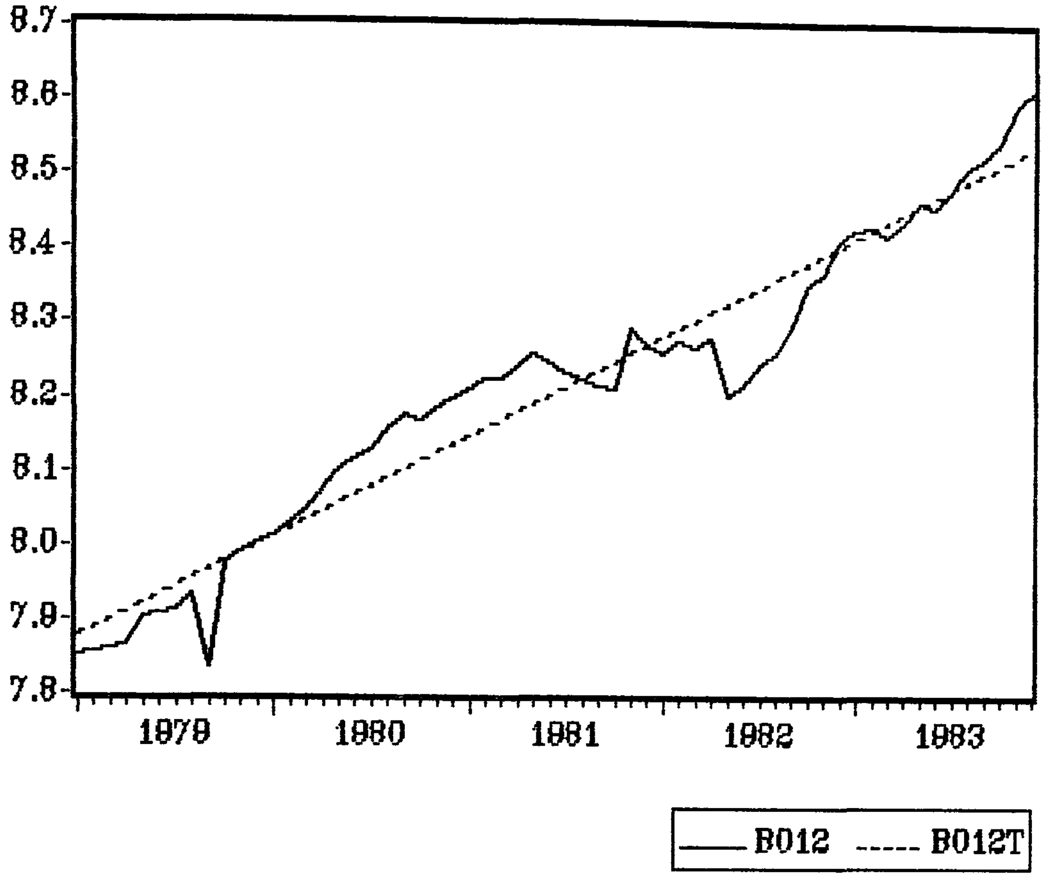


Figure 8.13b   Banco BICE: Asset Growth

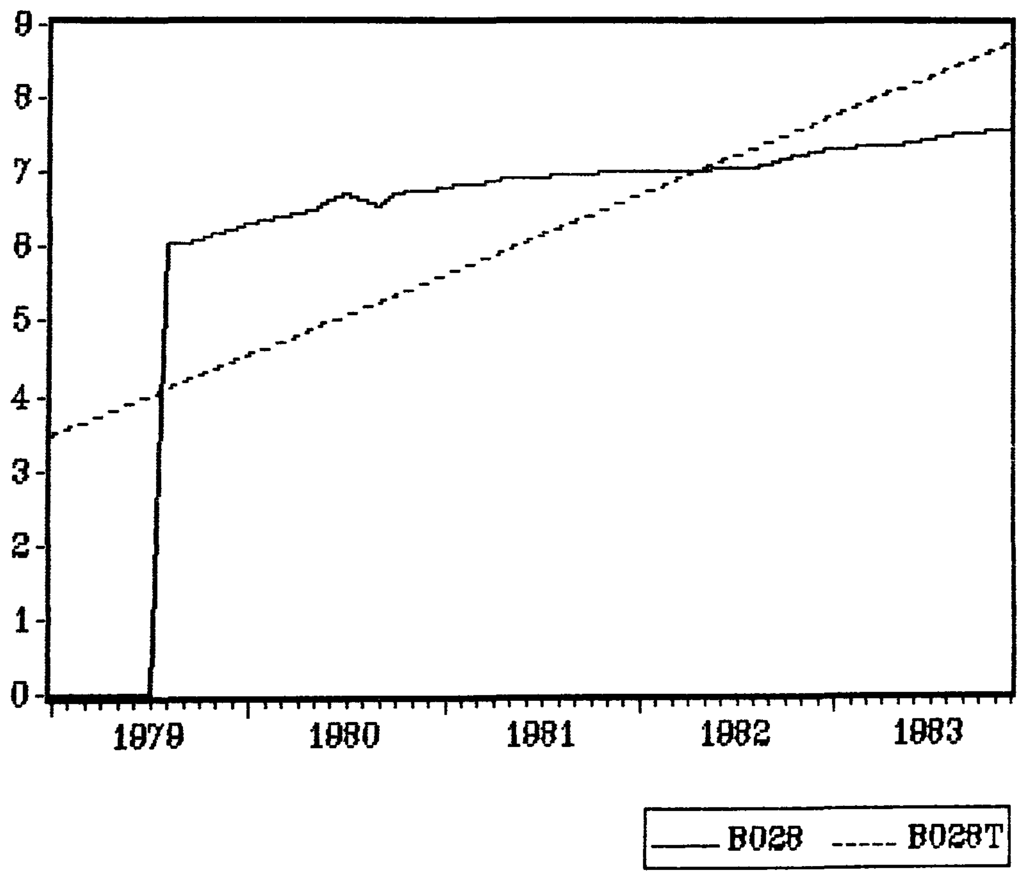


Figure 6.13c Banco Real: Asset Growth

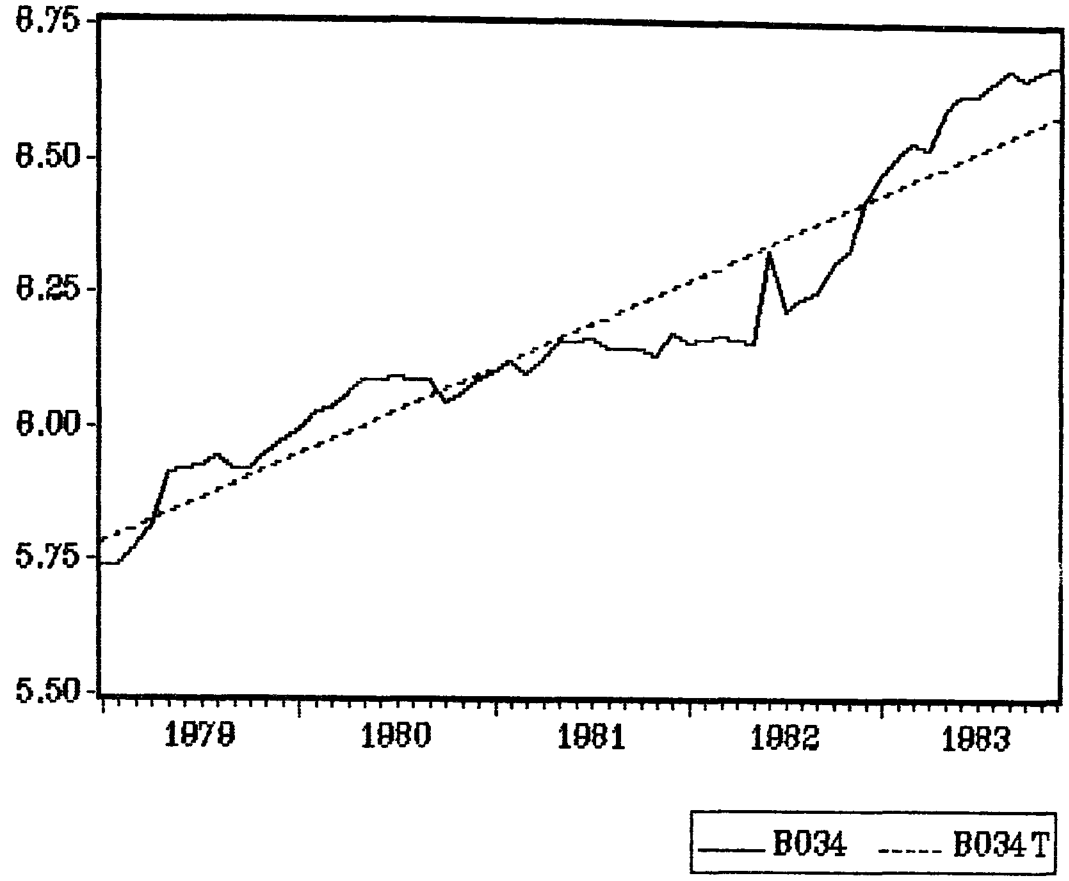
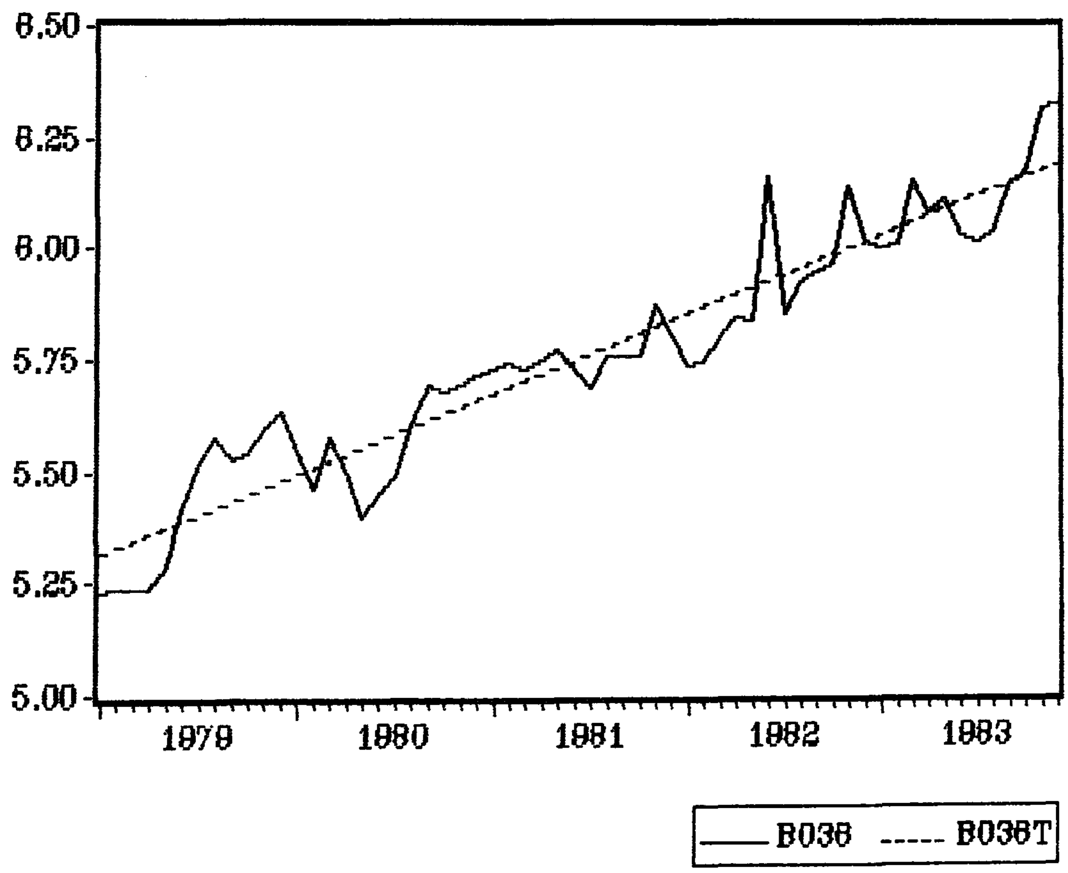


Figure 6.13d Banco de Sao Paulo: Asset Growth



The evidence presented in tables 4a and 4b for a grouped data and the charts for individual selected banks support, at first hand, the view that moral hazard was present in the Chilean banking system. In fact, it reveals a greater propensity to take risk among those financial institutions which failed or experienced financial difficulties.(problem banks)

However, a more sophisticated model is necessary to support this hypothesis and its incidence on the failure of financial institutions in the Chilean banking system. There are three conjectures about bank failures/problems and the role of moral hazard on the likelihood of bank failure which I would like to explictly test.

Firstly, the role of moral hazard was present throughout the period of study and it was significant in explaning the failure of financial institutions in Chile. Specifically, I should be looking for the empirical link and the statistical significance of the selected proxies for risk-taking over the period between 1979 and 1983.

Secondly, if conjecture one is found to be true, we should also test the assertion that excessive risk-taking (moral hazard) was more acute for the years between 1982-83 than 1979-81. Thus, the model will be estimated and tested for each year separately for comparison purposes.

Thirdly, once we accept that hypothesis which relates moral hazard with the likelihood of bank failure/problem, it is possible to use the "best" model to estimate the ex ante probability and assess the prediction accuracy as I did in chapter 6 and 7.

In order to evaluate these conjectures I have estimated the restricted logistic model for quarterly panel data following the methodology and estimation procedures described thoroughly in chapter 6 and 7 and reviewed in earlier sections of this chapter.

-Conjecture 1: The Likelihood of Bank Failures/Problems and Moral Hazard during the period 1979-1983.

The first conjecture establishes the relationship between excessive risk-taking (moral hazard) and the failure of financial institutions, and the subsequent debacle of the banking system. It is argued that the incidence of risk-taking is present throughout the period of study.

Table 5 provides econometric evidence on the significance of some selected proxies which measure banks' propensity to take risk and the probability of bank failure/problem. It should be stressed that the ratios as proxies for banks' attitude towards risk-taking are expressed in terms of the deviation from its trend. A positive sign on a coefficient indicates that the higher the value of the ratio, the greater the propensity to take excessive risk and hence the larger the likelihood of failure.

Apart from a general model specification which included all selected regressors, alternative specifications are reported as the explanatory variables exhibited multicollinearity. As can be seen from the estimates and the covariance-correlation matrix of the explanatory variables included in appendix 7, the ratio total loans/total assets (TL/TA) is highly collinear with assets growth (LACTOT) and liability growth (LPASCIR). Similarly, asset growth and liabilitity growth also present a high correlation coefficient. It can be seen that the correlation coefficient exceeds 80% in most cases.

Specification M1 corresponds to a general model which included all the selected proxies for bank's risk-taking. We can observe that the overall equation is statistically significant at 0.5%. Specifically, the likelihood ratio statistic is 129.5 and the critical value of the chi-square distribution for the 0.005 level of significance is 35.71 so we reject the null hypothesis that $\beta 1=\beta 2....\beta k=0$. Although M1 exhibits the largest likelihood ratio and the largest goodness of fit measured by the likelihood ratio index (Lklhd RIndex), most of the regressors are insignificant. Indeed, besides the nonperforming loans/capital ratio

(NPL/K) for group A (failed/problem banks) and group B (nonfailed/nonproblem banks), and the proxy for "related portfolios" (cartint), the remaining regressors are insignificant according to their t-statistics at 1% and 5% significance. The theoretical value for t-statistic for 0.01 and 0.05 is 2.58 and 1.96 respectively and hence the estimated ratios fell outside the critical region.

I suspect that multicollinearity is serious among some independent variables judging from the covariance-correlation matrix included in appendix 7. As we are aware, the presence of collinearity among the regressors affects the standard errors and the stability of the coefficient. To obtain meaningful estimates and inferences, different specification were carried out by dropping those variable found to be highly collinear.

Table 8.5 Logit Analysis of Selected Proxies for Risk-Taking for the Period 1979.1 to 1983.4 (a)

Proxies	Alternative Specifications M1	M2	M3	M4	M5
Constant	-0.17	-0.16	-0.18	-0.16	-0.17
	(-1.65)	(-1.60)	(-1.80)	(-1.61)	(-1.69)
(Pr/TA)A	-20.80	-14.82	-13.55	-14.53	-25.25
	(-1.12)	(-0.85)	(-0.79)	(-0.84)	(-1.39)
(TL/TA)A	-1.64		3.83		
	(-0.51)		(2.51)		
(NPL/K)A	0.24				0.24
	(3.25)				(3.26)
(NPL/TL)A	-0.05	0.05	0.03	0.05	
	(-0.06)	(0.06)	(0.04)	(0.06)	
(Prv/TL)A	-1.13	-4.78	-2.10	-4.64	-2.64
	(-0.32)	(-1.91)	(-0.89)	(-1.86)	(-1.03)
(Dep/TLi)A	-3.03	-4.38	-3.53	-4.42	-2.97
	(-1.27)	(-1.96)	(-1.64)	(-1.97)	(-1.27)
(LACTOT)A	-3.55	0.22			0.02
	(-1.25)	(2.81)			(0.21)
(LPASCIR)A	3.67			0.22	
	(1.27)			(2.83)	
(Pr/TA)B	-0.01	0.60	0.49	0.15	-0.11
	(-0.007)	(0.48)	(0.38)	(0.12)	(-0.09)
(TL/TA)B	0.007		-1.95		
	(0.003)		(-1.17)		
(NPL/K)B	0.46				0.37
	(2.42)				(2.15)
(NPL/TL)B	1.02	0.95	0.83	0.96	
	(3.29)	(3.14)	(2.75)	(3.17)	
(Prv/TL)B	0.15	-0.16	-0.49	-0.39	0.53
	(0.22)	(-0.35)	(-0.88)	(-0.82)	(1.08)
(Dep/TLi)B	-0.31	0.06	-0.16	0.0005	-0.44
	(-0.30)	(0.06)	(-0.16)	(0.0005)	(-0.43)
(LACTOT)B	-0.28	-0.45			-0.30
	(-0.37)	(-2.66)			(-2.14)
(LPASCIR)B	-0.33			-0.44	
	(-0.44)			(-2.67)	
CARTINT	3.32	2.92		2.92	
	(6.55)	(6.51)		(6.51)	
ln Lklhd(-)	294.43	304.34	309.49	304.28	306.20
Lklhd Ratio(b)	129.50	109.60	99.38	109.80	106.00
Lklhd RIndex(c)	18.00	15.27	13.84	15.29	14.76
A.I.C.(d)(-)	312.43	316.34	321.49	316.28	318.20

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lnLklhdu] and it has chi-square distribution with j degree of freedom.
(c) The pseudo-R square is 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -ln(Lklhd)+K where K is the number of estimated parameters.

Model specification M2 did not include the ratio TL/TA and the LPASCIR for both groups of banks. Similarly, LACTOT was replaced for TL/TA and LPASCIR in models M3 and M4 respectively. The results clearly show a marked improvement in the t-statistic and the sign of the coefficient so that we can draw some important observations from it.

Firstly, the negative and the statistically significant coefficient of the provision/total loans ratio (Prv/TL) for failed/problem banks (group A) at 10% and 5% confirm its importance as a determinant of failure. This result indicates that banks which have chosen a lower provision for bad loans were more likely to fail. This ratio was found statistically insignificant for nonfailed/nonproblem banks (group B). It should be pointed out that although this variable was significant in different variations of specification M2, it did not perform well in the alternative specification examined in table 5.

Secondly, the proxies for the quality of bank assets were an important determinant of the likelihood of bank failures. The NPL/TL ratio was found particularly important for nonfailed/nonproblem banks (group B) in all the alternative specifications. The estimated coefficient was both consistent with the a priori expected sign, and significant at 1%. This suggests that the higher the ratio the more likely a bank was to fail. As we have seen in the earlier data from table 4a-4b, nonfailed/nonproblem banks did exhibit a lower mean value for the ratio's deviation over its trend and the confirmation of its significance supports the hypothesis that this group did not incur excessive risk-taking (moral hazard) and hence remained financially healthy.

This result was not confirmed for failed/problem banks (group A) except in the case where we estimate the model (M5) using nonperforming loans/ capital ratio (NPL/K). Alternative modifications of M5, not reported in the table, indicate that both ratios NPL/TL and NPL/K are significant for both groups of banks. Similarly, the TL/TA ratio, included in estimation M3, confirms the importance of the asset quality on the likelihood of failure for group A. This finding contrast sharply with the irrelevant statistical incidence of the profit/total asset ratio in every specification.

Thirdly, the deposit/total liabilities ratio as a proxy for bank costs by failed/problem banks (group A) was found significant at 5%, especially in model M2 and M4. The negative sign for the estimated coefficient, consistent with a priori expectations, indicates that those financial institutions which borrowed most cheaply (sight deposits, and passbook savings) had a lower probability of failure. The coefficient for the second group was found insignificant in all the alternative versions.

Fourthly, one of the most telling indication of the growing fragility of the banking system was the explosive growth of bank assets and liabilities. Although the economy was buoyant, there were significant risks in expanding assets and liabilities in a period of high real interest rates. The statistical estimates confirm these worries. For instance, the variable which measures the growth of bank assets (LACTOT) is significant at 1% in both groups for model M2. The positive sign for (LACTOT)A is consistent with a priori expectations implying that the deviation over its trend was an important determinant of bank failures. This regressor was also significant for the group of nonfailed/nonproblem banks but with an opposite sign. This finding is puzzling since it suggests that excessive asset growth reduces the likelihood of failure in this particular group. It could be argued that this result reflects specific advantages of this group of banks in extending credit efficiently. Additional evidence such as the banks' profitability, low nonperforming loans, and the absence of related portfolios help to support this reasoning. As we have seen from the previous evidence, Banco del Estado and BICE are particularly good examples.

Similar results and conclusions are obtain from the growth of banks' liabilities from model M4. It should be said that the banks' ability to maintain relatively good asset quality enhance the capability of sound banks to expand their liabilities beyond a certain point. This appears to be the case of nonfailed/nonproblem banks group.

Finally, the model includes a dummy variable which took the value of 1 in those financial institutions which maintained a significantly large proportion of their loans portfolios with related firms,individual, and/or conglomerates and the value of 0 otherwise. In all the alternative estimations the variable was very significant and with a correct sign for the estimated coefficient. This result clearly indicates that an increasing concentration of the banks' loan portfolios among related parties (related risks) raises the probability of bank failure.

All in all the logit estimates of failing and non-failing banks indicate that the quality and the growth of bank assets, and the expansion of bank liabilities have proven to be important determinants on the likelihood of failure or sucess. The impact of bank provisions and leverage are less clear. Some preliminary results have also shown that nonfailed/nonproblem banks maintained better asset qualities, relatively larger provisions for bad loans, and relatively slower growth in bank assets and liabilities.

With the exception of technical provisions, all these proxies for excessive risk-taking are subject to a considerable degree of managerial control. Therefore, one can conclude that bank managers failed/problem banks did incur larger risks and hence contributed to the likelihood of bank failures. These results do not establish the relative strength of each proxy nor if moral hazard was more prominent during the early period or the later period of study.

-Conjecture 2: The Incidence of Moral Hazard on the Likelihood of Bank Failures in Each Single Year.

In the second conjecture, the model attempts to establish that moral hazard was more serious during the period 1982-83 than in early years. The collapse of the macroeconomy in 1982 and 1983 where real GDP fell by nearly 15% and 0.5% respectively should had encouraged financial institutions to roll-over what constituted bad loans and to capitalised the interest. Indeed, Mckinnon (1989) argued that in the presence of macroeconomic instability which will create positive covariance in the default rates of the banks' borrowers, moral hazard on the part of the bank will be present. A loosely regulated bank with both inadequate loan-loss provision and implicit free deposit insurance has an strong incentive to extend credit at high interest rates knowing ex ante that a favorable macroeconomic outcome will generate him high profits. In the opposite case, the bank will be able to transfer the heavy losses ultimately to the taxpayers.

It is reasonable to expect that macroeconomic instability should exacerbate even further the problem of moral hazard in the banking system. One simple procedure to verify this conjecture would require us to estimate the logit model separately for each year and test the significance and the goodness of fit of the model by means of the likelihood ratio (Lklhd Ratio) and the likelihood index (Lklhd R-Index) respectively. These results for the alternative specifications of the logit model are presented in table 6. It should be mentioned that the missing results from the tables can be explained by the failure of the iterative process to converge after 20 successive iterations.

At the outset, the empirical evidence gives support to the second conjecture. The examination of the likelihood ratio for each year and alternative specifications are statistically significant at 1%. This means that the statistic rejects the null hypothesis that all estimates are equal to zero. The chi-square statistic with 17 degree of freedom at 1% is 33.4.

Table 8.6 Logit Analysis of Selected Proxies for Risk-Taking for Single Periods. (a)

1983	M1	M2	M3	M4	M5
	Alternative Specifications				
ln Lklhd(-)	25.03	29.95	28.21	30.44	32.10
Lklhd Ratio(b)	86.60	76.76	80.24	75.78	72.46
LklhdRIndex(c)	63.36	56.16	58.71	55.45	53.02
A.I.C.(d)(-)	43.03	41.95	40.21	42.44	44.10
1982					
ln Lklhd(-)	30.00	38.32	32.87	38.35	38.82
Lklhd Ratio(b)	83.38	66.74	77.64	66.68	65.74
Lklhd RIndex(c)	58.15	34.37	54.14	46.50	45.85
A.I.C.(d)	48.00	50.32	44.87	50.35	50.82
1981					
ln Lklhd(-)		40.22	38.05	40.42	42.16
Lklhd Ratio(b)		68.68	73.02	68.28	64.80
Lklhd RIndex(c)		46.05	48.92	45.78	43.45
A.I.C.(d)		58.22	50.05	52.42	54.16
1980					
ln Lklhd(-)	39.93	51.45	58.44	50.94	47.41
Lklhd Ratio(b)	69.52	46.48	32.50	47.50	54.56
Lklhd RIndex(c)	46.53	31.11	21.75	31.79	36.52
A.I.C.(d)(-)	56.93	62.45	69.44	61.94	58.41
1979					
ln Lklhd(-)			39.48		39.62
Lklhd Ratio(b)			55.40		55.12
Lklhd RIndex(c)			41.23		41.02
A.I.C.(d)(-)			50.48		50.62

(a) The models were estimated for each year with quarterly data.
(b) The likelihood ratio is -2[lnLklhdr - lnLklhdu] and it has chi-square distribution with j-1 degree of freedom.
(c) The pseudo-R square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -ln(Lklhd)+K where K is the number of estimated parameters.

However, a closer look at the likelihood value over time suggests that it rises as we go back from 1983. For instance, the value of the likelihood function for M1 in 1983 is -25.03 in comparison to a value in 1980 of nearly -40.00.

Even more telling are the values from the goodness of fit of the model. For instance, the likelihood index ratio for M1 in 1983 is more than 63% in comparison with only 46% in 1980. Similar conclusions are obtained from the evidence of the alternative specifications where we also observe a clear deterioration in the goodness of fit.

This conjecture may also be tested in the form of a hypothesis that the coefficients on each variable were equal in all years against the alternative that they were significantly different. The likelihood ratio test is defined as $-2[\ln Lklhd(Z)-\Sigma \ln Lklhd(Z)]$ where $\ln Lklhd(Z)$ is the log of the likelihood function estimated with the whole sample data and $\Sigma \ln Lklhd(Z)$ is the sum of the log of the likelihood functions for each year estimated individually. For model M1, the likelihood ratio test statistic was 239.54. At 1% level of significance, the value of the chi-square with 70 degrees of freedom is 100.42. It follows that model M1 rejects the null hypothesis that all coefficient are equal.

The likelihood ratio was also estimated for all pairs of years and these results are reported in table 7. At the 5% of significance the chi-square with 17 degrees of freedom has a value of 27.58. We observe that the pairwise comparison of 1983 with each individual year (except 1982) is significant and hence we reject the null hypothesis that the coefficients are equal from year to year.

Table 8.7 Likelihood Ratio Test for Equality of All Coefficients Across Years for Model M1.

	1980	1981	1982	1983
1979	1.00	2.86	18.96	28.90
1980	---	3.76	19.86	29.80
1981	---	----	20.44	30.38
1982	---	----	----	9.94

(a) Correspond to the M3 likelihood function given the missing the values for M1.

In general, these tests have proven two things: Firstly, the coefficient on each variable for M1 model for the years 1979,1980, and 1981, and 1982-1983 were equal. Secondly, this finding did not hold for the 1983 pairwise comparisons as they differ from year to year.

In consequence, it appears reasonable to believe that although moral hazard was present throughout the period 1979-83, it was more severe during the years of macroeconomic instability.

-Conjecture 3: The Prediction Accuracy of the Bank Failure Prediction Model.

As we have seen from the evidence of the logit model, the role of moral hazard in the likelihood of bank failure/problem was found significant during the whole period of the study. It is not inconceivable to suggest that if the moral hazard hypothesis was overwhelmingly significant then it is plausible to construct a bank failure prediction model from the set of proxies for moral hazard. This model enables us to evaluate not only its prediction accuracy at the time of failure (critical time), but also its accuracy to signal early warnings with some leading time before the critical time. Indeed, it will be shown that this model performs better than the traditional early warning model estimated with annual accounting and financial ratios shown in chapter 6.

Following a similar methodology of chapter 5, I have proceded to estimate a quarterly logit model with those proxies for risk-taking similar to the one used in testing the moral hazard hypothesis. The dependent variable a1b183 which includes a quarterly classification of failed/problem banks and nonfailed/nonproblem banks for 1983 was regressed against regressors measuring excessive risk-taking. As before, each ratio (proxy) for each bank was expressed in terms of the deviation from its own trend.

Table 8.8a Logit Analysis of Selected Proxies for Risk-Taking at the Time of Failure/Problem in 1983.

Variables	Alternative Specifications M1	M2	M3	M4	M5
Constant	2.61	0.75	0.79	0.82	0.52
	(4.19)	(2.48)	(2.52)	(2.60)	(1.69)
Pr/TA	8.27	-0.53	-0.55	-0.40	-1.00
	(1.78)	(-0.36)	(-0.38)	(-0.28)	(-0.72)
TL/TA	-1.31		1.60		
	(-0.33)		(0.58)		
NPL/K	0.01				0.006
	(0.27)				(0.15)
NPL/TL	3.00	3.09	2.96	3.04	
	(0.94)	(1.52)	(1.49)	(1.50)	
Prv/TL	0.72	-3.59	-3.28	-3.54	-2.35
	(0.32)	(-2.73)	(-2.40)	(-2.70)	(-2.21)
Dep/TLi	10.83	-1.49	-1.44	-1.49	-2.89
	(2.69)	(-0.80)	(-0.78)	(-0.79)	(-1.10)
LACTOT	-19.45	0.08			0.32
	(-3.42)	(0.30)			(1.25)
LPASCIR	19.67			0.21	
	(3.44)			(0.79)	
ln Lklhd(-)	43.52	56.06	55.93	55.78	61.69
Lklhd Ratio(b)	48.48	23.40	23.66	23.96	12.14
Lklhd RIndex(c)	35.77	17.26	17.45	12.98	8.90
A.I.C.(d)(-)	52.52	62.06	61.93	61.78	67.69

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lsLklhdu] and it has chi-square distribution with j-1 degrees of freedom.
(c) The pseudo R-square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -lnLklhd+K where K is the number of estimated parameters.

Table 8.8b Prediction Accuracy of M1 Logit Model for 1983

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	4	10	17	29
Failure Accuracy(%)	92.8	82.1	69.6	48.2
Type-II Error	11	15	18	23
Non-Failure Accuracy(%)	74.4	65.1	58.1	46.5
Overall Accuracy(%)	84.8	74.7	64.6	47.4
Predicted Num. Fails	52	46	39	27
Actual Num. Failures	56	56	56	56
Predicted Num.NonFails	32	28	25	20
Actual Num. NonFails	43	43	43	43

Tables 8a-12a present the logit results for alternative specifications at the time of failure/problem (critical time) and for years before the critical time. Among the alternative specifications presented in table 8a, equation M1 is preferred to the alternatives on the basis of the Akaike`s information criteria (A.I.C.) for model selection. As we have seen in chapter 7, according to this criterion for selection of non-nested models, the researcher chooses the lowest A.I.C.

Specification M1 includes the constant and the set of explanatory variables used in the previous estimations; that is proxies for asset quality (profits/capital (Pr/K), total loans/total assets (TL/TA), nonperforming loans/capital (NPL/K), nonperforming loans/total loans (NPL/TL), reserves adequacy (provisions/total loans (Prv/TL)), liabilities qualities (total deposits/total liabilities (Dep/TLi)), and the growth rates for banks` assets and liabilities (LACTOT and LPASCIR respectively).

Although most of the regressors are statistically insignificant, the overall equation is still significant judging from the likelihood ratio statistic evaluated at 1% of significant.(chi-square with 8 d.f is 20.09)

Equation M5 is insignificant and M2,M3, and M4 are just above the significant level to reject the null hypothesis. Similarly, the likelihood R-Index (pseudo R) confirms the superiority of M1 with respect to the goodness of fit.

As we will see shortly, the overall prediction accuracy of specification M1 in comparison to the alternative specifications is exceptionally good. This indicator together with the Akaike's criterion should be the overwhelming criterion in choosing the best specification.

Table 8.9a Logit Analysis of Selected Proxies for Risk-Taking One Year Before the Critical Time.(1982) (a)

Variables	Alternative Specifications				
	M1	M2	M3	M4	M5
Constant	1.02	0.84	0.67	0.85	0.54
	(2.05)	(2.29)	(1.66)	(2.29)	(1.57)
Pr/TA	45.79	68.28	71.85	69.06	46.42
	(1.34)	(2.74)	(2.83)	(2.76)	(2.47)
TL/TA	12.55		5.60		
	(1.58)		(1.06)		
NPL/K	-0.81				-0.86
	(-1.91)				(-2.26)
NPL/TL	-5.98	-4.08	-4.42	-4.10	
	(-1.62)	(-1.99)	(-2.22)	(-2.01)	
Prv/TL	12.14	13.56	14.51	13.75	9.16
	(2.60)	(3.62)	(3.78)	(3.68)	(3.21)
Dep/TLi	14.55	14.37	14.19	14.46	11.72
	(3.03)	(3.38)	(3.38)	(3.39)	(3.02)
LACTOT	12.11	0.16			0.86
	(2.38)	(0.62)			(2.18)
LPASCIR	-11.97			0.12	
	(-2.30)			(0.54)	
ln Lklhd(-)	32.65	40.54	40.07	40.63	41.18
Lklhd Ratio(b)	80.68	64.90	65.84	64.72	63.62
Lklhd R-Index(c)	55.26	44.45	45.10	44.33	43.58
A.I.C.(d)(-)	41.65	46.54	46.07	46.63	47.18

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lsLklhdu] and it has chi-square distribution with j-1 degrees of freedom.
(c) The pseudo R-square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -lnLklhd+K where K is the number of estimated parameters.

Table 8.9b Prediction Accuracy of M1 Logit Model for 1982.

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	8	9	12	15
Failure Accuracy(%)	87.5	85.9	81.2	76.5
Type-II Error	6	7	11	17
Non-Failure Accuracy(%)	86.3	84.1	75.0	61.3
Overall Accuracy(%)	87.0	85.1	78.7	70.3
Predicted Num. Fails	56	55	52	49
Actual Num. Failures	64	64	64	64
Predicted Num.NonFails	38	37	33	27
Actual Num. NonFails	44	44	44	44

In tables 9a-12b the evidence also shows that specification M1 is preferable to the alternatives for every year prior to 1983 based on the likelihood ratios, A.C.I., and overall prediction accuracy.

Table 8.10a Logit Analysis of Selected Proxies for Risk-Taking Two Years Before the Critical Time. (1981)(a)

Variables	M1	M2	M3	M4	M5
	Alternative Specifications				
Constant	3.81	1.39	1.52	1.43	0.62
	(4.44)	(3.60)	(3.89)	(3.64)	(1.93)
Pr/TA	-11.81	34.48	32.46	34.24	-2.36
	(-0.33)	(1.48)	(1.37)	(1.46)	(-0.13)
TL/TA	-8.20		1.52		
	(-1.09)		(0.51)		
NPL/K	0.56				0.53
	(2.43)				(2.82)
NPL/TL	-3.49	-1.50	-1.51	-1.49	
	(-3.34)	(-2.98)	(-3.03)	(-3.02)	
Prv/TL	6.91	13.76	14.55	14.00	6.94
	(1.23)	(3.67)	(3.89)	(3.74)	(3.21)
Dep/TLi	-1.76	-0.63	-0.52	-0.60	-0.18
	(-0.83)	(-0.40)	(-0.34)	(-0.38)	(-0.12)
LACTOT	31.29	0.28			-0.16
	(3.90)	(1.19)			(-0.71)
LPASCIR	-31.43			0.21	
	(-3.90)			(0.97)	
ln Lklhd(-)	35.75	53.37	54.12	53.70	59.30
Lklhd Ratio(b)	74.48	39.24	37.74	38.58	27.38
Lklhd R-Index(c)	51.02	26.88	25.85	26.42	18.75
A.I.C.(d)(-)	44.75	59.37	60.12	59.70	65.30

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lsLklhdu] and it has chi-square distribution with j-1 degrees of freedom.
(c) The pseudo R-square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -lnLklhd+K where K is the number of estimated parameters.

Table 8.10b Prediction Accuracy of M1 Logit Model for 1981

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	5	7	10	21
Failure Accuracy(%)	92.1	89.0	84.3	67.1
Type-II Error	9	14	15	17
Non-Failure Accuracy(%)	79.5	68.1	65.9	61.3
Overall Accuracy(%)	87.0	80.5	76.8	64.8
Predicted Num. Fails	59	57	54	43
Actual Num. Failures	64	64	64	64
Predicted Num.NonFails	35	30	29	27
Actual Num. NonFails	44	44	44	44

Table 9.11a Logit Analysis of Selected Proxies for Risk-Taking Three Years Before the Critical Time. (1980) (a)

Variables	Alternative Specifications M1	M2	M3	M4	M5
Constant	1.19	1.10	0.73	1.14	1.01
	(3.02)	(3.91)	(3.18)	(4.03)	(3.67)
Pr/TA	11.07	94.37	68.22	93.72	79.01
	(0.20)	(2.40)	(1.99)	(2.37)	(2.08)
TL/TA	21.81		-9.85		
	(2.32)		(-2.42)		
NPL/K	-0.04				-0.005
	(-0.22)				(-0.03)
NPL/TL	-2.09	-1.96	-1.56	-1.95	
	(-1.33)	(-1.81)	(-1.66)	(-1.79)	
Prv/TL	4.86	12.40	10.93	12.58	10.99
	(0.72)	(2.33)	(2.11)	(2.34)	(2.19)
Dep/TLi	1.97	5.65	4.12	6.07	5.54
	(0.39	(1.46)	(1.09)	(1.56)	(1.46)
LACTOT	50.26	-0.54			-0.54
	(4.18)	(-2.85)			(-2.80)
LPASCIR	-52.44			-0.61	
	(-4.21)			(-3.07)	
ln Lklhd(-)	34.11	58.05	59.31	57.08	60.58
Lklhd Ratio(b)	77.76	29.88	27.36	31.82	24.82
Lklhd R-Index(c)	53.26	20.46	18.74	21.79	17.00
A.I.C.(d)(-)	43.1	64.05	65.31	63.08	66.58

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lsLklhdu] and it has chi-square distribution with j-1 degrees of freedom.
(c) The pseudo R-square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -lnLklhd+K where K is the number of estimated parameters.

Table 8.11b Prediction Accuracy of M1 Logit Model for 1980

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	4	4	11	19
Failure Accuracy(%)	93.7	93.7	82.8	70.3
Type-II Error	12	13	15	16
Non-Failure Accuracy(%)	72.7	70.4	65.9	63.6
Overall Accuracy(%)	85.1	84.2	75.9	67.5
Predicted Num. Fails	60	60	53	45
Actual Num. Failures	64	64	64	64
Predicted Num.NonFails	32	31	29	28
Actual Num. NonFails	44	44	44	44

Table 8.12a Logit Analysis of Selected Proxies for Risk-Taking Four Years Before the Critical Time. (1979)(a)

Variables	Alternative Specifications M1	M2	M3	M4	M5
Constant	1.52	1.43	1.42	1.45	1.47
	(4.10)	(4.14)	(4.17)	(4.15)	(4.12)
Pr/TA	-24.65	-21.64	-23.04	-23.26	-22.04
	(-2.19)	(-2.25)	(-2.48)	(-2.41)	(-2.36)
TL/TA	-4.70		-6.25		
	(-0.91)		(-1.58)		
NPL/K	0.14				0.08
	(0.76)				(0.50)
NPL/TL	-0.02	-0.06	-0.20	-0.05	
	(-0.03)	(-0.09)	(-0.35)	(-0.07)	
Prv/TL	-11.30	-9.68	-11.29	-10.10	-9.71
	(-3.18)	(-3.52)	(-3.77)	(-3.64)	(-3.50)
Dep/TLi	-0.03	-0.79	-3.67	-0.59	-0.12
	(-0.006)	(-0.14)	(-0.84)	(-0.11)	(-0.02)
LACTOT	0.10	-0.45			-0.50
	(0.07)	(-1.54)			(-1.73)
LPASCIR	-0.45			-0.45	
	(-0.32)			(-1.56)	
ln Lklhd(-)	43.52	46.95	47.12	46.94	46.83
Lklhd Ratio(b)	58.94	52.08	51.74	52.10	52.32
Lklhd R-Index(c)	40.37	35.67	35.44	35.68	35.84
A.I.C.(d)(-)	52.52	52.95	53.12	52.94	52.83

(a) t-statistics are in parentheses.
(b) The likelihood ratio is -2[lnLklhdr-lsLklhdu] and it has chi-square distribution with j-1 degrees of freedom.
(c) The pseudo R-square is defined as 1-[lnLklhdr/lnLklhdu]
(d) The Akaike's Information Criteria is -lnLklhd+K where K is the number of estimated parameters.

Table 8.12b Prediction Accuracy of M1 Logit Model for 1979

Cut-Off Point	0.5	0.6	0.7	0.8
Type-I Error	1	5	12	37
Failure Accuracy(%)	98.3	91.6	80.0	38.3
Type-II Error	15	16	20	21
Non-Failure Accuracy(%)	59.4	56.7	45.9	43.2
Overall Accuracy(%)	83.5	78.3	67.0	40.2
Predicted Num. Fails	59	55	48	23
Actual Num. Failures	60	60	60	60
Predicted Num.NonFails	22	21	17	16
Actual Num. NonFails	37	37	37	37

Now we turn to the prediction accuracy of M1 where the model aims at minimising the misclassification errors. As we are aware from earlier discussions, one could make two types of errors. Type-I error occurs when the model predict a failed/problem bank as a nonfailed/nonproblem bank. In contrast, type-II error occurs when the model classifies a nonfailed/problem bank as a failure.

The classification results from model M1 are reported for each subsequent years in tables 9b-12b. In most previous studies the assigned cut-off point of the likelihood of failure/problem was 0.50 (50%). In the present study, I have assigned even more stringent cut-off points.

The data provide some interesting findings and gives ample support to the conjecture tested here.

Firstly, the overall accuracy of M1 is superior to the other specifications at different cut-off points during 1983 as shown in table 8b. For instance, the overall accuracy at 0.5 in 1983 was nearly 85% with a failure and nonfailure accuracy of nearly 93% and 75% respectively.

Secondly, the prediction accuracy of the model decreases only slightly as the cut-off point is raised. This is particularly evident in the years prior to the critical year of 1983. For example, in 1982 the overall accuracy went from 87% at 0.5 to 70.3% at 0.8.. The prediction accuracy also hold very well for the periods of 1981, 1980, and to a lesser extent but still quite impressive for the year of 1979.

Finally, the data indicate that the overall accuracy of the model has shown a minor deterioration in the classification accuracy. At a 0.5 cut-off point, the overall accuracy has fallen from 87% in 1982 to 85% and 83.5% in 1980 and 1979 respectively. Even with a stricter classification criterion, the same conclusion applies in each case. This performance is superior to the model estimated in chapter 6 with simple accounting and financial ratios, particularly for the years of 1981,1980, and 1979. Recalling the findings from chapter 6 and tables 10-14 for E1 logit model, we notice that the overall accuracy at 0.5 for the years 1981,1980, and 1979 were 80.4%, 79.4%, and 76% respectively. It is clear that these estimates are well below to the ones obtained from the M1 model. Similar conclusions are obtained at even stricter cut-off points. In consequence, the capability of the moral hazard model (M1) to predict failure/problems with data before the critical time is much superior to its counterpart model estimated with accounting and financial ratios (E1).

All in all, the econometric evidences support the general assertion concerning the overwhelming importance of moral hazard on the likelihood of bank failures/problems in the Chilean banking system between 1979 and 1983. Moreover, the data confirm the three basic conjectures which states the incidence of excessive risk-taking during the entire period of study, and particularly in the years of the collapse of the economy's output. Finally, the results also confirm the superiority of the logit model M1 estimated with proxies for risk-taking over its counterpart E1 as an early warning model. Indeed, the model was predicting the banking debacle with at least three years lead time.

There are two issues which remain unanswered by the model. One involves the relative importance of the macroeconomic and microeconomic variables in the failures of financial institutions. The second is that the model does not not shed any light on the banks' performance under different scenarios such as a stable macroeconomy vis a vis an unregulated financial system and vice versa. These issues will be presented and assessed empirically in chapter 9.

Finally, it should be pointed out that the macro and the micro model are non-nested therefore the estimates should be treated with caution. According to the econometric theory the ommision of an explanatory variable could lead to an specification bias unless they are orthogonal. Specifically, if we have $y= X_1 \beta_1 + X_2 \beta_2 + e$ and we ommit X_2 then the $E[b_1]=\beta_1 + [X'_1 X_1]^{-1} X'_1 X_2 \beta_2$. Unless X_1 and X_2 are orthogonal (i.e $\beta_2=0$), b_1 is biased upwards if $\beta_2>0$ (downwards if $\beta_2<0$).

Endnotes.

(1) The optimal value is affected by both cyclical fluctuations and secular trends. Balance-sheet data capture cyclical fluctuations and the time trend captures the secular trend.

(2) Wheelock (1992) found that the balance sheets of insured banks reflected greater risk-taking and the probit model estimates indicated that they were more likely to failed. It also included the age of the bank as proxy of bank management.

(3) This general specification follows closely the model of bank failure introduced by Ho and Saunders (1980). Their model assumes the existence of small and large banks. In the context of the US banking system, the formers are fully insured by FDIC whereas the latter are insured only partially. In addition, large banking firms are member of the FED system so that they have access to the discount window (lender to the last resort facilities). One of the most important implicit assumption underlying the model is that bank failure is considered as a discontinuous or explosive event involving a sudden crash or catastrophe.

(4) Guttentag and Herring (1986) argued that the economic net worth (ENW) is more accurate than the book net worth (BNW). In the latter method, the measurement of bank's assets includes only tangible assets and financial instruments (As) which appears in the standard bank balance sheet. In contrast, ENW includes not only As but also options (Af) such as lines of credits, acceptances, and forward contracts (Af), and intangible assets (Ag) such as bank's charter, customer relationship established over time, and expertise of bank's management. Thus, BNW differs from ENW mainly in the fact that it includes narrow definition of bank assets which will reflect the original cost of tangible assets and the face value of financial claims. They rarely will be recorded at a market value and Af and Ag will not appear at all. Changes in the value of assets and deposits resulting from changes in interest rates (volatile) would always be a source of difference between ENW and BNW.

(5) Other authors have also conviniently measured management risk-taking by relying on other set of proxies. For instance, Wheelock (1992) included the number of years since a bank has been chartered to capture such intangible as management quality. The coefficient should be negative as older banks becomes more conservative in their management. Bovenzi, Marino, and McFadden (1983) use the bank examiners' report as a proxy for management capability.

Chapter 9. Some Predictions of the Logit Model for Chile.

(9.1) Introduction.

This chapter looks into the question concerning the relative importance of factors external to the banks (macroeconomic instability) and internal factors (banks' risk-taking) on the likelihood of bank failure. Indeed, an overwhelming econometric evidence on the significance of these two hypothesis on the failures of the Chilean banks was presented in chapters 7 and 8.

This chapter attempts to solve this empirical question based on the logit model specified in the two previous chapters by looking at the robustness of each model in turn.

This chapter also presents and discusses the results from some simple prediction exercises conducted by assuming different scenarios. Specifically, I simulate the effect of changes in the macroeconomic environment, such as an improvement in the economy's GDP growth, on the probability of failure.

Moreoever, the model will assess the impact of a change of a selected proxy for risk-taking on the probability of bank failure. It could be argued that if supervision had encouraged banks to behave more conservatively, the likelihood of failure would certainly have been certainly smaller.

All these questions will be verified by the statistical evaluation of the logit model by using a procedure for non-nested model by evaluating any probability changes from the prediction probabilities of the model when the regressor changes.

(9.2) <u>The Econometric Testing of Non-Nested Logit Models: Macroeconomic Hypothesis vs. Moral Hazard Hypothesis.</u>

As we have seen in chapter 5, the Akaike Information Criterion (A.I.C.) was one of the scalar criteria for model selection. According to Amemiya (1981), if two competing models are non-nested, the A.I.C. offers a useful and simple measure which is adjusted by the degrees of freedom. This scalar seeks to incorporate in model selection the divergent consideration of accuracy of estimation and the best approximation to reality. The Akaike statistic gives a measure of precision of the estimate and a measure of the parameterisation of the model. Clearly, the Akaike criterion (defined as $AIC=-\ln ML+K$ where $\ln ML$ is the log likelihood and K the number of parameters) introduces a trade-off between precision and parameterisation, since increases in K involve a penalty in the value of the AIC. According to this criterion one chooses the model with the smallest AIC.

Let's recall from chapter 7 and 8, the two general models which test the role of macroeconomic instability and moral hazard on the probability of bank failure respectively.

(1) $H_0 : P(Y_{it}=1)= F(\mathbf{x}'_{it} \beta)$ (macro model E1)

In equation (1) the column vector Y contains the endogeneous dichotomous variable for each bank i in a given quarter t for the ordered group A and B, **x** is a K-vector of known macroeconomic variables (GDP, stock prices, real lending interest rates, and the real exchange rate), and **ß** is a k-vector of unknown parameters.

(2) $H_1 = P(Y=1) = F(\mathbf{z}'_{it} \alpha)$ (moral hazard model M1)

As before Y is a sequence of observations of an independent binary random variable. Also, **z** is a k-vector of known proxies for moral hazard (ratios for asset quality, provision for risky loans, liability quality, and growth of bank assets and liabilities) measured as deviation from its trend. α is a k-vector of unknown parameters.

These two hypotheses are non-nested since the explanatory variables of H_0 are not a subset of the explanatory variables in the other model (i.e H_1)

Table 1 summarises the main results of these two general competing models (i.e specification E1 and M1) estimated in chapter 7 and 8 respectively.

Table 9.1 Summary Statistics From the Two Competing Models.

	H_0	H_1
Number of Parameters K	9	18
ln Lklhd(-)	227.00	294.43
Lklhd Ratio(a)	264.36	129.50
AIC(-)(b)	236.00	312.43

(a) The likelihood ratio is -2[lnLklhdr-lnLklhdu] and it has a chi-square distribution with (j-1) degrees of freedom.
(b) The Akaike's Information Criterion is -lnLklhd + K where K is the number of estimated parameters.
H_0 : Macroeconomic model
H_1 : Moral Hazard model

We observe from the table that both models are highly significant judging from the overall likelihood ratio test. However, model H_0 (macro model) is superior to H_1 (moral hazard model) as the former exhibit a much lower AIC. This implies that macroeconomic factors explain the probability of bank failure in Chile better than the moral hazard factor, but it does not allow us to reject either of these hypotheses in favour of the other. For this, we need to apply some formal test of competing non-nested hypotheses.

Davidson and Mackinnon (1981) have introduced a test for non-nested models which is easy to apply to either linear or non-linear models. The Davidson and Mackinnon's test (DM) assesses the statistical significance of H_0 against H_1. Thus, the truth of H_0 implies the falsity of H_1 and vice versa.

The DM test consists of the following steps: Firstly, from the estimated model (2) we obtain the predicted value of Y_1 given by $\hat{Y}_1 = z\hat{\alpha}$. These predicted values of Y are then included as a regressor in (1). That is, $Y=F(x`ß +z\hat{\alpha})$ and test the hypothesis that $\alpha=0$ based on the t-statistics for Y_1. If the hypothesis is not rejected, then H_0 is not rejected by H_1.

A test of H_1 against H_0 is analogous to the previous steps as we estimate the fitted value as $\hat{Y}_0=x\hat{ß}$ and regress them against $\hat{Y}$ in model (2), that is, $Y=F(z\alpha+xß)$. Then, we test $ß=0$ so that if the hypothesis is not rejected, then H_1 is not rejected by H_0.

Treating the DM as a one-tailed test since the fitted values are expected to have positive coefficients, the critical values for the t-statistic at 0.025 and 0.01 are 2.03 and 2.44 respectively. Given that the t-statistics for α is 7.28 and for ß is 10.9 then it follows that H_0 is not rejected by H_1 and vice versa. This result implies that the appropriate model is an encompassing model incorporating both H_0 and H_1, since each of the t-statistics cited can be considered as a test of H_0 or H_1 against an encompassing model incorporating the full set of regressors from H_0 and H_1.

In my view this can be interpreted as indication that although moral hazard has been important in raising the likelihood of bank failure, macroeconomic instability (shock) also triggers bank failures.

(9.3) Simple Aggregate Predictions from the Logit Models.

One of the important use of the logit model once the structural parameters of the model have been estimated is to make predictions when the factors which determine the probability of an event change. In this study, I have estimated two competing models which explain the likelihood of bank failure. As we have seen in the previous section, the non-nested test has accepted both hypotheses as significant.

It would be useful to assess the impact on the probability of bank failure if some macroeconomic variables (e.g. change in GDP), or some proxies measuring risk-taking (e.g. provision/total loan ratio) change at a particular point in time. This exercise will be useful for comparison purposes of the two competing models rather than prediction per se for the population.

Let's consider the logistic models specified in expressions (1) and (2). The predicted probability of the model is $F(x'\hat{\beta}) = \hat{F} \equiv \hat{P}(Y_{it} = 1)$. If there is a small change in one of the independent variables controlling the probability of failure of the ith bank in quarter t, the estimated change in $\hat{F}$ will be given by

$$(3)\ d(\hat{P}) = \hat{\beta}\ \hat{P}(1-\hat{P})\ d(x)$$

where d(x) is the change in the explanatory variable for the ith bank, $\hat{\beta}$ is an estimated coefficient from the model and $d(\hat{P})$ is the estimated probability for bank ith. Given that the predicted change in the probability is not constant for all banks but depends on each original probability then we could extrapolate the estimated change in probability by taking the probability average of the group.

It should be pointed out that this approximation is not desirable if we are interested in assessing the predictions per se. Instead, given that each bank will have a different probability, the expected probability of an event can be found by aggregating individual P's by their relative frequency of occurrence in the population. (Westin 1974)

Table 2 presents the estimated impact on the probability of bank failure of a change in some of the selected macroeconomic variables. I have assumed that the change in the macroeconomic variables is 5% (0.05) and the average probability of bank failure is 77.4% (0.774).

Table 9.2 Marginal Effects on the Macro-Model.

Variables	Coefficient	Marginal Effect
VPGA	0.13	0.001
VIPAA	-0.01	-0.0001
TIAA2A	0.09	0.0007
VTCR1A	-0.09	-0.0007

VPGB= GDP
VIPAA= Stock Prices
TIAA2A= Real Lending Rate
VTCR1A= Real Exchange Rate

For instance, a 5% increase in GDP growth (VPGBA) reduces the probability of bank failure by 0.1% (0.001). Similarly, the model also predicts that a 5% reduction in the rate of interest (TIAA2A) and an equal real devaluation (VTCR1A) reduces the likelihood of failure by 0.07% (0.0007) in each case. Finally, the effect of a rise in stock prices on the probability of failure is also very small. (i.e. 0.01%)

In general, the predictions from the macro-model suggest that the impact of changes in macroeconomic variables is small in normal circumstances, particularly if we take into account the fact that these variables are not always moving in the same direction. How do we reconcile the small figures in the second column of table 9.2 with the importance of macroeconomic factors shown by the non-nested test ?

The explanation clearly lies in the abnormal macroeconomic circumstances of 1982-83. Most of the relevant macroeconomic variables moved sharply in an adverse direction - GDP and stock prices fell, real interest rates rose and the real exchange rate appreciated strongly - and the combined effect of these changes on the probability of bank failure was large. In this respect the crisis of 1982-83 in Chile was comparable to the Great Depression in the United States, which also caused many banks to fail.

Table 3 shows the impact on the probability of failure from changes in the proxies of moral hazard. The average probability of failure for this model is 61.09%. Again, I assume a 5% change in the proxy, expressed in terms of the deviation from the trend. A proxy smaller deviation from its trend will mean a more conservative bank's attitude towards risk-taking (moral hazard).

Table 9.3 Marginal Effects on the Moral Hazard Model.

Variables	Coefficient	Marginal Effect
NPL/K	0.24	0.002
Prv/TL	-4.78	-0.057
LACTOT	0.22	0.002
CARTINT	3.32	0.039

NPL/K=non-performing loans-capital ratio
Prv/TL=provisions-total loans ratio
LACTOT=asset growth
CARTINT= related portfolios.

The evidence from the selected variables is very robust. For instance, a 5% reduction of related portfolios (risk concentration) reduces the probability of bank failure by nearly 4%. Similarly, a rise in the provision-total loans ratio by 5% contributes to a reduction in the likelihood of failure by 5.7%.

The effect of changes in the non-performing loans-capital ratio and asset growth on the probability of failure is negligible (i.e. 0.2%). These results are surprising one would expect that rapid growth of bank assets should deteriorate the quality of bank portfolios, particularly at high interest rates.

The predictions from the moral hazard model support the view that a reduction in moral hazard has a significant impact on the likelihood of failure. Regulation and effective supervision should encourage banks to make larger provisions for bad loans. Similarly, an effective monitoring of loan concentration among affiliates should also be a top priority in the banking authorities` agenda, particularly in a buoyant economy experiencing a rapid expansion of bank assets.

All in all, the evidence from this chapter suggests that the presence of both macroeconomic instability and moral hazard have been significant in explaining bank failures in Chile. One could argue that macroeconomic shocks have triggered the collapse of the already weak financial institutions. This conclusion can also be supported from the early warning model estimated in chapter 6 which signals bank failures with three years in advance.

Furthermore, the evidence appears to suggest that from a policy stance prudential regulation and supervision should have a more immediate impact on reducing the average probability of failure than macroeconomic policy. Certainly, this does not mean that macroeconomic instability is unimportant since even financially healthy institutions will be unable to withstand a macroeconomic shock which entails a drop of output of the magnitude observed in Chile, and during the Great Depression.

Chapter 10. Conclusions.

(10.1) Summary of the Main Conclusions from the Study.

As we have seen from chapter 2, the expected results from financial liberalisation in Chile were achieved only partially. Although there was a substantial increase in financial deepening and an important increase in operative efficiency in the banking system, the level of saving and investment as well as its quality of allocation did not show an improvement. On the contrary, it appears that the banks were fostering a rapid loans expansion, a risky concentration of their loan portfolios with their affiliated firms, and financing stock market bubbles and the consolidation of large and powerful economic "groups". All this behaviour occurred in spite of high real interest rates during most of the liberalisation period, and a significant deterioration of the macroeconomy after several years of buoyant output growth.

After 6 years of sustained financial growth and stability (i.e between 1976 and 1981), the banking system experienced one of the worst financial crises in the country's history in 1981, reaching its peak of intensity in 1983. As we saw from chapter 3, by January 1983 5 banks had to be subject to interim management (intervened), among them the two largest commercial banks. Moreover, 2 banks and 1 non-bank financial institution had to be liquidated. All in all, they accounted for nearly 50% of the total loans of the system. However, the dimensions of the banking crisis were much wider if we also include those intermediaries which, although they were subject to no intervention, had to sell part of their nonperforming loans to the Central Bank. The intervention and the rehabilitation of the banking system avoided the total disruption of the intermediation and payment mechanism preventing a further deepening of the economic recession, and also acted as an aid to reactivate the economy.

One of the most revealing results from this study is the fact that there were signals at least four years before the banking debacle that financial institutions were experiencing some difficulties. This empirical result was confirmed by the early warning model developed in chapter 6. Specifically, the econometric results confirm the view that the failure of some financial institutions in Chile might have been anticipated before its critical time in 1983 with an acceptable degree of confidence.

The study has also lent support to two of the hypotheses stated in chapter 4 to explain bank failures in Chile. The logit model estimated in Chapter 7 provides econometric evidence to support the hypothesis that the episodes of bank failures in Chile reflected the impact of macroeconomic variables on the likelihood of bank failures. Particularly significant variables were the growth in GDP and real lending interest rates.

Similarly, the econometric evidence from the logit model estimated in chapter 8 also supports the alternative hypothesis concerning the importance of moral hazard for the likelihood of bank failures in the Chilean banking system between 1979 and 1983. Moreover, it was proven that although moral hazard was present throughout the period 1979-83, it was more severe during the years of macroeconomic instability. Finally, the results also confirmed the marginal superiority of the logit model estimated with proxies for risk-taking over its counterpart of chapter 6 as an early warning model.

Finally, the non-nested tests of the two logit models (i.e. macro model and moral hazard model) conducted in chapter 9 suggest that neither of the two hypotheses is unambiguously superior in explaining the bank failures in Chile. Given that both competing hypotheses were found significant according to the Davidson and Mackinnon's test, the appropriate inference is that an encompassing model is preferred. That is, one needs both sets of variables to explain the phenomena of bank failures. In my view this can be interpreted as providing support to the assertion that although moral hazard was important throughout the period of study, macroeconomic instability (shocks) is the triggering factor of bank failures.

The prediction exercises of each of the two models suggest that under normal circumstances the average probability of failure is more sensitive to changes in banks' attitudes towards risk-taking than changes in some macroeconomic variables. From a policy-stance this could mean that the role of prudential regulation and supervision to reduce moral hazard should be more important than trying to ensure macroeconomic stability at all times. An unusually deep macroeconomic crisis is always likely to rise the probability of bank failure, but healthier banks will be more able to withstand macroeconomic shocks.

(10.2) <u>Limitations of This Study and Further Research.</u>

One of the limitations of the study is that the banks' data from their balance sheet used in the ratio analysis and in the estimation of the models is expressed in historical cost rather than market value. For instance, the book value of an asset will reflect the original cost and few, if any, assets will be recorded at current market value. Similarly, on the right-hand side of the balance sheet, banks' liabilities (deposits) are also expressed in book value. This should introduce a bias in the bank's valuation and in the insolvency determination, particularly in the case of volatile interest rates. Thus, a further line of research should include balance-sheet data adjusted for changes in their market value. The process of securitisation permits today the transformation of the banks' nonmarketable assets such as loans and mortagages into marketable securities.

A second important limitation involves the absence of any stock market data for identifying banks with financial difficulties. The early warning model of chapter 6 was estimated using accounting data, given the limitations on the availibility of information on banks' equity prices. It was argued that if the market for actively-traded bank equities is efficient, information about potential problems at a bank will be translated into the bank's security price. Therefore, in any further research on early warning models, banks' equity prices will also provide a relatively efficient early-warning system.

Finally, it would have been desirable to extend the period of study in order to assess the pattern of banks' behaviour before the period of financial liberalisation for comparison purposes. There are two advantages of doing this: Firstly, it will make it possible to test moral hazard during the pre-liberalisation period. And secondly, it should improve the estimation of the time trend used in chapter 8 by having a longer period as reference. This line of research would be possible so long as the data becomes available.

APPENDIX 1. List of Chilean Financial Institutions.

B A N K S

N A M E	C O D E		YEAR INTERVENTION
- COMMERCIAL BANKS:			
BANCO DE CHILE	001	*	1983 RK AND PR
BANCO ESPAÑOL DE CHILE	002	*	1981 LIQ
BANCO DE TALCA	006	*	1981 LIQ
BANCO O'HIGGINS	008	**	
BANCO INTERNACIONAL	009	*	1983 RK AND PR
BANCO OSORNO Y LA UNION	010	*	1976 RK AND PR
BANCO CONTINENTAL	011	**	
BANCO SUD AMERICANO	014	**	
BANCO DE CREDITO E INVERSIONES	016	**	
BANCO DEL TRABAJO	022	**	
BANCO AUSTRAL	024	*	1981 LIQ
BANCO DEL PACIFICO	025	**	
BANCO NACIONAL	026	**	
BANCO CONCEPCION	027	*	1983 RK AND PR
BANCO INDUSTRIAL Y DE COMERCIO EXT.	028	**	
BANCO DE A. EDWARDS	029	**	
BANCO DE SANTIAGO	035	*	1983 RK AND PR
BANCO REGIONAL DE LINARES	030	*	1981 LIQ
BANCO DEL ESTADO DE CHILE	012	**	
- FOREIGN BANKS:			
CITYBANK N.A.	033		
ESPAÑOL (SANTANDER)	037		
CENTROBANCO	048		
CHASE MANHATTAN	041		
REPUBLIC NATIONAL BANK OF NEW YORK	031		
THE FIRST NATIONAL BANK OF BOSTON	039		
SUDAMERIS	040		
THE HONG KONG AND SHANGHAI	050		
EXTERIOR	036		
BANK OF AMERICA	032		
MORGAN FINANSA	047		
CHICAGO CONTINENTAL	044		
DO BRASIL	017		
AMERICAN EXPRESS INTERNATIONAL	042		
TOKIO LTD.	045		
REAL	034		
DE LA NACION ARGENTINA	043		
DE COLOMBIA	046		
DE SAO PAULO	038		
I.- DEVELOPMENT BANKS:			
BANCO DE FOMENTO DE VALPARAISO	501	*	1981 LIQ
BANCO UNIDO DE FOMENTO	[illegible]	*	198[illegible] LIQ

BANCO DE FOMENTO DEL BIO-BIO	503	*	1981 LIQ
BANCO HIPOTECARIO DE FOMENTO	504	*	1983 RK AND PR
BANCO HIPOTECARIO DE CHILE	505	*	1983 LIQ
BANCO COLOCADORA NACIONAL DE CHILE	506	*	1983 MERGED
BANCO EMPRESARIAL DE FOMENTO	507		

IV.- NON BANK FINANCIAL INSTITUTIONS:

FINANCIERA CASH	705	*	1981 LIQ
NACIONAL FINANCIERA	708	**	
FINANCIERA DE ADELANTOS Y CREDITOS S.A	710	*	1982 LIQ
FINANCIERA COMERCIAL	713	**	
CIA. GENERAL FINANCIERA S.A.	715	*	1981 LIQ
FINANCIERA ATLAS	716	**	
FINANCIERA CIGA	717	*	1983 LIQ
FINANCIERA LATINOAMERICANA DE DESARROLLO	718		
FINANCIERA DAVENS S.A.	720	*	1985 LIQ
FINANCIERA CORFINSA S.A.	721	**	
FINANCIERA FUSA S.A.	722	**	
FINANCIERA LOS ANDES	723		
FINANCIERA DE PAPELES Y CARTONES	724		
FINANCIERA DE CAPITALES	725	*	1981 LIQ
FINANCIERA MEDITERRANEO S.A.	726	*	1985 LIQ
FINANCIERA DEL SUR S.A.	731	*	1981 LIQ
FINANCIERA DE INTERES SOCIAL S.A	732	**	
FINANCIERA CONDELL S.A.	733	**	

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*	FAILED BANKS.
**	PROBLEM BANKS.
LIQ	LIQUIDATED
RK	CAPITALISED
PR	PRIVATISED
	MERGED

APPENDIX 2. Balance Sheet of a Chilean Bank.

Current Assets
- Cash
- Loans
  - With their own resources
    - Less than 1 year
    - More than 1 year
  - With resources from the Central Bank
    - Less than 1 year
    - More than 1 year
  - Mortgage
  - Contingent
    - Less than 1 year
    - More than 1 year
  - Nonperforming
- Financial Investment
  - Equities
  - Financial instruments issue by Central Bank
  - Other investments

Other Assets
- Notes issue Central Bank in return for NP & risky loans
- Other Assets
- Realisable Guarantees

Fixed Assets

Losses

Total

Current Liabilities
- Deposits
  - Less than 1 year
  - More than 1 year
- Intermediation of Documents
  - Less than 1 year
  - More than 1 year
- Mortgage Obligations
- Contingent Obligations
- Loans Obtained in the Country
  - Less than 1 year
  - More than 1 year
- Loans Obtained Abroad and Other Obligations
  - Less than 1 year
  - More than 1 year

Other Liabilities (provisions)

Capital and Reserves

Profits

Total

Income Statement of a Chilean Bank.

(1) Interest earned from loans and investment
(2) Interest paid to deposits, debts, and other obligations
(3) Financial Margin = (1) - (2)
(4) Other Incomes
(5) Gross Operating Margin = (3) + (4)
(6) Expenses on provisions and write off of risky assets
(7) Administrative expenses (nonfinancial operating expense)
(8) Other expenses
(9) Gross Profits = (5) - (6) - (7) - (8)

Income and Expenses Accounts

Nominal Income

- Operating Income
  - Interest earned from
    - Loans in local currency
    - Loans in foreign currency
    - Mortgage
    - Contingent loans in local currency
    - Contingent loans in foreign currency
    - Financial investments in local currency
    - Financial investment in foreign currency
    - Others
  - Adjustments earned from
    - Loans
    - Financial Investment
    - Others
  - Benefits from intermediation
    - Promissory notes discounted by Central Bank
    - Other financial operations
  - Profits from currency exchange
  - Commissions eraned
- Other Income from
  - Sale of fixed assets
  - Recovery of nonperforming loans
  - Recovery of expenses
  - Others

Monetary Correction

Net Loss

Total Income

Nominal Expenses

- Operating Expenses
  - Interest and discounts paid on
    - Sight deposits
    - Time deposits
    - Saving accounts
    - Loans from Central Bank
    - Loans from other institutions
  - Adjustments paid on
    - Deposits
    - Saving accounts
    - Operations with Central Bank
    - Others
  - Price differences on intermediation
    - Promissory notes descounted by Central Bank
    - Other financial operations
  - Losses from currency exchange
  - Commissions paid on
    - Operations in local currency
    - Operations in foreign currency
- Fixed Expenses
  - Wages and Salaries
    - Employees wages and salaries
    - National insurance contributions
    - Directors salaries
    - Profit sharing
    - Salaries to professionals
  - Administrative Expenses
    - Materials, Repairs
    - Rents
    - Marketing
    - Representation expenses
  - Taxation
    - Income tax
    - Property tax
    - Others
  - Write-offs
    - Loans & Financial investment
  - Depreciations and Provisions
    - Depreciations of physical assets
    - Global provisions on loans
    - Individual provisions on loans
    - Other provisions
    - Provisions for repurchase of loans from Central Bank
- Losses from branches abroad
- Other expenses

Monetary Correction

Net Profits

Total Expenses

APPENDIX 3. Financial Ratios.

CATEGORIES	CODE	VARIABLES
CATEGORY 1: CAPITAL ADEQUACY	1	Capital and Reserves / Assets 1
	2	Capital and Reserves / Total Assets
	3	Total Loans / Capital and Reserves
	4	Bad Loans / Capital and Reserves
	5	Net Capital / Assets 1
	6	Net Capital / Total Liabilities
CATEGORY 2: LIQUIDITY	1	Financial Investment / Assets 1
	2	Liquid funds (Cash) / Assets 1
	3	(Financial Investment + Cash) / Assets 1
	4	Financial Investment / Total Loans
	5	Cash / Total Loans
	6	(Financial Investment + Cash) / Total Loans
CATEGORY 3: PROFITABILITY	1	Operating Earnings / Operating Expenses
	2	Operating Earnings / Assets 1
	3	Gross Profits / Assets 1
	4	Gross Profits / Total Liabilities
	5	Gross Profits / Capital and Reserves
CATEGORY 4: ASSET RISK	1	Total Loans / Assets 1
	2	Financial Investment / Assets 1
	3	Provisions for Bad Loans / Operating Expenses
	4	Provisions for Bad Loans / Total Loans
	5	Mortgage Loans/ Total Loans
	6	Mortgage Loans/ Assets 1
CATEGORY 41:	1	Fixed Assets / Assets 1
	2	Fixed Assets / Total Loans
	3	Total Loans / Capital and Reserves
	4	Bad Loans / Capital and Reserves
	5	Bad Loans / Total Loans
	6	Bad Loans / Assets 1
CATEGORY 42:	1	Rate of Growth of Total Loans (Domestic Currency)
	2	Rate of Growth of Total Loans (Foreign Currency)
	3	Total Loans (Foreign Currency) / Assets 1
CATEGORY 5: EFFICIENCY	1	Fixed Expenses / Total Expenses
	2	Fixed Expenses / (Total Loans + Financial Investment)
	3	Fixed Expenses / (Operating Earnings - Operating Expenses)
CATEGORY 6: LIABILITY QUALITY	1	Deposits (Less than a year) / Liabilities 1
	2	Deposits (More than a year) / Liabilities 1
	3	Total Deposits / Liabilities 1
	4	Loans from Abroad (Less than a year) / Liabilities 1
	5	Loans from Abroad (More than a year) / Liabilities 1
	6	Total Loans from Abroad / Liabilities 1
	7	Total Liabilities (Foreign Currency) / Liabilities 1

CATEGORY 61:	1	Rate of Growth of Total Liabilities (Domestic Currency)
	2	Rate of Growth of Total Liabilities (Foreign Currency)
CATEGORY 7: MISMATCHING	1	Total Liabilities (Foreign Currency) / Total Assets
	2	Cash / Total Loans
	3	Cash / Liabilities 1
	4	(Financial Investment + Cash) / Liabilities 1
	5	(Financial Investment + Cash) / Total Loans

DEFINITIONS:

1) TOTAL ASSETS = Assets 1 + Fixed Assets + Other Assets.
   Where: Assets 1 = Cash + Total Loans + Financial Investment.
   Other Assets: - Documents Holding from the sale Bad Loans to the Central Bank.
   - Goods Received in Payments.
   - Others.

2) TOTAL LIABILITIES = Liabilies 1 + Other Liabilities.
   Where: Liabilities 1 = Deposits + Intermediation of Documents + Loans from Home + Loans from Abroad.
   Other Liabilities = Provisions for Loans and Financial Investment + Other Liabilities.

3) FIXED EXPENSES = Wages + Administrative Expenses + Taxation + Depreciations.

4) NET CAPITAL = Capital and Reserves - Bad Loans.

5) GROSS PROFITS = Total Earnings - Total Expenses.

APPENDIX 4. Testing Mean Differences.

TESTING DIFFERENCES BETWEEN MEANS.

LET'S SUPPOSE WE ARE DEALING WITH AN INDEPENDENT RANDOM SAMPLE OF SIZE $n1$ AND $n2$ FROM TWO NORMAL POPULATIONS HAVING THE MEANS $\mu 1$ AND $\mu 2$ AND VARIANCES $\sigma 1^2$ AND $\sigma 2^2$.

WE WISH TO TEST THE NULL HYPOTHESIS

$$H0: \mu 1 - \mu 2 = \delta$$

AGAINST THE ALTERNATIVE

$$H1: \mu 1 - \mu 2 =/= \delta$$

HOWEVER IF WE HAVE THAT $n1$ AND $n2$ ARE SMALL, AND ALSO $\sigma 1^2$ AND $\sigma 2^2$ ARE UNKNOWN THEN FOR INDEPENDENT RANDOM SAMPLE FROM TWO NORMAL POPULATION HAVING THE SOME UNKNOWN VARIANCE, THAT IS $\sigma 1^2=\sigma 2^2$ WE TEST BY MEANS OF t-STATISTICS.

(1) $t* = (X1-X2-\sigma)/[Sn \sqrt{(1/n1)+(1/n2)}]$

WHERE:

$$Sn = [(n1-1)S1^2+(n2-1)S2^2]/(n1+n2-2)$$

THE ABOVE EXPRESSION FOR t IS A VALUE OF A RANDOM VARIABLE HAVING A t DISTRIBUTION WITH $n1+n2-2$ DEGREES OF FREEDOM. THUS, THE APPROPRIATE CRITICAL REGION OF SIZE α FOR TESTING $H0: \mu 1-\mu 2 = \delta$ AGAINST $H1: \mu 1-\mu 2 =/= \delta$ UNDER THE GIVEN ASSUMPTIONS IS:

(2) $|t*| > t\alpha/2,\ n1+n2-2.$

APPENDIX 5. Two Separate Regressions.

Logit Analysis for Two Separate Variables

Variables	Specifications S1	S2
Constant	-7.79 (-2.56)	4.15 (2.50)
X13	0.81 (2.73)	
X43		-0.94 (-2.25)
Log Likelihood	-8.86	-10.38

t-Statistics in Brackets

Covariance-Correlation Matrix For Macroeconomic Variables.

Date: 5-29-1997 / Time: 11:46
SMPL range: 1 - 521
Number of observations: 521

Variable	Mean	S.D.	Maximum	Minimum
TINTA	1.0505019	1.1785998	3.6112600	-0.1099624
TINTB	0.7211171	1.0892717	3.6112600	-0.1099624
TPASA	0.6305381	1.0687395	3.3882650	-0.9442292
TPASB	0.4357481	0.9337091	3.3882650	-0.9442292
VIPAA	-0.3502787	10.988682	38.697250	-16.938010
VIPAB	-0.3553186	9.1753367	38.697250	-16.938010
VPGBA	0.2993854	3.6046937	9.5566700	-7.4196190
VPGBB	0.1945798	2.9656567	9.5566700	-7.4196190
VTCRA	0.1838377	5.7921532	23.437500	-13.150810
VTCRB	0.1114087	4.8203283	23.437500	-13.150810
M1A	40943.131	36762.683	102720.00	0.0000000
M1B	28844.726	36496.943	102720.00	0.0000000
M2A	161197.00	155748.87	411720.00	0.0000000
M2B	114019.72	151777.91	411720.00	0.0000000

	Covariance	Correlation
TINTA,TINTA	1.3864313	1.0000000
TINTA,TINTB	-0.7575349	-0.5912000
TINTA,TPASA	0.9933622	0.7901395
TINTA,TPASB	-0.4577542	-0.4167627
TINTA,VIPAA	-2.4684431	-0.1909614
TINTA,VIPAB	0.3732629	0.0345829
TINTA,VPGBA	-0.5588413	-0.1317917
TINTA,VPGBB	-0.2044065	-0.0585925
TINTA,VTCRA	-0.2640136	-0.0387484
TINTA,VTCRB	-0.1170351	-0.0206399
TINTA,M1A	31503.343	0.7284797
TINTA,M1B	-30301.438	-0.7057888
TINTA,M2A	136928.48	0.7473721
TINTA,M2B	-119777.93	-0.6708667
TINTB,TINTB	1.1842355	1.0000000
TINTB,TPASA	-0.4546918	-0.3913302
TINTB,TPASB	0.8267582	0.8144513
TINTB,VIPAA	0.2525919	0.0211433
TINTB,VIPAB	-1.8722736	-0.1876919
TINTB,VPGBA	-0.2158919	-0.0550892
TINTB,VPGBB	-0.3438823	-0.1066564
TINTB,VTCRA	-0.1325685	-0.0210523
TINTB,VTCRB	-0.1395646	-0.0266316
TINTB,M1A	-29524.791	-0.7387165

TINTB,M1B	31167.074	0.7854846
TINTB,M2A	-116241.91	-0.6864928
TINTB,M2B	131829.17	0.7989160
TPASA,TPASA	1.1400118	1.0000000
TPASA,TPASB	-0.2747558	-0.2758658
TPASA,VIPAA	-2.5268707	-0.2155758
TPASA,VIPAB	0.2240419	0.0228913
TPASA,VPGBA	-0.0632187	-0.0164414
TPASA,VPGBB	-0.1226900	-0.0387838
TPASA,VTCRA	-0.9843641	-0.1593229
TPASA,VTCRB	-0.0702475	-0.0136621
TPASA,M1A	21908.010	0.5586737
TPASA,M1B	-18187.697	-0.4671795
TPASA,M2A	92867.869	0.5589888
TPASA,M2B	-71893.774	-0.4440637
TPASB,TPASB	0.8701393	1.0000000
TPASB,VIPAA	0.1526333	0.0149048
TPASB,VIPAB	-1.7764651	-0.2077579
TPASB,VPGBA	-0.1304566	-0.0388348
TPASB,VPGBB	0.0233795	0.0084593
TPASB,VTCRA	-0.0801069	-0.0148407
TPASB,VTCRB	-0.6465625	-0.1439318
TPASB,M1A	-17840.893	-0.5207535
TPASB,M1B	20582.322	0.6051467
TPASB,M2A	-70241.295	-0.4839388
TPASB,M2B	85412.885	0.6038619
VIPAA,VIPAA	120.51936	1.0000000
VIPAA,VIPAB	-0.1244605	-0.0012368
VIPAA,VPGBA	12.967806	0.3280099
VIPAA,VPGBB	0.0681572	0.0020955
VIPAA,VTCRA	-21.173418	-0.3333034
VIPAA,VTCRB	0.0390241	0.0007382
VIPAA,M1A	-90829.786	-0.2252734
VIPAA,M1B	10103.692	0.0252413
VIPAA,M2A	-555369.81	-0.3251218
VIPAA,M2B	39938.674	0.0239924
VIPAB,VIPAB	84.025216	1.0000000
VIPAB,VPGBA	0.1063772	0.0032225
VIPAB,VPGBB	8.5989900	0.3166204
VIPAB,VTCRA	0.0653210	0.0012315
VIPAB,VTCRB	-14.599932	-0.3307399
VIPAB,M1A	14547.857	0.0432120
VIPAB,M1B	-72056.080	-0.2155890
VIPAB,M2A	57276.298	0.0401571
VIPAB,M2B	-420612.60	-0.3026120
VPGBA,VPGBA	12.968877	1.0000000
VPGBA,VPGBB	-0.0582544	-0.0054598
VPGBA,VTCRA	-11.147525	-0.5349392
VPGBA,VTCRB	-0.0333542	-0.0019233
VPGBA,M1A	4120.8713	0.0311564
VPGBA,M1B	-8635.6899	-0.0657668
VPGBA,M2A		

	-76323.238	-0.1362065
VPGBA,M2B	-34135.841	-0.0625127
VPGBB,VPGBB	8.7782385	1.0000000
VPGBB,VTCRA	-0.0357711	-0.0020864
VPGBB,VTCRB	-7.7394080	-0.5424312
VPGBB,M1A	-7966.7075	-0.0732125
VPGBB,M1B	6361.1828	0.0588837
VPGBB,M2A	-31365.686	-0.0680367
VPGBB,M2B	-38036.192	-0.0846646
VTCRA,VTCRA	33.484645	1.0000000
VTCRA,VTCRB	-0.0204811	-0.0007350
VTCRA,M1A	9116.2009	0.0428944
VTCRA,M1B	-5302.7488	-0.0251327
VTCRA,M2A	175926.06	0.1953888
VTCRA,M2B	-20961.127	-0.0238891
VTCRB,VTCRB	23.190967	1.0000000
VTCRB,M1A	-4561.4229	-0.0257900
VTCRB,M1B	7580.5316	0.0431719
VTCRB,M2A	-17958.756	-0.0239667
VTCRB,M2B	126276.31	0.1729303
M1A,M1A	1.349E+09	1.0000000
M1A,M1B	-1.181E+09	-0.8818976
M1A,M2A	5.520E+09	0.9659890
M1A,M2B	-4.668E+09	-0.8382617
M1B,M1B	1.329E+09	1.0000000
M1B,M2A	-4.650E+09	-0.8195517
M1B,M2B	5.393E+09	0.9753994
M2A,M2A	2.421E+10	1.0000000
M2A,M2B	-1.838E+10	-0.7790007
M2B,M2B	2.299E+10	1.0000000

APPENDIX 7. Covariance-Correlation Matrix for Proxies of Moral Hazard.

Date: 5-29-1997 / Time: 11:54
SMPL range: 1 - 521
Number of observations: 521

Variable	Mean	S.D.	Maximum	Minimum
RAT33A	3.128E-05	0.0074274	0.0419369	-0.0366147
RAT33B	-1.118E-05	0.0711194	1.3810690	-0.3499970
RAT413A	0.1458204	3.0127734	53.070900	-11.474870
RAT413B	0.0175063	0.6913445	8.3736600	-2.0999950
RAT415A	-0.0002125	0.1066331	1.9895420	-0.4810206
RAT415B	0.0278432	0.6528848	7.2582160	-4.2357290
RAT41A	0.0092808	0.0780741	0.4601894	-0.3360773
RAT41B	0.0051149	0.0691491	0.2535625	-0.2992915
RAT44A	0.0012076	0.0488016	0.3240680	-0.1301527
RAT44B	-0.0003107	0.1970641	1.5209580	-0.7145254
RAT63A	0.0042807	0.0584755	0.3217423	-0.2863547
RAT63B	0.0010886	0.0889291	1.2270470	-0.3697882
LACTOTA	0.2244404	1.5814583	10.903850	-6.1029440
LACTOTB	0.1022897	0.7453265	5.3852900	-3.2671470
LPASCIRA	0.2215570	1.5654534	10.763420	-6.0389760
LPASCIRB	0.1042100	0.7715854	5.2126420	-3.4743170
CARTINT	0.1689060	0.3750289	1.0000000	0.0000000

	Covariance	Correlation
RAT33A,RAT33A	5.506E-05	1.0000000
RAT33A,RAT33B	3.499E-10	6.636E-07
RAT33A,RAT413A	0.0017588	0.0787495
RAT33A,RAT413B	-5.477E-07	-0.0001069
RAT33A,RAT415A	-8.900E-05	-0.1125943
RAT33A,RAT415B	-8.711E-07	-0.0001800
RAT33A,RAT41A	8.379E-05	0.1447638
RAT33A,RAT41B	-1.600E-07	-0.0003122
RAT33A,RAT44A	-0.0001283	-0.3545519
RAT33A,RAT44B	9.721E-09	6.654E-06
RAT33A,RAT63A	0.0001183	0.2728502
RAT33A,RAT63B	-3.406E-08	-5.166E-05
RAT33A,LACTOTA	0.0002611	0.0222718
RAT33A,LACTOTB	-3.200E-06	-0.0005792
RAT33A,LPASCIRA	0.0002833	0.0244164
RAT33A,LPASCIRB	-3.260E-06	-0.0005700
RAT33A,CARTINT	2.569E-05	0.0092406
RAT33B,RAT33B	0.0050483	1.0000000
RAT33B,RAT413A	1.631E-06	7.626E-06
RAT33B,RAT413B	0.0047185	0.0961519
RAT33B,RAT415A	-2.377E-09	-3.140E-07
RAT33B,RAT415B	-0.0025174	-0.0543204
RAT33B,RAT41A	1.038E-07	1.873E-05

RAT33B,RAT41B	0.0002015	0.0410445
RAT33B,RAT44A	1.351E-08	3.899E-06
RAT33B,RAT44B	-0.0010709	-0.0765550
RAT33B,RAT63A	4.787E-08	1.153E-05
RAT33B,RAT63B	2.430E-05	0.0038490
RAT33B,LACTOTA	2.510E-06	2.236E-05
RAT33B,LACTOTB	0.0006811	0.0128748
RAT33B,LPASCIRA	2.478E-06	2.230E-05
RAT33B,LPASCIRB	-0.0040073	-0.0731665
RAT33B,CARTINT	1.889E-06	7.096E-05
RAT413A,RAT413A	9.0593816	1.0000000
RAT413A,RAT413B	-0.0025528	-0.0012280
RAT413A,RAT415A	0.0010934	0.0034102
RAT413A,RAT415B	-0.0040601	-0.0020681
RAT413A,RAT41A	0.0814408	0.3468991
RAT413A,RAT41B	-0.0007459	-0.0035870
RAT413A,RAT44A	-0.0091417	-0.0622963
RAT413A,RAT44B	4.531E-05	7.647E-05
RAT413A,RAT63A	0.0226236	0.1286635
RAT413A,RAT63B	-0.0001587	-0.0005936
RAT413A,LACTOTA	1.7747148	0.3731975
RAT413A,LACTOTB	-0.0149159	-0.0066554
RAT413A,LPASCIRA	1.7602187	0.3739335
RAT413A,LPASCIRB	-0.0151959	-0.0065496
RAT413A,CARTINT	-0.1165410	-0.1033432
RAT413B,RAT413B	0.4770398	1.0000000
RAT413B,RAT415A	3.721E-06	5.057E-05
RAT413B,RAT415B	-0.0003880	-0.0008613
RAT413B,RAT41A	-0.0001625	-0.0030159
RAT413B,RAT41B	0.0151753	0.3180469
RAT413B,RAT44A	-2.114E-05	-0.0006278
RAT413B,RAT44B	-0.0430100	-0.3163019
RAT413B,RAT63A	-7.494E-05	-0.0018573
RAT413B,RAT63B	0.0064928	0.1058110
RAT413B,LACTOTA	-0.0039291	-0.0036006
RAT413B,LACTOTB	0.1358270	0.2641068
RAT413B,LPASCIRA	-0.0038786	-0.0035907
RAT413B,LPASCIRB	0.1575975	0.2960091
RAT413B,CARTINT	-0.0029569	-0.0114265
RAT415A,RAT415A	0.0113488	1.0000000
RAT415A,RAT415B	5.918E-06	8.516E-05
RAT415A,RAT41A	-0.0003074	-0.0369935
RAT415A,RAT41B	1.087E-06	0.0001477
RAT415A,RAT44A	0.0002740	0.0527476
RAT415A,RAT44B	-6.604E-08	-3.149E-06
RAT415A,RAT63A	-0.0002908	-0.0467308
RAT415A,RAT63B	2.314E-07	2.445E-05
RAT415A,LACTOTA	-0.0047538	-0.0282442
RAT415A,LACTOTB	2.174E-05	0.0002741
RAT415A,LPASCIRA	-0.0047677	-0.0286158
RAT415A,LPASCIRB	2.215E-05	0.0002697
RAT415A,CARTINT	0.0007029	0.0176101

RAT415B,RAT415B	0.4254404	1.0000000
RAT415B,RAT41A	-0.0002584	-0.0050792
RAT415B,RAT41B	0.0127518	0.2829967
RAT415B,RAT44A	-3.362E-05	-0.0010573
RAT415B,RAT44B	0.0168173	0.1309625
RAT415B,RAT63A	-0.0001192	-0.0031279
RAT415B,RAT63B	-0.0014220	-0.0245392
RAT415B,LACTOTA	-0.0062491	-0.0060640
RAT415B,LACTOTB	0.1478774	0.3044760
RAT415B,LPASCIRA	-0.0061689	-0.0060473
RAT415B,LPASCIRB	0.1624433	0.3230841
RAT415B,CARTINT	-0.0047029	-0.0192441
RAT41A,RAT41A	0.0060839	1.0000000
RAT41A,RAT41B	-4.747E-05	-0.0088097
RAT41A,RAT44A	-0.0007793	-0.2049318
RAT41A,RAT44B	2.884E-06	0.0001878
RAT41A,RAT63A	0.0023115	0.5072857
RAT41A,RAT63B	-1.010E-05	-0.0014580
RAT41A,LACTOTA	0.1020998	0.8285039
RAT41A,LACTOTB	-0.0009493	-0.0163455
RAT41A,LPASCIRA	0.1020225	0.8363408
RAT41A,LPASCIRB	-0.0009672	-0.0160856
RAT41A,CARTINT	-0.0028657	-0.0980591
RAT41B,RAT41B	0.0047724	1.0000000
RAT41B,RAT44A	-6.177E-06	-0.0018338
RAT41B,RAT44B	-0.0068955	-0.5069985
RAT41B,RAT63A	-2.190E-05	-0.0054252
RAT41B,RAT63B	-0.0001481	-0.0241374
RAT41B,LACTOTA	-0.0011480	-0.0105178
RAT41B,LACTOTB	0.0224553	0.4365356
RAT41B,LPASCIRA	-0.0011332	-0.0104888
RAT41B,LPASCIRB	0.0280137	0.5260580
RAT41B,CARTINT	-0.0008639	-0.0333781
RAT44A,RAT44A	0.0023770	1.0000000
RAT44A,RAT44B	3.752E-07	3.909E-05
RAT44A,RAT63A	-0.0007729	-0.2713453
RAT44A,RAT63B	-1.315E-06	-0.0003035
RAT44A,LACTOTA	0.0121303	0.1574760
RAT44A,LACTOTB	-0.0001235	-0.0034025
RAT44A,LPASCIRA	0.0105185	0.1379479
RAT44A,LPASCIRB	-0.0001258	-0.0033484
RAT44A,CARTINT	0.0006268	0.0343162
RAT44B,RAT44B	0.0387597	1.0000000
RAT44B,RAT63A	1.330E-06	0.0001157
RAT44B,RAT63B	0.0009138	0.0522416
RAT44B,LACTOTA	6.974E-05	0.0002242
RAT44B,LACTOTB	0.0029243	0.0199484
RAT44B,LPASCIRA	6.885E-05	0.0002236
RAT44B,LPASCIRB	-0.0152919	-0.1007635
RAT44B,CARTINT	5.249E-05	0.0007115
RAT63A,RAT63A	0.0034128	1.0000000
RAT63A,RAT63B	-4.660E-06	-0.0008979
RAT63A,LACTOTA	0.0409013	0.4431388
RAT63A,LACTOTB	-0.0004379	-0.0100660

RAT63A,LPASCIRA	0.0410545	0.4493458
RAT63A,LPASCIRB	-0.0004461	-0.0099060
RAT63A,CARTINT	-0.0013212	-0.0603627
RAT63B,RAT63B	0.0078932	1.0000000
RAT63B,LACTOTA	-0.0002443	-0.0017406
RAT63B,LACTOTB	0.0048820	0.0737981
RAT63B,LPASCIRA	-0.0002412	-0.0017359
RAT63B,LPASCIRB	0.0032452	0.0473853
RAT63B,CARTINT	-0.0001839	-0.0055239
LACTOTA,LACTOTA	2.4962100	1.0000000
LACTOTA,LACTOTB	-0.0229579	-0.0195148
LACTOTA,LPASCIRA	2.4697481	0.9995146
LACTOTA,LPASCIRB	-0.0233889	-0.0192045
LACTOTA,CARTINT	-0.0787601	-0.1330510
LACTOTB,LACTOTB	0.5544454	1.0000000
LACTOTB,LPASCIRA	-0.0226630	-0.0194610
LACTOTB,LPASCIRB	0.5587238	0.9734216
LACTOTB,CARTINT	-0.0172773	-0.0619298
LPASCIRA,LPASCIRA	2.4459405	1.0000000
LPASCIRA,LPASCIRB	-0.0230885	-0.0191516
LPASCIRA,CARTINT	-0.0779714	-0.1330653
LPASCIRB,LPASCIRB	0.5942013	1.0000000
LPASCIRB,CARTINT	-0.0176017	-0.0609453
CARTINT,CARTINT	0.1403767	1.0000000

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