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Primary indicators of financial distress in Canadian Trust companies

by

Theresa Karen Lynne McCurdy

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Abstract

This thesis attempts to determine whether the analysis of economic and financial variables based on published financial statements can allow prediction of financial health of trust companies. The research intent is to develop a quantifiable early warning system that would allow regulators and trust employees to identify and correct high risk trusts before they become insolvent. Detailed analysis of the balance sheet data of the failed trusts between 1980 and 1993 in Canada establishes major indicators of future insolvency categorically. These major indicators are then are used to develop a model by which to grade existing trusts. The resulting model can be used as an early warning system in order to reduce the probability of future insolvencies.

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Dedication

This thesis is dedicated to my husband, James McCurdy, my son Matthew and to my parents, Ross and Violet Garland.

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I Introduction

1.1 Canadian Financial Institutions - descriptions

The financial community in Canada used to be separated into what was referred to as the "four pillars". The term "pillars" defined the four major parts, which were chartered banks, trusts and mortgage companies, the insurance industry, and the investment houses. Due to Bank Act changes, allowing chartered banks into the other sectors, the definition of the pillars has been eroded, but, for ease of description, they have been left as general areas for discussion.

1.1.1 Trusts

Trust companies can be either federally or provincially incorporated, although most are provincially chartered. Those that are federally chartered must still be licensed to operate in each province. They differ from chartered banks and all other Canadian financial institutions[1] in that they are the only Canadian corporation allowed to engage in trust activities, a fact that has been legally enforced since the 1871 Bank Act. The reason for this enforced separation centres on the premise that a financial institution might face a conflict of interest if it was both the investor for its client and trying to make the highest profit for itself. Prior to 1967 trust companies were still closely associated with banks, but the

[1] the terms "financial institution" and "bank" are used generically in this study to refer to all banks or near banks, which are different from other financial institutions in that they

revised Bank Act in that year required that chartered banks own no more than 10 percent of the voting shares of any trust. The 1991 Bank Act revisited this enforced separation, and now banks are again allowed to own controlling interests in trust companies. Trust deposits are insured by the Canadian Deposit Insurance Corporation (CDIC) outside of Quebec, and by the Quebec Deposit Insurance Board inside Quebec. Both insurers will make temporary loans to member institutions with liquidity difficulties.

Trusts offer a wide range of financial services that duplicate those offered by chartered banks. These include term deposits, tax sheltered savings plans (registered retirement savings plans or RRSPs and registered retirement income funds, or RRIFs), demand deposits, and chequing deposits. They provide loans, including personal, real estate, and commercial. Trust company assets come from three main sources. The first is company funds, which represent shareholder equity. Next are guaranteed funds, which are funds deposited with the company by individuals, companies, or other, on which the trust company guarantees some fixed rate of return, and are more likely to be of a term rather than demand nature. By law, equal assets must be matched to these deposits and segregated from other trust assets. Lastly, there are estate, trust and agency funds, which were the original base of operation for Canadian trust companies. These can arise when a person appoints the trust company as the executor of a will. As an agency, the trust company will manage and hold in safekeeping individual's securities portfolios and engage in the management of

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are deposit takers. In Canada, these terms would specifically refer to chartered banks, trust companies, and credit unions.

income property on behalf of the owners. There are various federal and provincial trustee acts as well as the Income Tax Act which define the types of investments trusts are allowed to engage in on behalf of their trust-holders. In general, they must keep the funds operational and invested. The funds must be invested conservatively and prudently, and in keeping with the best interests of all benefiting parties.

Significant reliance on real estate lending exposed the trust industry to the recessions in 1981 - 82 and 1989 - 93. This, combined with the revised Bank Act, changed this sector of the Canadian financial community. The chartered banks took advantage of the trusts' troubled balance sheets and the modified Bank Act, and purchased approximately 66 percent of the outstanding assets.

1.1.2 Mortgage and Loan Companies

Mortgage and Loan companies were licensed originally to take deposits and make mortgage and personal loans, but were disallowed, unless specifically granted the privilege, to act as a trustee. Of all Canadian financial institutions, they most nearly resemble trust companies and are often grouped together for analysis and discussion purposes. The activities are similar to the intermediary business of trust companies. Most of the major companies are affiliated with the banks or trust companies. Their activities are regulated by either the federal or provincial government, most have provincial charter and therefore are subject to provincial regulation.

Mortgage loans companies' primary source of funds is personal savings, chequing deposits, term deposits and debentures. Most of their assets are in the form of mortgage loans with only a small proportion in liquid assets.

1.1.3 Chartered Banks

Chartered banks are the single largest arm of the Canadian financial community. Comprised primarily of "the Big Six" banks which control 90 percent of the banking assets of Canada, they are governed by the Bank Act, which is updated about once every ten years by federal review. The Act defines what the chartered banks may and may not do and provides operating rules within its framework. The 1980 Bank Act revision allowed foreign banks to operate within Canada. They are federally chartered, and their stability comes from their comparative lack of regional concentration (compared to the trusts, for example) and their international presence.

Their primary function is lending to individuals, corporations, and governments. In order to perform their primary function, they take in funds from the same groups, and make a profit based on the difference between the lending and deposit interest rates, or spread. Fees charged for various services and investment income from funds in profitable ventures supplement this spread. Lending encompasses corporate and consumer lending, residential mortgages, term lending, project financing, foreign lending to corporations or governments, venture lending, credit card lending, and equipment leasing. Deregulation has allowed the banks to venture into the securities and trust areas of the Canadian financial community. Their major source of funds is in the form of deposits, of

which over half is in Canadian dollars. Deposits encompass demand deposits from government, businesses, and personal savings, including chequing, non-chequing and fixed term, as well as tax-sheltered deposits.

The Bank Act requires chartered banks to maintain secondary reserves, and does not require any cash reserves. Secondary reserves must be maintained in the form of cash, day-to-day loans with money market dealers and treasury bills. This requirement is echoed in international lending markets via the Basle Accord. Although privately owned, because of their importance to the Canadian economy, chartered banks are regulated as if they were quasi-public.

1.1.4 Credit Unions

Credit Unions were initially co-operatives created by groups of individuals, or members, who felt that the chartered banks were too profit oriented, showing little interest in small savers and their communities. They were formed to provide a convenient source of low-cost credit to their members to finance consumer goods. Originally they were most likely to centre on common interests, such as residence location, ethnic background, business or social group and, as such, were referred to as "closed bond" membership. Although closed bond credit unions still exist, most of those currently in existence are "open bond" status, meaning anyone can become a member. In Quebec, they are referred to as caisse populaires, while outside of Quebec, they are known as credit unions.

The credit union's major source of funds is deposits, similar to those obtained by the chartered banks. Their primary use of funds focuses on mortgages, both residential and commercial, personal and consumer loans and investments.

Credit unions have also expanded into commercial lending activity; especially those situated in large urban areas. They now operate with goals and purposes similar to that of chartered banks, trusts, and mortgage loan companies. Most credit unions are about the size of a single bank branch, which makes them too small to engage in many of the activities pursued by other deposit-taking financial institutions.

Caisses populaires and credit unions are chartered under provincial legislation. With similar legislation enacted in most provinces, regulations include specifics regarding where excess funds may be invested and provisions for government inspections to verify adherence to established rules. Members' deposits and shares are protected by provincial stabilisation funds.

1.2 Regulation of FIs - Banking as a Regulated Industry

Financial institutions (FIs) have long been charged with being responsible for more than just making a profit. Because of their unique status in the economy as the primary credit source for both individuals and small- to mid-size business, they are expected to have above normal levels of fiduciary responsibility. Even more than the normal business enterprise, they are expected to maintain operations on a continuing stable but profitable basis. In a sense, they are perceived almost as a public utility. Canadians, even those in small hamlets, have the "right" of access to banks and basic bank services at low cost. Some stakeholders feel that a FI's overriding corporate goal should focus on political

and social needs as opposed to economic ones.[2] Regardless of whether this argument should be accepted, it has influenced the political and regulatory climate in which banks find themselves.

A major reason for the heavy regulation is the nature of the business itself "Banking by its very nature provides opportunities for theft or mismanagement, because it deals with money and depends on human judgement. Banking has become a highly regulated industry. The general reason for this is that it takes only a single individual, sometimes a dishonest one, but more often a person lacking in balanced judgement, to take down an institution, and thereby damage a much wider community."[3]

In the absence of deposit insurance, an FI run could result if depositors fear they might lose their deposits in the event of failure. Deposit insurance eliminates this possibility to the extent that the FI's deposits are insured. By its nature, deposit insurance encourages riskier investments by weaker financial institutions (FIs), because the FI operates with the assurance that its depositors are less likely to withdraw insured deposits. Thus, shareholders do not pay the full price for increased risk. This situation magnifies the potential for moral hazard. As higher interest returns only occur with higher risk, the FI has the incentive to enter into potentially fatal financial transactions. As was noted by Franklin D. Roosevelt in the United States, "[a]s to guaranteeing bank deposits, the minute the government starts to do that ... the government runs into a

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[2] MacIntosh, Robert, *Different Drummers: Banking and Politics in Canada*, 1991, MacMillan Canada, Toronto, Ontario, page 3

[3] MacIntosh, Robert, *Different Drummers: Banking and Politics in Canada*, 1991, MacMillan Canada, Toronto, Ontario, page 23-24.

probable loss."[4] In essence, the stronger FIs subsidise riskier activities of the weaker FIs, resulting in less efficient use of resources. Regulation attempts to address moral hazard by regulating and minimising risky bank opportunities as defined by investment and lending practices, and methods of sourcing funds.

Regulators help to ensure that FIs will survive by using a variety of methods. FIs are expected to operate in a prudent manner, investing in activities that a prudent person would accept, without undue risk of loss. FIs are expected to diversify their portfolio sufficiently such that a failure in any one part of the balance sheet would not unduly jeopardise the FI's life expectancy. This latter is often a legal requirement specifying limits of concentration in areas such as commercial and mortgage lending. FIs also must comply with minimum equity levels, depending on the profile of their asset base and the proportion of ownership equity. The calculated equity level includes expected funding requirements for ongoing FI operations, as well as the defined riskiness of the asset base.

Regulations have been developed over time and apply to all FIs, whether they are provincially or federally chartered. Regulators study the comparative and absolute health and performance of different FIs based on balance sheet activity and behavioural actions such as management and lending decisions.

Guaranteeing bodies such as the Canadian Deposit Insurance Corporation (CDIC) were established in case the FI fail despite standards and monitoring. Their purpose is two-fold. They provide an assurance to the depositor that some

[4] Gardner, Mona J., and Dixie L. Mills, *Managing Financial Institutions: An Asset/Liability Approach 3rd ed.*, The Dryden Press, Fort Worth, Texas, 1994, page 479

minimum savings level will be returned to them should the FI fail, minimising bank-run mentality. It allows perceived riskier FIs to establish themselves by providing a backstop to customers. Secondly, it will pay out pre-defined dollars to savers in the event of actual failure.

The FI's and thus the customer bear the ultimate cost for the regulation. Surviving FIs pay a regular insurance cost to groups such as CDIC in order to provide this guarantee. If a FI fails and, as has occurred in the past, the guaranteeing body decides to support savings claimants past the agreed upon amount and the remaining FIs pay via increased insurance costs.[5] Because all FIs supervised by the same regulatory body must pay insurance premiums, and because historically, Canada has seen an increase in regulatory insurance rates to cover any CDIC deficit, the healthy FIs are indirectly paying for any failed member FI. The remaining FIs in the system bear the bulk of the cost of bank failure. As their costs for doing business increase, they must respond by increasing the charges to their customers.

1.3 The Canadian Deposit Insurance Corporation

The Canadian Deposit Insurance Corporation (CDIC) is the main deposit insurance body in Canada. It assesses FI risk, collects and pays insurance dollars at the federal level, and its clients include all of the big six banks.

Canadian Deposit Insurance Corporation (CDIC) is an insurer in the Canadian banking industry. Its regulatory counterpart, the Office of the Superintendent of Financial Institutions (OSFI) regulates Canadian banks and

[5] Saunders, Anthony and Hugh Thomas. *Financial Institutions Management, First Canadian Edition.* McGraw-Hill 1997. Pages 85-88.

federally chartered trust companies. The Canadian banking system, as with most national banking systems, is among the most regulated industries in Canada[6]. Reasons for the level of regulation are as diverse as the countries in which they are implemented. In an environment characterised by increasing levels of deregulation, proponents of maintaining the regulation status quo in financial institutions use the following arguments as the basis for maintenance. If deregulation occurred in the financial institutions industry, the need for an Early Warning System (EWS) would be reduced because the financial institution would be expected to survive or fail based on its own decision-making, with little interaction with outside parties. In Canada, major reasons to reduce regulation levels include high expected levels of fiduciary responsibility, unwanted side effects to deposit insurance, and the nature of the business itself.

CDIC regulation concentrates on ensuring the continuing health of financial institutions. In the event of one failure, deposit insurance is set up to guarantee customer deposits for amounts less than $60,000. The CDIC is funded entirely by member financial institutions, and all federally regulated financial institutions are required to be members. Each member is required to pay fees in proportion to its insurable deposits. Because of the dominance of the big six banks, they pay the bulk of the fees, effectively subsidising smaller and possibly less robust FIs.

CDIC has been incurring losses since 1983 because of FI failures. "The cost of operating the CDIC from 1967 to 1992, as estimated on April 1, 1993, was

[6] Dermine, Jean, *Pricing Policies of Financial Intermediaries: Studies in Contemporary Economics*, Springer-Verlag, Berlin, Germany, 1984, page 149

$3.59 billion. Premiums assessed from member institutions totalled $2.09 billion, leaving a deficit as at year end 1992 of $1.50 billion."[7] Most of these losses were actually incurred between 1982 to 1992. CDIC has incurred $6 billion in losses, of which almost $3 billion has been recovered through the sale of assets with most of the remainder recovered through increased member premiums. Money paid out to uninsured depositors may never be recovered, meaning that ultimately the taxpayer will have to bear the burden.[8] Additional losses incurred imply 100 percent guarantees by the government, even though the stated guarantee is much less. The losses have had a severe impact on CDIC operations.

As a result of these failures, CDIC's financial health itself has deteriorated, which may indicate a flawed structure to its method of insurance payouts and premiums.[9] Although the original funding Intent was to be through the assessment and collection of an annual premium, limited CDIC fund-raising powers made it difficult to raise the necessary funds for significant claims on resources.[10] CDIC has been reviewing the method of compensation for failed members, largely as a result of the financial institution failures of the 1980s.

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[7] Canada Deposit Insurance Corporation, Corporate Communications, August 31, 1993
[8] MacIntosh, Robert, *Different Drummers: Banking and Politics in Canada*, Macmillan Canada, Toronto, Ontario, 1991, page 203
[9] Sheldon, Gordon, "Deposit Insurance: It's Safe, but is it Sound?", *Canadian Banker*, volume 101, issue 6, November/December 1994, page 32
[10] McGuinness, Kevin P., and Linda S. Abrams, "Deposit Protection: Lessons Learned from Recent Experiences - Part 1, *Canadian Business Law Journal*, volume 12, issue 2, December 1986, page 185

CDIC identifies four methods by which to resolve failures.[11] The first alternative is deposit pay out, where CDIC pays depositors up to the limit of their insured earnings. Second, the failed institution is sold to another institution, and CDIC supports the transaction in a number of ways. Third, another institution, acting as an agent of CDIC, takes over the running of the institution, and is paid for it by CDIC. Finally, CDIC could provide direct assistance to the failing member by making or guaranteeing loans and advances, by acquiring assets and by guaranteeing or making deposits to the failing institution. The first two alternatives are the most commonly undertaken.

CDIC could come up with another method to assess the solvency of the remaining 136[12] financial institutions under its jurisdiction. All federally incorporated banks and trust and mortgage companies are required to be members of the CDIC. As well, any provincially incorporated trust or loan company whose origin is not Quebec is also required to be a member. In order to reduce its exposure to a repeat of the financial institution failures of the 1980s, CDIC could establish a method by which to monitor financial institution health to reduce risk of insolvency. An analysis of the indicators of future insolvency found in those financial institutions that failed could lead to an early warning system allowing more time for corrective measures.

In order to control some of the hard costs being experienced by the CDIC, as well as soft costs experienced by other concerned stakeholders, a system could be devised by which to analyse FIs in such a way as to establish which FIs are

[11] 1993 CDIC Annual Report. Canada Deposit Insurance Corporation. page 15.

most likely to fail. If high risk FIs could be defined, more effective efforts better using the limited CDIC resources could be directed to where they would be most valuable.

The government backstops the CDIC, and if alternate sources are unavailable, taxpayers ultimately bear the cost[13]. The Government of Alberta alone[14] has paid out almost $500 million to support Alberta financial industries, including the Principal Group that failed in 1987. The federal government has displayed similar action. No individual investor lost money in the collapse of either Northlands or Canadian Commercial Bank, both of which failed in 1985. The government, using an estimated $1 billion[15] of taxpayer dollars, helped to repay all depositors in order to maintain financial stability.

The current system of regulation is needed because deposit insurance allows FI participants to ignore some costs when determining wealth maximisation strategies[16]. Regulators are charged with monitoring FIs to overcome this problem. One chief purpose is to ensure that FIs do not take undue risk, resulting in insolvency.

Customers of failed institutions and customers of healthy institutions are both affected by FI failures. Even if 100 percent insured, customers of failed institutions face delays and confusion with respect to funds access. For those

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[12] Anonymous, "CDIC enacts Bylaws", *CA Magazine*, volume 126, issue 11, December 1993, page 11

[13] In situations such as were found in Principal Trust, the government stepped in to guarantee those funds not covered by insurance.

[14] Smith, Wendy, *Pay Yourself First: Donald Cormie and the collapse of the Principal Group of Companies,* Bruce Press, Toronto, 1993, page 435

[15] Johnson, Arthur, *Breaking the Banks,* General Publishing, Toronto, 1987, page 243

that exceed the $60,000[17] limit, they face possibly permanent asset loss. Also, customers of healthy FIs along with taxpayers become the ultimate payers for FI failure for insured funds.

CDIC was officially established to maximise economic efficiency. Arguably, part of the intent of the CDIC's establishment was also political[18]. It imposes a specific tax on large chartered banks and on conservatively managed trust companies. This tax has been used to provide a subsidy to politically important high-risk and regionally concentrated financial institutions such as Principal Trust and Northwest Trust. They were established and politically supported partly in response to western sentiment that the financial institutions based in Eastern Canada were unconcerned with financing issues in the west[19], despite empirical evidence suggesting otherwise. If some financial institutions were originally established to solve political problems, their demise would be inappropriate politically.

Another threat to politicians with regard to financial institutions exists when failed FI customers lobby for full restitution. If a large enough group lobbies, it

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[16] Dermine, Jean, *Pricing Policies of Financial Intermediaries: Studies in Contemporary Economics*, Springer-Verlag, Berlin, Germany, 1984, page 158

[17] Canadian deposits are currently insured for the first $60,000 by CDIC. This means that the depositor is assured of collecting up to a maximum of $60,000 in principal and interest should the bank in which the deposit exists fail. Because of the legal aspects of this insurance, a depositor can be insured separately for individual accounts, joint accounts, and registered plans for each bank in which he/she has money.

[18] Carr, J.L., G.F. Mathewson, and N.C. Quigley, *Ensuring Failure: Financial System Stability and Deposit Insurance in Canada*, C.D. Howe Institute Observation 36, Renouf Publishing, February 1994, page 9

[18] Hibben, Alan R., "Bank of Nova Scotia", *Richardson Greenshields Equity Research*, 93-207, December 21, 1993, page 3

[19] Johnson, Arthur, *Breaking the Banks*, General Publishing, Toronto, 1987, page 51

becomes politically difficult to ignore significant portions of the voting public when making policy decisions despite the lack of legal liability.

"Perhaps nowhere in the world can be found so intensive a degree of close organisation as among the bank interests of Canada. ... It is some comfort to know that the process can't go much further."[20] While controversy exists as to the optimal number of financial institutions necessary to ensure both adequate competition and financial health, many feel that Canada is underrepresented by the current selection.

A Bank of America report[21] shows that among the G7 industrialised nations, Canada has the fewest FIs with the highest concentration of assets, based on 1990 numbers. The assets of the five largest Canadian banks represent more than 72 percent of total FI assets in the country. This compares to the five big banks in France at 51 percent, Italy at 43 percent, Germany at 25 percent, the United Kingdom at 31 percent, Japan at 23 percent and the United States at 13 percent. Canada's chartered banks hold 57 percent of the Canadian financial services industries' assets, 54 percent of all deposits, and account for 65 percent of consumer credit. In terms of numbers, there are 65 banks in Canada, 12,000 in the U.S., 4,600 in Germany, 2,000 in France, 1,100 in Italy, 700 in Japan, and 560 in the U.K. The three largest Canadian Banks, Royal Bank, CIBC, and Bank of Montreal, currently have a combined market share of about 37 percent[22]. This

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[20] Stewart, Walter, *Towers of Gold, Feet of Clay: The Canadian Banks*, Collins Publishers, Toronto, 1982, page 51

[21] Babad, Michael, and Mulroney, Catherine, *Pillars: The Coming Crisis in Canada's Financial Industry*, Toronto, Stoddart Publishing, 1993, page 218

[22] Babad, Michael, and Mulroney, Catherine, *Pillars: The Coming Crisis in Canada's Financial Industry*, Toronto, Stoddart Publishing, 1993, page 215

does, however, compare favourably with the concentration of power that these same three banks had in 1910, when they controlled 70 percent of the banking assets in the country[23]. Should the joining of the Royal Bank of Canada and the Bank of Montreal as well as the merger of the CIBC and Toronto-Dominion Bank proceed, concentration will further increase. Trusts have grown to offer competition for the consumer to Canadian banks.

Because of the comparatively small domestic market, many Canadian financial institutions also compete internationally in order to survive. Financial institution failure burdens healthy FIs with additional taxes that make them less competitive domestically and internationally, and result in less efficient use of resources.

1.4 Application of an Early Warning System

Any Early Warning System (EWS) should operate in conjunction with regular supervision by regulatory bodies, rather than as a replacement. Altman (1977), Korobow et al (1975, 1977), Lane et al (1986), Meyer et al (1970), Pettway et al (1980), Sinkey et al (1975, 1987), Thomson (1992), and West (1985) consider any EWS to be a tool by which to establish another surveillance dimension for regulatory bodies.

There are a number of indicated advantages in using an effective EWS. First, it provides a means by which to review operations of financial institutions between inspections, and to indicate where additional inspections may be appropriate given an identified change. Second, on-site inspection is often time-

[23] Bliss, Michael, *Northern Enterprise: Five Centuries of Canadian Business*, Toronto,

consuming and expensive and not always the most cost effective method by which to track small but important changes in financial condition. Third. EWSs incorporate objective criteria in addition to examiner's subjective judgements. It would provide regulatory agencies with an evaluation of their examination and supervisory performances and potentially provide a basis for assessing deposit-insurance premiums. Fourth, it would also make more efficient use of pre-examination data such as financial statements. Finally, while an inspector's findings are part of the official record, providing the basis for enforcement or other supervisory action, an EWS is informal, giving the opportunity of uncovering financial weakness at an early point when informal methods for correction can still be applied.

Given the number of methods a financial institution can use to circumvent valid results, any EWS would be more effective as a tool by which to identify potentially "high risk" institutions and practices as opposed to specific categorisation. Sinkey (1975) points out that the costs to examine a specific financial institution are high, and any categorisation plan that ranks financial institutions in order of risk would allow regulators to prioritise their examinations, spending more time on those with the highest identified risk levels.

Potential confounds are numerous in any study. Trying to identify the definition of a risky loan could be discretionary, based on discussion between the trust and the supervising body. Embezzlement is always a risk when dealing with large sums of money, as is the trust's primary function. Given sufficient access to funds and associated records, any stolen funds can be disguised for

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McClelland and Steward Inc, 1987, page 387.

some time by the embezzling party. Because of the dual regulator responsibility - to protect the depositors, and to keep the financial institution functioning - cash infusions as well as other forms of support may disguise the financial picture. There can be a number of ways to define failure and the one used may not be the definitive one for a particular trust. In some cases, the trust may continue to operate even though it is technically bankrupt.

The control financial institutions exert over both sides of the balance sheet exceeds that experienced by other companies. Because profit is dependent on the spread between deposit and loan interest, FIs experiencing financial difficulties can manipulate the returns by moving along the yield curve, affecting future returns volatility for current profitability.

The use of accrual accounting with risky loans combined with the standard of including loan interest earned but not paid makes the use of accounting data sometimes suspect. As well, accounting data introduces heteroscedasticity and favours the larger over the smaller institutions. Homoscedasticity, a desired outcome, and the opposite of heteroscedasticity, occurs when the variance of the error term appears constant over a range of predictor variables as opposed to increasing or modulating, or from a skewed distribution. Because of its intrinsic nature, the use of accounting data can lead to skewed distribution and therefore modulating variance. The use of financial ratios should mitigate this problem.

Bank runs can adversely influence FI health even in the absence of financial difficulties. An example of this occurring in Canada can be seen in both the Bank of British Columbia and the Continental Bank. In both cases, both were forced

into selling or merging, even though healthy, because of backlash from the failures of Northlands Bank and the Canadian Commercial Bank. Forbearance can also be a confound, and occurs when a FI that is technically bankrupt is allowed to continue operations with regulator approval for reasons other than financial ones. On the other hand, supervisory bodies could have more information regarding the health of the financial institution than is present in financial statements. This could result in supervisory action prior to any indication in the early warning system suggesting such action be taken.

1.5 Research Objectives

The research intent is to develop a quantifiable early warning system that would allow regulators and trust employees to identify and correct high risk trusts before they become insolvent. Detailed analysis of the balance sheets of failed trusts between 1980 and 1993 in Canada should establish major indicators of future insolvency categorically. These major indicators can then be used to develop a model by which to grade existing trusts. It can be used to establish an early warning system (EWS)[24] in order to reduce the probability of future insolvencies.

The research proposes to answer the following questions. What were the primary indicators of financial distress for those trust companies failing in Canada between 1980 and 1993? Can the identified indicators be developed into an early warning system to help prevent future failures? How early can these factors be detected?

The study's value focuses on the number of Canadian financial institutions that have experienced financial difficulties. Many of the trust companies faced severe equity erosion during the time under study. FIs, unlike many businesses, are expected to operate to achieve economic goals beyond mere financial gain. They are seen as essential to the fabric of the Canadian economy and are often treated as if they were quasi-public institutions by both Canadian citizens and the Canadian government. They provide economic value to the communities in which they operate, acting as the conduit by which lenders and borrowers connect. The loss of an FI has far-reaching repercussions within its community to those same lenders and borrowers. If there are further steps that could be taken to reduce FI failure, they should be considered.

Unlike most businesses, after insurance coverage end, the government has often stepped in, such as was the case with Principal Trust, in order to provide full monetary restitution to FI clients. The government must pay for these overruns through the use of tax funds, for which the taxpaying public is ultimately responsible. Again, if the number of failures could be reduced, the taxpaying public would ultimately benefit to the extent of current government funding.

The costs of doing on-site examinations are significant. Without some type of risk-ranking model, examiner funds may be put to less than optimal use. The examiner may be spending the same amounts to examine healthy trusts as he would to examine failing trusts. Incorporating this model into current practices may identify failing institutions prior to their demise to allow better resource

[24] a partial glossary is available at the end of this document in Appendix 12

deployment. Although the model could not replace on-site examination, it may help to better utilise scarce resources.

II Literature Review

2.1 Methods

2.1.1 Overview

The literature review looks at relevant publications defining solvent and insolvent financial institutions, and measures developed to analyse financial institution solvency in Canada and the United States. It reviews methods used on the failed institutions that attempted to determine solvency before, during, and after the insolvency occurred. It reviews alternative actions taken by the insuring institution, such as forbearance, and how such actions can complicate study parameters. Finally, it reviews alternate statistical methods by which to analyse the data. A summary of key factors pertaining to EWS journal publications can be found in *Appendix 2: Literature Review Summary.*

2.1.2.1 Ex post empirical. This category includes most of the studies analysed and defines failure from individual case studies after the event, using regulatory or legal definitions. These studies analysed financial institutions that had already been determined to have failed, studying their characteristics either against a solvent financial institution "pair" or alone for one or more years prior to failure.

2.1.2.2 A priori, defined. This category abstracts from the problem of defining whether a financial institution failed by defining failure to occur when

equity becomes negative. It still compares identified failed and healthy financial institutions, but develops *a priori* probabilities of this event in terms of observed probability distribution of earnings, loan losses, and other factors considered to influence solvency. The measure of risk is independent of the historical record of actual failures, but is defined as the probability of a specific event, based on an explicit theory of what causes that event to occur. This methodology would allow a financial institution to be classified as failed even though it is still operational.

2.1.2.3 A priori, undefined. This category analyses the measure of risk independently from the historical record of actual failures. The concept of FI vulnerability is posited without reference to failure or any other specific event. Vulnerability is thus undefined. The analysis is based on an individual FI's deviation from the average of its banking peer group. This methodology look's at all institutions, and then comparatively ranks them on a scale from risky to solvent.

2.2 Literature Review - Theoretical Studies

2.2.1 Catastrophic models of FI failure

Diamond and Dybvig (1983) analyse the real economic damage caused by bank runs. They identify the circular reference implicit in a bank run - depositors rush to withdraw their deposit because they expect the FI to fail, which, if it occurs quickly enough, can force an otherwise surviving FI into bankruptcy. In a panic, with many FI failures, there is a disruption of the monetary system and a reduction in production.

Their analysis gives the first explicit review of the demand for liquidity and the transformation service provided by FIs. They analyse the explicit economic role for FIs to perform, changing illiquid assets into liquid liabilities. The model demonstrates three points. First, if FIs can improve risk sharing among those customers who hold demand deposits, they can improve their competitive position because customers consume at different, random times. Second, demand deposits have multiple equilibrium actions, including the undesirable bank run. Third, bank runs cause real economic problems because, in the event of a bank run, even healthy FIs can fail, causing a termination of loan contracts and, thereby, productive investment. The model provides a framework by which to analyse devices traditionally used to stop or prevent bank runs (for example, suspension of convertibility and demand deposit insurance). They note the similarity between protection from creditors provided by bankruptcy laws and the suspension of convertibility. The firm that is viable but illiquid is guaranteed survival. The major assumption is that management always makes decisions that are in the best interest of the depositor. Should moral hazard intrude into the equation, this could change conclusions, and offer this extension as a logical next step in their analysis, although not covered in this paper.

The study is completely theoretical, with an environment created that includes one mutually-held FI, and three time periods: time zero when deposit decisions are made, time one when some customers withdraw, and time two, when the remaining customers withdraw. Because it is mutually owned, customers withdrawing in time two reap all benefits from successfully invested money, and

lose out on any poorly invested funds. All fund sources are in demand deposit form, allowing for the possibility of a bank run. A bank run resulted in less than optimal disposal of assets meaning that less was returned than could be achieved if they were sold in the absence of a bank run, because there was insufficient time in which to find the highest bidder for the asset. In contrast, any asset that was invested for the entire second time-period length earns more than the original investment, implying intelligent investment decision-making abilities by management. After the original model was developed, it was modified to show the effects of suspension of convertibility, and then to show the effects of government-backed deposit insurance.

Ho and Saunders (1980) analysed the probability of a FI failure given a catastrophic occurrence for large FIs in the United States banking system. They questioned accounting ratio methodology's assumption that FIs fail over time. They pointed out that these systems are of little use when the FI's path toward failure is explosive. The paper argues that there is a strong relationship between the power of regulatory intervention and depositors' confidence level that is seen as both necessary and sufficient for a catastrophe to occur. It does not reject accounting ratios out of hand for all forecasting, but rather establishes a specific instance where time-based analysis is inappropriate. Empirical research was beyond the scope of the paper.

Theoretical modelling required the following assumptions be made. There had to be divergence, where small continuous changes in initial conditions could

lead to large discontinuous changes in state variables. There must occur bifurcation in the behaviour of the dependent variable, where the dependent variable has more than one possible outcome from a given independent variable, which occur in large, discontinuous steps. Finally, the catastrophe condition is robust to marginal changes in the structural relationships underlying the system.

The model assumed that any increased riskiness in asset selection would lead to greater cash flow variability, and that any decrease in capital deposits ratio would reduce the FI's ability to pay off net interest margin shortfalls. Together, these two assumptions defined changes in FI riskiness for failure.

The model was developed assuming both a regulator-free environment and a regulated environment. Conclusions indicated that with the presence of regulators in the American system, any increase in cash flow variability or decrease in equity in a large FI will lead to greater relative sensitivity of large depositors because they have some of their funds at risk. It also concluded that the presence of regulatory intervention increased riskiness despite the fact that the regulators know they will ultimately be responsible for any shortfalls in the event of bankruptcy. The study showed, however, that regulators would intervene too late, even though the Federal Reserve was willing to act as a continuous source as lender of last resort. The paper argues that regulatory intervention should start earlier than it does currently, and always exceed any response made by depositors to increases in riskiness. The fact that the Federal Reserve acts as a lender of last resort actually introduces additional moral

hazard to FI management, in that they know that FIs have an alternative source of funding once depositors start withdrawing their money.

Under certain reasonable behavioural conditions, a catastrophic jump (a term defined by Ho and Saunders as a critical event for FI health) in the probability of FI failure could occur, even if the Federal Reserve was willing to act as a continuous source of lender to last resort loans. The important relationship that determines catastrophe appears to be the rate of regulatory intervention relative to the rate of deposit withdrawals over the whole range of FI failure probability. In particular, it was shown that even if regulators intervened or heavily aided FIs when the perceived FI failure probability was very high, this was not sufficient to prevent catastrophic jumps in probability of FI failure. As well, in order for a FI to return to its previously perceived safety level once it has made the catastrophic jump, it required a reversal in the trend of cash flow variability and equity levels past what existed previously, creating a more secure FI in the process.

Ho and Saunders also state that as FIs become more homogenous in a given area, the possibility of mass default increases, not because of the domino effect, but because as the riskiness increases for one FI, so does it for all FIs in the homogenous group. The more homogeneous the large group of FIs in terms of their decision parameters, the more likely it is that a macro-catastrophe can occur where macro-catastrophe would be defined as many FIs failing together.

2.3 Literature Review - Empirical Studies

The different approaches used to analyse financial institution early warning systems can generally be grouped into three broad approaches, and two broad methodologies. The three broad dimensions are *ex post* empirical, *a priori* defined, and *a priori* undefined. Martin (1977) first cited these groupings. The two broad methodologies are Multiple Discriminant Analysis (MDA) and Regression Analysis.

2.3.1 *ex post* defined models

Altman (1977b)[25] developed a system for identifying serious financial problems in the Savings and Loan industry, where serious problems were defined to exist when The Federal Savings & Loan Insurance Corporation (FSLIC) provided financial assistance or where the Savings and Loans company (S&L) was supervisory merged with a sounder institution. He discretely classifies S&Ls into one of three categories: serious problem, temporary problem, and no problem. He uses quadratic discriminant analysis with three - two group models to compare the three groupings, with the intent of developing an EWS by which to identify serious financial problems at the earliest possible moment.

Altman uses data from 212 S&Ls. Of the total, 56 were classified as serious problem, 49 were temporary problem, and 107 were classified as no problem between the years 1966 and 1973. Serious problem S&Ls included those that went into receivership, received contributions in the form of loans, purchases of

[25] see Appendix 3 for summary list of important indicators from all literature review studies

assets, straight contribution, or a combination of these, or that entered supervisory mergers. The serious problem S&Ls were matched to temporary problem S&Ls that also had serious financial problems at the same time, but did not result in FSLIC action, supervisory merger, or any other externally imposed action. They were matched based on location and time. The final group of S&Ls showed no indication of financial problems during the time period. They were matched based on their location. The data was taken from five semi-annual reporting periods preceding the critical date for the serious problem S&Ls. A successful measure would have to classify accurately both in the period immediately preceding failure, and also over the 2.5 year horizon.

Results indicate predictive ability for up to three semi-annual reporting periods prior to a specified critical date. The model was very robust in separating no problem S&Ls from serious problem S&Ls, and less robust in separating each of these from temporary problem S&Ls. Altman concludes that this occurs because of difficulties in differentiating temporary problem S&Ls from the other two, and because these S&Ls can be mis-classified in two directions whereas no problem and serious problem errors can only be mis-classified in one direction.

Cole (1993) examined the determinants of both book-value insolvency and regulatory closure in the thrift industry. He used a bivariate probit model to jointly examine determinants of insolvency and closure. He used data from the last financial report in which institutions reported positive Generally Accepted Accounted Principles (GAAP) net worth to construct a bivariate probit model to

explain both why thrifts became GAAP insolvent and why they were closed. Insolvency is hypothesised to be a function of two broad risk factors: operating risk and agency risk. Operating risk is defined as encompassing risks associated with both interest rate exposure and asset-quality or credit exposure. Agency risk is defined as risk arising from principal-agent conflicts. Principal-agent conflicts include those between shareholders and creditors, shareholders and managers, and regulators and taxpayers. Agency risk is also cited as being a function of organisational structure, whether it be a closely held, a publicly held, or a mutually held institution. Agency risk specifically addresses moral hazard as a contributor to the probability of failure.

The data used predates the passage of the Financial Institutions Reform Recovery and Enforcement Act of 1989 (FIRREA), as it relates to those thrifts that failed during the 1980-89 period. The sample consisted of 769 institutions that the FHLBB sold, merged, or liquidated, and 2,783 other institutions that filed for bankruptcy between the specified dates, of which 270 had reported GAAP insolvency in their September 1988 call report. Insolvent thrifts are defined as those reporting continuous GAAP insolvency on their call report beginning in some quarter after December 1979, while closed thrifts are defined as those resolved at a cost to the FSLIC during the sample period as well as any supervisory mergers.

Cole's analysis indicates that organisation type and agency risk as being contributing factors to insolvency risk. Publicly traded stock thrifts are less likely to be insolvent than closely held stock thrifts. Mutual-charter thrifts are more

likely to be insolvent than their closely held stock counterparts. Unlike the other two organisational types, he conjectures that mutual fund operations may be unable to raise funds when necessary to stave off insolvency. Mester (1991) and Cebenoyan et al (1992) provide evidence that mutually held thrifts in general are less efficient, and this may be another contributing factor to the result. As well, organisational changes in the thrift industry have led to demutualisation of thrifts during the sample period. Since almost two-thirds of the sample's insolvencies occurred prior to 1985, failed mutually held companies may be over-represented in the results. Given that publicly traded thrifts are generally the largest, followed in size by closely held, and then finally mutually held thrifts, it may also be a reflection of size differences as well. This issue was considered in a subsequent re-estimation, but the revised regression did not indicate significant relationship between size and propensity for insolvency.

Kyrzanowski et al (1993) analyse Canadian banking solvency between 1922 and 1940. They hypothesise that, rather than a few large FIs and branching as primary components of banking success, forbearance was the primary contributor to Canadian FI survival. While the characteristics of Canadian FIs made them stronger than their U.S. counterparts, their survival was assisted by government factors and the role of the Canadian Bankers Association as a group that assisted co-operation between strong and weak FIs. They note that 27 FIs failed in Canada between 1867 and 1940, and consider this to be abnormally large considering the Canadian banking system's reputation for solvency. They

argue that after the 1923 failure of the Home Bank, the Canadian government provided an implicit 100 percent guarantee that no chartered bank would be allowed to fail and cause depositor losses. They cite evidence indicating active participation from the stronger FIs who took over still economically viable but weaker FIs as a means by which to expand.

This study used a securities index to adjust collateral to market value for the fact that GAAP was modified at the time to allow the lower of book or market as of August 31, 1933 for the 1930s. Similarly, current loans were adjusted to consider the impact of default risk and interest rate risk. Calculating the market value of current loan cash flow to a change in economic activity captured default risk. Pricing error was assumed to be small for well-diversified, nationally branched FIs, and was therefore not incorporated into the valuation model. Interest rate risk was proxied using the corporate yield at the end of the period to discount cash flows back to the previous year. This assumed that all loans excluding bad loans, mature after one year.

The authors found that for nine of the ten largest Canadian FIs, asset write-downs exceeded shareholder capital at least from 1930 through 1935, and frequently for longer time periods. Sensitivity tests found the results insensitive to the amount of the margin required for cash in proportion to total assets. Variation tests were also implemented on loan balances, which also showed minimal sensitivity. Further, the authors used a test that had previously been used on U.S. FIs during a similar time period, which also indicated that Canadian FIs faced similar circumstances to those faced by the American FIs. They

conclude that forbearance was a significant issue in the survival of Canadian FIs during the 1930s.

Lane et al (1986) uses the Cox Proportional Hazards Model (CPHM) in conjunction with Regression Analysis to develop a model for forecasting FI failure. They note that previous models did not include an explicit forecast for expected time to failure. Further, because they are parametric measures, MDA, regression, logit, and probit required assumptions that are often difficulty to meet in most empirical applications, thereby potentially reducing their effectiveness. CPHM addresses both these issues, and has been used extensively in biomedical studies. As well, "censored" data can be used in building the model. Censorship refers to the fact that, while we know when sample failed FIs will fail, we do not have comparative data for sample healthy FIs. This latter group is said to have a censored survival time. The authors note they must assume time dependence of the independent variables. In other words, they assume that the ratios remain unchanged between measured time periods, and between the last measured time period and failure. Although this is acknowledged as a questionable assumption, they argue that the goodness of fit and prediction results indicate that even if the assumption of constant ratios is not valid for these data, the Cox model based on this assumption still provides useful results.

The first stage of the Cox Model is the hazard component. The hazard is the probability of failure in the next instant, given that the FI was alive the instant before. In actuarial statistics, this is referred to as the force of mortality and in

economics, its reciprocal is called Mill's ratio. The Proportional Hazard's Model (PHM) cites the possibility of the hazard (failure) as a function of z independent variables. The inclusion of regression parameters (parametric) and arbitrary baseline hazard function (non-parametric) results in the Cox Model being referred to as semi-parametric. They restrict off-site information sources to financial statements, noting that, except for the few largest financial institutions, market data such as stock prices are unavailable. They use the basic CAMEL[26] identification system for ratio selection, but use multiple indicators because the areas are not clearly defined. Univariate tests indicate that multivariate normality should be rejected, even after log transformation was applied. Backward and forward elimination was used to produce the best subset of the 21 ratios initially chosen.

The authors calculated both a Cox model and a multiple discriminant analysis model (MDA) as a basis for comparison. Results indicate that the classification ability of the Cox model is comparable to MDA. The major contribution of the Cox model lies in the additional information regarding the likely time to failure provided by the model. By giving a probable time to failure, it facilitates ordering of preventive action to counteract this direction. The results from the holdout sample indicate that the Cox model tends to predict failure to occur before it actually occurs. The authors argue this allows a troubled FI more time for appropriate preventive action.

[26] for definitions of this and other banking terms, please see appendix 12: glossary of terms

Martin (1977) uses a logit distribution as the dependent variable with a regression analysis to analyse the independent variables. The probability of failure is a continuous function of the regression model, approaching zero for very large negative values and approaching one for very large positive values. The curve slopes upward at all points, since an increase in the regression model means a high probability of failure. The slope becomes small at the extreme upper and lower ends of the scale. He argues the intuitive sense of this curve, stating that if a FI has a very large or very small possibility of failure, a marginal change in its independent variables will have little effect on its probability. At the same time, a FI in the middle of the curve, where probability of failure is .5, will experience significant changes in probabilities for a given change in regression model results.

Martin notes that it can sometimes be difficult to establish the true occurrence of failure in the legal sense. He argues that, since the motivation for a merger is not always made public, and the report on what was actually a supervisory merger may not distinguish it from the vast majority of mergers where viable FIs are involved understates the number of actual failures. As well, in the event of financial assistance, while some would have failed without cash infusion, the life expectancy of other FIs is not so clearly dependent on the cash infusion. Twenty-five initial variables were selected to represent capital adequacy, asset quality, liquidity, and earnings. A FI was assigned to the failed-FI group if its estimated probability was higher than .0041, the sample proportion of failures for

this period. The cut-off point assumed *a priori* probabilities of group membership equal to the sample frequencies and equal misclassification costs.

He interpreted the results in light of banking developments since 1970. In the first part of his study's time frame, more failures resulted from fraud or local economic trends in the FI's immediate service area. Neither of these factors was well reflected in FI financial statements. In the later part of his study, recession-related asset problems were more closely reflected in the financial statements. The early regressions show less relationship between ratios drawn from the earlier statements and the risk of failure than did the later ones. As well, the early part of the study showed low loan loss levels which meant earnings and capital adequacy were less important. The later sharp increase in loan problems affected the entire banking system and increased the importance of earnings and capital. Loan risk, illiquidity, or management strategy, for which the Commercial Loans/Total Loans variable was a proxy, became more important.

Policy implications of these findings include the relevance of conventional FI soundness criteria, which varies over the business cycle. In periods when FI failures are extremely rare, the empirical link between capital adequacy, and other measures of FI safety, and the actual occurrence of failure will be weak. Supervisory use of a statistical EWS estimated from that period will yield questionable results, regardless of the technique used. To the extent that supervisory standards on capital, etc. hamper FI profitability and growth, one might expect that the industry will use the lack of empirical connection between financial ratios and failure to argue for relaxation or abandonment of those

standards. On the other hand, in periods of stress due to increased loan losses, when a larger number of FIs fail, the conventional supervisory wisdom reasserts itself. Ratio tests of FI soundness may break down completely in an extreme situation when even the most conservatively managed institutions find themselves dependent on the central bank in its role as lender of last resort. If that is true, then statistical EWS are of most interest in periods of moderate adversity, rather than in times that are either better or substantially worse.

Meyer and Pifer (1970) argue that sometimes bankruptcies are desirable because they prevent further losses and misallocation of resources. They argue that there are four general factors that explain FI failures: local economic conditions, general economic conditions, quality of management, and integrity of employees. In order to incorporate local and general economic conditions, a paired FI is deemed necessary. Although direct economic data was preferred, pairing based on this criterion was considered preferable to a simple paired sample. They feel that over a period of time, differences between good and poor management will be systematically reflected by balance sheet and income data, with analysis of such data enabling prediction. As well, defalcation due to employee dishonesty, although not directly measurable, usually occurs over a long period of time, affecting several financial statements. Given the relevance of defalcation (one financial institution failed per year between 1948 and 1965 due to employee dishonesty according to FDIC reports), it would be reflected, again, in the financial statements.

All data was obtained from year-end balance sheets and income statements and from the summary of the examination report from FDIC. The financial information was summarised into 28 operating ratios and 4 balance sheet levels, eliminating scale effects from most of the variables for six years prior to failure. Each ratio was judged based on i) current year; ii) previous year; iii) growth; iv)error in predicting variable value; and v) variation. Stepwise regression was incorporated that combined forward selection with backward reduction at each step. Failure detection was deemed to occur in the last financial statement prior to dated failure.

The study found most statistically relevant results to occur one and two financial statements prior to failure, and the analysis concentrated on these two years. The percentage of Type 1[27] errors was greater with time remaining at two years versus one. Type 2 errors had the opposite time-emphasis. The discriminant score of most solvent FIs was less the further in the future a nearby FI failed. The holdout sample showed an 83 percent prediction success rate in year one and 78 percent in year 2. The study format was required to determine cut-off points for minimisation of Type 1 and Type 2 errors. Conclusions included: i) results could provide up to a two-year period for correction of impending bankruptcies; ii) more than the current financial position is needed to discriminate among groups; iii) results could be used to sequence examinations.

[27] Type 1 error: classifying a failing FI as non-failing or non-problem; Type 2 error: classifying a healthy FI as a failing one

Pettway and Sinkey (1980) analysed large United States FIs based on market and accounting measures. The accounting measure used discriminant-analysis with the same variables but different coefficients depending upon the year before failure. Twenty-four large healthy FIs were selected prior to and contemporaneous with the classification of any potential failed FI. The market sample included at least six estimates of independent variable rates prior to any adverse information about the actual failure of any of the sample FIs.

A two-variable multi-dimensional approach was used with total operating expenses as a percentage of total operating income and investments as a percentage of total assets, where investments included all securities plus federal funds sold. They claimed that the former measured operating efficiency while the latter measured safety or risk. The assets of failed FIs tended to be less efficient, and they tended to make more loans than did good FIs. The second measure focused on liquidity as a way of proxying the increased loan sizes as a percentage of assets.

The accounting screen provided an average lead-time of 66 weeks ahead of the beginning date for an exam with a Type 1 error (labelling a problem FI as a non-problem FI) of zero. The lead times for the market test averaged 53 weeks ahead of the average start of bank examination. The authors concluded that these similarities in lead times indicated the market was efficient in translating accounting data into market response. In all cases, the dual-screening technique provided an earlier warning than did the existing system of establishing examination priorities.

Rose and Kolari (1985) used FDIC's Integrated Monitoring System (IMS) as a starting point to critically analyse FI performance and evaluate the predictive ability of the ratios used in this monitoring system. Twenty-three independent predictor variables were included in the study and focused on FI earnings, expense control, liability management, capital adequacy, liquidity, and loan portfolio composition. These areas agreed with previous studies that indicated these areas were significantly different between failing and solvent FIs. The dependent variable was a binary grouping classifying FIs as either failed or healthy. Statistical analysis spanned eight years prior to failure, allowing an analysis of the variable's long range and short range FI surveillance capacities.

Univariate tests for mean differences between the two groups of FIs were run for each of the 23 ratios. Multivariate models were developed based on their correlations. Alternative configurations of variables included as many IMS variables as possible without resulting in variance-covariance matrices that were less than full rank. Not all possible combinations of variables were considered, but a wide variety of models were studied. The failed FIs were randomly selected from the population of all failed FIs during the years 1964 and 1977. Only those failed FIs with a suitable healthy FI match were chosen, and healthy FIs were selected based on size, supervisory authority, and location similarities. For the one-year sample, there were 71 pairs, while for the two-year sample there were 63 pairs. The pairs declined over the eight-year time span.

Univariate tests showed that many variables were significant up to six years prior to FI failure. The multivariate models of FI failure prediction performed less successfully than the univariate tests. Multivariate techniques showed limited classificatory ability and a high number of Type 1 error rates. Multivariate prediction models appeared to contribute little to understanding the process that leads to the FI failure event. The authors concluded, however, that the failure of most banking institutions is not the consequence of unstable volatile forces that suddenly precipitate a crisis, but rather are a gradual result and that a FI becomes statistically abnormal prior to failure. The authors also conclude that further work is needed to improve the multivariate EWS techniques. They recommend additional general theory development in the area of classification of financial ratios to reduce the arbitrariness in the assembly of financial ratios to predict FI failure.

Simpson (1983) concentrated on large commercial FI failures. He noted three approaches that exist to predict problem FIs: i) on-site bank examinations, ii) early-warning mechanisms based on financial statement data, and iii) surveillance systems tied to capital market returns. His study addresses the question whether capital markets are a better surveillance system than on-site examinations. He identifies three possibilities which could result in market information being more timely than on-site examinations: i) capital markets for FI stocks are strong-form efficient[28]; ii) information obtained by examiners is publicly

[28] strong form efficient market: a market in which security prices reflect instantaneously all the information that is available to investors

available; iii) public proxies are available for information available to examiners. He discounts the first alternative, arguing the existence of a large body of evidence suggesting a semi-strong market form[29]. He discounts the second alternative, arguing that much examiner information is confidential. He therefore concentrates his study on the third possibility. He considers both instantaneous and lagged information, and states that even if the information is imperfectly transmitted, the proxies would still reach the market prior to examination because of the periodicity of examination schedules. He uses an intervention model to test his theory.

He developed a model that tests forecasting ability in four different time periods: one year prior to examiner's awareness of serious problems, six months prior, at the same time, and six months prior to failure. He used weekly returns as the basis by which to determine whether the FI is experiencing financial difficulties as perceived by capital markets. He also plotted the Cumulative Residual Plot for all the FIs under analysis, emulating a previous analysis. The plot indicated solid indications of financial distress in two cases, but showed examiners finding distress before the market in another case. He also tested for parameter stability by testing the intercept and slope parameters for the periods before and after the cumulative residuals became significantly different from zero. He found that the intercept parameter did not change, but large standard errors resulted. On the other hand, slope parameter change indicated major shifts in systematic risk around the date of the market flag. Again, variation was

[29] semi-strong form efficient market: market in which security prices instantaneously reflect all publicly available information

significant, resulting in low t-values, and putting into question any results calculated.

His results suggested that the capital markets do not predict FI failures before on-site examinations do, in contravention of previous studies. He recognised that other studies have shown a positive relationship, and supplied some possible explanations. The first is that systematic risk parameters were unstable. A second possibility suggested that randomness of the model residuals might not have been reviewed. While he admits that these findings may conflict with the accepted theory of capital markets, he noted that if the capital markets are not strong-form efficient, then the crucial information necessary to predict failure might not be publicly available. Because insiders are usually instrumental in creating the conditions that lead to distress, they will actively attempt to prevent proxy information from reaching the market. While information on fraud, mismanagement, and faulty loan decisions cannot be kept from the market indefinitely, insiders may attempt to delay its release for as long as possible, which could be until after on-site examinations occur. He suggested that his conclusions not be used to infer that capital market signals should be ignored. Rather, he proposed that capital market prediction might be more complex and potentially misleading than first believed.

Sinkey (1975a) matches a non-problem FI to every problem FI. The paired FIs are selected so that each problem FI and matching non-problem FI have similar structural characteristics, including geographic market area, total

deposits, number of banking offices, and federal examining agency. Using statistical comparisons, univariate, and analysis-of-variance (ANOVA) tests, 62 pairs were established. The control group versus the non-control group showed specific characteristics of problem FIs. He chose a time period where technically neither group was part of the problem FI community, but, rather, that they became problem FIs at a subsequent bank review. A series of measures were incorporated to compare the two groups, focusing on capital adequacy, liquidity, loans characteristics, efficiency, and rates of return. While more than one measure was used in most cases for each category, the final list was much shorter. All areas were found to show significant results up to three years prior to the FI being labelled problematic, except for liquidity and rates of return. The latter became significant two years prior to being so labelled.

Sinkey (1975b) presents a multivariate statistical analysis of the balance sheet and income statement characteristics of problem FIs. He matches newly identified problem FIs with non-problem, or control, FIs. He finds asset composition, loans characteristics, capital adequacy, sources and uses of revenue, efficiency, and profitability are good discriminators between the groups. His chi-square measures indicate that significant overlap exists. The two groups were matched using the same criteria as was used in his previous study. The most important new variable used in this study was other operating expenses to total operating income where other operating expenses included all expenses

except interest paid on deposits. He proposes that the significance of this ratio indicates self-serving management and/or operating inefficiencies.

In contrast to the earlier study, he uses a number of measures by which to determine relative contribution to predictive power of each variable. In addition to F-test, he also uses conditional deletion, stepwise forward and stepwise backward rankings in order to see whether variable choice changes under different selection criteria. He finds that, for the most part, the different types of selection criteria yield similar results. The chi-square test also indicated similarities between the control and problem FI groups. Although the group mean vectors are significantly different from each other, the distributions of the individual vectors of the two groups overlap substantially for each of the four years under study.

The classification results, which measure the overlap of the two groups, describe groups that are relatively separate even in the first year and overlap less and less over the next three years. He concludes that problem FIs appear to be quite distinct from non-problem FIs and that this distinctness increases as the time of detection approaches. Given the high degree of group overlap, the classification results are better than might otherwise be expected.

Sinkey (1978) proposed that 'problem' FIs, which have a specific definition in the United States (see definitions at end of text) have low net capital ratios. The most important component of the capital ratio is the volume of 'substandard loans'. He argued that FIs that failed almost invariably had low net capital ratios

for many months prior to failure, although most FIs with low net capital ratios do not fail. He concurs with the FDIC's statement that the classification of FI assets is an art rather than a science, and good judgement is a fundamental determining factor.

The probability coefficients address the accuracy predictions of ex post write-offs divided by ex ante predictions of write-offs in each questionable loan category. He concentrated his research on classification and analysis alternatives for loan losses as a way by which to predict the occurrence of problem FI status.

The 143 commercial FIs on the FDIC's March 31, 1974 problem FI list were compared against a random sample of 163 non-problem FIs, drawn from 9,060 FIs, which, in turn, represented about 65 percent of the population. No deliberate pairing was used, but there were no statistically significant differences between the two groups in terms of average size or average number of banking offices. Six variables were tested independently and in a multivariate environment to determine their predictive ability.

The most significant variable and most important discriminator between the groups, using either a univariate or multivariate basis was the net capital ratio, with the Type 1 error at 4.9 percent and Type 2 error at 4.3 percent. A FI with a net capital ratio of less than or equal to 2.74 percent was classified as a problem FI. Net capital ratio as a predictor with 95 percent accuracy could not be improved by adding other examination variables if net capital ratio was included in the set. He points out that banking agencies recognise that identification of FIs

experiencing financial difficulty is a multi-dimensional problem. In practice, however, bank capital is the important variables in predicting problem FI status.

Sinkey (1979) analysed the Franklin Bank failure that occurred on October 8, 1974 in the United States. At that time, it was the largest bank failure in the United States with total deposits at $1,445 million. It had been identified by the Comptroller of the Currency as a troubled financial institution on November 15, 1973. He used both single-variate and multi-variate tests in order to determine the unique characteristics of Franklin Bank that made it riskier in comparison with the 50 largest U.S. FIs. The comparison done using primarily financial ratios derived from the financial statements for the period between 1969 to 1973 inclusive. Data analysed concentrates only on domestic assets. He recognised this as a weakness in the analysis given the significant foreign operations of large FIs.

The statistic used in the outlier tests was a chi-square score that indicated the degree of similarity between variable profile and that of the control group. The statistical tests were specifically designed to determine whether Franklin was an outlier. No assessment was made to determine whether or not it was 'safer' or 'riskier'.

Franklin was compared to the control group based on six measures, namely total operating income as a percentage of total assets, total operating expense as a percentage of total assets, net operating income as a percentage of total assets, net income as a percentage of total assets, net income as a percentage

of total capital, and total operating expense as a percentage of total operating income.

In the univariate tests, both net income as a percentage of assets and operating expense as a percentage of total operating income indicated that Franklin was experiencing difficulties as early as 1971. Both net operating income and net income as a percent of assets declined by 50 percent between 1969 and 1973 compared with a decline of 6.6 percent from the other banks. Three expense items were also significantly different from the control group: i) expenditures on Federal funds as a percentage of total operating income, ii) provision for loan losses as a percentage of total operating income, and iii) net occupancy expense of FI premises as a percentage of total operating income. Data also indicated that, on average, Franklin made fewer loans, charged higher prices, and had larger loan losses than the control group. Thus Franklin appeared to have poor loan quality, risky liability management, high fixed expenses due to its rapid expansion program, and poor net income/capital growth.

In a two-variable analysis, Net Loan Losses (charge-offs minus recoveries) as a percentage of loans and net operating income as a percentage of assets were used as proxies for risk and expected return. Using these two measures, a risk-return grid was created which compared the movement of the different FIs over the four-year period. Franklin and three other FIs were correctly identified as outliers. The other three outliers had been already been defined as risky FIs by either their regulators or through adverse publicity.

A seven-variable multivariate test was also used. The seven variables were interest and fees on loans as a percentage of total operating income (measures revenue concentration), total operating expense as a percentage of total operating income (measures operating efficiency), U S. government securities as a percentage of total assets (measures liquidity and asset composition), state and local securities as a percentage of total assets (measures asset composition), total loans as a percentage of total assets (measures loan volume), net federal funds (sales minus purchases) as a percentage of total assets (measures Federal-funds activity and aggressiveness of liability management), and capital and reserves for bad debt losses on loans as a percentage of total assets (measures capital adequacy). Except for 1971, Franklin's chi-square scores indicated that it was a statistically significant outlier compared to the average control FI for each measure. The longest long-range indicator that shows declining profitability consistently is Franklin's operating inefficiency.

Sinkey concluded that the seven-variable model presents a more complete picture of Franklin's health, and should, in theory, provide a better definition of health than any univariate measure. Nonetheless, he conceded that the univariate and bivariate analysis appeared to more successfully predict Franklin's demise than did the multivariate method. The bivariate model appears to be the most successful because, in addition to predicting Franklin, also successfully predicted other unhealthy FIs.

Finally, Sinkey analyses the market reaction to Franklin's demise using the Capital Asset Pricing Model (CAPM). Regressing Franklin's rate of return

against Standard & Poor's Index of New York City FIs estimates Beta. Results showed that Franklin's beta is stable and low over the entire period, indicating Franklin's volatility was less risky than the average New York FI. The results are statistically significant, but only explained 10 percent of Franklin's variation on return. Time, the three-month Treasury Bill, and the Standard & Poor rating were used to establish expected returns for Franklin using the following formula:

$$R_{FNB,t} = R_{TB,t} + b_{t-60,t-12}(R_{S\&P,t} - R_{TB,t})$$

where R_{FNB} = Franklin's expected returns, t = 1970, 1971, 1972, 1973, and R_{TB} = three-month Treasury bill and $R_{S\&P}$ = the Standard and Poor rating. The interest rates were expressed on a monthly basis and the Betas used were those developed using the regression analysis described earlier. For example, for the year 1970, the estimated Beta for the 1965 to 1969 period was used.

The moving average of both Standard and Poor and treasury bill rates were used in order to capture any change in Franklin's market sensitivity. Actual to the forecast returns was compared to establish the monthly residuals, focusing especially on the cumulative monthly residuals. The hypothesis was that if the market was inefficient, these residuals would approximate 0, and the cumulative residuals would approach zero. Results indicated that the cumulative residual was positive from January 1970 to September 1971, and after September, the cumulative residual was never again positive, although there still were positive values.

Sinkey interpreted these figures as an indication that the market appeared to be reacting to Franklin's deteriorating condition as early as 1971, which is

reflected in Franklin's financial statements. He concluded that the market was aware of Franklin's problems and was discounting the figures. He concluded these findings might not be meaningful because of the numerous problems associated with estimating the asset-pricing model. The non-discounted results suggested that the market and an early-warning system using accounting data came to the same conclusion about Franklin at roughly the same time: 1971.

Sinkey (1979) also analyses Security National, with over $1 billion in total deposits, which was merged with Chemical National Bank in an emergency regulatory action on January 18, 1975 using a technique similar to what he used with Franklin. Results indicate that the market place was aware of Security National's financial difficulties. Evidence indicates that a three and one-half year lead-time occurred prior to the company's forced merger.

He also analysed Security National and a control group based on total operating expense as a percentage of total operating income, measuring operating efficiency for the years between 1969 and 1973 inclusive. They showed a steady decline in operating efficiency since 1969, with statistically significant figures by 1973, and with only one bank displaying a greater propensity for being an outlier. It increased by 38 percent between year-end 1972 and year-end 1973, and then increased another 50 percent by year-end 1974, with 79.4 percent of that increase accounted for by provision for loan losses. All of the univariate tests used in analysing Franklin were also used in Security National's analysis, and they indicated that it was not atypical until 1973. Using the multiple-variable outlier test, Security National was an outlier or close

to being one in each of the six years, but only marginally so. Rather it indicated that Security National was atypical and had some adverse trends. He concluded that while such a label would not warrant classification as a problem FI, it would classify it as a potential problem FI. With growth patterns similar to those exhibited by Franklin and Hamilton, Security expanded very rapidly prior to its downfall. Sinkey states that such rapid growth is often difficult to manage efficiently even by top quality management. The regulatory bodies did not find top quality personnel governing Security National.

Finally, Sinkey analysed the second largest failure in the United States at the time of his article: The United States National Bank of San Diego (USNB), which was declared insolvent on October 18, 1973 after being declared a problem bank on November 9, 1972. At that time, it was the 83rd largest bank in the United States, and, until Franklin's demise less than one year later, was the largest bank failure to date in the United States with deposits at $932 million. The official cited cause of failure referred to loan loss classifications exceeding capital, and involving funds advancement to the major stockholder and chairman of the board, C. Arnhold Smith.

USNB is compared to a control group of the 30 largest California FIs and a paired sample of problem/non-problem FIs. The first test indicated that USNB was not a typical bank for this area. Because of this, the paired sample was given greater attention. The FIs were paired based on i) similar geographic area, ii) total deposits iii) number of banking offices and iv) Federal Reserve membership status. Single variable analysis sifted through 149 variables,

establishing three as being outliers in each of the five years (1969-1972) under study. The first was the ratio of deposits of states and political subdivisions to total deposits. The second was customer liability on acceptances outstanding to total assets (acceptances are drafts or bills of exchange). The third was the ratio of the balance sheet (assets) to balance sheet (liabilities), essentially the counterpart of the second ratio. The ratio of total operating expense to total operating income showed that USNB was relatively inefficient, but did not indicate cause for concern until after 1972, at which time USNB was already considered a problem bank. It also grew rapidly in the years immediately prior to its demise. A linear regression failure-prediction model was used with operating expenses as a percentage of operating income and investments to assets ratio to determine whether the bank should be labelled as problematic. Using this approach, USNB was indicating early warning signals as early as 1969.

Sinkey, Terza, and Dince (1987) use the general zeta bankruptcy prediction model to see whether it is accurate for FIs. The zeta bankruptcy prediction model was initially developed for manufacturing and retailing firms. They found that although the zeta model predicts three out of four FI failures successfully, it nevertheless was less successful than the original zeta model. They cited the inability of FI accounting data to reflect market values, the presence of criminal misconduct as a major contributing cause of FI failure, and the actual process by which FIs are declared insolvent as reasons as to why the general zeta model was not appropriate.

Although the first problem was general to all industries, the latter two were specific to the banking industry. They noted that failure prediction models were misleading for FIs because too many loans were carried at book value when they were worth less than book value. When the examiner reclassifies these loans, these non-accruing loans must be written off. This usually results in the FI going under. Until the time for the examiner's reclassification, the books look reasonable. They conclude that this explains the high degree of overlap between failed and healthy FIs, at least until examination.

The test used the pairing of failed and healthy commercial FIs based on location, approximate size, and regulatory jurisdiction. Each variable was measured one, two, three and four years prior to failure. Conclusions indicated that the failed FIs as a group were consistently less profitable, less liquid, more levered, and have greater earnings volatility and less interest coverage. A holdout sample was used to check the predictability of the model. They concluded that bank regulators needed a surveillance mechanism based on audit and accounting information, as well as on-site examination, and suggested the development of non-financial audit profiles of FI failures as a starting point for this analysis.

Thomson (1992) analysed FI failure using a two-step approach. His first model calculated probability of FI insolvency, while his second equation modelled the probability of an insolvent FI being closed. While the first model used previous approaches to determining insolvency, the second model used a call

option. The two together expressly treated FI closings as an event determined by bank regulators. He expressly determined the value of forbearance based on four constraints: information, political, funding, and staff. He also differentiated between asset book value and asset market value as a determinate of probability of closure, arguing that asset book value produces "hidden equity", and that equity holders in this position would have incentives to reveal it to prevent closure of their institution.

The closed-bank sample is made up of FIs whose insolvency was officially recognised between July 1984, and June 1989. He defined a closed FI as one that is liquidated, taken into conservatorship, merged with FDIC assistance, or required FDIC assistance to remain open. Data is collected from up to nine semi-annual reports (4.5 years) prior to the date that the FI was closed. The failed FI model took into account both portfolio and operating characteristics, as well as the impact of the local economy. The dependent variable was book-equity capital plus the reserve for loan losses net of non-performing loans as a percentage of total assets. It measured the book equity net of bad loans. The equation was estimated using ordinary least squares (OLS).

The adjusted R^2 exceeded .79 for all the sub-samples, indicating that the majority of the variation in the dependent variable was captured by the independent variables. It was negative and significant for FIs closed within 30 months of the call date, but was positive and insignificant for FIs in the 42 to 48 month sub-sample, implying book net worth measured out that far is positively related to failure. The author hypothesised that while well-managed FIs establish

reserves and take write-downs on their portfolios earlier than those that are eventually closed, troubled FIs overstate their net worth early on by delaying recognition of losses and by realising unbooked gains.

2.3.2 *a priori*, defined models

Martin (1977) acknowledges that an *a priori* model assumes that one can generate forecasts from the estimated distribution of changes in the capital accounts, and simulate the effect on overall risk in the banking system of a change in capital levels. The models all assume that the underlying probability distributions change sufficiently slowly such that those estimates based on a previous ten-year period, for example, can be used for forecasting.

Santomero and Vinso (1977) note that there have been calls for the elimination of regulatory standards, including such things as EWS, as well as the call for increases in regulatory demands. Market discipline could be used to pressure FIs by profit maximising behaviour to obtain the uniquely optimal leverage position dictated by the capital market equilibrium. Others argue that externalities that result from FI failure overshadow the desire for market discipline. Capital regulation is needed to minimise failure that is socially undesirable. Those who argue in favour of increased regulation need to show how increased regulation actually reduces the possibility of FI failure. They also note that while increased capitalisation reduces the probability of failure, it also reduces the economy's productivity to efficiently use resources. Their paper evaluates the cross-section risk of the banking industry, using a stochastic

process modelling approach to obtain evidence on the return to FI capital. It results in estimates of cross-section failure probabilities for the industry. It also analyses the sensitivity of this distribution to capital account shifts of varying magnitudes. Finally, it develops a problem FI screen that may be used as a first approximation to the present technique to isolate outliers that warrant special attention. They also note that the static nature of EWS devices contain a fundamental flaw. Rather than indicate future ability to avoid failure, they indicate the ability of the FI to avoid present failure given its present asset characteristics. Future failure is dependent on the dynamic characteristics of FI operation, and these characteristics' ability to circumvent failure in the future. To capture this time dimension, a shift to time series techniques is required. They use negative or zero equity as the definition of failure, noting that regulators may actually consider a FI failed prior to this situation. They argue, however, that negative/zero equity is objective, and should regulators normally close a FI prior to this point, the study would only result in a shift to higher riskiness, rather than to create an invalid study.

Their approach estimates the probability of failure based on the stochastic process generating variations in the capital account up to that point in time and the buffer stock at the beginning of the period. In this form, risk exposure is defined as the cumulative probability that at some time *t* this pool of funds has been depleted sufficiently to lead to suspension of operations by the regulator. It takes into account the possibility that this time *t* may never occur. They incorporate the low probability of failure into their study by expressing it as the

number of standard deviations from the mean of a standard normal variate. It concludes that FIs with high probabilities of not being ruined still interest regulators and investors in the area of knowing the maximum risk exposure and the time when it occurs. The study's goal is to estimate the greatest possibility of ruin given the initial level of the capital account. It assumes that the probability of a given change in the capital account is the same over time. The model used weekly data, including securities and capital accounts carried at book value. The data reflects any reluctance on the part of management to write-off uncollectible loans, which could distort results. Rather than aim for minimising prediction error, the authors' goal was to obtain the simplest adequate representation.

The results indicate that there is only a small probability of failure in the American banking system, and that it has been stable over the period from January 1965, to January 1974. It found that the level of stability was fairly insensitive to reasonable changes in capital account levels. The authors note one major caveat to their results. The data studied uses historical results to forecast future probabilities. They note that if the financial environment should radically change in the future, these results may be less robust. A second test to determine at which levels of capital a FI becomes healthier was also done. Results showed that varying the capital accounts had little or no noticeable effect on the risk of failure, even if substantial amounts are used, questioning a regulator's understanding that higher capital levels are always a better. One major finding showed that FIs with less account dollar variation also had lower capital to asset ratios. They argue that this could mean either that lowered

variability causes lower capital ratios, or that lower variability occurs in smaller FIs, which also tend to have lower capital to asset ratios. Adjusting for this situation shows evidence that this latter alternative has merit. They conclude that a bivariate measure incorporating the FIs' capital-asset ratio and the coefficient of variation of the capital account change will provide a good EWS system.

West (1985) uses factor analysis combined with a multivariate logit estimator to measure the condition of individual institutions and to assign each of them a probability of being classified as a problem FI. He discretely identifies early warning systems as unique from actual condition monitors such as CAMEL, and points out the differences in what they measure, which ultimately leads to weaknesses in the total system. He then proposes a new method of monitoring FI condition that is more complementary to the examination process. The definition of successful prediction in this model refers to its later classification by examiners as a problem FI, using the CAMEL rating system (rating of 1 or 2 equates to a sound FI, while a rating of 3, 4, or 5 equates to problem FI).

Data was obtained from the Call and Income reports and examination reports for commercial FIs in Colorado, Kansas, Missouri, Nebraska, New Mexico, Oklahoma, and Wyoming, which are primarily in the Tenth Federal Reserve District in the United States. The sample included 1900 FIs out of the total population of 2900. The FIs were generally small (only eight percent have assets greater than $100 million) and predominantly rural. Most FIs were single branch outlets. Nineteen variables were used and all except the variable total assets

were in ratio form, reducing heteroscedasticity resulting from cross-sectional data. Factor analysis yielded eight identical factors for the years 1980 and 1981 and seven for 1982. Individual factors were generated with the intent of explaining the largest possible amount of variation in the sample. Successful factors explained variances ranging from eight to 18 percent. Each FI's score on a given factor was based on a normalised standard deviation.

The second, more stringent, test used to evaluate the results shows that financial institutions that were subsequently identified as problem FIs were correctly predicted 91.9 percent of the time, while FIs subsequently identified as sound were correctly identified 89.9 percent of the time. It is noted that four of the common factors that emerge from the analysis bear a very close resemblance to CAMEL components (all except management quality), which supports the CAMEL rating system. It concludes noting that the use of examination data makes the model an identification process rather than a true monitoring system. If asset quality data were incorporated in the submitted data that truly reflects asset quality, it would allow the construction of a true EWS.

2.3.3 *a priori*, undefined models

A priori, undefined, in its pure form, is subject to the criticism that what is being a measured bear no relation to FI risk. The chi-square test is ambiguous in that it labels both ends of the normal curve's tail as problematic. A FI, which is extremely conservatively run, should be eliminated, but this does not occur in the standard chi-square test. The modified version used in most of these types of

studies, however, takes this into account, by incorporating a ranking approach. This form of the model allows the identification of exceptional situations for further study. If a FI is significantly different from the group average, it may not be a problem, but the difference calls for some explanation.

Korobow, Stuhr, and Martin (1976) concentrate on the development of early warning indicators from financial reports and comment on the role that early warning research can play in improving bank supervision. He cites four reasons for an effective statistical early warning system over and above on-site review. First, significant changes in a FI's management policies and financial condition can occur between examinations. Second, an on-site examination is lengthy and expensive, and not always the most cost effective method to track small, but important, changes in a FI's financial condition. Third, although examiners are generally sensitive to developing trends indicative of future management/ financial problems, they must necessarily emphasise current actual over future possible issues. Fourth, an examiner's findings are part of the official record and could provide the basis for enforcement actions, while a statistical rating system can be informal.

The study used approximately 350 FIs from the Second Federal Reserve District in New York. The study used financial data routinely reported to FI regulatory agencies. Its stated goal was to find the least number of financial variables that could be used to detect early signs of financial deterioration. External economic indicators were included, affirming the substantial impact

possible from external economic conditions. The model first determined the averages and standard deviations for each of the independent variables. Next, each FI was individually compared to the average.

Taking into account the standard deviation, an individual score for each independent variable was calculated, and these were then summed together for a resulting composite score. Thus, each component was weighted equally. The higher the resulting score, the more resistant the FI to adversity, while the lower the score, the greater its vulnerability. They recognise that while they end up with a ranking of relative riskiness in comparison, there is not a "cut-off" point. At what point is a risky FI too risky? At what point should a FI be considered resistant? The dividing line was drawn with the aid of a cost function that minimised the costs of two types of error, drawing the line too high and examining more FIs than necessary, and drawing the line too low, thus failing to identify FIs that were likely to deteriorate or fail. They then translate the scores into a probability estimate of financial difficulty using regression analysis.

They found that FIs with a probability of 15 percent or greater would be considered vulnerable. They compared the prediction against the incidence of low subsequent supervisory ratings. They found that if FIs with a 10 percent or higher probability of receiving a low supervisory rating were examined, the gain in efficiency relative to annual examinations would have been 34 percent in the 1970-72 period and 14 percent in 1972-74 period. Analysis of time periods subsequent to this also gave encouraging results. Only 2.2 percent of 1975 FIs with probability estimates of 20 percent or less received low ratings, but 41.5

percent of FIs with probability estimates of 80 percent or more had low ratings. This showed evidence of the predictive ability of the developed model.

The study, while defining a FI as resistant or vulnerable, did not go further to define those FIs likely to deteriorate/fail in each group. Subsequent analysis found that many of the vulnerable FIs experienced financial difficulties, and a few resistant ones did as well. It did not explain why these FIs experienced these problems. They argue this occurred because, while dependent on economic environment and loan composition, both reflected in the selected measures, it was also dependent on management initiatives, which cannot be forecast reliably. They also note a need for focus on industry or geographic concentrations of loans and investments during adverse economic conditions that their study did not address.

Korobow, Stuhr, and Martin (1977) used a nation-wide test of the early warning concepts and procedures developed by them from information on member FIs in the Second Federal Reserve District of New York. This study extended the original study to include all FIs for all Federal Reserve Districts that were made available to the authors. This subsequent study indicated consistency in the extent to which FI vulnerability could be detected through statistical techniques.

As in the previous study, the differences from the average for each variable were divided by the standard deviation for the entire group to weight each FI's deviation from the average. These standardised deviations about the average

were then added together for each FI to form a FI score or index. This procedure captures the combined influence of all the variables and ensures that moderate weakness in several ratios will not be overlooked. Each deviation from the mean is given an appropriate algebraic sign to indicate whether high or low values of the variables imply vulnerability or strength. A direct estimate is obtained of the probability that a FI will receive a low supervisory rating under given economic conditions in the future. As well, the method used here yielded separate estimates of the contribution of each of the five key variables to the estimated probability that a particular FI would receive a low supervisory rating. The dependent variable was the probability of a low supervisory rating. The value of one was assigned to those FIs that received a low supervisory rating during the relevant estimation period. The value of zero was assigned to those FIs that did not receive a low supervisory rating.

Results suggested usefulness across the United States. In the Northeast, Midwest, and South, the low-rated FIs had an average estimated probability of weakness about three times that of FIs that did not receive low supervisory ratings. In the West, the probability accorded low-rated FIs was just over twice as large. When the FIs were arrayed from the lowest to the highest probability of financial deterioration, the weakest percentiles of each region contained high concentration of those FIs that actually received low supervisory ratings over the estimation period. The weakest 20 percent of the FIs in each of the four regions contained over 50 percent of all low-rated member FIs observed during 1970-72.

The weakest 50 percent contained 82 percent to 95 percent of all these low-rated FIs.

The authors argue that higher probabilities were unlikely because of the nature of the function. Intangible factors such as management skill that was not captured by the variables were often the deciding factor in the success of the FI. Again, they reiterate that focusing on the weak-rated FIs by the regulatory body would result in better use of resources. They note that the function's utility is highly sensitive to mis-classification of large FIs. The costs of failing to properly identify subsequently failing large FIs is substantial, and can make the function inefficient if even one is classified incorrectly. As well, they identified the points at which an optimal cut-off occurs for priority scheduling for on-site examinations, but realised that this point could only be found *ex post*. They concluded that while the point occurs somewhere between 43 percent to 79 percent, the optimal cut-off point would have to be based on judgement and experience.

They expanded the study to analyse the elasticities of the various coefficients used in the model at both the 50 percent level and the optimal 20 percent levels. They found that Operating Expense/Operating Revenues was the most elastic, followed by Losses and Leases to total source of funds. All other variables had considerably smaller elasticities. The 20 percent results showed generally higher elasticities when compared to the 50th percentile. For the purposes of the study, they defined vulnerable FIs as those in the top 50 percentile. This study also expanded on the original study by cross-referencing based on size. They first note that the function has more difficulty accurately placing large FIs in the

weakest 10 percent and 20 percent rankings. They suggest that these results may not be significant due to the small number of low-rated FIs in the larger size classes.

Marcus and Shaked (1984) calculate probabilities of insolvency under the assumption that asset returns are log-normally distributed by calculating the parameters of that distribution for each FI. The model uses a shorter time frame than is usually required, giving more credibility to the notion that the results are relevant to the failure event. They then assess the usefulness of financial variables in measuring insolvency risk by calculating 23 financial ratios for each sample FI and correlating these ratios with the direct estimates of insolvency probabilities. The study concentrates only on large FIs because of the lack of necessary information for smaller FIs from Compustat/CRSP tapes and which are publicly traded.

The authors did not place as much emphasis on financial statements as do many of the other studies. Total assets were estimated by the sum of market value of equity (based on actual stock prices and number of outstanding shares) and deposits as reported by the Bank Compustat tape. The authors argue that commercial FI deposits have a short maturity, allowing book value of deposits as adequate proxy for their market value. The expected rate of return for the FI's asset portfolio is set to .91 times the average prime rate, taking into account 9 percent held in non-interest assets. The results use a sensitivity analysis ranging prime plus/ minus .55 percent around the average rate. The range was

determined by taking into account 9 percent non-interest bearing assets. After this adjustment, the effective range was .50 percent.

Results indicate that insolvency risk is extremely sensitive to the rate of return earned on assets. It also showed that FIs with adequate levels of capital face almost zero probability of failure for any conceivable return on investment. It also showed that the solvency of marginal FIs could critically depend upon current earnings. Results also indicated that, for any given year, only a very small percentage of all FIs are at risk, with four/fifths facing a failure probability of less than 1/1000, which lends weight to the argument that risky FIs obtain insurance at relatively advantageous rates compared to safe FIs.

They find a weak empirical association between capital and insolvency and argue that while equity decreases insolvency risk, equity is correlated with asset variability, which increases risk of failure. They argue that FIs that face binding capital-ratio restrictions from regulatory authorities might react by shifting into riskier assets and actually emerge with greater portfolio variance than before the imposition of the capital requirement. They also found that reduction of the examination interval reduces the estimated chances of insolvency before the next exam from a mean value of .71 percent to .15 percent in 1979 and from .17 percent to .008 percent in 1980.

Summary statistics show sensitivity to outlier FIs, indicating that FDIC's exposure to losses can be greatly reduced by examining problem FIs fairly often and mandating capital additions at the necessary time. They found that as variance rates increase, adequate capital-to-asset ratios must be redefined. As

well, capital requirements may affect the FI's optimal mix of assets and hence the variance of its asset portfolio. If FIs do switch into high-risk, high-return assets in response to more stringent capital requirements, then regulators must either adjust capital requirements accordingly or oversee asset-mix as well as capitalisation. Individual financial variables such as the capital ratio or variance rate should not be evaluated in isolation. Finally, they found that capital ratios and asset return variability were highly correlated in the sample. They conclude that because these two factors exert opposite effects on FI safety, any empirical study that does not control for both factors runs a great risk of drawing incorrect conclusions regarding the effect of either factor taken alone.

2.3.4 Other Studies

Rose and Kolari (1985) find that univariate studies have predictive ability, but multivariate studies and studies with years greater than two are less predictive than previous studies. Their study showed no more than 75 percent accuracy. Of all of their univariate analyses, they found that the ratio of gross loans to total deposits accounted for about 22 percent of the total discriminatory power of the equations one year prior to failure, and from 12 to 16 percent two years prior to failure. Other variables displaying predictive power include net operating income to total assets, with about 18 percent and 15 percent discriminatory power for one and two years previous respectively. Interest expense on deposits and federal funds purchased to total operating income displayed about 17 percent and 22 percent discriminatory ability for one and two years previous to failure.

All of these tests were relevant in the univariate tests as well, implying that simultaneous consideration of these variables does not significantly alter their relative importance in evaluating individual FI performance. This fact is consistent with the development of these ratios as an aid to univariate rather than multivariate analysis by the FDIC.

2.4 Potential Confounds

While the above review of literature describes the various methods and analyses that can be used in identifying troubled insolvent FIs, it should be noted that the uniqueness of FIs presents some unique confounding factors that may affect the predictive ability of the methods. These are described below.

2.4.1 Defining a risky loan

A financial institution's balance sheet is unlike other institutions because most of its assets are in the form of loans to customers. Loans, unlike most assets, must be periodically reviewed to determine probability of repayment, a subjective judgement. For potentially insolvent financial institutions, this figure can be misleading. Financial institutions with high-risk loans may not categorise risky loans as unproductive until forced to by the governing regulatory body. At this point a balance sheet that appeared healthy could become unhealthy. Sinkey et al (1987) noted that because of this problem, financial institution balance sheets could be more misleading than most other types of industries' balance sheets. Any EWS that fails to consider this issue could produce misleading results.

2.4.2 Embezzlement

A financial institution handles cash, a highly portable and generic asset. Given inadequate controls, funds can be transferred via illegal means, and disguised for a time within the confines of the financial statements, resulting in fraud or embezzlement. As well, the principals of any financial institution are, again given inadequate controls, in the position to grant loans to themselves that might not be otherwise approved. They can function as both the representative of the person/group that requests the loan, and the one exerting unusual influence on the decision to grant the loan. As such, they are in position to induce the FI to grant loans that may not necessarily be in the best interests of either the shareholders or the debt providers, resulting in self-dealing.

Sinkey et al (1987) note that criminal misconduct by insiders of financial institutions was a major contributing factor in approximately one-half of all commercial FI failures and one-quarter of all savings and loans failures between 1980 and 1983. Sinkey (1979) notes that the failure of Hamilton National Bank of Chattanooga in 1976, the third largest bank failure up to 1979, was the direct result of illegal channelling of speculative real estate loans between affiliates within its holding company. These risky investments, totalling $30 million in 1974, exacerbated the effects of the 1974 recession for Hamilton. Nonetheless, Meyer et al (1970) conclude that even with embezzlement, financial measures can evaluate the relative strength of a firm. They reason that eventually any embezzlement will be reflected in the financial statements. As well, they note

that financial indicators still give comparative measures of financial health, even if embezzlement is concealed.

2.4.3 Dual Regulator Responsibility

Korobow et al (1975, 1977a) note that regulators have a responsibility to both depositors and the economic community because of the potential costs of widespread instability which extends beyond individual FI involvement. Financial institutions that fail financial health tests are "hidden" from the depositor and the economic community. This is justified as protection of the economic community on the grounds that any financial institution in difficulty may be forced to close down if facts were made public. Depositors would lose confidence in the FI and withdraw their funds, causing a "bank run" that would cause real economic damage (Diamond et al: 1983). Because of this duality of purpose, two regulatory responses occur that can disguise the health of a financial institution. First, Thomson (1992) notes that regulators, as a standard practice, do not release regulatory FI ratings to the general public. Second, they practice "forbearance", meaning they will assist a troubled financial institution in a number of ways, including the infusion of funds, to keep it operating. Because of these monetary advances, tests generally used for institutions must be modified in order to exclude any funds advanced by the regulatory body. Because of the first practice, it can be difficult to identify these funds.

2.4.4 Multiple Definitions of "Failure"

Because of the dual purpose of regulators, a benevolent response could occur once a financial institution becomes technically insolvent. While most institutions are deemed to have failed once their liabilities exceed their assets (or where equity is negative), this does not necessarily occur in the case of a financial institution. Once a financial institution is technically insolvent, a regulatory decision is made concerning closure. Thomson (1992) notes that negative equity is a necessary, but not sufficient reason for financial institution closure, unlike most businesses. As well, there is an added layer of intervention resulting from a regulator-defined state of financial distress. Regulator inspection leading to a sufficiently poor rating can result in direct intervention by the regulatory body before the financial institution becomes technically insolvent. Three definitions of failure (negative equity - market and book, regulatory "closure", and poor ratings) exist as dependent variables in the development of an EWS for financial institutions. A generic insolvency prediction tool does not adjust for alternative dependent variable possibilities.

2.4.5 Use of Accounting Data

Results of using examination and general accounting data are mixed. Sinkey (1978) found them to be very useful, but Bovenzi et al (1983) found them to be less useful in predicting failures. Sinkey (1979) also indicates that any ratio analysis should be used in conjunction with on-site review, and that it should operate more as an indicator for more detailed regulatory review rather than sufficient in itself. West (1985) notes that if the purpose of the development of an

EWS is to identify potential future insolvent FIs, and thus guide the examination process, it is reasonable to incorporate information from past accounting and examination procedures into the EWS. Sinkey (1979) concludes that the value of EWS occurs in its ability to direct regulatory effort, thereby efficiently employing scarce resources.

West (1985) notes that one of the difficulties involved in interpreting accounting earnings figures revolves around the use of accrual accounting. Any loan that may be risky, as reflected in the interest rate charged, would show higher earnings even though the loan may be uncollectible. Accrual accounting will show an increase in income that would not occur in a strictly cash accounting environment. His analysis shows a positive coefficient on earnings, indicating strong earnings lead to a higher probability of being a problem FI. This data served as the basis for the above conclusion. West notes that nearly all EWSs employ accrual accounting, booking interest that has been accrued, but not necessarily received, as a potential confound.

Sinkey et al (1987) state the possibility for misleading accounting data is potentially more important for financial institutions than for non-financial ones. Unlike most businesses, financial institutions generate revenue that does not necessarily translate to actual dollars or cash received. An unhealthy financial institution could manipulate financial statements in such a manner as to appear in financial health. Again, this means that the numbers being used to analyse the health of a financial institution need more than the standard level of care in interpretation.

Despite this, Rose et al (1985) conclude that most banking institution failures are not the consequence of unstable, volatile forces, but rather a gradually deteriorating condition that becomes statistically abnormal. EWSs that incorporate accounting measures still contribute to the understanding of the financial institution.

2.4.6 Financial Ratios versus Accounting Figures

Accounting figures by themselves can make comparisons difficult, and can lead to heteroscedasticity in any analysis. Given that different FIs have different asset sizes, without the use of ratios, large FIs would have a larger influence on any analytical outcome than would small ones. Ratios were considered to produce a more balanced basis by which to compare different FIs.

2.4.7 Market Valuation

Market valuation has the advantage over accounting valuation to the extent they provide the market's interpretation of the value of the different financial assets. In a FI, especially, whose assets and liabilities are primarily composed of cash-type balances, the market valuation would show a truer value than would values calculated using historical balances and generally accepted accounting principles.

Reasons for not using market valuation encompass two areas. First, not all FIs are publicly traded, and thus objective measures may be difficult to find. Second, given the possibility of "hidden" equity resulting from market values exceeding accounting values, shareholders have an incentive to keep their FI

from failing even when negative balance sheet equity occurs. Their actions in this situation would provide information about the true market value of their FI.

2.4.8 Bank Runs

Both Diamond and Dybvig (1983) and Ho and Saunders (1980) note that bank runs present a special case for FI failure. Diamond et al (1983) find that bank runs can and do cause real economic damage if they occur for reasons other than true FI weakness, and that they can especially occur in the absence of deposit insurance. Even if the FI is healthy, exogenous factors can result in failure. Ho et al (1980) note that EWS may be of little use when the path to failure occurs rapidly. They argue the necessity for a relationship between regulatory intervention and depositor confidence as precondition for catastrophe to occur. If regulatory intervention is weak, greater probability of lost deposit confidence, and by extension bank runs, occurs. They also note multiple consumer confidence level equilibria for a given FI risk level as a catalyst for bank runs. Both sets of authors argue that should a bank run occur, no EWS reader would be adequately forewarned of the resulting failure.

The Continental Bank in Canada and the Bank of British Columbia offer substantive support to the backlash theory even in the presence of deposit insurance. These two banks, despite healthy balance sheets, were forced to sell because of public concern resulting from the closure of the Canadian Commercial Bank and Northlands Bank.[30] Because the two healthy banks were

[30] Saunders, Anthony and Hugh Thomas. *Financial Institutions Management.* McGraw-Hill Ryerson Ltd., 1997. Page 129.

regionally concentrated, public concern over their viability was undermined, resulting in a steady deposit drain.

Sinkey (1979) argues, however, that it is unusual for most FIs that eventually fail to fail rapidly. Most FIs deteriorate gradually rather than develop financial difficulties overnight. This point is concurred with by Korobow et al (1976). He also says, "poorly-managed banks tend to generate stronger signals than dishonestly run institutions. The role of early-warning or surveillance systems is to attempt to identify symptoms of mismanagement and/or dishonesty. Of course, since the latter tends to be deliberately masked and therefore harder to uncover, there will always be a need for on-site bank inspections".[31] He concludes that EWS have value, and should be used, while recognising the limitations of the data being analysed.

2.4.9 Forbearance

Forbearance occurs when a financial institution is allowed to continue operations after it is technically insolvent as defined by negative equity. Forbearance can change the ultimate dollar value at risk should the financial institution subsequently be closed. Forbearance recognises that insolvency is a necessary, but not sufficient reason to close a financial institution. To the extent that forbearance occurs, EWSs may predict failure that does not ultimately ensue, should the FI recover. It over-represents failed FIs to the extent that they do not ultimately occur.

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[31] Sinkey, Joseph F. Jr., *Problem and Failed Institutions in the Commercial Banking Industry*, JAI Press Inc., Greenwich Connecticut, 1979, page 233

An effective counter-argument focuses on the costs of forbearance. If the intent of any EWS is to avert regulatory expense, forbearance should be avoided, as it can be costly to regulators in terms of time, money, and resources. The costs of forbearance increase in proportion to the constraints being faced by the regulator. There are four constraints to effective forbearance monitoring as itemised by Thomson (1992):

1. Information constraints represent the costs of monitoring the insolvent institution. The insuring corporation faces a trade-off between these costs and the expected loss should the FI become insolvent.
2. Political constraints arise out of principal-agency problems that exist in bureaucratic regulatory agencies and cover three broad areas. The government's dual job is to ensure a sound banking system while simultaneously minimising taxpayer loss exposure, political clientele decisions are influenced by the desire for re-election, and regulator post-government career aspirations can affect current decision-making.
3. Funding constraints refer to the value of the deposit insurance relative to the FI's explicit and implicit balance. As funding constraint costs increase, the regulatory body is less likely to act to close an insolvent FI.
4. Staff constraints refer to the ability to close a financial institution as constrained by the size and ability of regulatory staff. As government or regulatory budgets constrict regulatory bodies, there are incentives to minimise staff. As well, the regulatory bodies' ability to attract and retain good people is limited by its ability to provide compensation packages that

are competitive with the private sector. When there are a great number of, or a few large troubled financial institutions, there are increased staff constraints. This situation also affects the information constraint because the regulator's ability to detect troubled institutions is a function of the size and skill sets of its staff.

Cole (1993) agrees that constraints are key in forbearance decisions using Ninth District as evidence. The Ninth District head office moved from Little Rock to Dallas in 1982. At this time, 37 of its 48 supervisory personnel resigned. Of the remaining 11, only two were field supervisors. These last two supervisors supervised 480 thrifts, resulting in experienced staff shortages in the Ninth District. Collapsing oil prices resulted in distressed regional economic conditions in Ninth District's area during the same time required close and knowledgeable supervision. As well, the 1980 Depository Institution Deregulation and Monetary Control Act and the 1982 Garn-St. Germain Depository Institutions Act granted new portfolio powers to the Ninth District's federal charter thrifts and removed growth constraints. This resulted in the phasing out of deposit rate ceilings and increasing the deposit insurance coverage limit from $40,000 to $100,000 per account. These Acts significantly increased the need for closer supervision exactly at the point when it was most weakened. Cole found that higher levels of forbearance occurred in the south-western thrifts in the Ninth District because of a more powerful congressional presence in this area. He charged that politicians pressured thrift regulators to grant forbearance. If the information, political and

staff constraints had been of lesser importance, much lower costs might have been incurred.

2.4.10 Moral Hazard

While most businesses make money by translating physical assets into revenue generating products, financial institutions borrow funds from depositors, lend to loan takers, and earn a profit on the net interest margin. Cole (1993) identifies the moral hazard resulting from the greater power to change the sources and uses of funds compared to other businesses. Changing interest rate spreads through yield curve manipulation allows management to increase their net interest margin. This manipulation will also increase the financial institution's risk exposure, but deposit insurance reduces the impact of the increased risk.[32] A specific measure for determining the net interest margin's volatility is generally missing from most standard business insolvency risk measures.

There is an implicit encouragement for financial institutions to engage in less efficient activities as a result of deposit insurance. Cole's example looks at thrift's funding ex ante high credit-risk assets with volatile liabilities. Future asset-quality problems are expected to result from ex ante high-risk asset and liability portfolio selections. Not all difficulties are blamed on abuse of moral hazard, and he separates "non-traditional" thrifts from "traditional" thrifts based on propensity to take advantage of moral hazard. Non-traditional thrift asset categories are ex ante high credit risk while traditional thrift investments are ex ante low credit risk

and are separated for two reasons. First, thrifts in the 1980s had less experience and expertise in assessing the creditworthiness of non-traditional assets because of their comparatively new entry into this field compared to their non-thrift competitors. Second, as a new source of funding for non-traditional assets, thrifts were only likely to aspire to marginal credits that were rejected by other financial institutions, resulting in adverse selection. He noted that regulators encouraged thrifts to engage in non-traditional asset growth in order to "grow" out of their interest rate mismatch problems. His analysis supports the hypothesis for the existence of moral hazard independent of effects from the south-western economy's 1980s collapse. His data also supports the existence of agency conflicts between owners and managers.

2.4.11 Supervisory Intervention

Competition between the various regulatory bodies in the United States has resulted in less than optimal efficiency in decision-making by regulators. Cole (1993) notes two specific instances where regulatory competition has hurt the thrift industry.

In California, all asset restrictions were removed from its state-chartered thrifts in 1980 to keep them from converting to federal charter status. This occurred in response to a state supreme court decision forcing them to make mortgage loans assumable. At the time the ruling was made, most of these mortgage rates were substantially below market rates, which eventually forced heavy losses on state chartered thrifts. Federally chartered thrifts were not

[32] Gardner, Mona J., and Dixie L. Mills, *Managing Financial Institutions: An*

bound by these restrictions. Texas, Florida, Ohio, and Illinois were other states with significantly fewer restrictions on state chartered thrifts when compared to federally chartered counterparts.

Cole also notes that there have been charges that lax supervision at state chartered institutions led to more severe problems in these institutions later. When he tested for regulator-type agency conflict, he found that south-western thrifts were more likely to be insolvent than thrifts located elsewhere, but the federal charter variable had a zero coefficient, failing to support the hypothesis that state thrift regulators were more lax than their federal counterparts. Ninth District analysis provides statistically significant indication that these supervised thrifts were more likely to be insolvent, but less likely to be closed, substantiating the hypothesis stating that political influence may change the propensity for closure once a thrift is in financial difficulty.

Another issue that can be raised here revolves around preventative regulatory action to avoid insolvency and failure. Sinkey (1979) notes that Security National Bank of Long Island was forcibly merged into Chemical Bank of New York. It occurred because of fears about the general public interpreting a second failure, so soon after the failure of Franklin National Bank, as the beginning of a bank run. In order to avoid this interpretation, regulators forcibly merged the failing FI. This sort of action often disguises insolvent FIs to casual review. Sinkey notes,

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Asset/Liability Approach 3rd ed., The Dryden Press, Fort Worth, Texas, 1994, page 479

"Security's weaknesses were not known publicly until about one week before its emergency consolidation."[33]

Korobow et al (1975, 1977b) notes that regulators have a dual responsibility to depositors and the economic community because of the potential costs of widespread instability which extend beyond individual FI involvement. Financial institutions that fail financial health tests are "hidden" from the depositor and the economic community. This is justified on the grounds that any financial institution in difficulty may be forced to close down if made public because the depositors would withdraw their funds, causing a "bank run" that may cause real economic damage (Diamond et al: 1983). Because of this duality of purpose, two regulatory responses occur that disguises the health of a financial institution. First, Thomson (1992) notes that regulators, as a standard practice, do not release regulatory FI ratings to the general public. Second, they practice "forbearance", meaning they will assist a troubled financial institution in a number of ways, including monetarily, and keeping it operating. Because of these monetary advancements, tests generally used for institutions must be modified in order to exclude any funds advanced by the regulatory body. Because of the first response, it can be difficult to identify these funds.

2.4.12 Management Incompetence

Sinkey (1979) notes that it is hypothesised that the major causes of FI failures and problem FIs come from inept and/or dishonest management, and that this ineptness should, over time, be reflected in the FI's financial statements.

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[33] Sinkey, Joseph F. Jr., *Problem and Failed Institutions in the Commercial Banking*

However, he also notes, that management without integrity is also likely to attempt to disguise any mismanagement for as long as is possible. He cites United States National Bank of San Diego as a case in point.

2.5 Critique and Conclusions

The literature overview indicates that any study of FI failure would benefit from the use of both accounting and non-accounting data. It was speculated that smaller FIs might be more likely to fail because they are unable to raise funds when necessary in order to get out of trouble. As well, there was conjecture that efficiency may be a function of size - that small FIs spent too much money as a percent of net income in administration when compared to large FIs, thereby making them less efficient and more vulnerable to failure. Evidence also indicated that smaller FIs have lower capital asset ratios. There was also speculation that large FIs can be "too big to fail", whereby forbearance by regulatory bodies will keep them afloat long after the smaller FI would have been closed. The time frame for studies ranges from one year to nine years prior to failure.

Many of the FIs studied experienced radically changing environments during the periods under study. They moved into new areas and changed the way they secured additional loans, which changed the importance of different ratios over time. Ratios were often used in order to minimise the effects of differing sizes in FIs. Ratio analysis as an indicator of FI health is most useful

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Industry, JAI Press Inc., Greenwich Connecticut, 1979, page 209

during a normal environment. In cases of either extreme risk (high or low), ratios do not tell the true story. The net capital ratio was often found to be important in differentiating between failing and surviving FIs. Any FI with low capital ratios was more likely to also be a problem FI.

Several studies discussed difficulty experienced in trying to define failure. One attempted to group the studied FIs into three rather than two categories - serious problem, temporary problem and no problem rather than failed and healthy. This was found to be useful in establishing serious problem versus non-problem FIs, but less useful in determining temporary problem FIs.

The technique of matching failed and healthy FIs was used often, and failure was generally said to occur in the last financial reporting period prior to closure. Both univariate and multivariate analyses was used. Although they used multiple indicators to predict financial health, it was unclear whether better predictive statistics resulted. Theoretically, it was argued that different key areas were necessary for complete financial health, but results did not consistently support the use of combined predictors. Many studies noted the similarities in results when comparing failed to healthy FIs. One study suggested that this might result from the importance of loan quality in the determination of FI health combined with the unwillingness of high-risk FIs to reclassify problem loans. Until the examiner forced a problem FI to reclassify problem loans, there is not a highly recognisable difference between the two in terms of financial statements. The different studies used probit, logit, and ratios as alternative dependent variables.

There is some debate regarding the wisdom of any type of regulation in the banking industry. While some argue that an efficient market would be more effective in bank regulation, others charge that the unique status of FIs in the economic environment demand that governing bodies have a responsibility. Those that prefer the increase or maintenance of regulation cite bank runs as one problem that might be unavoidable if market regulation were imposed rather than regulatory supervision. Those that favour increase in regulatory intervention have not proven that increased intervention actually reduces FI failure risk. Those that argue for the implementation of market regulation suggest this is a more effective form of regulation. They argue that the presence of regulators as a lender of last resort increases the possibility of moral hazard because the FI knows it will have an alternate source of funding in the event of a bank run. Those that supported the maintenance or increase in regulatory intervention consistently indicated that any ratio analysis of this type would not replace regulatory review. Instead, it would provide an additional source of information to the regulator in ordering the riskiness of the various FIs under supervision to efficiently deploy scarce resources.

Ratio analysis in any form measures the probability that a FI will fail in the future because of the current situation, and does not address the dynamic environment that FIs find themselves in. The reluctance to write off bad loans on the FI's part will distort results. Most studies specifically suggest that moral hazard, at best, can only be suggested by the analysis of ratios. Without on-site

experience and knowledge, most of the studies include a codicil stating that all results assume the absence of moral hazard such as embezzlement.

Analysis attempted to define the dollar value of examining too many FIs (type two errors) versus too few (type one errors), and quantified the logical cut-off point for bank examinations based on economic and financial returns. There was difficulty in consistently establishing where the greatest payback occurred. Although FIs could be ranked on a riskiness scale, it was more difficult to draw the line between risky and non-risky. The final analysis suggested that this line be drawn based on judgement and experience rather than some discrete point in ranking.

There are no standard ratios that are used to predict the various key issues raised by the analysts. Instead, each group spends a considerable amount of time establishing what is important for study purposes, and then spends little time critically describing the different ratios that might proxy for the key issue. Although there is general agreement that ratios are helpful in developing a health meter for FIs, there is not any clear definition of what key issues impact the future health of FIs. The only general agreement is that capital adequacy and asset return variability are key and opposing definers for the probability of FI failure. The greater the amount of capital the less the risk of failure, while the greater the variability of assets, the higher the probability of failure.

A summary of the six most important indicators from each of the literature reviews can be found in Appendix 3: Summary of important indicators from all literature review studies.

III Research Design

The objective of the study is to analyse the characteristics of FIs that failed in Canada in order develop an EWS that will enable the regulators and the industry to identify problems ahead of time. The warning system would compare healthy FIs with failing ones in order to identify critical areas of difference. The basic purpose is to identify a possible relationship between equity as the dependent variable, and various independent variables.

3.1 Definitions Used in Study

3.1.1 The Definition of Insolvency

FI failure can be defined in a number of ways: negative equity, legal failure, and regulatory failure.

Negative equity as a definition of FI failure occurs when either the market or book value of equity, adjusted for loan reserves and subordinated debt, becomes negative. Legal failure is defined to occur after negative equity takes place, when either regulatory forced action, such as a regulatory merger, closure, or funds advancement, or legal means such as court action, forces an FI to cease to exist in its previous form. Finally, a FI may also be subject to regulator action even in the absence of negative equity, should the regulatory body feel the FI is unable to continue. An example of a situation requiring regulatory action would occur if the FI only operated in a small and declining town or city, where insufficient future business exists.

The last definition is specific to any regulated industry, including the banking industry. It says that insolvency occurs when the regulator says that it has occurred. If the regulator feels that the institution can recover, it will assist in any manner necessary to keep the institution operational. Such action is known as forbearance. If, during the implementation of forbearance, the regulator changes its mind regarding the possibility of recovery, regulatory insolvency can still occur. The regulatory body can withdraw support, whether financial or other, forcing the FI to either survive unassisted or fail.

Because of the dual purpose of regulators, a benevolent response could occur once a financial institution becomes technically insolvent. While most institutions are deemed to have failed once liabilities exceed assets (or where equity is negative), this does not necessarily occur in the case of a financial institution. Once a financial institution is technically insolvent, a regulatory decision is made concerning closure. If the FI difficulties are seen as temporary, or stakeholder interests suggest salvageability despite current difficulties, or whether the FI in question is too important to its economic environment, steps will be taken by the regulatory body to support the FI.

Thomson (1992) notes that negative equity is a necessary, but not sufficient reason for financial institution closure, unlike most businesses. As well, there is an added layer of intervention resulting from a regulator-defined state of financial distress. Regulator inspection leading to a sufficiently poor rating can result in direct intervention by the regulatory body before the financial institution becomes technically insolvent. All three definitions of failure (negative equity - market and

book, regulatory "closure", and poor ratings) exist as dependent variables in the development of an EWS for financial institutions.

In order for the study to be of value as a future indicator for failure, the legal definition does not work well. The FI must be considered failed, often after the fact, by outside bodies before it fits into this category. If the EWS's goal is to identify those FIs in financial difficulty prior to failure, this legal definition makes it impossible for this a priori situation to occur.

There are also some difficulties in using negative equity. FIs may move in and out of negative equity, and be allowed to continue because the negative values are deemed to result from a poor, but not permanent economic environment, or because of some other exogenous variable that is expected to change. At the same time, a non-negative equity FI might still be treated as failed by regulators if they feel that the FI's environment cannot be corrected. The environment could be caused by internal problems, such as poor management or embezzlement. It could be caused by external issues such as being in an economic environment that cannot support it. In either event, the FI would be subject to regulatory interference even though negative equity has not occurred. As well, should regulatory action occur prior to FI failure, the study will be underrepresented with failed FIs to the extent that they have been 'rescued' prior to technical insolvency.

For the purposes of this study, the first definition, negative equity, will be used. There are three reasons for this decision. First, the measures to be used in the study are primarily financial in nature. In order to study the five years prior

to failure, it would be difficult to produce relevant analysis for the period leading up to insolvency, if insolvency is not clearly defined numerically. Second, the intent of the study is to establish an early warning system. As the need for forbearance can not be predicted before insolvency occurs, it would negate some of the value of the study. Finally, forbearance is often an expensive method by which to maintain an institution. To intentionally include this time period would negate some of the value of the study.

3.1.2 The Definition of Equity

A clear definition of "capital" must be established. Santomero et al (1977) state rationale for inclusion of different accounts into the equity measure. First, they identify loan and security loss reserves as specific reserves established to provide a buffer against the main source of equity erosion - loan losses and losses incurred via investment setbacks. Second, the equity account focuses on general accounts whose primary purpose is to establish a buffer against extenuating or unexpected circumstances. These include debt capital, retained earnings, and paid in equity capital. Thomson (1992) notes that because this equity valuation measures book equity net of bad loans, it should be a better proxy for enterprise-contributed capital than a simple capital-to-assets ratio. This definition of equity will be used in the proposed study.

There are difficulties in this measure. There remains the possibility that a financial institution may be reluctant to write off loans that have little chance of collection. To the extent this is true, the capital account series is overstated.

The latter problem should be lessened through regular auditing (internal and external) and regulatory review.

An alternative to equity valuation is market valuation. This could overcome some of the difficulties identified with the use of book value, including reluctance on the part of management to write-off uncollectible loans as well as problems associated with unspecified risk exposure. A recognised is the assumption of efficient markets. To the extent that the market will be reacting to imperfect information, or to the extent that there has been insufficient time for dissemination of information, these figures may be non-representative.

Further, it is recognised that some other corporation may closely hold some trust companies, and their stock values may not represent a true value, nor will stock variations necessarily reflect trust market reaction. It is also recognised that common stock values may be a flawed indicator. To the extent that the common stock holds an option value even after any equity value has been erased, the value will be overstated. This could occur if the votes of common shareholders are needed to effect a reorganisation. In those situations where more than one class of shares is traded, a weighting based on the original number of shares times their book value will be used.

The model proposed in this study will use book value to determine the relative health of the FI. The equity to assets ratio is equal to the accounting definition of equity divided by total assets for the sample trust. See Appendix 4 for specific definitions of variables.

3.2 Independent Variables

Based on the results of the literature review[34], twenty-two independent variables were selected as having an impact on equity levels. Given the Canadian environment these were felt to be the most relevant. These 22 variables were used as proxies to represent different risk exposures that are most likely to result in FI failures. A list of identifiable risk factors includes the following:

1. credit exposure
2. asset quality
3. management ability
4. financial risk
5. interest rate risk
6. securities portfolio risk
7. real estate appraisals issues
8. internal control issues
9. wholesale fund dependence
10. financial loss arising from uses other than the lending of money
11. funding risk
12. strategy risk
13. too rapid loan growth
14. liquidity risk

[34] The most top independent variables found in the literature review can be found in Appendix 3. Included in this appendix are the independent variables used by this study and their relation to the literature review variables.

15. economic risk

The matrix below provides the links between the independent variables as proxies for risk exposures and the justification are provided below.

3.2.1 Proxies for Terms: Independent Variables

Summary Analysis of Risk to Proxy Measure	credit exposure	asset quality	Management Ability	financial risk	interest rate risk	security ties portfolio risk	real estate appraisals	interest control issues	wholesale fund dependence	other users risk	overhead risk	funding risk	strategy risk	too rapid loan growth	liquidity risk	economic risk
1. Operating Expense/Operating Revenue				x	x											
2. Variance of Net Interest Margin	x	x	x	x	x			x					x			
3. Liquid Assets/Total Assets			x			x				x					x	
4. Total Loans/Total Deposits			x						x				x			x
5. Risk Adjusted Assets		x		x				x					x	x		
6. Collateral Loans Concentration	x												x			
7. Consumer Loans Concentration	x												x			
8. Mortgage Loans Concentration	x						x	x					x			
9. Net Loan Charge-offs/Total Loans	x	x	x					x					x	x		
10. Variation of Net Loan Charge-offs	x	x	x					x					x	x		
11. Borrowed Funds/Total Deposits									x			x				
12. Variance of the Total Deposits			x									x				
13. Term Deposits/Total Deposits					x							x	x			
14. Return on Assets			x													
15. Variation in ROA for previous 5 years			x	x	x			x					x			
16. Operating Overhead/Total Assets			x					x			x					
17. Trust Op Overhead ratio to Sample Op Overhead ratio			x					x			x					
18. Operating Overhead/Net Income			x					x			x					
19. Variance of Operating Overhead ratio			x					x			x					
20. Natural log of total assets				x				x								x
21. Economic Indicator 1: GNP							x									x
22. Economic Indicator 2: CPI							x									x

1. Operating Expense/Operating Revenue: This ratio represents the total of all operating expenses divided by the total operating revenue including interest expenses and interest income and excluding gains or losses on investments and income taxes. It is used as a proxy for financial and interest rate risk because it shows how much margin is available to meet economic uncertainty.

2. Variance of the Net Interest Margin (NIM): The net interest margin is interest revenues less interest expenses for any year under study. It can be used to show how the interest returns vary over a five year time period. It also can be used as a proxy for asset quality for the same reason. It can be used as a proxy for management ability, indicating their ability to regulate and standardise returns, or to create consistent income earning ability. It can be used as a proxy for financial risk, internal control risk and interest rate risk for the same reason. Strategy risk can also be proxied using this term, as the results of different long-term deposit and loan-gathering strategies are reflected in this ratio.

3. Liquid Assets/Total Assets: Liquid assets refer to those assets the FI could turn into cash in the short term in order to fund expected and unexpected expenses. To a certain extent, it can be used as a proxy for management ability since it reflects their ability to translate deposits into assets. An extreme value in either direction would suggest weakness by management to either gather deposits or loans. It also can be used as a proxy for securities portfolio risk. As this ratio increases, it may reflect a higher concentration of assets in securities. It may be used to generally proxy for other uses of funds risk for the same reason.

It may proxy for liquidity risk, with a low ratio suggesting inability of management to access payment funds rapidly in the event of a bank run.

4. *Total Loans/Total Deposits:* Total loans includes collateral, consumer and mortgage loans made by the FI while total deposits include demand and term deposits. This ratio may proxy for management ability to the extent that they are successful in translating deposits to assets. It can also proxy for fund dependence, on both the asset and liability sides of the balance sheet. The greater the difference from zero in either direction, the larger the dependence by the trust on either borrowings or non-loan related investments. The disparity can also proxy for strategy risk, given that management will sometimes intentionally reduce loans or deposits in anticipation of a rapid change in interest rates. Finally, it can also suggest economic risk, if the trust is unusually weighted in one direction or another, should interest rates change rapidly.

5. *Risk Adjusted Assets (as defined by the Basle Accord) Levels/Total Assets:* The Basle Accord defines the riskiness of each major type of bank asset and then assigns a required level of equity to them. The higher the level of risk associated with the asset, the higher the level of equity required to satisfy Basle Accord or Risk Adjusted Assets requirements. It can be used as a proxy for asset quality, with a higher ratio suggesting a concentration of high-risk assets. It can also proxy for financial risk, strategy risk and internal control risk for the same reason.

6. *Collateral Loans Concentration:* This ratio calculates the percentage of total loans that are collateral loans, the first of three similar ratios that are included in

the study. It can be used as a proxy for credit exposure, showing the percentage of loans that are collaterallised. It can also proxy for strategy risk to the extent that choosing a particular loan type in which to specialise or concentrate changes the risk of financial failure for the trust.

7. Consumer Loans Concentration: This ratio indicates the percentage of total loans that are consumer loans, the second of three similar ratios that are included in the study. It can be used as a proxy for credit exposure, showing the percentage of loans that are consumer in nature. It can also proxy for strategy risk to the extent that choosing a particular loan type in which to specialise or concentrate changes the risk of financial failure for the trust.

8. Mortgage Loans Concentration: Of the total loans, this ratio indicates the percentage that is mortgage loans, the third of three similar ratios that are included in the study. It can be used as a proxy for credit exposure, showing the percentage of loans that are mortgage in nature. It can also proxy for strategy risk to the extent that choosing a particular loan type in which to specialise or concentrate changes the risk of financial failure for the trust. It can also be used as a proxy for real estate appraisal to the extent that current portfolio size reflects the risk of sudden swings in real estate valuation.

9. Net Loan Charge-offs/Total Loans: This ratio represents the dollar value of the loans that have been written off the books as a percentage of the total loans remaining on the books. It can be used as a proxy for credit exposure if it is assumed that historical charge-offs will be repeated in the future. It can be used to proxy for both asset quality and management ability. The lower the ratio, the

higher the asset quality. In the case of management ability, a significant ratio, either too low or too high calls into question the ability of management. If the ratio is high, too many high-risk loans are being accepted. If it is too low, it suggests that too many good loans are being rejected. For this same reason, it can also proxy for internal control risk and strategy risk. It can be used to proxy for too rapid loan growth to the extent that too rapid loan growth may translate to higher levels of charge-offs if management pursues volume over quality.

10. Variation of the Net Loan Charge-offs Ratio: This ratio represents the variation experienced by the trust for loans written off the books as a percentage of total loans. It can be used as a proxy for credit exposure if it is assumed that historical charge-offs will be repeated in the future. It can be used to proxy for both asset quality and management ability. The lower the ratio, the higher the asset quality. In the case of management ability, a significant ratio, either too low or too high calls into question the ability of management. If the ratio is high, too many high-risk loans are being accepted. If it is too low, it suggests that too many good loans are being rejected. Banks play a game of odds, accepting a specific level of risk for bad marginal loans that should be more than covered by good marginal loans with the same risk of failure. If the level of risk is set too low, the definition of "marginal" or "skinny" loans is too conservative, meaning that the bank is giving up too many good loans for a much smaller percentage of bad ones. This hurts the bank for two reasons. The obvious first problem occurs in that they do not get the revenue accruing from those loans that will probably pay out. The second issue, both more long-term, and harder to quantify, occurs when the

potential borrower is lost to the bank – this borrower is unlikely to return to the bank for a subsequent and possibly more secure loan if he or she obtains a loan from another FI. As well all future financial business from the borrower can be lost, which includes lucrative deposit and chequing accounts, as well as retirement plans, and term deposits. For this same reason, it can also proxy for internal control risk and strategy risk. It can be used to proxy for too rapid loan growth to the extent that too rapid loan growth may translate to higher levels of charge-offs if management pursues volume over quality.

11. Borrowed Funds/Total Deposits: This ratio shows the total amount of funds borrowed by the trust company as a percentage of those funds raised by the trust through normal deposit-taking activity. This is a proxy for wholesale fund dependence as well as funding risks to the extent that borrowed funds are more volatile than deposits.

12. Variance of the Total Deposits: This ratio represents the variance of total deposits over time. It can be used as a proxy for management ability to the extent that it defines the ability of management to acquire and retain deposits at a steady level. For the same reason, it can proxy for funding risk, if it is assumed that previous ability to acquire and maintain steady deposit levels can be used to predict the future.

13. Term Deposits and Certificates of Deposit for guaranteed funds/ Total Deposits: This ratio represents the percentage of non-demand deposits as a percentage of total deposits. This measures the amount not quickly repriced in the event of either a significant change in the economy or in the trust's perceived

health. This ratio can be used as a proxy for funding risk and strategy risk to the extent that a rapid decline in interest rates would lead to the re-negotiating of loan rates downward, with the funding coming from the still higher term deposit rates, which would also imply interest rate risk. As a proxy for strategy risk, it would reflect the willingness of management to trade off more volatile demand deposits for higher cost term deposits.

14. Return on Assets (ROA): This ratio represents the amount of profit earned by the trust expressed as a percentage of total assets. It can be used as a proxy for general management ability where the return reflects the entire trust's profitability as a result of management decision-making.

15. Variation in the ROA for previous 5 years: It can be used as a proxy for general management ability where the variation in the return reflects the entire trust's profitability as a result of management decision-making over time. It also can be used to proxy financial risk as it shows the variability of profitability over time. For the same reason, it can be used to proxy interest rate risk, internal control risk, and strategy risk

16. Operating Overhead / Total Assets: This ratio shows non-interest expenses as a percent of total assets, which defines management and trust efficiency in resource use. It can proxy for management ability and internal control issues to the extent that it is assumed that a more efficient trust will have less operating overhead. It can also proxy for overhead risk.

17. [Operating Overhead / Total Assets] / [Sample average operating overhead / Sample average Total Assets]: It defines management and trust efficiency in

resource use, the result of which is further divided by the group average to determine the trust's health in relation to the study group. It can proxy for management ability and internal control issues to the extent that it is assumed that a more efficient trust will have less operating overhead compared to the norm. It can also proxy for overhead risk.

18. Operating Overhead/Net Income: This ratio shows non-interest expense as a percentage of net income, defining management and trust resource use efficiency. It can proxy for management ability and internal control issues to the extent that it is assumed that a more efficient trust will have less operating overhead. It can also proxy for overhead risk. It can further show the efficiency with which management can manage overhead when faced with changing revenues from year to year. This differs from the Overhead to Total Assets analysis in that the former denominator would not change as significantly from year to year. While it would show longer-term management ability, this measure would analyse short-term ability.

19. Variance of the [Operating Overhead/Net Income]: This ratio shows the variance non-interest expense as a percentage of net income. It looks at management trust resource use efficiency for the current year and the previous four years to see whether significant changes have occurred over time. It can proxy for management ability and internal control issues to the extent that it is assumed that a more efficient trust will have less operating overhead. It can also proxy for overhead risk.

20. Natural log of total assets: This ratio represents a proxy of the size of the company, with the log value reducing the intrinsic heteroscedasticity that would occur if the widely varying asset sizes were used instead. This ratio can be used as a proxy for financial risk, and economic risk if it is assumed that smaller FIs are more likely to fail than large ones.

21. Economic Indicator 1: Gross National Product: This ratio is one of two general Canadian economic indicators included in the study. This one shows the level of Gross National Product for Canada for the year under study. It may serve as a proxy for real estate appraisal risk to the extent that real estate prices change in relation to the health of the economy. It can also be used as an indicator of economic risk.

22. Economic Indicator 2: Consumer Price Index: This ratio is the second of two general Canadian economic indicators included in this study. This one shows the Canadian Purchasing Index or level of inflation experienced by Canada in the year under study. It may serve as a proxy for real estate appraisal risk to the extent that real estate prices change in relation to the health of the economy. It can also be used as an indicator of economic risk.

3.3 Sample Selection and Data Characteristics

3.3.1 Sample Selection

The thesis will use the *ex post, defined* approach to develop an EWS model. This decision was made because of the small size of the sample to be studied. It overcomes the difficulties inherent in trying to define insolvency. If the goal of regulation is to identify and avert financial distress, the accounting definition of

insolvency removes the influence of regulators on the balance sheet. This approach would more closely produce results accomplishing the EWS's goal. A potential difficulty is regulator financial relief to the financial institution prior to insolvency. Financial statements will have to be scrutinised to ensure that additional funding is not reflected.

There were 29 financial institutions that failed between 1980 and 1992, as summarised in *Appendix 1: Failure of Members of the CDIC*. They were composed of banks, trust companies, and mortgage and loan companies. They were defined to have failed if they were either closed down or merged because of official failure. It was felt that the banks might be too different from the others, which could skew the results. For this reason, they were eliminated from the population. Although mortgage and loan companies are similar to trust companies, they, too, were removed to minimise potential skewness problems. However, a possible study could be used to test the validity of the EWS developed in this study against these excluded financial institutions. This resulted in 18 insolvent trust companies. Of these, only seven had existed for a sufficiently long period of time to be of use in this study.

During this same period, there were 40 other trust companies operating in Canada. This is the core population from which the sample of "healthy trusts" was selected, and can be found in *Appendix 6: Complete list of all Trust Companies (Federally and Provincially Chartered) in Canada*. Where trust companies have merged, the combined data for all joined trusts are used, even for those periods prior to consolidation. In the event of changed net book equity

resulting from consolidation, the book value of equity measure will use each year-end valuation, regardless of changes.

There were only a small number of trust companies that exist or have existed in Canada. In the time frame under study, there were only 47 trust companies available for study, of which seven had failed. By matching five healthy trusts to each failed trust, primarily based on time of operation and size, this provides a sample size of 42 trusts, both failed and healthy. The seven failed trusts' data was isolated to the five years prior to failure, with year one equalling the last year that financial statements were published before the trust closed its doors. Each of the seven failed trusts were matched, based on whether the healthy trust operated during the same five years and based on similar sizes.

A validation sample of twelve healthy trusts were removed from the thirty-five healthy trusts, leaving twenty-five for model development. Twenty-five healthy trust companies were necessary to create a sample of sufficient size to produce statistically significant results. The remaining seven failed and twelve other healthy trusts were grouped into a control group by which to validate the robustness of the EWS model being developed.

The entire failed trusts group was used in the validation study for two reasons. First, as the model was developed to forecast healthy trusts, including failed trust data would skew the results. Second, additional evidence in ratio results indicated that only the year immediately prior to failure for failing trusts was strongly different from surviving trust data, so only the final year was used

for validation purposes. The list of failed and healthy trust companies is given in Appendix 5 and Appendix 7.

3.3.2 Use of Panel Data

Given the size of the resulting sample and the minimum requirements to establish statistical significance, panel data was chosen to enhance the analysis. Each trust has all five of its years' data included in the results as opposed to only one year which would be the case if non-panel data were used. The pooled cross-sectional time series data was collected over a five years in order to obtain statistically valid results. With a total of twenty-five healthy trusts in the model development, this would total 125 different observations.

3.3.3 Data and Time Frame for Analysis:

For each of the five years prior to official failure, the dependent and independent variables were calculated for the five healthy trusts. This was done to minimise outside effects such as recessions. Initial data was collected from multiple sources, with the primary source being Office of the Superintendent of Financial Institutions (OSFI)[35]. The data ranged from 1976 to 1993. In the event that more than one financial statement was issued for any given year, the latest statement was used. The large number of years for the healthy trusts is necessary in order to match the time frames for the failing trusts. One dependent variable (Equity to Assets), and twenty-two independent variables were calculated for each trust company for all years in which data was available.

Meyer and Pifer (1970) suggest grouping based on a more strenuous linkage, including local economic conditions, general economic conditions, quality of management and integrity of employees. These factors were not specifically taken into account in the grouping process because of the small sample size, and the lack of non-accounting information. By linking each failed to five surviving trust companies, it was felt that these factors might be passively taken into account.

The literature review indicated various time frames for analysis. They ranged from one year to 10 years. Those that used a time frame of greater than three years found that predictive ability decreased. The degradation was quite pronounced across all studies for more than five years.

In order to gather sufficient data, nine years of data must be collected. This was necessary to obtain variance ratios. Hence, four years prior to the initial fifth year must also be collected, totalling nine years[36].

There were other difficulties in trust grouping which also resulted from the small numbers of trusts available. In Canada, with its low numbers of financial institutions generally, it was sometimes difficult to match failed trust companies to comparably sized surviving ones.[37]

Two pieces of market and economic information were required beyond financial statement results in order to produce all calculations. The period-end

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[35] All data was collated and entered onto the computer using Microsoft© Access Software. Summary totals were taken.

[36] In order to get sufficient data for nine years analysis, data was collected, whenever possible for the years 1976 to 1993 inclusive.

36 All calculations needed to generate final comparison numbers were generated using Microsoft™Access Software and Visual Basic, Unix SPSS, and Shazam 7.0

federal Consumer Price Index (CPI) and the Gross National Product (GNP) were required for each year.

3.4. Proposed Data Analysis

3.4.1 Comparison of Linear Probability Model (LPM), Logit, Probit, and Tobit approaches in defining regression model

Instead of using a logit or probit dependent variable, this study used a normal dependent variable. This approach reduced statistical problems associated with the other approaches, including a non-independent error term. Further, if the goal were to determine high-risk institutions in time for corrective action, a logit dependent variable whose only possibilities are zero (failed institution) or one (healthy institution) would require an after-the-fact classification for subsequent model use that would defeat the purpose of the study. Similarly, any probit model that had a discrete number of possibilities would require *ex post* knowledge by the regulators in order to be of value. Further, in the literature review, only one study used the probit alternative, suggesting that it may not be the most appropriate alternative for the situation.

The use of a Logit Probit Model (LPM) with failed trusts equal to zero and healthy trusts equal to one was an option for the dependent variable. But if the model is to be used in the future to predict failed versus healthy trusts, it should be used as a predictor rather than *ex post*. Although it could be argued that the closer to zero, the more likely the failure, questions in usage could arise. What is a failed trust? At what point on the relative scale does a healthy trust become a failed trust, or even a trust that needs closer attention? As well, a dependent

variable would allow better prediction of the amount of negative equity. A dollar figure is a more easily understood criteria compared to some value between zero and one. Hence, multiple regression was chosen because of its being more easily understood by the ultimate users – the bankers and the regulators.

Another reason for the use of an equity dependent variable rather than a logit dependent variable focuses on the timing of the data collection. All of the trust data was collected during a time of potential financial upheaval in the trust community. With changing regulations granting them greater access into markets previously unavailable, coupled with greater access to their markets by Canadian banks, as well as a volatile interest rate market, clear lines of demarcation differentiating failed and healthy trusts might be misleading. If all trusts are being subjected to financial shocks, all trusts may actually be in a financially precarious position. To designate one trust as clearly healthy and another as clearly failing, as the logit alternative would require, may impose an artificial structure on the situation.

3.4.2 Two-Sample t-test

The first step was to test for significant differences between the failed and the successful trust companies for each of the independent variables using the two-sample t-test. The null hypothesis was that no statistical difference between the healthy and failed trusts be found for any of the independent variables. The use of panel data meant that there were 35 data points for failed trusts and 125 data points for healthy trusts.

3.4.3 Factor and Regression Analysis

As seen in Appendix 2: Literature Review Summary, most analyses used for developing EWS were univariate, multiple discriminant analysis, or regression analysis. Rose et al (1985) used both univariate and multivariate measures and concluded that multivariate approaches contribute little to the understanding of the process that leads to FI failures. Univariate analysis consistently produced superior results. Despite this, insolvency was felt to be a function of a series of problems as opposed to individual indicators.

Thomson (1992) used factor and regression analysis and also did a comparative test using multiple discriminant analysis. He found that the most successful discriminant model, which used the ratios from factor analysis, correctly identified less than 70 percent of the problem institutions in 1982 compared to a 90.4 percent success rate using regression analysis. This is the only reported study that shows the results from both alternatives, and was used as the basis by which to determine which method to use for the current study. Because of these findings, the proposed study will use a combination of regression and factor analysis.

Different studies found varying independent variables contributing to EWS prediction abilities. Rose et al (1985) complained about the lack of general analytical theory available about different financial ratios. Diversity of selected independent variables and lack of a unified general ratio theory suggested an approach starting with a broad cross-section of potential independent variables.

Factor analysis depends on the assumption that observed dependent variables can be expressed as linear functions of one or more common factors and another factor that is unique to each observed variable. It assumes that there is a causal relationship between the factors and the observed variables. Statistical packages can produce factors based on the correlations or covariances among the variables. They are set by statistical relationships as opposed to heuristic researcher-defined expectations. The researcher's task focuses on inferring the causal structure of the model from the factors produced and on determining what each of the factors represents (West: 1985).

Factor analysis was used to narrow down the number of independent variables for later multiple regression analysis. Each of the twenty-two variables was subjected to factor analysis in order to establish which independent variables would be significant predictors of FI health. Factor analysis results focused on the highest loading using varimax rotation using Kaiser-Meyer-Olkin (kmo) measure of sampling adequacy and the Bartlett test of sphericity.

Regression analysis independently determined which of the independent variables had the best predictive ability. Factor analysis and regression analysis results were tabulated to jointly determine the independent variables for multiple regression analysis.

3.4.4 Multiple Regression Analysis

Once the most predictive independent variables were determined using factor and regression analysis, the next step was to combine them into a multiple regression model. The previous steps determined which individual independent

variables had the strongest association with equity, based on significant statistical relationships. The next step would incorporate the best independent variables to develop a model that determined the combined impact on equity.

The model estimates the coefficients for the multiple regression model. Two different sets of independent variables were used in order to test whether one was more predictive than the other. The first five independent variables were used in both regression analyses, and were ranked as excellent indicators of trust health. The four additional independent variables included in the second regression analysis were ranked good in terms of their predictive ability.

3.4.5 Type I versus Type II Errors

Type one errors would occur when a failing FI is labelled as healthy. Type two errors would occur when a healthy FI is labelled as failing. If a type one error occurs, this would result in increased assistance costs, assuming that costs to avert a catastrophe or the closing down of an FI increase incrementally the higher the level of financial difficulty the FI faces. It would also result in public regulatory embarrassment, such as occurred in Principal Trust, Northlands Bank and the Canadian Commercial Bank. In each case, government was required to step in to partially fund deposits that were otherwise unrecoverable.

Type two errors would result in increased examination costs. If the model results were used for scarce resource assignment, capital may be inappropriately used to review a healthy FI. The model could also be used to rank FIs by comparative health. This means that higher risk FIs would be those that are

examined if a type 2 error occurred. To that end, the incidence of type one errors would be of much lesser desirability than the incidence of type two errors.

Whenever difficulty in grouping arises, the study will err to the side of the type two errors. More trusts will be found to be unhealthy than are truly the case in order to minimise the occurrence of failed trusts that are labelled healthy.

It should be noted that because a continuum dependent variable is being used, Type 1 and Type 2 errors should not occur, nor need to be interpreted. It should result in a comparative list of trusts that have descending levels of risk exposure.

3.4.6 Confounding issues: multicollinearity, heteroscedasticity, autocorrelation

Multicollinearity, in its pure form, refers to a perfect linear relationship between some or all of the explanatory variables and the dependent variable. In this study, the test for multicollinearity would refer to the inter-connectedness between the independent variables. If it exists extensively, the value of the individual independent variables as a predictor of trust failure would be reduced. Comparison of the adjusted R-squared with significant t-ratios will be used to determine multicollinearity.

Homoscedasticity, a desired outcome, suggests that the population regression function all have the same variance. Heteroscedasticity, in contrast, is the difference in variation among the sample trusts. If, for example, the absolute size in assets for each trust were used, there would be a wider heteroscedasticity resulting from the size difference. This problem was addressed by using ratios and logarithmic values rather than absolute accounting

values for the independent variables. Nonetheless, the results could still be skewed by previously undeterminable variations.

Autocorrelation occurs in a series of observations over time or space, of which the former is used in this study. The presence of autocorrelation suggests that the disturbance term relating to any observation is not related to any other observation. In the panel data, disturbance terms for a particular trust over the course of the five-year observed time could be an issue. The Durbin-Watson d statistic will be used to test for auto-correlation.[38]

IV Empirical Results

4.1 Sample t-test results and regression and factor analysis

Factor and regression analysis was used to identify significant relationships between independent and dependent variables. Sample t-test results were also taken in order to provide an independent correlation of results.

However, given that there were 22 independent variables, the regression results of failed trusts was statistically inconclusive, and only the results for the healthy trust panel data were used in subsequent multiple regression analysis. Thus, the ranking of the 22 independent variables using single regression was based primarily on the healthy trust panel data, although the failed trust data was reviewed for agreement. The statistically inconclusive results generally supported or remained neutral to those results obtained using the panel data.

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[38] Gujarati, Domodar N., "Basic Econometrics", McGraw-Hill, 1988, pages 283-84, 316-17, 353-354.

4.2 Ranking of Independent Variables

The single regression and factor analysis results did not always agree with each other. Hence, a ranking scheme was used to group the independent variables in their order of importance and significance in affecting the dependent variable. For each independent variable the single regression results as well as the factor analysis results were compared to identify consistent effects on the dependent variable.

The twenty-two independent variables first had to pass the test for significance at a 95 percent confidence interval. At the same time, they were required to pass the single regression test. Finally, they were ranked based on their score as a proxy for the factor they represent. Because the different tests did not always agree, they were assigned a ranking based on their standing. The rankings were totalled, and this total became the basis by which they were categorised. See Appendix 8 and Appendix 9 for the ranking summary total.

Of the twenty-two independent variables, five showed high relationships between the independent and dependent variables and were ranked as excellent. Four showed good relationships between the dependent and independent variables. Four out of the twenty-two independent variables showed a fair rank. The other independent variables (eleven) showed either moderate relationship from either single regression or factor analysis, or no support from either type of analysis. These were ranked as moderate or poor respectively.

Each ranking is listed in Table 1 with its defining characteristics, along with those independent variables that comply with the definition. The t-test results for

significant differences between the sample of failed and healthy trusts are indicated beside each. The F-values and the confidence intervals are also included.

The graphical analysis of statistical outliers can be found in Appendix 10. Visual inspection shows the significant existence of statistical outliers in the Net Interest Margin Variance, Collateral Loan Concentration, Consumer Loan Concentration, Deposit Variance, Gross National Product, Consumer Price Index, Overhead to Assets, Overhead to Income Variance, and the log of Total Assets.

The factor analysis correlation matrix can be found in Appendix 11. The generally highest correlations occur between Overhead to Assets and other independent variables, and between Log of Total Assets and other independent variables. These relationships make sense when the underlying information is reviewed. Both Overhead to Assets and the Log of Total Assets are made up of a large number of raw data points, which would increase their likelihood of relationships between them and other independent variables.

TABLE 1: Summary Ranking for Simple Regression

Independent Variable	t-value	F-Value	95% C.I.
Group 1: Excellent Ranking			
Liquidity Levels to Total Assets (3)	32.30	1043.42	reject null hypothesis
Loans to Deposits Ratio (4)	14.72	216.620	reject null hypothesis
Total Assets Log (22)	-12.14	147.294	reject null hypothesis
Mortgage Loan Concentration (08)	-11.78	138.846	reject null hypothesis

TABLE 1: Summary Ranking for Simple Regression			
Independent Variable	**t-value**	**F-Value**	**95% C.I.**
Overhead to Assets (18)	10.85	117.688	reject null hypothesis
Group 2: Good Ranking			
Net Interest Margin variation (2)	-5.75	33.074	reject null hypothesis
Expenses to Revenue Ratio (1)	-5.464	60.747	reject null hypothesis
Collateral Loan Concentration (6)	5.356	28.689	reject null hypothesis
Deposits Variance (12)	-5.009	25.087	reject null hypothesis
Group 3: Intermediate Ranking			
Consumer Loan Concentration (7)	3.429	11.838	reject null hypothesis
Return on Assets (16)	2.801	7.846	reject null hypothesis
CPI Levels	-2.784	7.750	reject null hypothesis
GNP Levels	-2.775	7.701	reject null hypothesis
Group 4: Poor Ranking			
Long-term Debt to Deposits Ratio (13)	1.932	3.734	reject null hypothesis
Overhead Levels to Income Ratio (20)	-1.323	1.750	reject null hypothesis
Charge Offs Percentage Variation (10)	1.285	1.652	reject null hypothesis
Return on Assets Variance (17)	1.021	1.043	cannot reject null hypothesis
Borrowing Levels to Deposits (11)	.9559	91.375	reject null hypothesis
Charge Offs Percentage (9)	.9695	.940	reject null hypothesis
Risk Adjusted Assets value to Total Assets (5)	.6111	.373	reject null hypothesis
Overhead Levels to income variance (21)	-.1353	.018	reject null hypothesis

4.3 Economic analysis of Single regression and Factor Analysis results for the nine key variables

4.3.1 Independent Variables with a Excellent Ranking

Liquidity levels to total assets (X03) shows a positive relationship between high liquidity levels and the possibility of bankruptcy, with a mean value of 1.0282. It may seem contrary to expectations that a large block of quickly accessible cash available to the FI would be problematic. However, another explanation exists that supports the positive relationship.

High liquidity levels can suggest two things. First, it suggests an inability to find sources of loans. This may be due to the competitiveness of the market, forcing the FI to invest temporarily elsewhere in short-term markets at comparatively lower interest rates. The FI is investing in low-risk short-term investments such as t-bills. Although they return good rates for the term of purchase, they return lower interest rates than would a longer-term loan. If the FI is not intentionally trading in high-risk paper, the restrictions on what constitutes acceptable investments firmly place the FI in a lower return category.

Second, it may also suggest that the investment strategy focuses on high-risk high-return investment vehicles rather than secure but lower return loans. The FI is trading off lower payment probabilities for higher profit possibilities. It may also suggest that the FI is trying to manipulate net profit to indicate a healthier financial position than in fact may exist.

The loan to deposits ratio (X04) shows a positive relationship to the possibility of bankruptcy with a mean of .80757. As borrowed funds are generally

more expensive than deposits, this relationship is logical. A second possible interpretation might be that the FI is still aggressively pursuing total growth via loans, where financial health may not be as much of a concern for clients. At the same time the FI is having difficulty retaining deposits because of a higher perceived risk attached to the FI by the public,

With an average of -0.43985, the log of Total Assets (X22) suggests an inverse relationship between the size of the FI and the probability of bankruptcy. The inverse relationship can be explained reasonably in a number of ways. First is the ability of the FI to minimise overhead. As an FI grows larger, it can effectively minimise the amount of overhead that must be paid for by each loan or deposit. As the FI grows, the overhead does not grow in proportion. Second is the specialisation of duties. Again, as an FI grows larger, in many cases, the number of people available that would specialise in particular areas would increase. The implication is that a specialist in an area would produce better results because of skill and attention, than would a generalist. Third, there is the probability of lesser dependence on any one market. The implication is that the smaller FI may be geographically concentrated. Should the geographical site experience financial decline, this would be immediately reflected in the FIs' financial condition. A larger FI would be less geographically concentrated, with downswings in one geographical area compensated for by upswings in others. Further, there is the suggestion that large Canadian FIs will not be allowed to close. This premise has been backed up by action on the part of the Canadian

government because of Canadian fiscal health issues. Instead, they will be forcibly merged into healthier FIs.

There is a negative relationship between mortgage loan concentration and the probability of bankruptcy with a mean of -6.2857. As the number of mortgages increases, the probability of bankruptcy declines. Although mortgages are traditionally the lowest interest rate loans, this relationship may make sense because they also represent the lowest risk to the FI. The FI has minimal financial exposure because the usual collateral, a building or home, rarely loses significant value, even in the event of default. Although there are exceptions to the significant value loss rule, notably Alberta mortgages in the early 1980s, and Toronto area mortgages in the late 1980s, mortgages still result in generally safer loans. Further, it might also indicate action on the part of the FI. If the FI is attempting to enter a new market, it must usually start by pursuing marginal loans, ones that other entrenched FIs have already rejected. Because of their more marginal status, such loans would rarely be mortgages.

There is a positive relationship, with a mean of .97225, between Overhead to Assets (X18) and the possibility of bankruptcy. Higher relative overheads imply a greater chance of failure. This relationship makes business and economic sense, in that it suggests that the high overhead institution is either much less efficient, or else it is smaller. If it were less efficient, the FI ratio may suggest that management is not effectively doing its job, allowing ineffective use of resources. If it is smaller, it reflects the need for a certain minimum level of infrastructure regardless of the size of the operation. In both cases, it means

that, in the event of economic downturn, the FI is less able to maintain financial solvency.

4.3.2 Independent Variables with a Good Ranking

There is a positive relationship between Net Interest Margin variation (X02) and the probability of bankruptcy. The less volatile the net interest margin in the five years prior to failure, the lower the probability of failure. This relationship makes logical sense, as it implies that the FI is diversified in its assets and liabilities. It suggests that it has a good time match between interest earned and interest to be paid. Although it reduces the upside earning potential, it also reduces the downside risk. This match means that the FI will be less exposed to interest rate fluctuations, as it is re-pricing its assets and liabilities in similar time frames. It also suggests a higher level of sophistication on the part of the FI, as it would seem unlikely that the FI would accidentally have sound net interest margin ratios over a long term. Instead, it would suggest that the problem has been specifically understood and addressed.

There is a positive relationship between the Expenses to Revenue ratio (X01) and the possibility of bankruptcy. This ratio refers to the general operating health of the FI as opposed to focusing on only its net interest margin or other revenues and expenses. This relationship makes economic sense. The higher the levels of expenses when compared to revenue, the lower the expected profit, regardless of the financial situation. It would suggest that the FI is either small or less efficient. The ratio represents a combined analysis of net interest margin (X02), overhead to assets (X18), as well as other revenues and expenses not

dealt with in either ratio. This combination may be the reason why it is lower than the others, as efficiencies in one area may disguise inefficiencies in others.

There is a positive relationship between the collateral loan concentration (X06) and the possibility of bankruptcy. Although collateral loans are less stable than mortgage loans, this result seems more difficult to understand. One possible interpretation of the result is that collateral loans are so unstable that FI's are financially better off if they did not pursue them. This would seem illogical. If the FI finds that collateral loans are so unstable, they would then either stop offering to finance them, or require increasingly high rates of interest to compensate for the risk. One possible explanation might be found in the companies under study. If the trusts were attempting to enter this market, they would be obliged to take the marginal collateral loan applications. The stronger applications would have already been accepted by FIs more entrenched in the business leaving only the less optimal loans for the trust industry. As well, they may be less sophisticated participants, meaning that they are less able to differentiate between a strong loan request and a weak one. If these possibilities were true, the relationship would make sense.

The final independent variable that was merited a "good" rank was deposits variance (X12). This ratio showed a negative relationship with the possibility of failure. This ratio was determined based on five years of variation in deposits. A higher volatility rating indicates the FI was either growing or shrinking more quickly than was standard, or experienced more difficulty in retaining steady deposit levels during the period of study. If rapid growth were the cause, it would

suggest that rapidly growing FIs might not have the infrastructure or management sophistication to manage the resulting growth. Assuming an aggressive and intentional plan for growth, it may also mean that the FI was forced to enter "fringe" markets. It had to offer better than competitive rates or accept marginal loans that had been already turned down by other FIs in order to grow. If rapid decline or unstable deposit base were the problem, it may be a reflection of consumer concern over the health of the FI.

These nine variables were incorporated into the multiple regression frameworks.

4.3.3. Factor Analysis and Confidence Interval Results

With a 95 percent confidence interval, only two variables suggest that there may be no difference between the failed and surviving FIs. Only the variation of ROA over the previous five years (X17), and Variance of Operating Overhead (X21) show indications that they may be the same. In both cases, the ratios are looking at variance over a five year time period, which may indicate that volatility of both surviving and failed FIs is significant in these areas, and can not be used reliably for forecasting purposes.

Using factor analysis, the best variables were Liquidity Levels to Total Assets (X03), Loans to Deposits Ratio (X04), Return on Assets Variance (X17), Overhead to Assets (X18), Overhead Levels to Income (X20), Overhead Levels to income variance (X21), and Total Assets Log (X22).

It is interesting to note that while the variation of ROA, Overhead levels to income, and variance of Overhead levels were not considered statistically

significant, they were selected as primary factors. They may represent unique factors, but not show strong separation between the failed and surviving FIs.

4.4 Expected Economic Conclusions from Multiple Regression Results

For the first five independent variables, the following relationships are expected to occur. There should be a positive relationship between Liquidity levels to total assets (X03), Loans to Deposits (X04), and Overhead to Assets (X18) and bankruptcy. There should be a negative relationship between Total Assets Log (X22) and Mortgage Loan Concentration (X08) and bankruptcy. It is predicted that the first three will be positively related because of the riskier portfolios, public concern regarding solvency and absolute size contributing to government intervention respectively. The two latter variables are expected to have an inverse relationship because the former shows the opposite effect of size and government intervention while the latter suggests the small financial risk attached to mortgages as a loan type. The first regression is as follows:

Equity =[(A) + (X03)(B1) + (X04)(B2) - (X08)(B3) + (X18)(B4) - (X22)(B5)]

When the four "good" variables are added, the relationship of the first five should remain unchanged. Of the second four independent variables, Expenses to Revenue Ratio (X01), Collateral Loan Concentration (X06) and Net Interest Margin variation (X02) should have a positive relationship to bankruptcy, while and Deposits Variance (X12) should be inversely related. The three with positive relationships should show general operating efficiency, the sophistication of management, and being marginal players in the business area. Deposits

variance should show growth instability. The expected revised formula is as follows:

Equity = [(A) + (X03)(B1) + (X04)(B2) - (X08)(B3) + (X18)(B4) - (X22)(B5)] + (X01)(B6) + (X02)(B7) + (X06)(B8) - (X12)(B9)

Any trust that is identified as failing should have a negative result, while any trust that survived will have a positive Equity result. The more extreme the resulting Equity result, the healthier or riskier the trust.

4.5 Summary and Conclusions from Multiple Regression Results

4.5.1 Regression Results

The results are given in Tables 2 and 3.

Table 2: Five Independent Variables

Variable Name	Estimated Coefficient	Standard Error	t-ratio
Constant	0.023402	.3979	-1.302
Liquidity Levels to Total Assets (3)	.66718	.5528E-01	12.07
Loans to Deposits Ratio (4)	.28579	.4639E-01	6.161
Mortgage Loan Concentration (8)	-.91817	.3706	-2.477
Overhead to Assets (18)	.11472	.5909E-01	1.942
Total Assets Log (22)	-.42745E-01	.3283E-01	-1.302
R-squared (adjusted): .9268; F-value: 299.931; Durbin-Watson: 1.2158			

The high adjusted R-square (.9268) suggests a good fit between the dependent and independent variables used. Strong F values (299.931 versus F-critical of 2.29) suggest the rejection of the null hypothesis. There is no relationship between the dependent and independent variables. In three out of five of the t-ratio results the t-test results are significant when compared to t-critical (1.98 at 95 percent confidence interval) which, combined with the high

adjusted R-square results, suggests that multicollinearity is not a major problem with these results. The Durbin-Watson results indicate positive first order serial correlation (d-lower at 1.571 and d-upper at 1.802 at .05 level of significance). Overall, this test indicates good predictive capabilities in determining a trust company likely to survive.

Table 3: Nine Independent Variables

Variable Name	Estimated Coefficient	Standard Error	t-ratio
Constant	.038382	.2149	.1786
Expenses to Revenue Ratio (1)	.16438	.06097	2.696
Net Interest Margin variation (2)	-.075910	.04029	-1.884
Liquidity Levels to Total Assets (3)	.52174	.06818	7.652
Loans to Deposits Ratio (4)	.31718	.05066	6.261
Collateral Loan Concentration (6)	-.027427	.05624	-.4877
Mortgage Loan Concentration (8)	-1.0274	.3715	-2.766
Deposits Variance (12)	-.0097644	.03523	-.2772
Overhead to Assets (18)	.016606	.07104	.2338
Total Assets Log (22)	-.062984	.04757	-1.324
R-squared (adjusted): .9194; F-value: 150.623; Durbin-Watson: 1.3689			

The adjusted R-square results for this study suggests that, other than for the failed trusts, there is a good fit between the dependent and independent variables. The F-test results (150.623 versus F-critical of 1.96) support this conclusion with good results reported for the panel data. Multicollinearity is not suggested nor rejected by the results. One test used to determine whether multicollinearity exists looked for a high adjusted R-square combined with few significant t-ratios. With 50 percent of all t-ratios studied being less than the critical t-value (1.98 at 95 percent confidence interval) for that number of observations, multicollinearity is a possibility, but not a surety. The Durbin-

Watson results indicate positive first order serial correlation (d-lower at 1.484 and d-upper at 1.874 at .05 level of significance).

This test also indicates relatively good predictive abilities for predicting a troubled trust company. The results were not quite as strong as those results coming from the use of five independent variables.

4.5.2 Comparison of actual results with expectation

$$\text{Equity} = [(A) + (B1)(X03) + (B2)(X04) - (B3)(X08) + (B4)(X18) - (B5)(X22)]$$

$$\textbf{Equity} = \textbf{[(.023) + .667(X03) + .286(X04) - .918(X08) + .115(X18) - .043(X22)]}$$

As can be seen in the above comparison, the predicted signs for each beta were evidenced in the results. It is interesting to note that the strongest beta to indicate a healthy trust is Liquidity Levels to Total Assets (X03) at .667, which is similar to the single regression results, but that the single largest negative beta is Mortgage Loan Concentration (X08) at -. 918, which was not the strongest negative indicator in the single regression results.

$$\text{Equity} = [(A) + (B1)(X03) + (B2)(X04) - (B3)(X08) + (B4)(X18) - (B5)(X22)] + (B6)(X01) + (B7)(X02) + (B8)(X06) - (B9)(X12)$$

$$\textbf{Equity} = \textbf{[.038 + .522(X03) + .317(X04) - 1.027(X08) +.017(X18) - .063(X22)] +.164(X01) - .076(X02) - 1.03(X06) -.010(X12)}$$

In the second multiple regression, the actual and predicted results show differences. While the first five betas agree with the predicted sign, not all of the last four betas agree. Neither Net Interest Margin variation (X02) nor Collateral Loan Concentration (X06) resulted in the predicted sign. The unexpected sign in Collateral Loan Concentration was further confounded by the high beta associated with it. Not only did Collateral Loan Concentration come out with the

opposite sign, but also it became the single largest negative influence on equity with a beta of –1.03. Liquidity Levels to Total Assets (X03) remained as the single largest positive influence on equity with a beta of .522.

4.6 Summary and Conclusions from Test Sample

The multiple regression model developed above used panel data for healthy trusts only. The sample of failed trusts was used only to validate the model. The model was also validated using a holdback sample of twelve healthy trusts. For the holdback healthy trusts, all five years were used. The fourth and fifth year for Metropolitan Trust and the fifth year for Nova Scotia Savings & Loan were eliminated. Because each of these trusts were experiencing rapid growth during the stated years due to their newness, they were producing results that appeared to skew the test sample. For the failed trusts, only the year immediately prior to closure was used.

4.6.1 Multiple Regression Results

Table 4: Test for Significance Results comparing failed panel data to surviving panel data:

	90% confidence interval	95% confidence interval
5 independent variables	Different	Different
9 independent variables	Same	Same

Table 5: Summary results for test data and tests for significance

			---------- Equity Calculation ------		
----------					
group	**trust**	**year**	**Actual**	**5 Independent Vars**	**9 Independent Vars**
Grouping:	A) panel, failed				

Table 5: Summary results for test data and tests for significance

				---------- Equity Calculation ------	
group	**trust**	**year**	**Actual**	**5 Independent Vars**	**9 Independent Vars**
A1	centguar	1	-0.01126	-1.11618	-6,778.23260
B1	contt	1	0.06567	-1.02681	-6,073.42040
C1	fidelity	1	0.01315	-1.20101	-279,134.77707
D1	pioneer	1	0.06952	-1.10634	-7,463.70383
E1	prenor	1	0.04115	-1.16301	-9,250.89421
F1	standard	1	0.05201	-1.15067	-1,739.75576
G1	westcap	1	0.04468	-1.06290	-6,420.20739
Summary for 'grouping' = A) panel, failed (7 detail records)					
Avg			**0.03928**	**-1.11813**	**-45,265.85589**
Min			**-0.01126**	**-1.20101**	**-279,134.77707**
Max			**0.06952**	**-1.02681**	**-1,739.75576**
StDev			**0.02899**	**0.05983**	**103,151.67021**
grouping	B) panel, surviving				
F2	general	1	0.04594	-1.14456	-1,592.15980
F2	general	2	0.03449	-1.14837	-1,594.07275
F2	general	3	0.02278	-1.12858	-1,228.41182
F2	general	4	0.02452	-1.12178	-1,031.90647
F2	general	5	0.02539	-1.15762	-10,114.88686
F3	househld	1	0.06873	-1.06250	-3,246.56745
F3	househld	2	0.06190	-1.05033	-3,494.19283
F3	househld	3	0.08066	-1.04839	-4,627.67434
F3	househld	4	0.05553	-1.05910	-4,275.06322
F3	househld	5	0.16707	-0.94949	-2,789.89882
F4	premier	1	0.03921	-1.11541	-2,244.94826
F4	premier	2	0.04134	-1.12640	-1,437.19450
F4	premier	3	0.04851	-1.11733	-733.92675
F4	premier	4	0.06494	-1.07883	-225.26769
F4	premier	5	0.07904	-1.03726	-1,709.91256
F5	welling	1	0.05987	-1.11372	-2,041.41588
F5	welling	2	0.06126	-1.12581	-1,578.44643
F5	welling	3	0.09204	-1.10417	-909.08383
F5	welling	4	0.13586	-1.08965	-517.35844

Table 5: Summary results for test data and tests for significance

---------- Equity Calculation ------

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group	trust	year	Actual	5 Independent Vars	9 Independent Vars
F5	welling	5	0.27091	-0.86257	-261.32650
F6	evangelt	1	0.08029	-0.96887	-65.69644
F6	evangelt	2	0.09734	-0.96178	-45.76523
F6	evangelt	3	0.11036	-0.94617	-41.54235
F6	evangelt	4	0.14790	-0.95799	-31.17093
F6	evangelt	5	0.21636	-1.02686	-34.03614
F7	dover	1	0.93100	0.22270	-4.41970
F7	dover	2	1.00000	0.41026	-3.47478
F7	dover	3	0.98110	0.41549	-1.84048
F7	dover	4	0.95842	0.10755	0.56700
F7	dover	5	0.00000	0.02340	0.03838
F8	keltic	1	0.62626	0.03471	-1.16453
F8	keltic	2	0.31004	-0.07488	-1.00148
F8	keltic	3	0.16185	0.01914	-0.66745
F8	keltic	4	0.52861	-0.01600	-0.50716
F8	keltic	5	0.00000	0.02340	0.03838
G2	metrot	1	0.11921	-1.07002	-2,994.48933
G2	metrot	2	0.15393	-1.05966	-1,814.05817
G2	metrot	3	0.15812	-1.06795	-1,109.83675
G3	sunlife	1	0.04582	-1.01801	-5,538.40681
G3	sunlife	2	0.03352	-0.90760	-3,697.75698
G3	sunlife	3	0.06452	-0.88956	-1,562.50059
G3	sunlife	4	0.06837	-0.84165	-536.20246
G3	sunlife	5	0.13634	-0.99862	-141.58545
G4	regional	1	0.06107	-1.04283	-349.30498
G4	regional	2	0.06801	-1.05213	-253.36992
G4	regional	3	0.09433	-0.93480	-365.74312
G4	regional	4	0.11953	-0.89554	-109.80995
G4	regional	5	0.10856	-0.93814	-32.33661
G5	agft	1	0.00000	0.02340	0.03838

Table 5: Summary results for test data and tests for significance					
				---------- Equity Calculation ------	
---------					
group	**trust**	**year**	**Actual**	**5 Independant Vars**	**9 Independant Vars**
G5	agft	2	0.00000	0.02340	0.03838
G5	agft	3	0.00000	0.02340	0.03838
G5	agft	4	0.00000	0.02340	0.03838
G5	agft	5	0.00000	0.02340	0.03838
G6	nsst	1	0.07055	-0.99106	-248.04259
G6	nsst	2	0.09819	-0.94227	-208.98505
G6	nsst	3	0.13518	-0.84146	-128.00802
G6	nsst	5	0.00000	0.02340	0.03838
Summary for 'grouping' = B) panel, surviving (57 detail records)					
Avg			**0.16079**	**-0.71384**	**-1,139.90464**
Min			**0.00000**	**-1.15762**	**-10,114.88686**
Max			**1.00000**	**0.41549**	**0.56700**
StDev			**0.25035**	**0.51250**	**1,820.57306**
grouping	C) year 1, surviving				
F2	general	1	0.04594	-1.14456	-1,592.15980
F3	household	1	0.06873	-1.06250	-3,246.56745
F4	premier	1	0.03921	-1.11541	-2,244.94826
F5	welling	1	0.05987	-1.11372	-2,041.41588
F6	evangelt	1	0.08029	-0.96887	-65.69644
F7	dover	1	0.93100	0.22270	-4.41970
F8	keltic	1	0.62626	0.03471	-1.16453
G2	metrot	1	0.11921	-1.07002	-2,994.48933
G3	sunlife	1	0.04582	-1.01801	-5,538.40681
G4	regional	1	0.06107	-1.04283	-349.30498
G5	agft	1	0.00000	0.02340	0.03838
G6	nsst	1	0.07055	-0.99106	-248.04259
Summary for 'grouping' = C) year 1, surviving (12 detail records)					
Avg			**0.17900**	**-0.77051**	**-1,527.21478**
Min			**0.00000**	**-1.14456**	**-5,538.40681**
Max			**0.93100**	**0.22270**	**0.03838**
StDev			**0.28887**	**0.52572**	**1,761.26290**
grouping	D) year 2, surviving				
F2	general	2	0.03449	-1.14837	-1,594.07275

Table 5: Summary results for test data and tests for significance					
				---------- Equity Calculation ------	
---------					
group	**trust**	**year**	**Actual**	**5 Independent Vars**	**9 Independent Vars**
F3	household	2	0.06190	-1.05033	-3,494.19283
F4	premier	2	0.04134	-1.12640	-1,437.19450
F5	welling	2	0.06126	-1.12581	-1,578.44643
F6	evangelt	2	0.09734	-0.96178	-45.76523
F7	dover	2	1.00000	0.41026	-3.47478
F8	keltic	2	0.31004	-0.07488	-1.00148
G2	metrot	2	0.15393	-1.05966	-1,814.05817
G3	sunlife	2	0.03352	-0.90760	-3,697.75698
G4	regional	2	0.06801	-1.05213	-253.36992
G5	agft	2	0.00000	0.02340	0.03838
G6	nsst	2	0.09819	-0.94227	-208.98505
Summary for 'grouping' = 4 year 2 surviving (12 detail records)					
Avg			**0.16334**	**-0.75130**	**-1,177.35664**
Min			**0.00000**	**-1.14837**	**-3,697.75698**
Max			**1.00000**	**0.41026**	**0.03838**
StDev			**0.27552**	**0.54153**	**1,339.86570**
grouping	E) year 3, surviving				
F2	general	3	0.02278	-1.12858	-1,228.41182
F3	household	3	0.08066	-1.04839	-4,627.67434
F4	premier	3	0.04851	-1.11733	-733.92675
F5	welling	3	0.09204	-1.10417	-909.08383
F6	evangelt	3	0.11036	-0.94617	-41.54235
F7	dover	3	0.98110	0.41549	-1.84048
F8	keltic	3	0.16185	0.01914	-0.66745
G2	metrot	3	0.15812	-1.06795	-1,109.83675
G3	sunlife	3	0.06452	-0.88956	-1,562.50059
G4	regional	3	0.09433	-0.93480	-365.74312
G5	agft	3	0.00000	0.02340	0.03838
G6	nsst	3	0.13518	-0.84146	-128.00802
Summary for 'grouping' = E) year 3, surviving (12 detail records)					
Avg			**0.16245**	**-0.71836**	**-892.43309**
Min			**0.00000**	**-1.12858**	**-4,627.67434**
Max			**0.98110**	**0.41549**	**0.03838**

Table 5: Summary results for test data and tests for significance					
				---------- Equity Calculation ------	
----------					
group	**trust**	**year**	**Actual**	**5 Independent Vars**	**9 Independent Vars**
StDev			**0.26258**	**0.54191**	**1,298.85386**
grouping	F) year 4, surviving				
F2	general	4	0.02452	-1.12178	-1,031.90647
F3	household	4	0.05553	-1.05910	-4,275.06322
F4	premier	4	0.06494	-1.07883	-225.26769
F5	welling	4	0.13586	-1.08965	-517.35844
F6	evangelt	4	0.14790	-0.95799	-31.17093
F7	dover	4	0.95842	0.10755	0.56700
F8	keltic	4	0.52861	-0.01600	-0.50716
G3	sunlife	4	0.06837	-0.84165	-536.20246
G4	regional	4	0.11953	-0.89554	-109.80995
G5	agft	4	0.00000	0.02340	0.03838
Summary for 'grouping' = F) year 4, surviving (10 detail records)					
Avg			**0.21037**	**-0.69296**	**-672.66809**
Min			**0.00000**	**-1.12178**	**-4,275.06322**
Max			**0.95842**	**0.10755**	**0.56700**
StDev			**0.30233**	**0.51314**	**1,309.58525**
grouping	G) year 5, surviving				
F2	general	5	0.02539	-1.15762	-10,114.88686
F3	household	5	0.16707	-0.94949	-2,789.89882
F4	premier	5	0.07904	-1.03726	-1,709.91256
F5	welling	5	0.27091	-0.86257	-261.32650
F6	evangelt	5	0.21636	-1.02686	-34.03614
F7	dover	5	0.00000	0.02340	0.03838
F8	keltic	5	0.00000	0.02340	0.03838
G3	sunlife	5	0.13634	-0.99862	-141.58545
G4	regional	5	0.10856	-0.93814	-32.33661
G5	agft	5	0.00000	0.02340	0.03838
G6	nsst	5	0.00000	0.02340	0.03838
Summary for 'grouping' = G) year 5, surviving (11 detail records)					
Avg			**0.09124**	**-0.62518**	**-1,371.25722**
Min			**0.00000**	**-1.15762**	**-10,114.88686**
Max			**0.27091**	**0.02340**	**0.03838**

Table 5: Summary results for test data and tests for significance					
				---------- Equity Calculation ------	
group	trust	year	Actual	5 Independent Vars	9 Independent Vars
StDev			0.09685	0.51925	3,040.14810

In both of the cases, the panel regression results were used as the basis for testing regression results. This decision was made after reviewing all the data from all test results.

For the five independent variables, as can be seen in Table 4, test for significance comparing failed panel versus surviving panel data, with a 95 percent confidence interval, there was a recognisable difference between failed and healthy trusts. In the case of the nine independent variables, at neither the 95 percent nor the 90 percent confidence interval was there found significant differences between the results. According to the results obtained through the test data, the better test is the one where five independent variables were used.

4.6.2 Note on negative average for healthy trusts

It should be noted that a negative mean was obtained for the test results for both healthy and failing trusts, and that only the degree of negativity was the factor in whether the trust would survive or not. It should be remembered that the time under study was a volatile time for the trust industry, with many changes occurring internally and externally. This volatility may suggest that a follow-up study be conducted with subsequent years to see, under a more stable environment, whether surviving trusts would return to a positive mean. Despite

this, it was necessary to concentrate on this time period in order to obtain sufficient numbers of failed trusts to produce a statistically significant study.

V Implications and Conclusions

5.1 Conclusions

The purpose of the study was to determine a number of related issues. The first was whether it was possible to establish key indicators of financial solvency for FIs. If this was so, the second goal was to determine what they might be, first independently of each other, and then in combination, using Canadian trust company data.

Using a combination of confidence intervals, factor analysis, and regression analysis, an initial group of twenty-two independent variables, chosen for their ability to proxy for key issues that were felt to be important to FI health, were culled down to a manageable group. The five independent variable alternative provided statistically significant results, while the nine independent variable alternative did not. Of the twenty-two original possible independent variables, the five combined best indicators were Liquidity Levels to Total Assets (3), Loans to Deposits Ratio (4), Mortgage Loan Concentration (8), Overhead to Assets (18), and Total Assets Log (22).

5.2 Implications

The five independent variables determined to be the best indicators of trust financial health point to particular parts of the financial statement where

management should focus their attention. In order of importance as defined by the coefficient, mortgage loan concentration, should be the first focus. Management should carefully monitor its mortgage loan concentration, ensuring that it is maintained at a relative percentage of total assets. Because mortgage loans are more stable and have a smaller default risk, management should not try to reduce mortgage levels as a percentage of other loans when compared to the total assets level. Second, as it was found that higher liquidity levels increase the possibility of failure, the next management focus should ensure that liquid assets are aggressively turned into higher interest rate earning vehicles, such as loans. Third, management should focus attention on the loans to deposits ratio. Again, a higher ratio between loans and deposits suggests a higher possibility of failure, so efforts should be directed at ensuring that sufficient deposits are available to finance loans, providing a lower-cost source to the trust, and increasing the interest rate spread. Fourth, management should focus on overhead costs to assets. As high overhead levels mean the trust may be less able to weather environmental difficulties and management strategy errors, a lean overhead focus will reduce the amount of fixed costs the trust must cover. Finally, the last relevant variable is the log value of total assets. As total assets increase in size, it appears that the trust is less likely to fail. This may be the result of more government support, or it may be the result of more efficient overhead levels as used by the large versus small trust. In either case, the general management strategy of growth would reduce the possibility of failure for the trust.

5.3 Limitations

5.3.1 Size of the sample

The sample could have been stratified further based on whether it was federally or provincially chartered, but given the small population, this may have resulted in a statistically insignificant sample for study. There is some justification for rejecting stratification because of the possibility of introducing bias.

Further, the study did not use step-wise regression. This approach would have allowed for the elimination of those independent variables that did not significantly contribute the dependent variable variation. The small sample size did not allow for this type of analysis.

5.3.2 Data Overfitting

A further problem relates to the possibility of data overfitting.

> Overfitting occurs when, due to the architecture of the network being too large for the problem space it is trained on, the network not only learns the significant regularities in the input, but also learns all the noise. Effectively, the network learns the training data by rote and cannot generalize to new data. Clearly, overfitting is what happens when a network does not 'reduce the possible concepts that [it] may represent'.[39]

A method by which to overcome overfitting was used in this study. The holdback sample for validation purposes helps to determine whether the model can predict other trust failures. Although the model appeared to successfully differentiate between healthy and failed trusts, it still calculated negative equity values for

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[39] Asudeh, Ash. *Neural Constructivism and Language Acquisition*. November 10, 1997. Web Journal of Formal, Computational & Cognitive Linguistics http://mirror-kcn.unece.org/science/fccl/papers/gp002.htm. (February 27, 1997)

those trusts that made up the healthy trust holdback sample. This suggests one of two possibilities. First, there may be data overfitting. The data used to develop the model may have created a model so sample specific that it cannot differentiate between healthy and unhealthy trusts. Second, it remains possible that the trust industry in its entirety was in financial difficulty. The trust companies used to make up the model may have reflected this fact.

5.3.3 Accounting data and financial ratios

The financial information was summarised into twenty-two operating ratios, eliminating scale effects from most of the variables for five years prior to failure. Nonetheless, many of the studies indicated that accounting data was not a sufficient source of information by which to complete analysis.

The use of equity was a standard for the dependent variable in the literature review. Although the use of equity made sense in terms of establishing whether or not the trust had failed, it also may have hidden some relationships between the dependent and independent variables. Unlike profitability, which would show annual effects, equity, by its nature, shows the culmination of all historical effects, rather than the immediate relationship. To the extent that profit volatility was a better dependent variable, some immediate cause and effect relationships may have been hidden because of the use of equity as the dependent variable.

Accounting data, by its nature, must balance. The use of independent and dependent variables based on accounting data means that this underlying fact could distort the results. This distortion, for example, could be reflected as heteroscedasticity mathematically. The conclusions drawn could be distorted by

the underlying problems inherent in such data. Although the use of ratios and log values mitigate some of these problems, the underlying risk still exists.

Because of the ratios themselves, it may be difficult to clearly understand what the trust is doing. Most of the ratios used were the compilation of a number of individual figures that were manipulated and grouped based on their relevance. Because of the volume of numbers that were combined, individual numerical changes may be lost in the aggregate. In order to understand what these variables are doing, one must look at the individual components. The decision-making process under which the trust is operating is more than the summary financial numbers represented in these ratios.

The relevant independent variables were identified in a strictly linear fashion, by the initial use of one-to-one analysis. This meant that identification of cross effects of the different independent variables, and interaction effects were less apparent. There remains the possibility that the independent variables chosen actually interact together on the dependent variable.

5.3.4 Use of trust data

In order to maintain homogeneity in the study, only trusts were used. In order for these results to be more universally applicable, the five-independent variable model could be re-tested with a wider variety of financial institutions in order to determine whether the environment faced by the trusts is a universal environment.

5.3.5 Economic Indicators

The two economic indicators were chosen because they coincided with the type of economic indicator used in those models studied in the literature review. In retrospect, these indicators seem to be too global, especially given the more localised nature of the trusts being studied. If more localised economic indicators were used, such as the real estate market results, or city or provincial labour market figures were used, these might have been found to be more relevant to the determination of whether the trust were healthy or not.

A further limitation is the method by which economic variables were incorporated into the study. A better measure might have time-lagged the economic variables with the dependent variable. This may more closely mimic the way that economic stress may not immediately be reflected in trust, but may be reflected after some time interval.

Another issue occurs in the nature of the dependent variable. Because the dependent variable is equity expressed as a ratio instead of the more volatile profitability figure, the cause and effect may have been too difficult or subtle to discern. The use of a dependent variable incorporating profitability rather than equity may have highlighted a relationship between the economic indicators and trust health.

5.3.6 Subsequent FI Manager Action

As was seen in the literature review, the actions of a regulatory body can have unforeseen repercussions. When capital adequacy stringency was increased, some of the studied FIs reacted by increasing the asset riskiness.

This became the worst thing to do, as it substantially increased risk, the exact thing the regulatory bodies were trying to reduce.

If ratios are defined as tools by which to measure FI health, the FIs themselves will use these criteria to measure themselves. It should be closely reviewed to ensure that the FIs are not trying to improve their health based on their measured criteria by increasing their risk in areas not measured by the ratios.

Some of the independent variables may be more subject to manipulation than are others. For example, a short-term solution may be to reduce overhead levels to levels that endanger future health. While it would provide a positive result in the near-term, future survival may be compromised. Special care should be taken in reviewing the underlying methods by which a trust has moved toward "health" as defined by these ratios, especially when dramatic rather than gradual changes can be discerned.

5.4 Areas for Further Study

5.4.1 Subsequent Analysis of Trust Industry to determine whether all trusts were in ill-health at the time of the study

"The risk exposure in a group of similarly situated FIs may be uniformly high or low and thus be misleading as a basis for determining the degree to which a particular FI may be vulnerable to economic and financial strains."[40] If all trusts

[40] Korobow, Leon, David P. Stuhr, and Daniel Martin. "A Probabilistic Approach to Early Warning of Changes in Bank Financial Condition", *Financial Crises*, Wiley-Interscience Pub., 1977, page 13

were similarly unhealthy and subject to a high-risk level of failure, comparing them to each other may disguise the risk of systematic failure risk.

Systematic risk might be suggested by the interest rate structure that the trust companies were faced with during the time under study. Given that all the trusts were faced with high interest rates that subsequently fell rapidly at the beginning of the period under study, this could have skewed all of the trusts' health. If this were the case, attempting to define a "healthy" trust during this time may be more difficult. It may be valuable to re-calculate healthy trusts in another time period to validate the definition of a healthy trust established in this thesis.

5.4.2 Using Supervisory Data: relevant independent variables

There was some evidence in the literature review supporting the theory that large FIs may need differing criteria to determine health when compared to smaller banking institutions. The difference revolves around the different markets in which the different institutions find themselves. A similar study could be done on large Canadian FIs to see if they present different results.

In another area, a similar analysis could be done using more the more detailed supervisory data. With additional levels of information granted to them that is unavailable to the general public, this may provide sufficient information in order to produce viable results.

5.4.3 Determinants of FI closure

Further research could be done in the determination of when and why a financial institution closes once technical insolvency occurs. At what point should forbearance be terminated? As well, further analysis could be developed to determine what common activities result in an insolvent financial institution that has not been closed. For example, do higher levels of perquisite activities result from of the difficulties surrounding proper supervision in an environment of forbearance? Is there an organisational structure that is more likely to face closure? Is size an issue at this point? Is there a time-related factor relating to closure? Would the regulatory body be more likely to close a financial institution that becomes insolvent at the beginning of a string of insolvencies when compared to the same financial institution that becomes insolvent at the end? Is there a particular balance sheet configuration that is more likely to result in closure than is another? Also, does the regulatory body being reported to significantly affect the probability of closure?

Another issue to be addressed focuses on the probability and causes of a financial institution's return to health once insolvency occurs. Under what circumstances would forbearance be the best decision?

5.4.4 Failures outside of Canada and United States

Unlike Canada and the U.S., there is evidence supporting the higher likelihood of FI failure resulting from bank runs in Mexico, Argentina, and Brazil. A continuation of the analysis in these countries may highlight why these countries appear to differ. Do they actually operate in a different environment, or

has the recent run of FI failures in these countries (24 months previous to January, 1995) been abnormal in an otherwise similar environment. Does this study translate successfully European countries? In Australia? Are there significant differences between North American FIs (excluding Mexico) and Middle-Eastern and Far Eastern countries, or can failure also be predicted in those countries based on this formula?

The literature review was confined to studies focusing on American and Canadian FIs. The further development of the model in non-North American countries could be concurrent with a literature review pertaining to other countries.

5.4.5 Effects of Deposit Insurance

Diamond and Dybvig (1983) argue favourably for deposit insurance as a method by which FIs can limit economically harmful bank runs. They note they assume that FI management will always make decisions in the best interest of the depositor. If moral hazard should intrude, this could substantially modify the model as currently developed. Carr et al (1994) argue against the value of deposit insurance, stating that it does not assist FIs. Instead, they argue it enables weak FIs to continue to operate, which, in turn, is economically inefficient because these companies would fail otherwise, leaving their sources of funds available to those FIs better equipped to more efficiently transform deposits into productive assets.

More study could be done in the area of regulatory versus market control. Which form of control is more costly, and which is more efficient?

5.4.6 Guidelines for independent variable development

There was no clear definition of which ratios are adequate proxies for the differing key issues as raised by the various studied groups. Further research could be concentrated on what the best proxies were for things such as capital adequacy and asset return riskiness. In the same vein, while many of the studies suggested that management quality was a key issue in determining FI health, there was no clear financial representation to measure this issue.

5.4.7 Analyzing costs of type one versus type two errors

There did not appear to be many analyses since Korobow, Stuhr and Martin (1976) analysed the actual costs of type one versus type two errors. This lack could be addressed both for the United States and for Canada.

5.4.8 Anatomy of a failed FI

While much study has been made of predicting failed FIs versus healthy FIs, little has been done to define key characteristics of a failed FI by itself.

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VII Appendices

Appendix 1: Failure of Members of the CDIC

Canadian Financial Institution Failures				
Year	Institution	Special Enquiries	Payments/ Exp (mill, est)	Losses to CDIC (mill)
1893	Commercial Bank of Manitoba		.77	
1895	La Banque du Peuple		6.87	
1899	Banque Ville Marie		1.50	
1905	Bank of Yarmouth		.28	
1906	Ontario Bank		12.66	
1908	Sovereign Bank of Canada		11.22	
1908	Banque de St. Jean		.34	
1908	Banque de St. Hyacinthe		.92	
1910	The Farmers Bank		1.31	
1914	Bank of Vancouver		.56	
1923	Home Bank of Canada		15.46	
1970	Commonwealth Trust		5	0
1972	Security Trust Company Ltd		9	0
1980	Astra Trust Company		21	3
1982	District Trust Company		231	15
1983	Amic Mortgage Investment Corp		28	15
1983	Crown Trust Company		930	5
1983	Fidelity Trust Company		791	359
1983	Greymac Mortgage Corporation		174	106
1983	Greymac Trust Companny		240	150
1983	Seaway Mortgage Corporation		120	4
1983	Seaway Trust Company		300	73
1984	Northguard Mortgage Corporation		28	8
1985	Continental Trust Company		113	0
1985	Pioneer Trust Company		201	27
1985	Western Capital Trust Company		77	3
1985	Canadian Commercial Bank	Estey Commission	352	243
1985	CCB Mortgage Investment Corp	Estey Commission	36	13
1985	London Loan Limited		24	5
1985	Northland Bank	Estey Commission	318	161
1986	Bank of British Columbia		200	200

Canadian Financial Institution Failures				
Year	Institution	Special Enquiries	Payments/ Exp (mill, est)	Losses to CDIC (mill)
1986	Columbia Trust Company		99	0
Feb86	Mercantile Bank of Canada	purchased by National Bank of Cda		
Oct86	Continental Bank of Canada	purchased by Lloyds Bank Canada		
1987	North West Trust Company		275	275
1987	Principal Savings & Trust Company	Code Inquiry	116	0
1988	Financial Trust Company		74	n.a.
1991	Bank of Credit & Commerce Canada		22	n.a.
1991	Standard Trust Company		1,326	n.a.
1991	Saskatchewan Trust Company		58	13
1992	First City Trust Company		500	n.a.
1992	Shoppers Trust Company		500	n.a.
1992	Central Guarantee Trust Company		4,400	n.a.
Sources: CDIC, *Annual Report 1991*				

Appendix 2: Literature Review Summary

SUMMARY ANALYSIS OF LITERATURE REVIEW							
	Insolvency Def'n Clear	**Dimension**	**Type of Dependent Variable**	**Methodology Used**	**Analyzes own methodology vs alternatives**	**Sample Source**	**Stratified Match?**
Altman (1968)	yes - legal	ex post emp	logit (fail/non-fail)	MDA (multiple discriminant analysis)	yes	66 manfacturing corps, 1946-65	yes; paired sample
Altman (1969)	yes - legal	ex post emp	chg in equity value resulting from declaring bankruptcy	univariate	no	76 companies that filed to reorganize under National Bankruptcy Act; 1941-1965	no;
Altman (1977)	yes - "serious problem" which exists when FDLIC provides fnsl assistance or forces supervisory merger	ex post emp	logit (serious problem/ non-serious problem)	quadratic discriminant anal; 3-2grp discriminant models	yes	212 S&Ls; 56 serious problem, 49 temporary problem, 107 no problem S&Ls	yes, by location; trioed
Cole (1993)	yes - -ve net worth (book)	ex post emp	probit - solvency & closure	bivariate	no	769 "closed" and 2,783 operating Thrifts	no
Diamond & Dybvig (1983)	no	catastrophe	theoretical paper	n.a.	n.a.	n.a.	n.a.
Ho & Saunders (1980)	no	catastrophe	theoretical paper	n.a.	n.a.	n.a.	n.a.
Jacklin & Bhattacherya (1988)	no	catastrophe	theoretical paper	n.a.	n.a.	n.a.	n.a.
Korobow et al (1975)	no - based on minimization of Type 1&2 errs	a priori undefined	logit - vulnerable and resistent banks	univariate	no	bank data from 1969-1974	no
Korobow et al (1976)							
Korobow et al (1977)	no - increased financial deterioration	a priori undefined	Σ of σ's of avgs of independ vars from group avg; sub-grpd: resistent or exposed to econ/fncl stress	univariate	no	350 member banks of New York Federal Reserve	no
Korobow & Stuhr (1984)							
Kryzanowski & Roberts (1993)	yes, negative market value	a priori defined	normal continuum curve	univariate	no	all Cdn banks from 1922 to 1940	no
Lane et al (1986)	yes - legal	ex post emp	logit - fail/nonfail	Cox proportional	yes	1978-84 failed commercial	yes, paired (geo,

SUMMARY ANALYSIS OF LITERATURE REVIEW							
	Insolvency Def'n Clear	**Dimension**	**Type of Dependent Variable**	**Methodology Used**	**Analyzes own methodology vs alternatives**	**Sample Source**	**Stratified Match?**
				hazards model		banks (130) and 334 matched nonfailed banks	charter statust, size, holding co, age)
Marcus and Shaked (1984)	no	a priori undefined	normal continuum curve	Poisson process superimposed on a lognormal diffusion process	yes	40 banks found in CRSP tapes for 1979 and 1980	no
Martin (1977)	yes - negative net worth (book)	ex post emp	logit - fail/nonfail	Regression	yes	56 failed Federal Reserve Mbr Banks between 1970-1976 as well as approx. 5700 nonfailed banks from same period	no
Meyer & Pifer (1970)	yes - closure	ex post emp	logit - fail/nonfail	Regression	no	39 banks closing 1948-1965, 39 solvent banks	yes, paired
Pettway & Sinkey (1980)	yes- insolvency as defined by chartering agency or reorganization	ex post emp	logit - fail/nonfail	univariate	no	problem as defined by acctg data and mkt info (large banks only) - 6 of the 9 largest US bank failures	no
Rose & Kolari (1985)	no	ex post emp	logit - fail/nonfail	univariate and multivariate tests	no	U.S. commercial banks declared insolvent by FDIC 1964-77 paired with solvent banks - 728 in total	yes; paired based on size, supervisory authority & regs, location
Santomero & Vinso (1977)	yes, zero or negative net worth (book)	a priori defined	probability distribution - ranging from fail to nonfail	Poisson process with bivariate analysis	yes	large U.S. banks that filed form 416 of the Federal Reserve System (wkly report) - number varied 300-400 dating between Jan/64 - Jan/74 (224 wks)	no
Sinkey & Walker (1975)	yes, problem bank as defined by FDIC (any of 3 categories)	ex post emp	logit - problem or nonproblem status	univariate	no	62 problem banks added to problem bank list in 1972 matched against 62 healthy banks	yes, paired based on geo mkt, total depos, # of banking offices, fed examining agency
Sinkey (1975)	yes, problem bank as defined by FDIC	ex post emp	logit - problem or nonproblem status	MDA and quadratic discriminant analysis	no	110 banks identified in 1972 and first few months of 1973 matched with a nonproblem bank	yes, paired based on geo mkt, toll deps, # of banking offices, Fed Res mbrship status
Sinkey (1978)	yes, problem bank as	ex post emp	logit - problem or nonproblem status	univariate and bivariate analysis	no	143 commercial banks of FDIC's march 31/74 problem	no

SUMMARY ANALYSIS OF LITERATURE REVIEW

	Insolvency Def'n Clear	Dimension	Type of Dependent Variable	Methodology Used	Analyzes own methodology vs alternatives	Sample Source	Stratified Match?
	defined by FDIC					bank list compared to random sample of 163 nonproblem banks drawn from 9,060 banks (65% of population)	
Sinkey et al (1987)	yes, legal	ex post emp	logit - fail/nonfail	probit and MDA	no	62 commercial banks that failed between 1980 and 1982 paired with 62 nonfailed banks	yes, paired based on location, size, regulatory jurisdiction
Stuhr & Van Wicklen (1974)	yes - defined by rating system used by regulatory inspectors (range 1-4)	ex post emp	logit - high/low rated banks	MDA	no	172 healthy state and national banks chosen for extreme health precondition in 1967 and 1968 compared against 42 unhealthy state and national banks for Fed Res Bnk of NY	not specified
Thomson (1992)	yes - 2-steps: economic insolvency as defined by -ve net worth (mkt) and closure - legal	ex post emp	logit - closure/non-closure	Regression using OLS, second equation Regression using logit	yes	banks whose insolvency was recognized between July/84 and June/89, 670 banks closing between Dec/82 and Jun/88; 1,736 nonclosed sample from those operating in US from Dec/82 through Jun/89 that filed complete call reports	no
West (1985)	yes - problem bank status as defined by CAMEL rating (3,4, or 5)	ex post emp	logit	Regression with factor analysis	yes	1,900 sample banks/2,900 population in Federal Reserve Bk of Kansas City District between 1980-82, state member banks and all banks in holding company supervised by The Fed (Kansas)	no

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Appendix 3: Summary of important indicators from all literature review studies (maximum six)

This list is included as a summary of the important indicators for forecasting FI health as determined by the articles covered in the literature review. If another study has also indicated the importance of a particular ratio, it would not be duplicated in this study. Because of this, not all listed studies have all six ratios. Independent ratios developed for this study are included in bold with a shadow background in order to highlight their similarity.

Ratios under analysis
9. Net Loan Charge-offs/Total Loans **10. Variation of Net Loan Charge-offs**
1 Foreclosed Real Estate Owned, Real Estate Held in Judgement and oth Repossessed Assets/Total assets: Directly related to failure. Fuller (1994):1 2 Loss Provision/(Loans+Provisions); Martin (1977):6 3 Net Charge-offs/Total Loans: Thomson (1992):1 4 Doubtful loans/total capital: measures asset quality. West(1985):1 5 Delinquent loans/Total liabilities: addresses asset-quality problem. Cole (1993):4 6 Gross Charge-offs/Net Operating Income: Marcus (1984):4 7 Provision for loan loss/total assets: Korobow(1976):4 8 Gross Charge-offs/(Net Income + Provision for Loan Losses): Numerator: Loan losses charged to reserves; Denominator: Net operating income + provision for loan losses; Korobow(1977): 4 9 Gross Charge-offs/Net Operating Income: Martin (1977):1
2. Variance of Net Interest Margin
10 Total Interest Income/Total Interest Expense: measures FI asset liability management; also known as debt service, net interest income or spread in banking.; Sinkey(1987):5
1. Operating Expense/Operating Revenue
11 Total Operating Expenses/Total Operating Income: Pettway(1980): 1 12 Operating Revenue/Operating Costs in last fncl stmt prior to failure: the more profitable a FI is today, the lesser the failure likelihood tomorrow. Conjectures that variable is less significant than would be expected because of defalcation. Meyer et al (1970):4 13 (Log total operating expense)/(Total operating income): measures earnings quality. Authors used lognormal transformation whenever the results were non-normally distributed to improve normality test results. Lane(1986):2 14 Expenses/Operating Revenues: Marcus (1984):5 15 Total operating expenses/Total operating revenues: Korobow(1976):1 16 Operating Expenses/Operating Revenues: Numerator: Total operating expenses; Denominator: total operating revenues; Korobow (1977):3 17 Operating Expense/Operating Income: measures efficiency. Sinkey (1975a):5 18 Other Operating Expense/Total Revenue: Other operating expense includes all expenses except deposit interest expense. measure management efficiency. Given the nature of the account, this finding appears to indicate self-serving management and/or operating inefficiencies. These expenses were a significantly greater financial

burden for the average problem FI. Sinkey(1975b):1*Note: other items in this list were covered by Sinkey(1975a). 19 Expenses/Operating Revenues: Martin (1977):2 20 Sales/Total Assets: Earning power of assets. Note this is not expressly an FI measure, but rather a generic manufacturing-based one. Altman (1968):5
16. Operating Overhead/Total Assets
21 Overhead/Total assets: measures management efficiency; Thomson (1992):6
14. Return on Assets **15. Variation in ROA for previous 5 years**
22 Net Income/Total Assets: Marcus (1984):3 23 Net Income before dividends/total capital: measures management quality. the competence of management would be expected to be related positively to the income and dividend variables and negatively to borrowings. Within limits, a FIs total borrowings may rise in response to stringent credit conditions without any adverse implications for management performance. Stuhr(1974):2 24 Net income before taxes and dividends/total capital: the competence of management would be expected to be related positively to the income and dividend variables and negatively to borrowings. Within limits, a FIs total borrowings may rise in response to stringent credit conditions without any adverse implications for management performance. Stuhr(1974):3 25 Net income after taxes/total assets: measures return on assets. Thomson (1992):5 26 Net Income/Total Assets: measures earnings ability; West(1985):2 27 EBIT/Total Assets: Indicates operating profitability of total assets. Altman (1968):3 28 Operating Income/Total Assets 2 financial statements prior to failure: Considered to be similar measure to Operating Revenue/Operating Costs (4th on his list); also implies that the more profitable a FI is today, the lesser likelihood of failure tomorrow. Meyer et al (1970):5 29 Net Income/Assets: Measures rates of return from management's perspectives (as opposed to stockholder's perspective). Sinkey (1975a):6 30 Net Income/Total Assets: Sinkey(1987):4 31 Current Net Income/Total Assets: Inversely related. Fuller (1994):3
32 Net Worth Certificates, Accrued Net Worth Certificates and Income Capital Certificates/Total Assets: these types of certificates are issued by the insuring/regulating body in order too bolster waning capital. Directly related. Fuller (1994):2 33 Market Value of Equity/(Estimated Market value of Total Assets): Kryzanowski (1993):1
5. Risk Adjusted Assets
34 (Gross Capital)/(Risk Assets). Marcus (1984):1 35 Net Worth/Total Assets: measures vulnerability of FI to shortage of capital. With 2 period trend (1 year) according to Altman (1977):2 36 Retained Earnings/Total Assets: Indicates reserves available to cover unexpected losses. Altman (1968):2 37 Earned surplus/total assets: Indicates vulnerability of FI to shortage of capital. Altman (1977):4
38 (Log total capital)/(total assets): measures capital (leverage). Authors used lognormal transformation whenever the results were non-normally distributed to improve normality test results. Lane(1986):1

39 Gross capital/total assets: Korobow(1976):6 40 Equity capital/Adjusted risk assets: Numerator: total equity capital + loan valuation reserves + deferred taxes of internal revenue service bad debt reserve + minority interest in consolidated subsidiaries; Denominator: total assets + loan valuation reserves - total cash and due from FIs (domestic office only) - US Treasury securities - US Government agency securities - trading account securities - Federal funds sold; Korobow (1977):2 41 Total Assets/Total Equity Capital: also known as the equity multiplier or leverage factor. measures FI capitalisation. Sinkey (1987):2
18. Operating Overhead/Net Income **19. Variance of Operating Overhead ratio** **17. Trust Op Overhead ratio to Sample Op Overhead ratio**
42 Net Operating Income/Gross Operating Income: measures operating efficiency through aggregate expense data and general profitability. With 2 period trend (1 year) Altman (1977):1 43 Marketing Expenses/Operating Expenses: Inversely related, possibly because marketing expense, being a discretionary expense, failing S&Ls reduced these as they experienced financial problems and/or large operating expenses. Fuller (1994):4 44 Commissions Paid for Deposits/Operating Expenses: failed S&Ls paid more for brokered deposits and/or relied more on brokered deposits. Fuller (1994):5 45 Cash Dividends/Net Income: Rose(1985):6 46 (Interest Income - Interest Expense)/Total Liabilities: broad measure of operating risk (encompasses interest rate risk and credit risk). Cole (1993):1 47 Equipment Expense/Total Liabilities: resulting from manager-type agency risk. Arises when managers attempt to maximise their return by expropriating wealth from owners, unsecured creditors, and government agency insuring deposits. Cole (1993): 2 48 Operating Expenses/Total Assets: failed S&Ls had more operating expenses per asset. Fuller (1994):6 49 Market Value Equity/Total Debt: Indicates market estimation of reserves available to cover unexpected losses. Altman (1968):4 50 Time/Demand Deposit Ratio 2 fncl stmts prior to failure: The difference in costs of demand and time deposits explains this ratio's importance. Meyer et al (1970):3
11. Borrowed Funds/Total Deposits **13. Term Deposits/Total Deposits**
51 Borrowed Money/Total Savings: Indicates relative weighting of source of funds. With 2 period trend (1 year) according to Altman (1977):6 52 Net Borrowings/Cash and U.S. Governments: Rose(1985):2 53 Borrowings/total capital: the competence of management would be expected to be related positively to the income and dividend variables and negatively to borrowings. Within limits, a FIs total borrowings may rise in response to stringent credit conditions without any adverse implications for management performance. Stuhr(1974):4
54 Non-deposit liabilities/cash and investment securities: measures liquidity; Thomson (1992):4 55 Total time and savings deposits/total deposits: analyses source of funds; West(1985):7
Collateral Loans Concentration **Consumer Loans Concentration** **Mortgage Loans Concentration**

56 Total Loans/Total Savings: Indicates riskiness of balance sheet. Altman(1977):5
57 Working Capital/Total Assets: Altman (1968):1

58 Loans and Leases/Total sources of funds: Numerator: Loans, total domestic and foreign + direct lease financing; denominator: total domestic and foreign deposits - cash items in process of collection + Federal funds purchased + other liabilities for borrowed money; Korobow (1977):1
59 Real Estate Owned/Total Assets: measures vulnerability of FI to shortage of capital. Negative relationship with insolvency suggests that solvent FIs are more aggressive in using foreclosure actions to remedy delinquencies, while insolvent FIs seek to avoid the accounting write-downs that accompany the reclassifications of loans as real estate owned. With 2-period trend according to Altman (1977):3

60 Commercial Loans/Total Loans: Martin (1977):3

61 Growth (b(i)) of Consumer Loans/Total Assets: Particularly up to the 1950's, this variable may have been a proxy for the quality of management. The consumer loan/total assets ratio increased more in aggressive well-managed FIs than in closed FIs. Meyer et al (1970):6

62 (1-4 family mortgages - Discount on Residential Mortgages)/(Total Liabilities): considered a traditional asset, FIs should possess superior information about such investments as a result of their long-term relationships with mortgage borrowers and their extensive experience in evaluating and monitoring mortgage credits. Cole (1993):5
63 Discount on Residential Mortgages: [($ value for 1-4 family mortgages)/(total liabilities)] - [($value for 1-4 family mortgages)/(total liabilities)]/(1 + 1 year Treasury Bill rate): approximation of market-value discounts from book value for residential mortgages. Gives approximation of the interest rate risk for mortgages. Especially relevant in thrift industry where long-duration, fixed-rate mortgage loans were being funded with short-duration savings deposits. Cole(1993):3

64 (Log commercial and industrial loans)/(Total loans): measures management quality. The authors defined management quality to be a function of two areas: loan composition, and pricing efficiency as far as they reflect explicit managerial decisions. This measure refers to the loan composition subset. Authors used lognormal transformation whenever the results were non-normally distributed to improve normality test results. Lane (1986):4
65 (Commercial Loans)/(Total Loans): may reflect the greater risk of commercial loans as compared with other types of loans. Alternatively, the percentage of commercial loans may be a proxy for illiquidity, since FIs with relatively heavy commercial lending volume also tend to have low amounts of liquid assets, or for management 'aggressiveness' and propensity to take risks in other areas. Marcus (1984):2

66 Total loans/Total assets: Korobow(1976):2
67 Commercial and Industrial loans/total loans: Korobow(1976):3
68 Commercial and Industrial Loans/Total Loans: Numerator: Commercial and industrial loans booked at domestic office; Denominator: total gross loans booked at domestic offices; Korobow(1977):5

69 Loans/Assets: the average problem FI held 5% to 9% more of its assets in loans than the average control FI. Measures quality of assets. The loans-to-asset ratio is an important component of the loans-to-capital ratio (Sinkey(1975):3), and this may cause similarity in factor analysis. Sinkey (1975a):1
70 Loans/Capital + Reserves: Loans = total loans and discounts; reserves = total reserves for bad debt losses and loans; measures capital adequacy. Sinkey

(1975a):3
71 Commercial and Individual Loans/Total Loans: analysis of the composition of the loan portfolio revealed that the difference between the loans-to-asset ratios was accounted for mainly by the significantly heavier volume of commercial and industrial loans in the average problem-FI's loan portfolio. Measures quality of assets. Sinkey (1975a):4.
72 Loans/Total Assets: Martin (1977):4 73 Classified loans, securities, and other assets plus 1/2 of specially mentioned loans/total loans and securities: measures assets quality. Stuhr(1974):1 74 total loans/total assets: reflects the allocation of a FI's portfolio between relatively higher earnings, higher risk loan assets and lower earning, lower risk government securities and liquidity reserves. Ceteris paribus, the lower the loan-asset ratio the lower the risk associated with the FI's total assets. Stuhr(1974):7 75 Loans portfolio concentration index: loan portfolio concentration index constructed as the sum of the squared portfolio shares of the following loan classifications: real estate loans, loans to depository institutions, loans to individuals, commercial and industrial loans, foreign loans, and agricultural loans. Would be higher whenever significant concentration in any one loan area occurs, increasing the risk. Thomson (1992):2 76 Net loans and leases/total assets: Thomson (1992):3 77 Total Loans/total assets: measures liquidity; West(1985):3
78 Commercial and industrial loans/Total loans: measures loans investment in risky loans; West(1985):4 79 Real Estate loans secured by 1-4 family residential properties/total loans: measures loans investment in less risky loans; West(1985):5 80 Loans to individuals for household, family, and other personal expenditure/total loans: measures investment in mid-risk consumer loans; West(1985):6
81 Error (X_i(T)forecast - X_i(T)actual) in predicting (Cash and Securities)/(Total Assets) one year prior to failure: measures current liquidity unexpected or unpredicted change. Meyer et al (1970):1
4. Total Loans/Total Deposits
82 (Total loans)/(Total deposits): measures liquidity. Lane (1986):3
3. Liquid Assets/Total Assets
83 (Log municipal securities)/(Total assets): measures liquidity. Authors used lognormal transformation whenever the results were non-normally distributed to improve normality test results. Lane (1986):5 84 Net liquid assets/total assets: Korobow(1976):5 85 Interest and Fees on Loans/Operating Income: measures FI's dependence on riskier assets for its income (loans as opposed to investments). The operating income of the problem-FI group was found to be more dependent on loan revenue than the control. Sinkey (1975a):2 86 Liquid Assets/Total Assets: the numerator is the sum of cash and due, U.S. Treasury securities, and net federal funds (sales minus purchases); the more liquid a FI is, the greater is its chance of success or non-failure. Measures liquidity; Sinkey (1987):1 87 Net Liquid Assets/Total Assets: Martin (1977):5 88 Investments/Total Assets: Investments include all securities plus federal funds sold; Pettway(1980):2 89 Net Liquid Assets/Total Assets: Rose(1985):1 90 Coefficient (COV(i)) of Variation in Rate of Interest on Time Deposit: Author

could not come up with firm interpretation, conjectured that this indicator manifests instability of objective or goal. Meyer et al (1970):2
91 Standard deviation of ROA for the previous five years: captures key dimension of risk for earnings as it measures the stability of earnings; Sinkey (1987):3
92 Natural log of total deposits: large organisations are better able to attract competent management and are ina position to diversify their assets and spread portfolio risks. Stuhr(1974):5
93 Number of branches: given two FIs of equal size, one a unit FI and the other having several offices, the latter would be expected to have a higher cost structure ceteris paribus; Stuhr(1974):6
94 Natural log of average deposits per banking office: measures comparative size; Thomson (1992):7

12. Variance of the Total Deposits

95 % Growth in Total Deposits: Rose(1985):3
96 % Growth in Equity Capital: Rose(1985):4
97 % Growth in Total Loans: Rose(1985):5

20. Natural log of total assets

98 Natural log of total assets: lower for riskier FIs; Santomero(1977):1
99 Variance of the jump in size of total assets: Santomero(1977):2

Appendix 4: Technical definition of Proxy Terms: title plus exact formula for calculation purposes

Equity to Assets Ratio: (dependent variable)

[(Bank Overdrafts - Guaranteed Trust Funds: Demand Deposits and Certificates) + (Company Funds: Subordinated Debt) + (Borrowed Money Including Interest Due and Accrued) + (Bank Overdrafts - Total Guaranteed Trust Funds) + (Provision for Deficiency of Maximum Statutory Value Under Book Value of Securities) + (Capital) + (General Reserve) + (Investment Reserves - Mortgages) + (Investment Reserves - Other) + (Retained Earnings) + (Contributed Surplus) + (Other Shareholder's Equity)] / [(Total Assets)]

1. *Operating Expense/Operating Revenue* (X01 ExpRev)

[(Expenses: Interest Incurred) + (Salaries and Staff Benefits) + (Other Operating Expenses) + (Depreciation)] / [(Investment Income Earned) + (Fees and Commissions Earned on Estates, Trusts and Agencies) + (Other Income)]

2. *Variance of Net Interest Margin* (X02 NIMVar)

The variance in the last five years of [(The mean for the previous five years for Investment Income Earned)] / [(The mean for the previous five years for Expenses: Interest Incurred)]

3. *Liquid Assets / Total Assets* (X03 LIQtoTOT)

[(Guaranteed Trust Funds: Cash) + (Guaranteed Trust Funds: Treasury Bills and Short Term Deposits) + (Company Funds: Cash) +(Company Funds: Treasury Bills and Short-term Deposits)] / [(Total Assets)]

4. *Total Loans / Total Deposits* (X04 Loans to deposits)

[(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)] / [(Guaranteed Trust Funds: Demand Deposits and Certificates) + (Guaranteed Trust Funds: Term Deposits and Certificates)]

5. *Risk Adjusted Assets* (X05 BASLEtoTOT)

{[(Company Funds: Cash) + (Guaranteed Trust Treasury Bills and Short Term Deposits) + (Company Funds: Cash) + (Company Funds: Treasury Bills and Short-term Deposits)] * 0.0} + {[(Company Funds: Mortgages and Sale Agreements) + (Company Funds: Mortgages and Sale Agreements)] * 0.5} + {[(Total Guaranteed Trust Funds and Company Funds) - (Company Funds: Cash) - (Guaranteed Trust Treasury Bills and Short Term Deposits) - (Company Funds: Cash) - (Company Funds: Treasury Bills and Short-term Deposits) - (Company Funds: Mortgages and Sale Agreements) - (Company Funds: Mortgages and Sale Agreements)] * 1.0} / [(Total Guaranteed Trust Funds and Company Funds)]

6. *Collateral Loans Concentration* (X06 COLLATCONC)

[(Guaranteed Trust Funds: Collateral Loans) + (Company Funds: Collateral Loans)] / [(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)]

7. Consumer Loans Concentration (X07 CONSCONC)

[(Guaranteed Trust Funds: Consumer Loans) + (Company Funds: Consumer Loans)] / [(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)]

8. Mortgage Loan Concentration (X08 MTGECONC)

[(Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds Mortgages and Sale Agreements)] / [(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)]

9. Net Loan Charge-offs / Total Loans (X09 chgoffs)

[(Investment Reserves - Mortgages (current year)) + (Investment Reserves - Other (current year)) - (Investment Reserves - Mortgages (previous year)) - (Investment Reserves - Other (previous year))] / [(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)]

10. Variation of Net Loan Charge-offs (X10 CHGOFFVAR)

The variation experienced by the trust company for the last five years for [(Investment Reserves - Mortgages (current year)) + (Investment Reserves - Other (current year)) - (Investment Reserves - Mortgages (previous year)) - (Investment Reserves - Other (previous year))] / [(Guaranteed Trust Funds: Collateral Loans) + (Guaranteed Trust Funds: Consumer Loans) + (Guaranteed Trust Funds: Mortgages and Sale Agreements) + (Company Funds: Collateral Loans) + (Company Funds: Consumer Loans) + (Company Funds: Mortgages and Sale Agreements)]

11. Borrowed Funds / Total Deposits (X11 BORRtoDEPS)

[(Guaranteed Trust Funds: Bank Overdrafts) + (Company Funds: Borrowed Money Including Interest Due and Accrued) + (Company Funds: Bank Overdrafts)] / [(Guaranteed Trust Funds: Demand Deposits and Certificates) + (Term Deposits and Certificates)]

12. Variance of the Total Deposits (X12 DEPVAR)

The variation experienced by the trust company for the last five years for [(Guaranteed Trust Funds: Demand Deposits and Certificates) + (Term Deposits and Certificates)]

13. Term Deposits / Total Deposits (X13 LTDPtoDEPS)

[(Guaranteed Trust Funds: Term Deposits and Certificates)] / [(Guaranteed Trust Funds: Demand Deposits and Certificates) + (Term Deposits and Certificates)]

14. Return on Assets (X16 ROA)

[(Net Profit)] / [(Total Assets)]

15. Variation of ROA for previous 5 years (X17 ROAVAR)

The variation experienced by the trust company for the last five years for [(Net Profit)] / [(Total Assets)]

16. Operating Overhead / Total Assets (X18 OHtoASSETS)

[(Salaries and Staff Benefits) + (Other Operating Expenses)] / [(Total Assets)]

17. Trust Operating Overhead ratio to Sample Operation Overhead Ratio

(X19 OHAtoGRP)

{[(Salaries and Staff Benefits) + (Other Operating Expenses)] / [(Total Assets)] for the particular trust company} / {[(Salaries and Staff Benefits) + (Other Operating Expenses)] / [(Total Assets)] average for all trust companies being studied}

18. Operating Overhead / Net Income (X20 OHtoINC)

[(Salaries and Staff Benefits) + (Other Operating Expenses)] / Net Profit)]

19. Variance of Operating Overhead ratio (X21 OHINCVAR)

The variation experienced by the trust company for the last five years for [(Salaries and Staff Benefits) + (Other Operating Expenses)] / Net Profit)]

20. Natural log of total assets (X22 TALOG)

The natural log for [(Total Assets)]

21. Economic Indicator 1: Gross National Product (GNP) (X14 GNP)

[(Canadian Gross National Product Indicator)]

22. Economic Indicator 2: Consumer Price Index (CPI) (X15 CPI)

[(Canadian Purchasing Index)]

Appendix 5: Sample selected for development of model

Trust companies in bold were used to validate study.

Sample of Trust Companies that have failed between 1980-1992					
Num	Year	Institution	Payments [41]	Losses to CDIC	Fed/prov charter
1	1980	Astra Trust Company	21	3	
2	1982	District Trust Co.	n.a.	n.a.	Prov-Ont.
3	1983	Crown Trust Company	930	5	
4	**1983**	**Fidelity Trust Company**	**791**	**359**	**Federal**
5	1983	Greymac Trust Company	240	150	
6	1983	Seaway Trust Company	300	73	prov-Ont.
7	**1985**	**Pioneer Trust Company**	**201**	**27**	**prov-Sask**
8	**1985**	**Continental Trust Company**	**113**	**0**	**Federal**
9	**1985**	**Western Capital Trust Company**	**77**	**3**	
10	1986	Columbia Trust Company	99	0	
11	1987	Principal Savings & Trust Company	116	0	prov-Alta
12	1987	Northwest Trust Co.	n.a.	n.a.	Prov-Alta
13	1988	First City Trust	n.a.	n.a.	
14	**1991**	**Standard Trust Company**	**1,326**	**n.a.**	**Federal**
15	1991	Saskatchewan Trust Company	58	13	prov-Sask
16	1992	First City Trust Company	500	n.a.	
17	1992	Shoppers Trust Company	500	n.a.	
18	**1992**	**Prenor Trust**	**n.a.**	**n.a.**	
19	**1992**	**Central Guarantee Trust**	**4,400**	**n.a.**	

[41] payments refers to total dollars paid out to customers, including both insured and uninsured amounts.

Appendix 6: Complete list of all Trust Companies (Federally and Provincially Chartered) in Canada

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	**Incorp Status**	**Assets**			**Year starting Operation**	**Status for Study**	**Information Source**
		1983	**1988**	**1993**			
Acadia Trust Co.	**Nova Scotia**	**0**	**0**	**178**	**1920**		**1983 OSFI, Ivisions**
AGF Trust Co.		**0**	**22**	**88**			**Ivisions; CDIC 1993**
Astra Trust Co.						fails - test: 1980	EF Review, Ivisions; CDIC 1993
Atlantic Trust Co. (to Prenor Tr 1989)	Federal				1964		1983 OSFI/T&E 1981; CDIC 1993
Bank of Montreal Trust Co (BMO sub)		0	0	17			Ivisions; CDIC 1993
Bank of Nova Scotia Trust Co. (BNS sub)		**0**	**9**	**178**			**Ivisions; CDIC 1993**
Bayshore Trust Company	**Federal**	**16**	**309**	**473**	**1978**		**1980 OSFI Rpt, Ivisions; CDIC 1993**
Bonaventure Trust Inc.							CDIC 1993; TrustIns
Cabot Trust Co. (to Manulife Bk of Cda 1993)							CDIC 1993
Canada Permanent Trust Co	Federal	-219	0	0	1913		1980 OSFI Rpt, Ivisions
The Canada Trust Company	**Federal**	**-1385**	**4892**	**5439**	**1901**		**1980 OSFI Rpt, Ivisions; CDIC 1993**
Canborough Corp (to Nat Tr 1989)							CDIC 1993
Canwest Trust Co. of Cda. (to Prenor Tr 1989)		161	330	8			Ivisions; CDIC 1993
Central Trust Co. (to Cntrl Guar Trust 1988)							1983 OSFI; CDIC 1993
Central&Eastern Trust Company (to CenGuarT81)	Federal	1883	3396	0	1920		1980 OSFI Rpt/T&E 1981, Ivisions
Central & Guarantee Trust Corp (to Cent Guar 1989)							CDIC 1993
Central Guarantee Trust (to TDB 1992)	Federal	0	10836	10173 (92)		fails - test: 1992	EF Review, Ivisions; CDIC 1993
CIBC Trust Corporation (CIBC sub)							CDIC 1993; TrustIns
Citicorp Trust Co.	Ontario						T&E 1981
Citizens Trust Co	**Federal**	**64**	**118**	**447**	**1980**		**1980 OSFI, Ivisions; TrustIns**
City Savings & Trust Co	Alberta						T&E 1981

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
Colonial Trust Co (to Peoples Trust 1983)	Federal						1983 OSFI
Columbia Trust Co.						fails - test: 1986	EF Review , CDIC 1993
Commerce Capital Trust	Alberta						T&E 1981
Commercial Trust Co Ltd	**Federal**	**3**	**3**	**4**	**1939**		**1980 OSFI Rpt/T&E 1981, Ivisions**
Community Trust Company							TrustIns
Confederation Trust Co. Ltd	**PEI**	**0**	**443**	**861**			**1983 OSFI, Ivisions**
Continental Trust Co	**Federal**	**169**	**136 (84)**	**0**	**1973**	**fails - validatio n: 1985**	**1980 OSFI Rpt/ T&E81, Ivisions; CDIC 1993**
Co-operative Trust Co of Cda	**Federal**	**661**	**758**	**1113**	**1952**		**1980 OSFI Rpt/ T&E 1981, Ivisions; TrustIns**
Coronet Trust							MTrust
Counsel Trust Co. (to Sun Life Tr 1991)	Ontario (?)				1981		Mtrust; CDIC 1993
Crown Trust Co.	Ontario					fails -test: 1983	T&E 1981; CDIC 1993
Desjardins Trust Inc.							CDIC 1993
Discovery Trust Co (to Okanagan Trust 1983)	Federal						1983 OSFI
Discovery Trust Co of Cda (from Norfolk Trust)	Federal				1916		1983 OSFI
District Trust Co.						fails - validation: 1982	T&E 1981; CDIC 1993
Dominion Trust Company	Ontario (?)					fails: 1993	Mtrust; CDIC 1993
Dover Trust Co.		**0**	**.5**	**0**			**Ivisions**
Earnscliffe Trust Co. Ltd	PEI						1980 OSFI
Eaton/Bay Trust Co	**Federal**	**732**	**750**	**0 (Eato n only)**	**1984**		**1983 OSFI, Ivisions**
Effort Trust Company (The)							CDIC 1993

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
The Equitable Trust Co	**Federal**	**19**	**47**	**137**	**1971**		**1980 OSFI, Ivisions; CDIC 1993**
Evangeline Trust Co	**Federal**	**20**	**7**	**22**	**1980**		**1980 OSFI, Ivisions; CDIC 1993**
Executive Trust	Ontario (?)						Mtrust
Farmers & Merchant Trust							Mtrust
Federal Trust Co of Toronto	Ontario						1980 OSFI
The Fidelity Trust Co	Federal	892 (82)	0	0		fails: 1983; liquid: 1988 CDIC	1980 OSFI, Ivisions; CDIC 1993
Fiducie Desjaradins Inc.							TrustIns
Fiducie Du Quebec	Quebec						1980 OSFI
Financial Trust Co.						fails: 1988	1980 OSFI
First City Trust						fails - test: 1992	EF Review; CDIC 1993
Firstline Trust Co		0	0	813			Ivisions
Fort Garry Trust Co. (to Fidelity Trust 1979)	Manitoba						1983 OSFI
Fortis Trust Corporation							CDIC 1993; TrustIns
General Trust Corporation of Canada						ceases ops 1993	CDIC 1993
General Trust of Canada (NATB sub)	**Quebec**	**747**	**1359**	**1521 (92)**			**1980 OSFI Rpt, Ivisions; CDIC 1993**
Greymac Trust Co.	Federal					fails: 1983; liquid 1988	1980 OSFI Rpt/T&E 1981; CDIC 1993
Guaranty Trust Co of Cda (to Cent Guar 1988)	Federal	-1508	5105 (87)	0	1973		1980 OSFI, Ivisions; CDIC 1993

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
Guardian Trust Co.	Quebec					ceases ops	T&E 1981; CDIC 1993
Heritage Savings & Trust Co.	Alberta					fails - test	T&E81/ 1980 OSFI/ T&E81
Home Savings & Loan							TrustIns
Household Trust Co.		**0**	**853**	**1695**			**Ivisions; CDIC 1993**
Huronia Trust Company (to Manulife Bk of Cda 1993)							CDIC 1993
Inland Trust & Savings Co. Ltd	**Manitoba**	**154**	**126**	**170**	**1966**		**1983 OSFI/T&E 1981, Ivisions; CDIC 1993**
Income Trust Co		**106**	**232**	**344 (92)**		**fails - validatio n: 1993**	**EF Review, Ivisions; CDIC 1993**
The Interior Trust Co.	Fed since 81/Man				1918		1983 OSFI
The International Trust Co	**Federal**	**77**	**19**	**14**	**1971**		**1980 OSFI/T&E 1981, Ivisions; CDIC 1993**
Investors Group Trust Co. Ltd	**Manitoba**	**272**	**818**	**1044**	**1968**		**T&E 1981, Ivisions; CDIC 1993; TrustIns**
Keltic Trust Co.		**0**	**.2**	**.2 (90)**			**Ivisions**
Laurentian Trust of Canada Inc.							CDIC 1993; TrustIns
London Trust & Savings Company							CDIC 1993
M.R.S. Trust Company							CDIC 1993
Marcil Trust Co.	Federal				1982		1983 OSFI
The Merchant Trust Co	**Federal**	**2**	**44**	**170**	**1978**		**1980 OSFI, Ivisions; CDIC 1993**
The Metropolitan Trust Co.	**Ontario**	**107**	**682**	**738**			**T&E 1981, Ivisions; CDIC 1993; TrustIns**
Monarch Trust						fails - 1994	Mtrust; CDIC 1993
Montreal City & District Trustees Ltd.	Quebec						T&E 1981
Montreal Trust Co of Canada	**Federal**	**1427**	**537**	**7287**	**1978**		**1980 OSFI/T&E 1981,**

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
			8				**Ivisions; CDIC 1993**
Montreal Trust Company							CDIC 1993; TrustIns
Montreal Trustco Mortgage Corp						ceases ops 1989	CDIC 1993
Morguard Trust Co (to Metro Tr 1993)	Federal				1972		1980 OSFI ; CDIC 1993
Morgan Trust Company of Cda	**Federal**	**264**	**185**	**1074**	**1979**		**1980 OSFI , Ivisions**
Municipal Trust Company (The)							CDIC 1993; TrustIns
Mutual Trust Co.		19	477	1605			Ivisions
Natcan Trust Co. (NATB sub)		0	0	0			Ivisions; CDIC 1993
National Trust Co. Ltd.	Ontario						T&E 1981; CDIC 1993; TrustIns
Norfolk Trust (to Discovery Trust 1983)	Federal						T&E 1981
North America Trust	Quebec						T&E 1981
North American Trust (formerly First City Trust)							CDIC 1993; TrustIns
The North Canadian Trust Co	Fed since 80/Mn				1914		1980 OSFI/ T&E 1981
North West Trust Co.	Alberta					fails - validation: 1987	T&E 1981; CDIC 1993
Northern Trust Company, Canada (The)							CDIC 1993
Northland Trust					1960s	fails (?)	Mtrust
Nova Scotia Savings and Trust Co (to Cent Guar 1988)	**Federal**	**23**	**57 (87)**	**0**	**1981**		**1983 OSFI, Ivisions; CDIC 1993**
Okanagan Trust Co (from Discovery Trust)	**Federal**	**3**	**3 (84)**	**0**	**1976**		**1983 OSFI, Ivisions**
Pacific & Western Trust Corporation							CDIC 1993
Pan American Trust Co.	PEI						1983 OSFI
Peace Hills Trust Co	**Federal**	**82**	**96**	**222**	**1981**		**1983 OSFI, Ivisions; CDIC 1993; TrustIns**
Peoples Trust Co (from Colonial T)	**Federal**	**2**	**160**	**270**	**1982**		**1983 OSFI , Ivisions; CDIC 1993**
Pioneer Trust Co	Federal	275	0	0	1974	fails - test:	1980 OSFI, Ivisions;

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
						1985	CDIC 1993
Premier Trust Co.	**Federal**	**156**	**469**	**616**	**1916**		**T&E 1981; CDIC 1993**
Prenor Trust Co.		67	152	1045 (92)		fails - 1993	Ivisions; CDIC 1993
Principal Savings & Trust Co.	Alberta					fails - test: 1987	T&E 1981;CDIC 1993
The Premier Trust Co							1980 OSFI, Ivisions
The Provincial Trust Co.		**0**	**1**	**1**		**ceases ops 1990**	**Ivisions; CDIC 1993**
R-M Trust Co.		**1**	**2**	**56**			**Ivisions; TrustIns**
RBC Trust Co. (RBC sub)		0	0	53			Ivisions; CDIC 1993
Regional Trust Co. (to Manulife Bk of Cda 1993)							
Royal Trust Corp of Cda (RBC sub)							CDIC 1993; TrustIns
Royal Trust Company (The) (RBC sub)							**CDIC 1993**
Royal Trust Company Mortgage Corp						ceases ops 1989	CDIC 1993
The Regent Trust Co.	**Manitoba**	**.4**	**.4**	**.4 (91)**	**1954**		**1983 OSFI, Ivisions**
The Regional Trust Co	Federal	42	69	64 (92)	1976		1980 OSFI, Ivisions
Royal Trust Corp of Cda	Federal	1790	140 95	1265 6	1977		1980 OSFI / T&E 1981, Ivisions
Saskatchewan Trust Co.	Saskatchewan					fails - test: 1991; liquid: 1991	CDIC Review; CDIC 1993
Savings & Investment Trust	Quebec						T&E 1981; CDIC 1993
Seaway Trust Co.	Federal					fails - test: 1983	1983 OSFI; CDIC 1993
Security Home Mortgage Inv. Corp							TrustIns
Security Trust Company (to Dominion Tr 1992)							CDIC 1993
Sherbrooke Trust Co.	Quebec						T&E 1981

TRUST COMPANY POPULATION - FAILED AND NON-FAILED							
Company	Incorp Status	Assets			Year starting Operation	Status for Study	Information Source
		1983	1988	1993			
Shopper's Trust Co.						fails - test: 1992	CDIC Review; CDIC 1993
Societe Nationale de Fiducie	Quebec						T&E 1981
Standard Trust Co	Federal	783	1379	1543 (89)	1966	fails - test: 1991; liquid: 1991	1980 OSFI / T&E 1981, Ivisions; CDIC 1993
State Street Canada							TrustIns
Sterling Trust Co	Federal				1911		1980 OSFI Rpt/ T&E 1981
SunLife Trust Co.		**38**	**540**	**2620**			**Ivisions; CDIC 1993; TrustIns**
TD Trust Co. (TDB sub)		**0**	**0**	**244**			**Ivisions; CDIC 1993; TrustIns**
Teachers' Trust Co		0	0	0			1980 OSFI, Ivisions
Vanguard Trust of Cda Ltd (to Pren Tr 1989)							CDIC 1993
Victoria & Grey Trust Co.	Ontario						T&E 1981
Wellington Trust Co		**0**	**266**	**510 (91)**			**Ivisions**
Western Capital Trust Co	Federal	80	80 (84)	0	1979	fails - test: 1985	1980 OSFI, Ivisions; CDIC 1993
Yorkshire Trust Co. (to Laurentienne Group 1985) (to Cent Guar 1988 as per CDIC 1993)	British Columbia						T&E 1981; CDIC 1993

Appendix 7: Sample list of Solvent Trust Companies to be included

Surviving Trusts used in validation sample are listed in bold

TRUST COMPANY SAMPLE - HEALTHY			
Company	**Incorporation Status**	**Year Commencing Operations**	**Info Source**
Acadia Trust Co.	Nova Scotia	1920	1983 OSFI
AGF Trust			**Ivisions; CDIC 1993**
Bank of Nova Scotia Trust			Ivisions; CDIC 1993
Bayshore Trust Company	Federal	1978	1980 OSFI Rpt
Canada Trust	Federal	1913	1980 OSFI Rpt; Ivisions; CDIC 1993
Canwest Trust			Ivisions; CDIC 1993
Citizens Trust Co	Federal	1980	1980 OSFI
Commercial Trust Co Ltd	Federal	1939	1980 OSFI Rpt/T&E 1981
Confederation Trust Co. Ltd	PEI		1983 OSFI
Co-operators Trust Co of Cda	Federal	1952	1980 OSFI Rpt/ T&E 1981
Dover Trust			**Ivisions**
Eaton/Bay Trust Co	Federal	1984	1983 OSFI; Ivisions
The Equitable Trust Co	Federal	1971	1980 OSFI; Ivisions; CDIC 1993
Evangeline Trust Co	**Federal**	**1980**	**19880 OSFI, Ivisions; CDIC 1993**
General Trust	**Quebec**		**1980 OSFI Rpt, Ivisions; CDIC 1993**
Household Trust			**Ivisions; CDIC 1993**
Inland Trust & Savings Co. Ltd	Manitoba	1966	1983 OSFI/T&E 1981
Income Trust			EF Review, Ivisions; CDIC 1993
International Trust	Federal	1971	1980 OSFI/T&E 1981, Ivisions; CDIC 1993
Investors Group Trust Co. Ltd	Manitoba	1968	T&E 1981
Keltic Trust			**Ivisions**
Merchant Trust	Federal	1978	1980 OSFI, Ivisions; CDIC 1993
Metropolitan Trust	**Ontario**		**T3E 1981, Ivisions; CDIC 1993; TrustIns**
Montreal Trust Co of Canada	Federal	1978	1980 OSFI/T&E 1981
Morgan Trust Company of Cda	Federal	1979	1980 OSFI
Mutual Trust			Ivisions
Nova Scotia Savings and Trust Co	**Federal**	**1981**	**1983 OSFI**
Okanagan Trust Co (from Discovery Trust)	Federal	1976	1983 OSFI
Peace Hills Trust Co	Federal	1981	1983 OSFI
Peoples Trust	Federal	1982	1983 OSFI, Ivisions; CDIC 1993
Premier Trust Co.	**Federal**	**1916**	**T&E 1981**
Provincial Trust			1983 OSFI, Ivisions; CDIC 1993
R-M Trust			Ivisions; TrustIns
The Regent Trust Co.	Manitoba	1954	1983 OSFI
The Regional Trust Co	**Federal**	**1976**	**1980 OSFI**
Royal Trust Corp of Cda	Federal	1977	1980 OSFI / T&E 1981
Sunlife Trust			**Ivisions; CDIC 1993; TrustIns**
TD Trust			Ivisions; CDIC 1993; TrustIns
Wellington Trust			**Ivisions**

Appendix 8: T-Test, Factor Analysis and Regression Analysis results

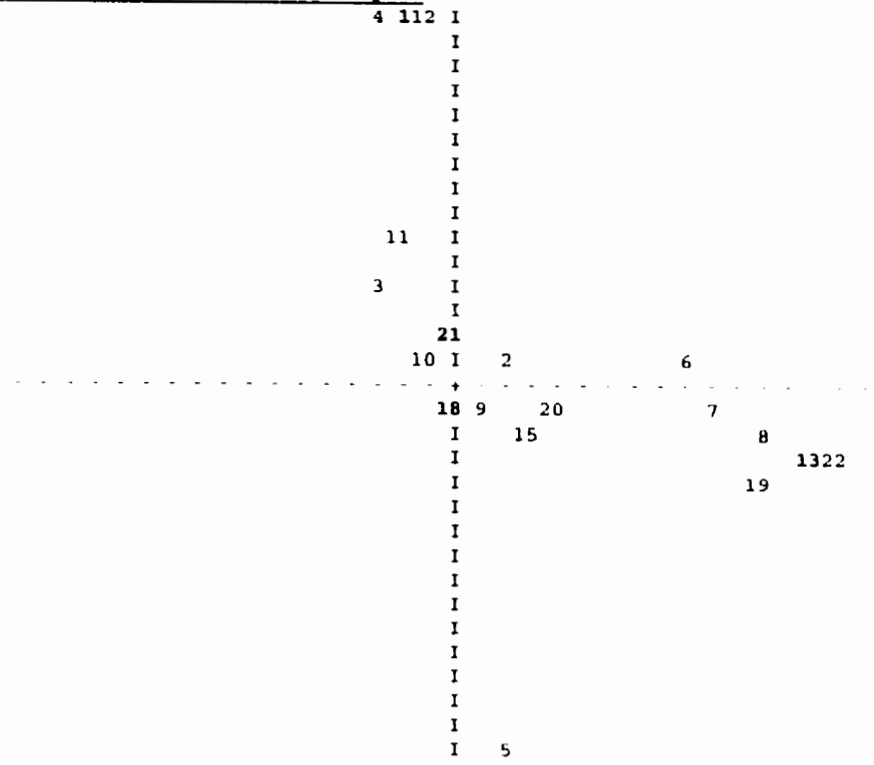
This appendix shows the details of the confidence interval factor analysis, and single regression analysis for each of the twenty-two independent variables. AIC Matrix: 229 variables < .10, 13 above; Correlation Matrix: 197 < .30; 34 above

Summary of Single Regression and Confidence Interval Analysis

Table App8a: Panel Data - Healthy Trusts

	90%CI	95% CI	# obs	Adj Rsq	t-value	F-value	D-W	Kurtosis	Std dev	Mean	Std dev	Factors gen'd	KMO	Bartlett	Factor #	Factor wgt	Ranking
X01	different	different	125	.3084	-5.464	60.747	1.0930	1.9059	.4142	1.0046	.1289	8	.61366	4393.42	B	.85922	B3
X02	different	different	125	.1931	-5.75	33.074	1.0645	12.6145	.4142	-.34460	.05992	8	.61366	4393.42	E	-.86380	E2
X03	different	different	125	**.8861**	**32.30**	**1043.415**	**.9639**	**1.2689**	**.4142**	**1.0282**	**.03183**	**8**	**.61366**	**4393.42**	**C**	**.90488**	**C1**
X04	Different	Different	125	**.6167**	**14.72**	**216.620**	**1.3239**	**2.0708**	**.4142**	**.80757**	**.05487**	8	.61366	4393.42	B	**.86739**	B1
X05	Different	different	125	.0047	.6111	.373	.9615	9.1631	.4142	.14184	.2321	8	.61366	4393.42	B	.86359	B2
X06	different	different	125	.1712	5.356	28.689	1.1097	10.6858	.4142	.45737	.08539	8	.61366	4393.42	A	.72202	A3
X07	different	different	125	.0468	3.429	11.838	.9863	11.6449	.4142	.25838	.07510	8	.61366	4393.42	A	.61149	A5
X08	different	different	125	**.5071**	**-11.78**	**138.846**	**1.0569**	**2.3378**	**.4142**	**-6.2857**	**.5334**	8	.61366	4393.42	A	.86960	A2
X09	different	different	125	-.0004	.9695	.940	.9683	9.5225	.4142	.24333	.2510	8	.61366	4393.42	F	.75804	F3
X10	different	different	125	.0048	1.285	1.652	.9750	9.5247	.4142	.15377	.1196	8	.61366	4393.42	F	.78143	F2
X11	different	different	125	**.4028**	**.9559**	**91.375**	**1.4136**	**3.6681**	**.4142**	**.55242**	**.05779**	8	.61366	4393.42	C	.85427	C2
X12	different	different	125	.1524	-5.009	25.087	.9667	14.6433	.4142	-2.0304	.04054	8	.61366	4393.42	B	-.83331	B4
X13	different	different	125	.0200	1.932	3.734	1.0149	9.4777	.4142	2.0470	1.059	8	.61366	4393.42	A	.71448	A4
X14	Different	different	125	.0476	-2.775	7.701	.9389	8.36094	.4142	-3.0707	1.107	8	.61366	4393.42	D	.22261	D3
X15	different	different	125	.0480	-2.784	7.750	.9411	8.3079	.4142	-2.5846	.9284	8	.61366	4393.42	D	.22118	D4
X16	different	different	125	.0486	2.801	7.846	.9429	8.9138	.4142	.27740	.09903	8	.61366	4393.42	D	.32852	D2
X17	different	same	125	.0003	1.021	1.043	.9586	9.7387	.4142	.10498	.1028	**8**	**.61366**	**4393.42**	**F**	**.93576**	**F1**
X18	different	different	125	**.4655**	**10.85**	**117.688**	**1.1905**	**8.9927**	**.4142**	**.97225**	**.08962**	**8**	**.61366**	**4393.42**	**G**	**.94791**	**G1**
X19												8	.61366	4393.42	A	.57376	A6
X20	different	different	125	.0056	-1.323	1.750	.9900	9.4257	.4142	-.14259	.1078	8	.61366	4393.42	D	-.56381	D1
X21	same	same	125	-.0074	-.1353	.018	.9506	9.5309	.4142	-.00679	.05021	**8**	**.61366**	**4393.42**	**E**	**.87399**	**E1**
X22	different	different	125	**.5219**	**-12.14**	**147.294**	**1.0237**	**7.6560**	**.4142**	**-.43985**	**.03624**	**8**	**.61366**	**4393.42**	**A**	**.89652**	**A1**

Factor Plot in Rotated Factor Space



Symbol	Variable	Coordinates	Symbol	Variable	Coordinates	Symbol	Variable	Coordinates
1	X1	(-.07968, .86739)	2	X2	(.11432, .04454)	3	X3	(-.13279, .22849)
4	X4	(-.16881, .85922)	5	X5	(.16211, .83331)	6	X6	(.57376, .03876)
7	X7	(.61149, .00496)	8	X8	(.71448, .07536)	9	X9	(.06521, .01733)
10	Y0	(-.05091, .01315)	11	Y1	(.07392, .34253)	12	Y2	(-.06050, .86359)
13	Y3	(.86960, -.11441)	14	Y4	(.18432, -.06805)	15	Y5	(.18236, -.07171)
16	Y6	(.24760, .00504)	17	Y7	(-.00161, .00230)	18	Y8	(.04659, .00924)
19	Y9	(.72202, .20919)	20	Z0	(.22766, .01968)	21	Z1	(-.00383, .11630)
22	Z2	(.89652, .16412)						

This is the Varimax Rotated Factor Plot showing the relationships between the 22 independent factors when compared to the dependent variable Independent variables that are found close together indicate similar relationships. It should be remembered when reading this that only the two largest factors are displayed, although seven were identified, because of limitations of trying to represent seven-dimensional space in a two-dimensional medium.

Appendix Table App8b - Panel Data - Failed Trusts											
	90%CI	95% CI	# obs	Adj Rsq	t-value	F-value	D-W	Kurtosis	Std dev	Mean	Std dev
X01	different	different	25	.0319	1.338	1.791				.20074	.1500
X02	different	different	25	-.0429	.1146	.013				.014586	.1272
X03	different	different	25	.0331	1.350	1.823				.49634	.3676
X04	different	different	25	.0333	-1.351	1.826				-4.2725	3.162
X05	different	different	25	-.0130	.8321	.692				2.4627	2.960
X06	different	different	25	.2133	2.740	7.508				.36518	.1333
X07	different	different	25	.4160	4.254	18.097				.39852	.09368
X08	different	different	25	.7053	-7.644	58.437				-19.183	2.509
X09	different	different	25								
X10	different	different	25	.1116	-2.004	4.016				-.18172	.09068
X11	different	different	25	.0138	1.156	1.336				.098996	.08565
X12	different	different	25	.3222	3.522	12.407				.46789	.1328
X13	different	different	25	.2689	-3.135	9.828				-6.2014	1.978
X14	different	different	25	.2923	3.304	10.914				3.2344	.9790
X15	different	different	25	.2959	3.330	11.088				2.7332	.8208
X16	different	different	25	-.0392	.3089	.095				.04376	.1417
X17	different	same	25	-.3092	.3089	.095				.04707	.1524
X18	different	different	25	.2285	2.848	8.109				1.6745	.5880
X19			25								
X20	different	different	25	-.0370	-.379	.144				-.040206	.1061
X21	same	same	25	-.0349	-.4379	.192				-.028145	.06428
X22	different	different	25	.5759	5.795	33.584				.58434	.1008

Notes on Table App8A: Analysis of Columns Details

90% C.I.; 95% C.I.: t-test determining, with a confidence interval of 90% and 95% respectively, whether there it is probable that there is a difference between the mean for the failed institutions and the mean for the healthy institutions for each variable.

Regression Analysis

Adjusted R-Square: measures the linear goodness of fit of a particular model. A high R-square suggests a good linear fit.

t-value and F-value: a test of significance by which sample results are used to verify the truth or falsity of a null hypothesis. The larger the t-value for a single regression, the greater the chance of statistical significance. The minimum level of statistical significance is dependent on the number of observations. The F-value is another test for significance, and operates similarly to the t-value. Each bolded variable in the first part of the table is highlighted because of its high t-value.

D-W or Durbin-Watson d-statistic: A specification error test which looks for positive correlation in the estimated residuals.

Factor Analysis

Correlation Matrix Summary: Since one of the goals of factor analysis is to obtain "factors" that help explain correlations, the variables must be related to each other for the factor model to be appropriate. If the correlations between variables are small, as is the case here, it is unlikely that they share common factors. If that is the case, it may be wise to reconsider the use of factor analysis as a method of analysis.

AIC Matrix Summary: Anti-Image Correlation Matrix: the number of coefficients that are high versus low. If there is a large number of low coefficients, such as was found here, factor analysis as a medium for analysis is acceptable.

Factors Generated: The total number of factors generated in the analysis. It is the same for all as the combined factor analysis was produced on all variables

Kaiser-Meyer-Olkin (KMO): Measure of sampling adequacy and is an index for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. A result of .61366 is considered to be mediocre, but acceptable, making the results useful.

Bartlett Test of Sphericity: Tests the hypothesis that the correlation matrix is an identity matrix. A large number, such as 4,393.417 suggests that it is unlikely that the results are an identity matrix, meaning that factors analysis is still a useful tool in this instance. It contradicts the correlation matrix summary above.

Rotated Factor Number: Using to maximise the fit, each variable was matched to a common factor, which was limited to 8 alternatives. As can be seen, only seven factors were well-matched.

Factor Weight: The weighting the variable received when relating to its strongest factor

Computer Ranking: The comparative ranking using the rotated factor number and the factor weight. This ranking shows which variables most strongly represent each factor.

Appendix 9: Summary Table: First Stage Results

First Stage Results				
Independent Variable	Single Regression	Factor Analysis	Test for Significance	Total
X01: Expenses to Revenue Ratio	**1**	**.5**	**1**	**2.5**
X02: Net Interest Margin (NIM) Variation	**1**	**.5**	**1**	**2.5**
X03: Liquidity levels to Total Assets	**1**	**1**	**1**	**3.0**
X04: Loans to Deposits Ratio	**1**	**1**	**1**	**3.0**
X05: Risk Adjusted Assets value to Total Assets	0	1	1	2.0
X06: Collateral Loan Concentration	**1**	**.5**	**1**	**2.5**
X07: Consumer Loan Concentration	1	0	1	2.0
X08: Mortgage Loan Concentration	**1**	**1**	**1**	**3.0**
X09: Charge Offs Percentage	0	.5	1	1.5
X10: Charge Offs Percentage Variation	0	1	1	2.0
X11: Borrowing Levels to Deposits	0	1	1	2.0
X12: Deposits Variance	**1**	**.5**	**1**	**2.5**
X13: Long-term Debt to Deposits Ratio	0	.5	1	1.5
X14: GNP Levels	1	.5	1	2.5
X15: CPI Levels	1	.5	1	2.5
X16: Return on Assets	1	1	1	3.0
X17: Return on Assets Variance	0	1	0	1.0
X18: Overhead to Assets	**1**	**1**	**1**	**3.0**
X19: Overhead levels to Group Average Assets	0	0	0	0.0
X20: Overhead Levels to Income Ratio	0	1	1	2.0
X21: Overhead levels to Income variance	0	1	0	1.0
X22: Total Assets Log	1	1	1	**3.0**

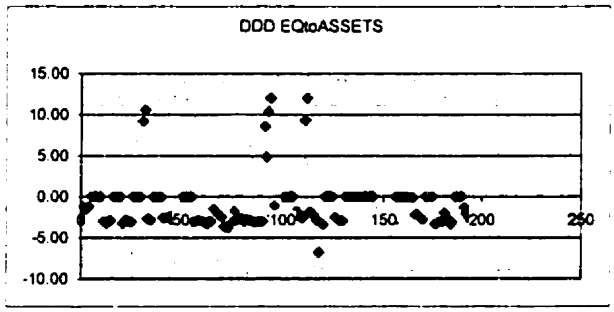
For all rankings, see Appendix 8 Table App8a. Note that although Return on Assets (X16) totalled to 3, and GNP Levels (X14) and CPI Levels (X15) totalled 2.5, they were not included as either excellent or good. This decision was made because of their poor proxy ratings for their respective factor.

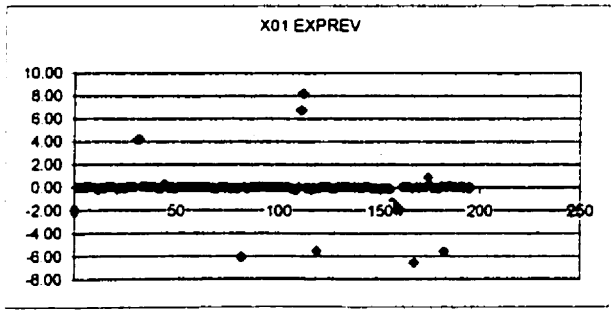
Single Regression Summary: ranking of 1 if in above t-critical, else 0.

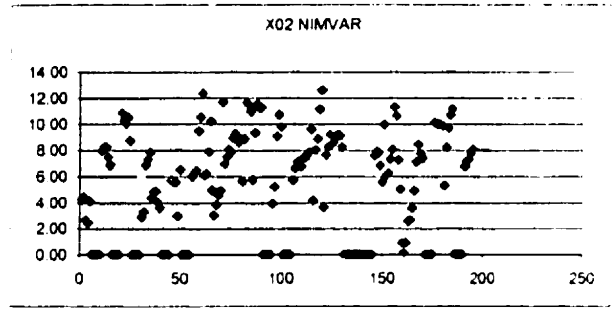
Factor Analysis Summary: ranking of 1 if either 1st or 2nd rank for factor, .5 if 3rd or 4th, else 0

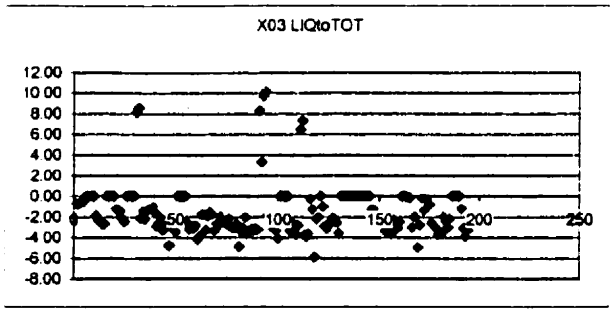
Test for Significance: ranking of 1 if statistically significant at 95% confidence interval, else 0

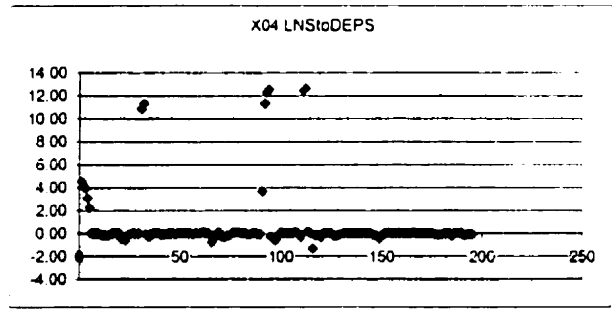
Appendix 10: Graphical Representation of Outliers

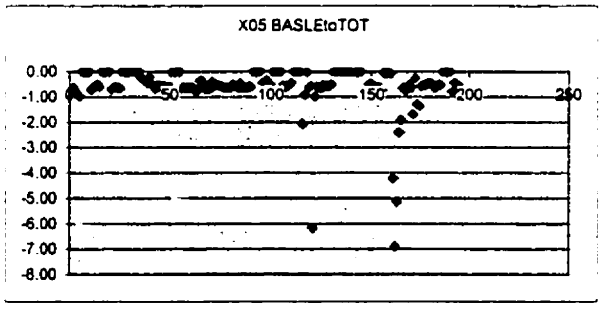


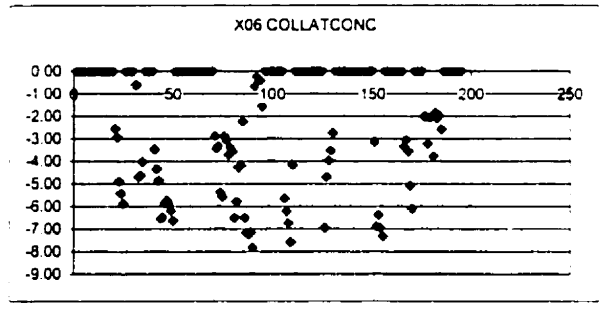


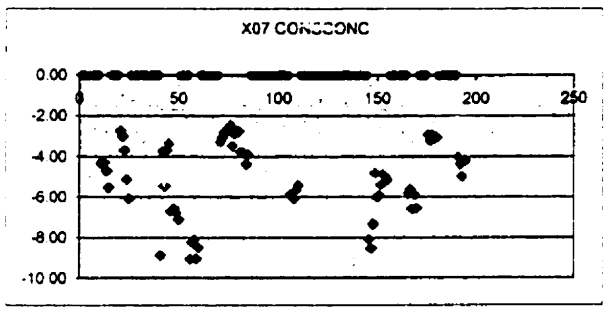


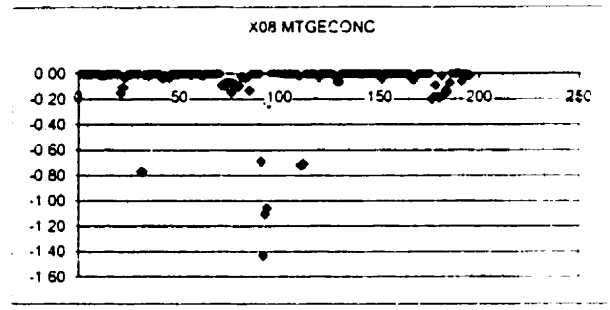


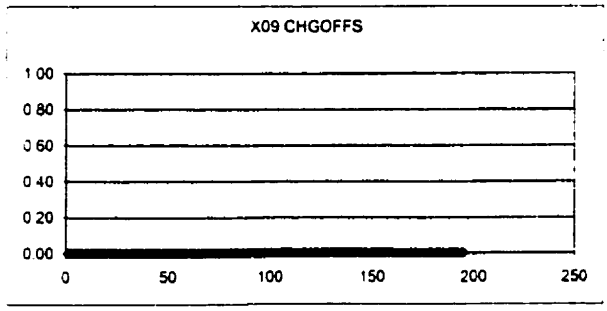


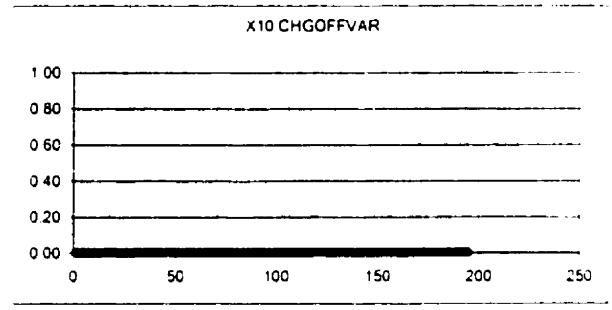


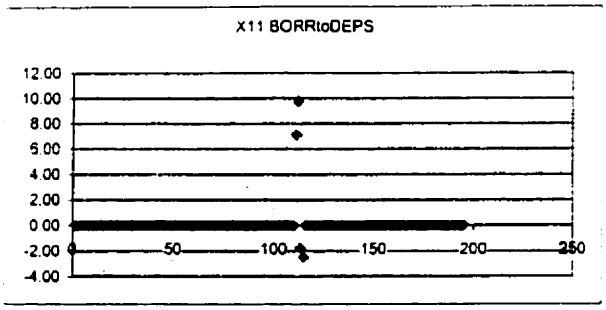


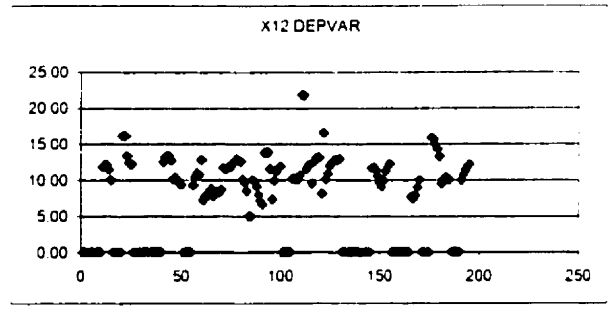

X07 CONSCONC
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
0
50
100
150
200
250

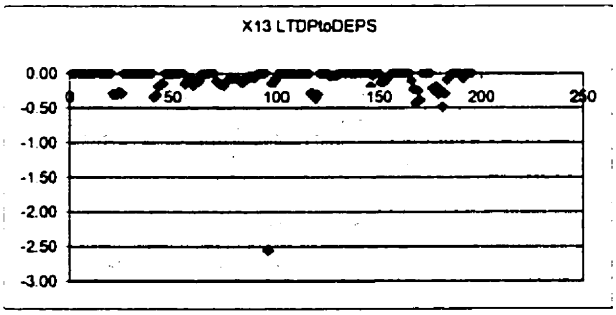

X08 MTGECONC
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
0
50
100
150
200
250

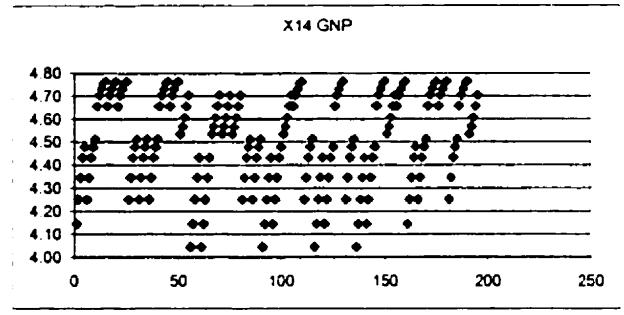

X09 CHGOFFS
1.00
0.80
0.60
0.40
0.20
0.00
0
50
100
150
200
250


X10 CHGOFFVAR
1.00
0.80
0.60
0.40
0.20
0.00
0
50
100
150
200
250

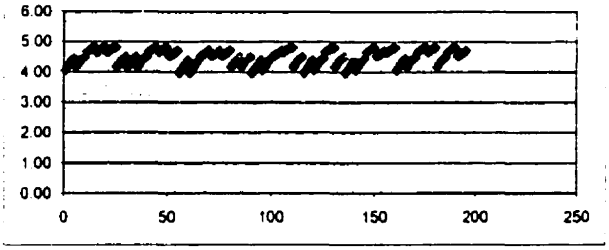

X11 BORRtoDEPS
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
0
50
100
150
200
250


X12 DEPVAR
25.00
20.00
15.00
10.00
5.00
0.00
0
50
100
150
200
250

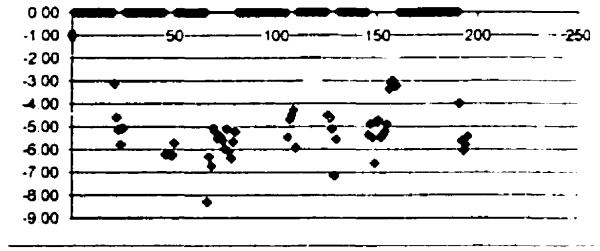

X13 LTDPtoDEPS
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
0
50
100
150
200
250


X14 GNP
4.80
4.70
4.60
4.50
4.40
4.30
4.20
4.10
4.00
0
50
100
150
200
250

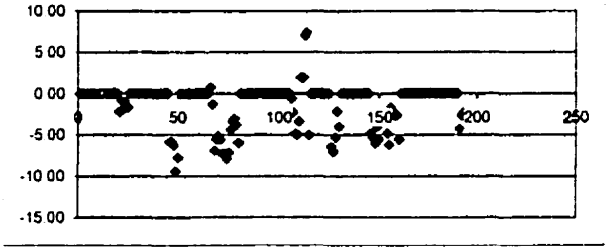
X15 CPI



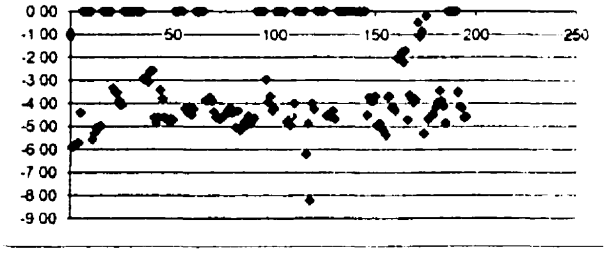
X16 ROA



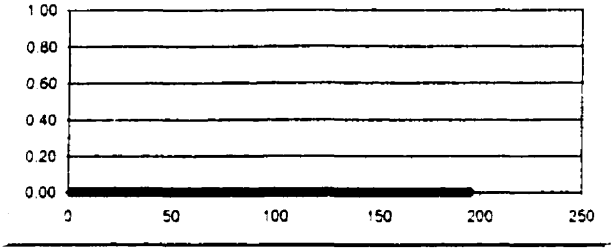
X17 ROAVAR



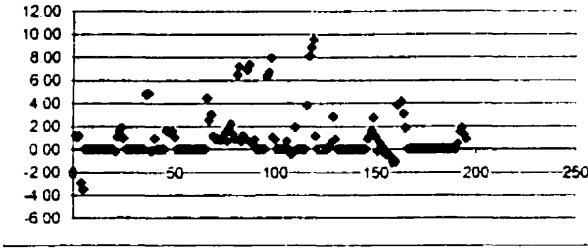
X18 OHtoASSETS



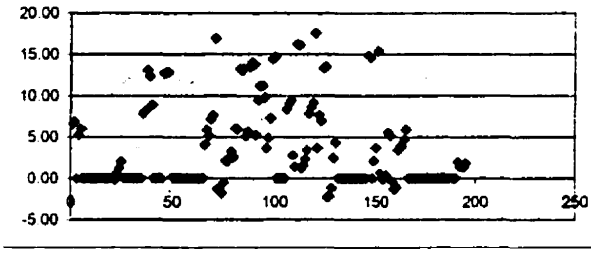
X19 OHAtoGRP



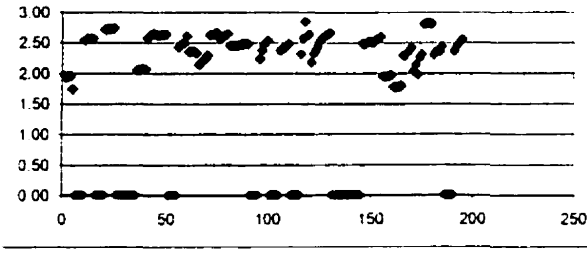
X20 OHtoINC



X21 OHINCVAR



X22 TALOG



Appendix 11: Correlation Matrix

Correlation Matrix:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	1.000																					
2	-0.185	1.000																				
3	0.418	-0.344	1.000																			
4	0.212	-0.107	0.483	1.000																		
5	0.081	0.073	0.277	0.005	1.000																	
6	0.180	-0.408	0.252	0.242	-0.143	1.000																
7	0.160	-0.392	0.229	0.223	-0.145	0.536	1.000															
8	0.118	-0.373	0.217	0.119	-0.117	0.578	0.427	1.000														
9	-0.134	-0.146	0.062	0.053	-0.020	0.025	0.165	-0.049	1.000													
10	-0.100	-0.159	-0.058	-0.198	-0.086	0.008	-0.021	-0.115	0.269	1.000												
11	0.249	-0.329	0.573	0.408	-0.021	0.242	0.289	0.190	0.109	-0.077	1.000											
12	-0.179	0.684	-0.182	-0.099	0.206	-0.456	-0.426	-0.421	-0.076	-0.223	-0.195	1.000										
13	0.129	-0.301	0.256	0.065	-0.091	0.360	0.252	0.279	0.125	0.103	0.225	-0.289	1.000									
14	-0.150	0.093	-0.235	-0.255	-0.064	-0.183	-0.213	-0.187	0.067	0.158	-0.177	0.126	-0.040	1.000								
15	-0.146	0.086	-0.236	-0.260	-0.072	-0.184	-0.212	-0.191	0.070	0.165	-0.176	0.123	-0.036	0.998	1.000							
16	0.337	-0.407	0.284	0.060	0.038	0.310	0.259	0.317	-0.100	-0.016	0.259	-0.312	0.300	-0.413	-0.417	1.000						
17	0.223	-0.291	0.161	0.054	0.112	0.349	0.228	0.335	-0.079	-0.284	0.225	-0.185	0.277	-0.348	-0.349	0.735	1.000					
18	0.411	-0.619	0.602	0.341	0.136	0.405	0.400	0.358	0.095	0.010	0.450	-0.492	0.331	-0.238	-0.235	0.400	0.318	1.000				
19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.000			
20	-0.171	0.124	-0.165	-0.027	-0.071	-0.142	0.078	-0.052	0.055	-0.088	-0.106	0.138	-0.164	-0.284	-0.282	-0.030	0.043	-0.115	.	1.000		
21	-0.174	0.315	0.042	0.170	0.041	-0.086	-0.102	0.013	0.079	-0.176	0.006	0.185	-0.111	-0.168	-0.177	-0.326	-0.310	-0.099	.	0.194	1.000	
22	-0.401	0.667	-0.659	-0.338	-0.141	-0.446	-0.424	-0.379	-0.069	0.035	-0.461	0.569	-0.305	0.285	0.287	-0.419	-0.304	-0.840	.	0.178	0.110	1.000

Appendix 12: Glossary of terms

Adversely Classified Assets: are mainly low-quality loans, and can be listed as "loss", "doubtful", or "substandard" based on examiners' estimation of probable default. The classification of assets is not an exact science, and is dependent on examiner's judgement. The category into which a loan falls is determined by a combination of factors, but mainly by the manner in which the loan is being repaid (if at all) and the quality of its collateral. See also Substandard Category.

ASC: See Alberta Credit Union Stabilisation Corporation

Alberta Credit Union Stabilisation Corporation: It is primarily a stabilisation agency rather than a direct protector of deposits. The Alberta credit union's 100% guarantor. Funded by quarterly levy of assessments on member credit unions as well as income from its loans and investments. Backed by the province of Alberta. (Cdn)

Anti-Image Correlation Matrix (AIC): The negative of the partial correlation coefficient is called the anti-image correlation. If the proportion of large coefficients is high, you should reconsider the use of the factor model. Another indicator of the strength of the relationship among variables is the partial correlation coefficient. If variables share common factors, the partial correlation coefficients between pairs of variables should be small when the linear effects of the other variables are eliminated. See factor analysis.

Asset Quality Risk: risk that a bank might not collect 100% of its assets

Bank: see chartered bank

Bank Run: during a bank run, depositors rush to withdraw their deposits because they expect the FI to fail. In fact, the sudden withdrawals can force the FI to liquidate many of its assets at a loss and force FI failure. A bank run can occur in two situations: i)when the financial institution is insolvent, thus becoming an economically efficient tool by which to move resources to a more efficient financial institution; ii)forced onto a particular financial institution because of reaction to a situation out of proportion to its reality. In this second case, real economic loss results. It is often difficult to determine which of the two alternatives is occurring at the time of occurrence.

Bartlett Test of Sphericity: A test used in factor analysis. It can be used to test the hypothesis that the correlation matrix is an identity matrix. That is, all diagonal terms are 1 and all off-diagonal terms are 0. The test requires that the data be a sample from a multivariate normal population. The value of the test statistic (based on a chi-square transformation of the determinant of the correlation matrix) for this study was 4.393.417 while the associated significance level was 0.00000, so it appears unlikely that the population correlation matrix is

an identity. If the hypothesis that the population correlation matrix is an identify cannot be rejected because the observed significance level is large, you should reconsider the use of the factor model; see factor analysis

Basle Accord: An international agreement designed to improve the stability and long-term profitability of banks operating in the international arena. It defines risk-based capital adequacy regulations in order to reduce the riskiness of the asset / liability structure of banks. The capital is made up of two parts: tier 1 capital (equity or near-equity such as shareholders' equity and retained earnings) and tier 2 capital (preferred shares, subordinated debt, and riskier debt provisions against unexpected loans losses). Each tier should be maintained at a minimum of 4% of risk-weighted assets. All bank assets are weighted according to their level of riskiness, and then assigned a weighting of either 0.0, 0 5, or 1.0. These weightings were then multiplied by the asset in question to determine the capital adequacy requirement.

CAMEL: an acronym for the five general areas analysed using financial statement data. The acronym refers to the first letter in each of the following words: capital, asset quality, management, earnings quality, and liquidity. This general measurement system was adopted in 1978 as the foundation for a uniform approach to examination. The Federal Deposit Insurance Corporation (FDIC), the Federal Reserve Board, and the Office of the Comptroller (OCC) all focus their financial analysis on these five general areas. There is little agreement among the three agencies, however, as to which financial ratios are best for screening the data off-site. Nor is there a consensus in the academic literature on which ratios are the best predictors of failure. Compounding the problem are the high correlations among accounting ratios.

Canadian Deposit Insurance Corporation: A crown corporation created in 1967 and funded through the assessment and collection from its member institutions of an annual premium. Backed by the government of Canada sufficient so as to provide income to meet payments to depositors, interest charges, and operational expenditures. Taxpayers have no explicit liability for losses resulting from the operating of the CDIC. Its statutory objects are to i)insure certain deposits in member institutions up to a limit currently set at $60,000 for each account, ii)promote standards of sound business and financial practices for member institutions; iii)promote the stability and competitiveness of the financial system in Canada and iv)pursue these objects in such a manner as will minimise the exposure of the Corporation to loss.

Capital Risk: can be caused by insufficient market standing

CDIC: see Canadian Deposit Insurance Corporation

Chartered Bank: See also Financial Institution, Trust Company, Credit Union, Mortgage and Loan Company

Commercial Bank: see chartered bank

Control Risk: financial loss arising from sources other than the lending of money

Credit Risk: the risk that a loan, once granted, will not be repaid. One common cause is loose credit policies

Credit Union: See also Financial Institution, Chartered Bank, Trust Company, Mortgage and Loan Company

EWS: see Early Warning System

Early Warning System: a method by which to grade different financial institution's health whose purpose is to identify high risk financial institutions.

Equity: Equity is stated to be equal to the traditional definition of equity used in accounting and finance analysis. It excludes, however, any government-contributed capital, primarily in the form of deposit-insurance subsidies and forbearances, which alter balance sheet equity, but not true equity. (Kane and Unal, 1990) Net-worth is book-equity capital plus the reserve for loan losses net of non-performing loans (Thomson: 1992). Having it net of bad loans means it should be a better proxy for enterprise-contributed capital than a primary equity measure.

Ex ante: expected

Ex post: actual

Factor Analysis: a statistical technique used to identify a relatively small number of factors that can be used to represent relationships among sets of many interrelated variables. The basic assumption of factor analysis is that underlying dimensions, or factors, can be used to explain complex phenomena. If a factor correlation coefficient is greater than .3 in absolute value, it suggests a strong correlation.; see Bartlett Test of Sphericity, Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy; Anti-Image Correlation Matrix (AIC)

failure: there are 2 defensible definitions for failure for a financial institution. a)insolvency occurs when total liabilities exceed total assets (net equity is negative); b)insolvency occurs when so defined by the regulators and is immediately followed by closure of the institution - forbearance by regulators is the difference between a)-type failures and b)-type failures. For the purposes of this study, a)-type insolvency will be considered to be the specific situation defining failure. *Problems:* i)it may be a much larger group that is currently not easily defined for study - could it be limited further to the study of those

institutions that have failed technically by a)-type definition, and then also failed using b)-type definition. The numbers under analysis would specifically pre-date a)-type failure; ii)if I) is used, I could also compare how much worse forbearance made the situation, but is this broadening the study too much?

FDIC: see Federal Deposit Insurance Corporation

Federal Deposit Insurance Corporation: created by the Glass-Steagall Act of the United States Government in 1933. Federal member FIs must be insured by the FDIC. If a FI purchases insurance, it must comply with rules set by FDIC. Operates independently of the Comptroller, and the Federal Reserve System, and is not required to co-ordinate actions with other two bodies (U.S.). The FDIC examines insured-non-member commercial FIs and federally-insured mutual savings FIs. As well, all state FIs (insured and non-insured) are subject to regulation by their respective state banking departments. The Comptroller and the Fed may recommend to the FDIC, based upon the results of their examinations, that a FI be placed on the problem-bank list. However, the final decision as to whether or not a FI is placed on the list is made by the FDIC after scrutinization of the recommending agency's examination reports. Only in rare instances will the FDIC conduct its own field examination of such a FI. Usually, with a year, OCC, the Fed, and FDIC will have examined the population of insured commercial FIs. See also Office of the Comptroller of the Currency and the Federal Reserve System, Federal Savings & Loan Insurance Corporation.

Federal Home Loan Bank Board: The surveillance arm of this institute was called the Office of Examinations and Supervision, and was called upon to perform corrective action for Savings & Loan Associations. Replaced by the Office of Thrift Supervision (OTS) in 1989. See also Office of Thrift Supervision

Federal Reserve System: regulates all state member FIs

Federal Savings & Loan Insurance Corporation: Insurer for the Savings and Loan Association Industry. Its counterpart organisations for commercial and mutual savings FIs and securities brokers and dealers are the Federal Deposit Insurance Corporation (FDIC), and the Securities Investor Protection Corporation respectively. See also Federal Deposit Insurance Corporation.

Financial Institution: Broadly defined, this group includes depository institutions, finance companies, investment companies, securities firms, and insurance companies. For the purposes of this study, it is more narrowly defined as only including depository institutions, including commercial FIs, chartered FIs, thrift institutions, trust companies, and credit unions. See also Chartered Bank, Trust Company, Credit Union, Mortgage and Loan Company.

FIRREA: see Financial Institutions, Reform, Recovery and Enforcement Act

Financial Institutions, Reform, Recovery and Enforcement Act: passed in 1989, it allowed FDIC additional powers to close FIs. Prior to this Act, only federal bank chartering agencies were given this discretion. While it does not give the FDIC the power to declare a FI insolvent or to revoke its charter, it does allow the FDIC to seize control of a failing institution and to operate it as a federally chartered bridge bank, under Section 214 of FIRREA (P.L. 101-73) which amends Section 11 of the Federal Deposit Insurance Act (12 U.S.C. 1821). Typically, however, the closure process reflects joint action by as many as three agencies: the chartering agency, the FDIC, and the Federal Reserve (Fed). For the failures of large national FIs the closure process usually involves the Fed calling in its discount window loan, the failure of the FI to repay the loan, the Office of the Comptroller of the Currency (OCC) declaring the FI insolvent and the appointment of the FDIC as a receiver. For state FIs the state chartering agency replaces the OCC in the closure process. For smaller FIs, especially those without a Fed discount window advance, the closure process involves only the chartering agency and the FDIC.

FHLBB: See Federal Home Loan Bank Board

Forbearance: occurs when a financial institution is technically insolvent and could be closed. The insuring institution either extends credit, or otherwise keeps the financial institution open despite problems in the hopes that it will recover financially. Considered to be especially a problem for the U.S. savings and loans institutions that ultimately led to greater losses than would have occurred if liquidation had been imposed immediately.

Foreign Exchange Risk: the risk that a loss will result when a foreign currency held by the FI is exchanged back into the home currency

FSLIC: see Federal Savings & Loan Insurance Corporation.

Funding Risk: the risk that the FI's uninsured creditors will sense insolvency and refuce to renew their uninsured funding

IMS: see Integrated Monitoring System

Integrated Monitoring System: developed by the Federal Deposit Insurance Corporation (FDIC) as an Early Warning System. It was introduced in 1977 as part of a surveillance program intended to monitor thousands of insured U.S. non-member FIs between routine examinations. The primary objective is to alert the FDIC to deteriorating FI condition and assist it in making decisions concerning the frequency and scope of examination and supervisory activities. The key feature of the IMS is a screening procedure called "Just a Warning System" (JAWS). The IMS operates in conjunction with with the URS as an interim FI tracking device.

Interest Rate Risk: the probability of loss resulting from future changes in interest rates

Insolvency: In the United States, a thrift institution is defined to be insolvent when its equity capital is negative. Insolvency refers to negative General Accepted Accounting Principles (GAAP) capital rather than negative capital measured according to Regulatory Accounting Principles (RAP), according to tangible net worth, or according to market value net worth.

JAWS: see Just a Warning System

Just a Warning System: a computer-based method for testing the financial performance of FIs by comparing selected bank ratios with established critical values.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: An index in factor analysis used to compare the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. Small values for the DMO measure indicate that a factor analysis of the variables may not be a good idea, since correlations between pairs of variables cannot be explained by the other variables. Kaiser (1974) characterises measures in the 0.90's as marvellous, in the 0.80's as meritorious, in the 0.70's as middling, in the 0.60's as mediocre, in the 0.50's as miserable, and below 0.5 as unacceptable.

Liquidity: the nearness to money or ease with which an asset can be sold or converted into money on short notice at a predictable price with little cost

Liquidity Risk: the risk that a FI will be unable to translate assets into cash in sufficient quantities to fund deposit withdrawal

Loan Classification: the determination of loans as substandard, doubtful, and lost is made by the examiners who have the opportunity to evaluate loans. The category into which a loan falls is determined by a combination of factors, but mainly by the manner in which the loan is being repaid (if at all), and the quality of its collateral.

Management Risk: the risk that management may make poor or detrimental decisions either for personal reasons or because of inexperience

Management Quality: the ability of senior management, generally considered to be vice-presidents and above, to manage the FI. It generally reflects on their experience levels, and personal inclinations that may be different from the best interest of the FI.

Moral Hazard: arises when a situation exists where a person/business entity gains benefits from a situation that is not reflected in the cost of being put in a

situation. The term originated in insurance contracts to represent situations where insurance coverage caused insured parties to take less care of their properties than they might otherwise. In the case of financial institutions, the intervention of deposit insurance means that the financial institution may take greater risks with depositors' funds with the deposit insuring company ultimately responsible for such risk taking.

Mortgage and Loan Company: See also Financial Institution, Chartered Bank, Trust Company, Credit Union

Multivariate Discriminant Analysis: an extension of univariate analysis of variance. The basic assumptions of the technique are i)the groups being investigated are discrete and identifiable; ii)each observation in each group can be described by a vector of m variables or characteristics, and iii)these m variables are assumed to have a multivariate normal distribution in each population.

National Bank Surveillance System: implemented by the U.S. Office of the Comptroller of the Currency. Depends on a detailed analysis of many statistical and subjective factors including examiners' subjective evaluations. See also Office of the Comptroller, System-wide Minimum Surveillance Program.

National Credit Union Share Insurance Fund: established in 1970 amendments to the credit union act, an insurance fund from which credit unions may purchase deposit insurance (U.S.)

NBSS: See National Bank Surveillance System

NCUSIF: see National Credit Union Share Insurance Fund

Near Banks: financial intermediaries whose operations are similar to those of the chartered banks but who are not allowed to call themselves banks or their activities banking

Net Interest Expense: all interest expenses accruing from deposits

NIX: see net interest expense

NPL: see Non-performing Loans

Non-Performing Loans: those loans as defined as technically non-performing. Depending on statutory requirements, the are defined as those loans that have not received payment of principal or interest for either 60 or 90 days.

OCC: See Office of the Comptroller of the Currency

Office of the Comptroller of the Currency: supervisor for all U.S. national banks

Office of Thrift Supervision: successor to the FHLBB in 1989, was charged with the responsibility for resolving all thrift institutions that were insolvent according to Regulatory Accounting Principles. From August, 1989 through September 1992, the OTS closed 643 thrifts institutions and placed an additional 72 into conservatorship awaiting final resolution. The present-value cost to the U.S. Treasury of these resolutions has been estimated by the General Accounting Office to be more than $100 billion.

Office of the Superintendent of Financial Institutions: A Canadian position created subsequent to the failures of the Northland and Canadian Commercial Banks. It supervises and regulates all Canadian federally chartered trusts and banks.

OSFI: see Office of the Superintendent of Financial Institutions

Other Problem (problem bank classification by FDIC): A banking situation involving a significant weakness with a lesser degree of vulnerability than serious problem - potential payoff or serious problem classified FIs. It requires aggressive supervision and more than ordinary concern by the FDIC. see also Problem Bank, Serious Problem - Potential Payoff, and Serious Problem

OTS: see Office of Thrift Supervision

Office of Thrift Supervision: successor to the Federal Home Loan Bank Board (FHLBB), it was charged with responsibility for resolving all thrift institutions that were insolvent according to Regulatory Accounting Principles. From August 1989 through September 1992, the OTS closed 643 thrifts institutions and placed an additional 72 into conservatorship awaiting final resolution. The present-value cost to the U.S. Treasury of these resolutions has been estimated by the General Accounting Office (GAO) to be more than $100 billion, U.S..

Overhead Risk: results when high operating expenses drive management into speculative ventures

Problem Bank: a bank that appears to have financial difficulties (short of insolvency). It has violated a law or regulation or engaged in an "unsafe and unsound" banking practice to such an extent that the present or future solvency of the bank is in question. Problem FIs are identified during bank examinations, and the final decision, based on regional recommendations, lies with the Washington office of the FDIC. There are three classifications of problem FIs in declining levels of seriousness as defined by the FDIC serious problem - potential payoff, serious problem, and other problem. A bank could be classified as a problem bank for various reasons. Some examples include i)poor asset

condition due to present and/or prior management (inadequate capital given a certain combination of management and assets); ii)present and/or prior management engaging in self-serving management techniques; iii)Defalcation and/or irregularities; iv)economy; v)out of area loans; vi)others such as cheque kites, contingent liabilities, link financing, poor earnings, capital-deposit growth. See also Serious Problem - Potential Payoff, Serious Problem, and Other Problem.

Quebec Deposit Insurance Board: Insurance organisation set up in Quebec to fund all provincially licensed trusts and credit unions

SAIF: see Savings Association Insurance Fund

Savings Association Insurance Fund: federal deposit insurance fund for thrifts and a subsidiary of the FDIC (U.S.)

Serious Problem (problem bank classification by FDIC): A banking situation that threatens ultimately to involve the FDIC in a financial outlay unless drastic changes occur. See also Problem Bank, Serious Problem - Potential Payoff, and Other Problem

Serious Problem - Potential Payoff (problem bank classification by FDIC): An advanced, serious problem bank presenting at least a 50% chance of requiring FDIC financial assistance in the near future. See also Problem Bank, Serious Problem, and Other Problem.

Strategy Risk: the risk that the current long-term management policy will result in financial loss

Substandard Category (adverse asset classification): includes loans which have positive, well defined weaknesses which jeopardise the orderly liquidation of the debt. Such loans are inadequately protected by the current sound worth and paying capacity of the obligor, or pledged collateral, if any. They are characterised by a degree of risk which poses the distinct possibility that the FI will likely sustain some loss if the deficiencies are not corrected. See al Adversely Classified Asset.

System-wide Minimum Surveillance Program: Implemented by the Federal Reserve System. Depends on a detailed analysis of many statistical and subjective factors including examiners' subjective evaluations. See also Federal Reserve System, National Bank Surveillance System.

Test for Significance: Uses the Standardised Normal Distribution. Calculates the probability that a difference at least as large as the one observed would occur if two population means were equal. It is used in this thesis to determine whether the means/standard deviation results for the twenty two independent variables for

the failed trusts can be statistically differentiated from those of the healthy trusts. The t-value formula is as follows: ((sample mean failed) - (sample mean healthy)) / The square root of [((standard deviation squared failed)/sample number failed) + ((standard deviation squared healthy)/sample number healthy)]. This is compared to the normal distribution value for 90% confidence interval (1.645) and the normal distribution value for 95% confidence interval (1.96) for a two-tailed test.

Trust Companies: originally established because, under common law, corporations were not allowed to act as trustees. Can be either federally or provincially incorporated, although currently most are provincially licensed. The single most important group of near-banks in Canada. See also Financial Institution, Chartered Bank, Mortgage and Loan Company, Credit Union.

URS: see Uniform Rating System

Uniform Rating System: the three U.S. federal banking agencies: Federal Deposit Insurance Corporation (FDIC), Federal Reserve Board (FRB), and Office of the Comptroller of the Currency (OCC), adopted the Uniform Financial Institutions Rating System on November 26, 1979 to evaluate the condition of individual FIs. It blends performance indicators from each agency's previous performance evaluation system into a consistent set of evaluation rules. Five key areas of FI performance - capital adequacy, asset quality, management capability, earnings, and liquidity, summarised by the acronym CAMEL, are both individually rated and combined into a composite rating that groups FIs from one (best) to five (worst).

Wholesale deposits: relatively large deposits solicited by depository institutions other than through their retail outlets.