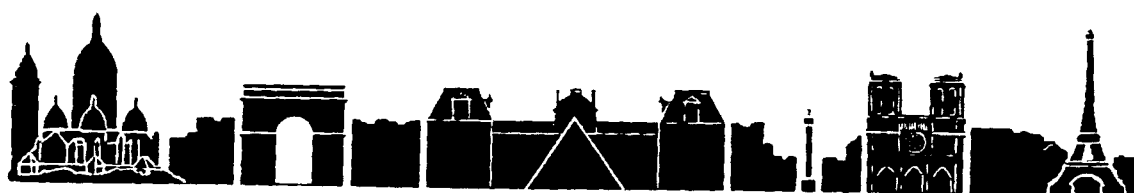


# Approche actuarielle des risques financiers

# 1

1<sup>er</sup> Colloque international AFIR - PARIS 23 - 27 Avril 1990

---



1<sup>st</sup> AFIR international colloquium - PARIS April 23<sup>rd</sup> - 27<sup>th</sup>

---

# 1

# Actuarial approach for financial risks

# SOMMAIRE

## VOLUME 1

### Risques des institutions financières Financial institution risks

- Contribution n°1 : The financial structure of pension plans.  
Michael COHEN (Canada) page 1
- Contribution n°2 : Formulating a pricing policy for financial  
service conglomerates.  
Ashok.K. GUPTA, Michael. BLACK (Grande - Bretagne) page 13
- Contribution n°3 : The current state of asset / liability modelling in the U.K.  
Andrew. J. WISE, Matthew. J. ANNABLE  
(Grande - Bretagne) page 27
- Contribution n°4 : An actuarial approach to the analysis of post  
deregulation thrift failures in the USA.  
Andrew. F. THOMPSON, Prasad V. MEDURY,  
Anju et Balasubramani RAMJEE (Etats-Unis) page 35
- Contribution n°5 : Normes de solvabilité des institutions financières  
et traitement des filiales à l'intérieur de ces normes.  
Michel GIGUERE (Canada) page 59
- Contribution n°6 : Perspectives du risque dans les opérations  
de crédit des sociétés financières.  
Roberto GORGUES, Vicente SERRA (Espagne) page 87
- Contribution n°7 : La relativité des valorisations financières  
et l'approche prudentielle du risque de taux :  
le cas des activités bancaires en France.  
Dominique GARABIOL (France) page 103

CONTRIBUTION N° 04

AN ACTUARIAL APPROACH  
TO THE ANALYSIS  
OF POST DEREGULATION  
THRIFT FAILURES  
IN THE USA

---

PAR / BY

Andrew. F. THOMPSON, P. V. MEDURY, A. RAMJEE, B. RAMJEE

Etats Unis / Unites States

---

UNE APPROCHE ACTUARIELLE DE  
L'ANALYSE DES FAILLITES DES  
ORGANISMES D'EPARGNE AUX  
ETATS UNIS A LA SUITE DE LA  
DEREGLEMENTATION

36 UNE APPROCHE ACTUARIELLE DE L'ANALYSE DES FAILLITES  
DES ORGANISMES D'ÉPARGNE AUX ETATS - UNIS, À LA SUITE DE  
LA DÉRÉGLEMENTATION

A.F. THOMPSON

**RESUME**

**Analyse selon le statut : fédéral ou étatique**

Des modèles tabulaires non ordonnés ont été élaborés pour les deux domaines de comparaison suivants : (1) 53 organismes d'épargne à statut étatique faillis, comparés à 515 organismes d'épargne bien - portants ; et (2) 61 organismes d'épargne à statut fédéral faillis, comparés à 515 organismes d'épargne bien - portants. Ces deux modèles ont été élaborés en utilisant des données financières concernant les 115 organismes d'épargne faillis et les 515 organismes d'épargne bien - portants, durant la période de 1984 à 1985, et validés sur 97 organismes d'épargne faillis (40 à statut d'Etat et 57 à statut fédéral) et 352 organismes d'épargne bien - portants, au cours des trois premiers trimestres de l'année 1986. La validation est effectuée en utilisant les données financières de l'échantillon présenté (97 organismes d'épargne faillis et 352 bien-portants), durant trois périodes ayant précédé la faillite, à savoir le quatrième trimestre 1985, le deuxième trimestre 1985 et le quatrième trimestre 1984. Ceci permet une comparaison de la capacité de prédiction des modèles élaborés à partir de données financières antérieures à la faillite, pour un nombre croissant de périodes antérieures à la faillite.

**A. Comparaison des organismes d'épargne faillis et bien - portants - statut étatique**

Le Tableau 2 donne les coefficients des variables significatives aux niveaux 0,05, 0,1 et 0,15 dans la comparaison de 53 organismes d'épargne à statut étatique faillis avec 515 organismes d'épargne bien - portants. Le BDTL, le MFTA, le TA, le FHLBA, le DOETE et le terme d'interception sont des variables explicatives significatives. L'adaptation du modèle est hautement significative avec un coefficient statistique khi-carré de 326,59.

La signification du signe du coefficient des variables peut être expliquée comme suit. Comme "0" indique la faillite d'un organisme à statut étatique et "1" indique la non faillite, un coefficient positif (ou négatif) représente une corrélation négative (ou positive) avec la faillite et une corrélation positive (ou négative) avec la non faillite. Les résultats obtenus indiquent que la faillite des organismes d'épargne à statut étatique présente une corrélation négative avec TA, mais une corrélation positive avec BDTL, MFTA, FHLBA et DOETE. Ainsi, les organismes d'épargne à statut étatique faillis, dépendent plus de dépôts non traditionnels (par exemple des dépôts sur titres), ont plus de saisies hypothécaires classiques, sont plus obérées par des avances FHLB à payer à court terme, et dépensent plus en frais de gestion et de personnel, mais sont plus petites que les organismes d'épargne bien - portants.

Le Tableau 3 donne des détails sur les exactitudes de classement au cours de l'estimation (c'est-à-dire de 1984 à 1985) et pour les trois périodes d'étude (c'est-à-dire premier trimestre 1985, second trimestre 1985 et quatrième trimestre 1984), antérieures à la

faillite des organismes d'épargne durant les trois premiers trimestres de 1986. Les indices C et Dyx de Somer sont utilisés pour évaluer la capacité de prévision des modèles. Alors que l'indice C indique la fraction de l'ensemble des paires pour lesquelles les valeurs calculées et observées sont concordantes, et est utilisé pour tester les probabilités calculées pour le groupe négatifs vrais, le Dyx de Somer est un indice de corrélation de niveau entre les probabilités calculées et les résultats observés.

La Partie A du Tableau 3 indique que le taux global de classement correcte durant l'estimation est de 99,12% avec des valeurs de C et de Dyx très proches de 1,00, avec une légère décroissance durant la période d'observation.

Le modèle a une exactitude globale de 96,77% durant le trimestre le plus proche des faillites en 1986 (c'est-à-dire le quatrième trimestre 1985) mais présente des exactitudes également impressionnantes de 95,04% et de 93,98%, quand la période précédant la faillite en 1986 augmente de trois (deuxième trimestre 1985) à cinq trimestres (quatrième trimestre 1984). Les paramètres statistiques C correspondant sont impressionnants, bien que présentant une décroissance jusqu'à 0,690, pour le trimestre le plus antérieur à la faillite en 1986 (quatrième trimestre 1984).

Dans les tableaux de classement, les faillites des organismes d'épargne à statut étatique sont prévues avec une exactitude de 96,23%, durant la période d'estimation, avec des exactitudes associées à chacune des périodes de mesure allant de 70 à 75% pour les trois périodes de mesure antérieures à la faillite.

#### B. Comparaison des organismes faillis et bien - portants - statut fédéral

Les résultats du classement de 61 organismes d'épargne à statut fédéral faillis, comparés à 515 organismes d'épargne bien - portants, sont donnés dans les Tableaux 2 et 3. Le Tableau 2 indique que les coefficients SLTA, MLTA et MFTA sont significatifs et que le modèle élaboré présente un coefficient statistique khi carré hautement significatif de 331,94. La faillite des organismes d'épargne à statut fédéral est en corrélation positive avec les quantités de prêts hypothécaires faiblement évolutifs (SLTA) et les faillites hypothécaires classiques (MFTA), mais en corrélation négative avec le niveau de prêts hypothécaires à évaluation rapide (MLTA). Ainsi, des variables reflétant la qualité des actifs semblent être significatives pour expliquer les faillites d'organismes d'épargne à statut fédéral (en comparaison des organismes non faillis).

La Partie B du Tableau 3 montre que les taux de classements corrects du modèle durant les périodes d'estimation et de mesure sont très élevés, avec des exactitudes globales de classement de 98,61% durant l'estimation et des exactitudes pour les périodes de mesure allant de 94,54% pour le quatrième trimestre 1985 à 92,53% pour le quatrième trimestre 1984. L'indice des paires concordantes, C, est très élevé, et dépasse 0,9 durant les périodes d'estimation et de mesure. Ainsi, le modèle élaboré donne des résultats très impressionnants en matière de classement des organismes d'épargne à statut fédéral faillis, par rapport aux organismes d'épargne bien - portants.

L'exactitude de classement des organismes d'épargne à statut fédéral faillis est très élevée, atteignant un taux de 93,44% durant l'estimation, et cohérent durant les périodes de mesure, c'est-à-dire que les exactitudes afférentes à ces périodes vont de 68,63% pour le quatrième trimestre 1985 à 66,63% pour le quatrième trimestre 1984.

**Analyse selon le type de société : mutuelle ou société par actions**

En un premier temps, des statistiques résumées à une seule variable sont établies pour les deux groupes d'organismes d'épargne faillis : à statut mutuel et à statut de société par actions (s.p.a.). Des modèles tabulaires non ordonnés sont ensuite élaborés pour les deux domaines d'intérêt suivants : (1) 60 organismes d'épargne à statut de société mutuelle faillis, en comparaison de 515 organismes bien - portants ; et (2) 55 organismes d'épargne à statut de s.p.a. faillis, en comparaison de 515 organismes bien-portants. Ces modèles sont élaborés en utilisant des données financières concernant 115 organismes faillis et 515 organismes bien - portants durant la période 1884 - 1985 et validés sur 97 organismes d'épargne faillis (52 mutuelles et 45 sociétés par actions) et 352 organismes d'épargne bien - portants, durant les trois premiers trimestres de 1986. La validation est effectuée en utilisant des données financières concernant les 97 organismes faillis et les 352 organismes bien - portants (choisis durant les trois premiers trimestres de 1986), durant trois périodes antérieures à la faillite effective, à savoir le quatrième trimestre 1985, le deuxième trimestre 1985 et le quatrième trimestre 1984.

**A. Statistiques univariabiles**

Les moyennes variables pour les deux groupes d'organismes d'épargne à statut mutuel et à statut de s.p.a. faillis sont données dans le Tableau 4, avec leur coefficients statistiques respectifs, les valeurs de  $t$  donnant les résultats du test  $t$ , effectué pour examiner l'hypothèse d'équilibre correspondant à des moyennes de variables homogènes pour les deux groupes (en supposant des dispersions des groupes inégales). Le Tableau 4 montre que les deux groupes ont des moyennes de variables homogènes, pour les coefficients LACL, TETR, PROF, RNWTA, JCDTL, BDTL, SLTA, MLTA, ITA, ADLTA, DOETE, INTINC et DEFNI.

Les organismes d'épargne à statut mutuel faillis ont des disponibilités marginalement plus élevées (LACL plus élevé) et sont plus rentables (c'est-à-dire ont un PROF négatif inférieur et un TETR inférieur), que les organismes d'épargne à statut de s.p.a. faillis. Concernant les mesures portant sur la composition des dépôts, les organismes d'épargne à statut de s.p.a. faillis se sont plus reposés sur des dépôts non classiques, sensibles aux intérêts tels que les très gros certificats de dépôt et les dépôts sur titres, que les organismes d'épargne à statut mutuel faillis. Une analyse des mesures de la qualité des actifs montre que les organismes d'épargne à statut de s.p.a. faillis présentent un plus haut taux de prêts hypothécaires et commerciaux à évolution lente, par rapport aux dits prêts à évaluation rapide, ont des investissements directs et des participations dans des sociétés de services, et ont de plus hauts taux de prêts d'acquisition et de développement. Enfin, alors que les organismes d'épargne à statut mutuel faillis présentent un taux plus faible de situations nette RAP négatives et ont des frais de direction et de personnel plus faibles, se sont plus reposés sur les gains financiers (par rapport à l'ensemble des chiffres d'affaire générés) et ont encouru plus de pertes sur des ventes d'actifs, si on les compare aux organismes d'épargne à statut de s.p.a. faillis.

Ainsi, des différences significatives se manifestent entre les organismes d'épargne faillis, relevant des deux types de statut de société, dans les ampleurs des disponibilités, la

rentabilité et de l'efficacité, la composition des dépôts, la qualité des actifs, l'adéquation des capitaux et de l'exposition aux risques des taux d'intérêt. Toutefois, les organismes d'épargne faillis, à statut mutuel et de s.p.a., sont d'importance similaire, celle-ci étant mesurée par leurs actifs totaux. Des publications antérieures ont suggéré que les organismes d'épargne de statut mutuel bien - portants sont moins rentables et performantes, disposent de capitaux moins adéquats et ont une plus faible tolérance au risque, en comparaison des organismes à statut de s.p.a également bien - portants.

#### B. Elaboration du modèle

Le Tableau 5 donne des coefficients des variables significatives (aux niveaux 0,01, 0,05 et 0,1) en comparant : (1) 60 organismes d'épargne faillis comparés 515 organismes bien - portants et (2) 55 organismes d'épargne à statut de société par action faillis comparés à 515 organismes bien - portants. La signification du signe du coefficient de la variable peut être expliquée comme suit : comme le groupe "0" signale les organismes d'épargne faillis (pour les deux premières comparaisons) et le groupe "1" indique les organismes bien - portants (pour les deux premières comparaisons), un coefficient positif (négatif) représente une corrélation négative (positive) avec la faillite et positive (négative) avec la non faillite.

Le premier modèle élaboré fait la distinction entre les organismes d'épargne à statut mutuel faillis et les organismes bien - portants. BDTL, MLTA, TA et DEFNI sont des variables significatives. L'adéquation du modèle a un coefficient statistique khi carré de 384,71, hautement significatif, au niveau 0,01. L'analyse des signes des coefficients des variables significatives indique que les DTL, MLTA et DEFNI sont en corrélation négative avec la probabilité de faillite, puisque la taille des organismes d'épargne (mesurée par ses actifs totaux) est en corrélation positive avec leur faillite.

La probabilité de faillite des organismes d'épargne à statut mutuel est d'autant plus basse que le niveau de leur dépôt en titres est élevé et que la qualité des prêts hypothécaires est bonne. Toutefois, lorsque la taille des mutuelles augmente, la probabilité de faillite augmente également. Seul le signe de DEFNI n'apparaît pas correspondre logiquement à la prédiction de faillite.

Le second modèle compare les organismes d'épargne à statut de s.p.a. faillis à des organismes bien - portants. Les variables explicatives significatives sont SLTA, ADLTA, FHLBA, COST et INTINC. Le modèle a un terme constant significatif et est hautement significatif au niveau 0,01 (avec un coefficient khi carré de 312,92). L'analyse des variables significatives indique que SLTA, ADLTA, FHLBA et COST sont en corrélation positive avec la probabilité de faillite, alors que INTINC est en corrélation positive avec l'absence de faillite.

La probabilité de faillite des organismes d'épargne à statut de s.p.a. est d'autant plus grande que les niveaux des prêts hypothécaires, ainsi que des prêts pour acquisition et au développement de mauvaise qualité (c'est-à-dire faiblement évolutif), sont élevés, que les avances FHLB dûes à court terme sont importantes et que les coûts des capitaux empruntés sont élevés. Toutefois, les organismes d'épargne à statut de s.p.a. qui génère une proportion plus élevée de leur chiffre d'affaire à partir du revenu financiers paraissent avoir moins de chance de faire faillite.

Les exactitudes de classement des deux modèles durant les périodes d'élaboration (à partir des données de la période 1984 - 1985) et des trois périodes de validation (c'est-à-dire quatrième trimestre 1985, deuxième trimestre 1985 et quatrième trimestre 1984) antérieures à la faillite effective au cours des trois premiers trimestres 1986 sont données dans le Tableau 6. Les deux indices importants utilisés pour apprécier la puissance de prédiction du modèle sont C et le Dyx de Somer. C indique la fraction de l'ensemble des paires pour lesquelles les valeurs calculées et observées sont concordantes, et est utilisé pour tester si les probabilités calculées pour le groupe positifs vrais (le groupe "1") sont différentes des probabilités calculées pour le groupe négatifs vrais (c'est-à-dire le groupe "0"). Le Dyx de Somer est un indice de corrélation de niveaux entre les probabilités calculées et les résultats observés. L'exactitude de prédiction du modèle est d'autant meilleure que les niveaux de C et de Dyx sont élevés.

Les deux modèles présentent des taux d'exactitude de classement et des valeurs C et Dyx très élevées durant la période d'estimation (1984 - 1985). Le premier modèle classe correctement 96,67% des organismes d'épargne à statut mutuel faillis, alors que le deuxième modèle classe correctement 90,74% des organismes d'épargne à statut de s.p.a. faillis. Toutes les valeurs de C dépassent largement 0,90, ce qui indique une exactitude de prédiction très élevés pour les deux modèles.

Les résultats de la validation pour les trois premiers trimestres de 1986 sont également donnés dans le Tableau 6. Le premier modèle classe correctement 76,19% des mutuelles faillies durant les trois premiers trimestres de 1986, à partir de données financières du quatrième trimestre 1985. Quand la période précédant la faillite effective en 1986 augmente, l'exactitude de prédiction de faillite du modèle décroît à 63,93% si l'on utilise les données du deuxième trimestre 1985, et à 52,54% en utilisant les données du quatrième trimestre 1984. Toutefois, les valeurs de C pour les trois périodes d'observation dépassent 0,90, ce qui indique clairement que la capacité de prédiction du modèle est impressionnante, que les données utilisées soient celles de la période 1 à 9 mois (quatrième trimestre 1985), 7 à 15 mois (deuxième trimestre 1985) ou 13 à 21 mois (quatrième trimestre 1984) avant la faillite observée en 1986.

Des résultats de validation aussi impressionnants sont obtenus pour le deuxième modèle, qui prédit la faillite des organismes d'épargne à statut de s.p.a., par rapport à la non faillite. L'exactitude de prédiction de faillite des s.p.a. décroît de 76,67%, lorsque l'on utilise les données de la période de 1 à 9 mois avant les faillites effectives en 1986, à 54,24%, résultat obtenu en utilisant les données des mois 13 à 21 avant la faillite. Là encore, les valeurs de C durant la période de validation sont très élevées, allant de 0,972, pour les données du quatrième trimestre 1985, à 0,899 pour les données du quatrième trimestre 1984.



AN ACTUARIAL APPROACH TO THE ANALYSIS OF POST 41  
DEREGULATION THRIFT FAILURES IN THE U.S.A.

BY

A.F. THOMPSON  
ASSOCIATE PROFESSOR OF FINANCE  
UNIVERSITY OF CINCINNATI  
CINCINNATI, OHIO 45221  
(513) 556 - 7075

PRASAD V MEDURY  
ASSISTANT PROFESSOR OF FINANCE  
COLLEGE OF BUSINESS ADMINISTRATION  
EASTERN KENTUCKY UNIVERSITY  
RICHMOND, KENTUCKY 40475  
(606) 622 - 2161

ANJU RAMJEE  
ASSISTANT PROFESSOR OF FINANCE  
COLLEGE OF BUSINESS ADMINISTRATION  
NORTHERN KENTUCKY UNIVERSITY  
HIGHLAND HEIGHTS, KENTUCKY 41076  
(606) 572 - 5158

BALASUBRAMANI RAMJEE \*\*  
ASSISTANT PROFESSOR OF FINANCE  
COLLEGE OF BUSINESS ADMINISTRATION  
NORTHERN KENTUCKY UNIVERSITY  
HIGHLAND HEIGHTS, KENTUCKY 41076  
(606) 572 - 5695

**I - INTRODUCTION**

Financially distressed thrifts are deemed to be failures when they are liquidated or merged by the Federal Savings and Loan Insurance Corporation (FSLIC) (currently replaced by the Savings Association Insurance Fund (SAIF)). During the seven year period from 1980 to 1986, the thrift industry has experienced a large increase in the frequency and magnitude of losses in failed thrifts,<sup>1</sup> leading to considerable legislative action by the Congress and other regulatory bodies.<sup>2</sup>

A sufficient condition for insolvency of uninsured thrift institutions, with currently due obligations, is when the market value of the institution's assets falls below the present value of its contractual obligations (Brickley and James, 1986). However, insolvency for an insured thrift institution is determined by the insuring agent rather than economic forces.<sup>3</sup>

Brickley and James (1986) show that modification of the meaning of the term "insolvency" during periods of financial distress helps avoid a significant number of

---

\*\* Contact Author

institution failures, and also increases the value of future deposit guarantees. Smith (1986) shows that regulatory agencies may constrain the operations of financially distressed institutions prior to failure and insolvency. Hence, given that the regulator (insurer) decides when to revoke an institution's charter and/or deposit guarantees, the decision about whether an institution has failed or not is essentially a regulatory one.

The FSLIC has a limited number of options available to resolve failure of an institution. The options are liquidation, merger (with or without significant costs), the provision of financial assistance through FSLIC and the Bank Board system, or use of the Management Consignment Program (MCP).<sup>4</sup>

FSLIC failure cost estimates reveal that resolution costs as a percentage of total assets for failed thrifts requiring FSLIC assistance increased from 11.4% in 1980 to 14.2% in 1986. Further, the 600 odd thrift failures between 1980 and 1986 (with assets exceeding \$120 billion) represent about 15% of all healthy thrifts in 1980. In comparison, about 300 commercial banks (insured by the Federal Deposit Insurance Corporation (FDIC) and currently replaced by the Bank Insurance Fund (BIF)) with assets of \$35 billion, failed between 1980 and 1985. These failed banks represent only about 2% of all active banks in 1980.

A substantial amount of literature on the failure of financial institutions is devoted to the problem of moral hazard associated with governmental deposit insurance (Avery and Hanweck (1984), and Benston (1984)). According to the moral hazard problem, the managers of some thrifts take inordinately high investment risks with depositor monies knowing that the government will fully back deposits in the event of extreme losses. This is especially true in the case of state chartered thrifts which assume greater risks and are perhaps less well supervised by regulatory bodies.

It has been argued (refer Carroll, Kalambokidis and Kise (1986)) that the imposition of higher capital requirements on thrifts may reduce the moral hazard problem with respect to the frequency and severity of failures. During the period from 1933 to 1980 (i.e., prior to deregulation of the thrift industry), the majority of thrifts operating under FSLIC coverage were run under a mutual form of organization. However, since 1980, an increasing number of FSLIC insured S&Ls have sought additional capital by converting to a stock form of organization. This investigation considers the mode of charter as an explanatory variable to explain how differences in risks assumed and capital structures might impact on the survival of thrifts.

The FHLBB has attempted to strengthen the capital adequacy of S&Ls by liberalizing its regulations regarding the conversion of federally chartered thrifts from the mutual to stock type of ownership in April 1981, and later permitting state chartered mutually owned institutions to convert to federally chartered stock owned thrifts. Since such conversions can potentially alter the nature of the thrift industry, this has generated considerable argument. While some researchers (Scott and Hester (1987)) argue that such conversions would eliminate the current benefits derived from the mutual form of organization by disrupting the industry's stability and increasing costs to borrowers, others (refer Brigham and Pettit) state that the stock form of organization would offer more incentives for greater profitability, cost efficiencies, rapid growth and higher risk tolerance.

There is limited evidence regarding whether differences exist between the mutual and stock forms of organization. Simpson and Kohers (1979) indicate that stock owned thrifts are more aggressively managed, while Smith and Kaplan (1977) provide considerable evidence supporting conversion to the stock form. The effect of converting a thrift from the mutual to stock form has been investigated by Masulis (1987), and Jordan, Verbrugge and Burns (1988), among others. There is conclusive evidence that conversions yield significant abnormal returns to the common stockholders of converting thrifts. However, since no research has been done on the impact of the form of organization on the failure or survival of thrifts, this study provide evidence on the role played by the form of organization (i.e., mutual vs. stock) in determining the failure of FSLIC insured thrifts in the post deregulation era.

Given the increase in the magnitude and severity of FSLIC losses during the last few years, several research issues arise. First, this paper considers the elements of a graded premium structure that may be used to cover thrift institutions with different risk characteristics. Second, logit analysis is conducted on S&L data during 1984 - 1986 to identify the financial characteristics that could be used to define risk - adjusted deposit insurance premiums. Third, this study determines whether failed thrifts by the modes of charter (i.e., state vs. federal) and ownership (i.e., mutual vs. stock) are different in their risk characteristics. Logit models are developed for failed federally chartered vs. failed state chartered thrifts and for failed mutually owned vs. failed stock owned thrifts. Finally, this study examines the predictive capability of the logit models developed on failure data for the first three quarters of 1986.

This paper is organized as follows. Section II briefly reviews important empirical contributions in the area of bank and thrift failures. Development of a graded premium structure for thrift deposit insurance is discussed in Section III. The data collection, variable selection and methodology processes are covered in Section IV. Development of logit models and testing of the predictive capabilities of various models are discussed in Section V. Finally, this paper concludes with a review of the significance of the empirical results of this investigation.

## II - REVIEW OF PRIOR LITERATURE

Previous studies in the area of failure of financial institutions concentrate on identifying the determinants of closure using a test sample of failed institution and a matched sample of non - failed (i.e., healthy) institutions. Numerous studies attempt to develop early warning systems of failure of commercial banks (e.g., Avery and Hanweck (1984), Martin (1977), and Sinkey (1978)). However, there are a limited number of studies focusing on the determinants of failure of savings and loan associations (Altman (1977), Block (1969), Barth, Brumbaugh, and Sauerhaft (1986), Barth, Brunbaugh, Sauerhaft and Wang (1985), Benston (1985), Pantalone and Platt (1987), and Rudolph and Hamdan (1988)). Further, to the knowledge of the authors, there is only one significant study dealing with closure of credit unions (Kharandia and Colins (1983)).

Studies dealing with failure of thrifts and commercial banks are aimed at identifying the underlying determinants of failures and developing failure prediction models. These

studies use ratios which can be accessed promptly from information contained in reported financial statements. Such financial ratios are developed to represent profitability, capital adequacy (i.e., net worth sufficiency), and various types of risks such as credit, interest-rate and liquidity risks. Capital adequacy is considered to be very important as it provides a buffer against future losses and also helps offset the problem of moral hazard caused by fixed rate deposit insurance.<sup>5</sup>

Earlier studies in thrift failure (e. g., Altman (1977)), predict thrift failures significantly. However, such studies use data from the 1960's and 1970's (i.e., prior to deregulation of thrifts), unlike the economically turbulent 1980's for the thrift industry. Altman (1977) uses multiple discriminant analysis (MDA) to classify serious problem v. temporary problem S&Ls for the period from 1966 to 1973. His results show efficiency (i.e., the ratio of net to gross operating income), capital adequacy (i.e., the ratio of surplus to net worth, change in net worth to total assets) and financial risk (i.e., borrowed funds to total savings) to be the important explanatory dimensions of failure.

Barth, Brumbaugh, Sauerharft and Wang (BBSW) (1985) consider the causes of thrift failures and develop models to estimate the regulator's closure rule for insolvent thrifts. They use multinomial logit analysis to examine the failure of 318 insolvent thrifts during 1981 - 1983. Their analysis uses net worth, profitability, interest rate risk, credit risk, and liquidity variables to explain failure. Their best logit model, specified six months prior to failure, relies on capital adequacy (ratio of net worth to total assets), net profit margin, liquidity ratio, and ratios of interest sensitive deposits to total assets and slow moving loans to total assets. However, their study is confined to semiannually reported thrift data for 1981 - 83.

Benston (1985) uses logit analysis to compare 178 closed v. 712 non - closed institutions for the period January 1981 - June 1985. Thus, his analysis considers both semiannually and quarterly reported thrift data. He uses 28 variables to conduct univariate and multivariate analysis, but his results show only capital adequacy and profitability (i.e., net income to total assets), interest and dividends to earning assets, and interest and fee income to earning assets) to be statistically significant.

More recently, Pantalone and Platt (1987), and Rudolph and Hamdan (1988) attempt to predict thrift failure. Pantalone and Platt (1987) use 15 failed S&Ls in the Boston district between 1981 - 84 to develop a regional early warning model. Their study uses MDA to distinguish between failed (15) and healthy (29) S&Ls in the Boston FHLB district and relies on 29 variables specifying leverage, liquidity, profitability, management efficiency, diversification and risk. Pantalone and Platt suggest leverage, liquidity, efficiency and deposit composition to be significant explanatory dimensions.

Rudolph and Hamdan (1988) use logit methodology to classify 26 failed thrifts during the period second quarter of 1984 to the first quarter of 1985. Thus, unlike the Pantalone and Platt study, their analysis uses quarterly reported thrift data. Similar to BBSW (1985), and Benston (1985), Rudolph and Hamdan use 18 financial variables specifying liquidity, profitability, capital adequacy, deposit composition and asset quality. They test the predictive accuracy of their logit models on 22 failed thrifts during the second quarter of 1985. Their results show capital adequacy, deposit composition and credit risk variables to be significant predictors of thrift failure.

In a very recent study, Elmer and Borowski (1988) utilize the CAEL (a framework employing capital, assets, earnings and liquidity characteristics) expert system to predict S&L failures and also to provide comparative evidence vis - à - vis earlier bankruptcy models developed using standard statistical analysis. Elmer and Borowski indicate that, during model development, the logit models used by BBSW (1985) for both the matched S&Ls sample and a sample consisting of the universe of S&Ls outperformed the expert system used for both samples. However, during validation on failure data for the first half of 1987, the expert system consistently outperforms the logit models used by BBSW.

### III - A GRADED MANUAL PREMIUM STRUCTURE FOR DEPOSIT INSURANCE

Graded deposit insurance premiums are based on actual loss experience incurred in covering S&Ls. The graded premium approach is self-correcting in that, this year's assessment is a function of last year's loss experience. The model presented here makes the following assumptions : (1) all institutions have met a minimal capital requirement of 1.5% of assets (2) an initial funding reserve of \$10 billion is available to the insurer (3) all elements of the S&L rescue plan remain in effect, however, premiums are increased by 1/4 of 1% of insured deposits to cover prospective loss experience and (4) no new S&L activities will be approved unless an actuarial study is made to determine their impact on insurer reserves. The third assumption is necessary to replenish FSLIC reserves lost from 1980 to 1984 and to develop a surplus to meet future loss experience. The fourth assumption is required in order to allow the experiential nature of the graded premium structure to work. An insurer cannot afford to relax underwriting standards to permit new S&L activities that impose additional loss exposure on reserve funds.

On the basis of the level of capital divide insured institutions into three risk premium classifications : (1) standard (2) 25% extra and (3) 50% substandard. Continued assignment of S&Ls into these classifications would depend upon risk factors identified by using logit analysis on prior loss experience. A substandard debit point system would be used by assigning points to S&Ls determined from the riskiness of their capital structure, management quality, mix of business, and size of loan write-downs. The deposit insurer would calculate a standard manual rate and then apply a 25% or 50% increased loading for substandard S&L risks. Premiums and risk classifications are revised every year as a result of new experience. The standard rate is calculated using the following aggregate reserve formulation :

$D$  = a moving average of FSLIC's loss rate on all claims using current year's experience excluding S&L failure data from 1980 through 1989. Each successive year's data would be added to the moving average until 10 years of information was included.

(VI)  $t$  = actual reserves on hand at the beginning of year  $t$ .

$I$  = the net yield on insurer reserves during year  $t$ , using the weighted investment yield on assets.

$(VT)_{t+1}$  = a target reserve for the beginning of year  $t + 1$ .

$rf_t$  = a risk - adjustment factor loading for year  $t$ , that alters premiums in relation to economic conditions.

$(Dep)_k$  = Amount of insured S & L deposits in premium class  $k$ ,  $k = 1, 2, 3$  or year  $t$ , in millions.

$(Dep)_1$  = amount of insured deposits in standard rated S & Ls.

$(Dep)_2$  = amount of insured deposits in 25% substandard rated S & Ls.

$(Dep)_3$  = amount of insured deposits in 50% substandard rated S & Ls.

$P$  = the net premium per \$ millions of insured deposits for S & Ls classed as standard.

If claims and premium income are uniformly distributed throughout the year, the present value of premium income to the deposit insurer is :

$$P\{(Dep)_1 + 1.25(Dep)_2 + 1.5(Dep)_3\} \quad (1)$$

the graded premium for each risk category multiplied by the dollars of insured deposits. The present value of future benefits has two components : (1) an amount covering actual incurred claims for the current year and (2) a reserve set aside to meet unexpected claims experience in the future. Actual claims are equal to the loss rate  $D$ , multiplied by insured deposits within each risk classification,  $(Dep)_k$ , adjusted by  $(1+i)^{-1/2}$  assuming claims occur on average during the middle of the year :

$$\text{Actual Claims} = \{D[(Dep)_1 + (Dep)_2 + (Dep)_3]\} (1+i)^{-1/2} \quad (2)$$

The reserve is developed under the assumption that FSLIC starts with an initial reserve position of \$10 billion (i.e.,  $(VI)_t = 10$ ), and desires a terminal year-end reserve position of  $(VT)_{t+1}$ . The beginning reserve  $(VI)_t$  in any given year accumulates to  $(1+i)(VI)_t$  at the end of the year. The difference between  $(VT)$  and  $(1+i)(VI)$  represents the amount of premium funding necessary to reach FSLIC's reserve objective  $(VT)_{t+1}$ . The difference, adjusted for macroeconomic changes and the middle of the year premium income assumption provides an estimate of required reserve funding for the year :

$$(1/rf_t) (1+i)^{-1/2} \{ (VT)_{t+1} - (VI)_t(1+i) \} \quad (3)$$

Equating the present value of premium income (1) with the present value of actual plus anticipated claim experience (i.e. (1) + (2)) :

$$P\{(Dep)_1 + 1.25(Dep)_2 + 1.5(Dep)_3\} = \{D[(Dep)_1 + (Dep)_2 + (Dep)_3] + (1/rf_t) [(VT)_{t+1} - (VI)_t(1+i)^{-1/2}]\} \quad (4)$$

The reserve variable  $(VT)_{t+1}$  is exogenous to the model. The insurer selects the terminal reserve it wants at the end of each year. Premiums are calculated in an effort to reach the final reserve position. The credibility of insurance premiums depends on the accuracy of claims and exposure information. This is an area where the FSLIC has been deficient in terms of developing a consistent method for recording, costing and assigning S&L failures to a particular year. Any premium formulation for deposit

insurance would need to include the following elements : (1) withdrawals from the system caused by merger, supervisory or otherwise, (2) withdrawals caused by failure (3) entrants of new associations either de novo or by state charter, and (4) the present value of the cost of S&L losses assigned to the year when the failures occurred. The graded premium structure also utilizes a risk factor loading that relates to the loss characteristics of insured institutions. The next section shows how these risk factors may be determined on the basis of loss experience between 1984 to 1986.

#### IV - DATA, VARIABLES AND METHODOLOGY

##### Data Collection

Data on thrift institutions for the eleven quarters' period from January 1984 to September 1986 have been compiled from information provided by the Federal Home Loan Bank board (i.e., Analysis and Evaluation Division, Mergers and Acquisition Division, and the Office of Regulatory Policy, Oversight and Supervision). After accounting for missing observations the final test sample consists of 212 failed thrift institutions and over 3000 non - failed thrifts.

The number of failures show a dramatic increase from 33 in 1984 to 97 in the first three quarters of 1986. Federally chartered failed thrifts are 119 in total (i.e., approximately 56% of all failed thrifts), while state chartered failed thrifts are 93 in total. Failed thrifts, whether state or federally chartered, show a steady increase over the test period. Mutually owned failed thrifts are 112 in total (i.e., approximately 53% of all failed thrifts), while stock owned failed thrifts total 100. Similar to state and federally chartered failed thrifts, mutually and stock owned failed thrifts show a steady increase over the study period.

Since one stage of empirical testing involves classifying failed thrifts vs. healthy thrifts, a control sample of healthy thrifts is developed by selecting non - failed institutions from the database provided by the FHLB Board (i.e., institutions that are not part of the FSLIC's failed institution case bank from 1984 to 1986). The matching healthy institutions are selected randomly from data in the same fiscal time period (i.e., same quarter during 1984 - 86) and district as the failed thrift. However, no further criterion, (e.g., size) is used to select matching healthy thrifts.<sup>6</sup> It should be noted that all healthy institutions for a particular district and time period (corresponding to the failed thrift's district and time period of closure) are retained in the control sample, subject to elimination of healthy thrifts which are duplicated or have missing data. Thus, the control sample of 867 healthy thrifts exceeds the test sample of 212 failed thrifts.

The resulting sample of failed and healthy thrifts include 115 failed thrifts (by both modes of charter) and 515 healthy thrifts (having positive net worth measured using GAAP and RAP net worth) during 1984 - 1985 (i.e., estimation) and 97 failed thrifts (by both modes of charter) and 352 healthy thrifts during the first three quarters of 1986 (i.e., holdout).

### Variable Selection

Examination and regulation of FSLIC insured S&Ls is the major factor in determining the data available for analyzing thrift institutions. The data collected by the FSLIC and the Federal Home Loan Bank Board (FHLBB) are directly related to their responsibility to provide a safe and sound savings system. In keeping with the data available for analyzing S&L failure, information used in past studies of institutional bankruptcy (Avery and Hanweck (1984), Barth, Brumbaugh, Sauerhaft, and Wang (1985), and Benston (1984)) and underwriting considerations for measuring S&L risk exposure, variables have been selected to conform with data available to supervisory agents working for the FHLBB over the period from 1980 to 1986. The process of selecting variables is also constrained by the fact that (1) the Bank Board went in March 1984 from collecting data on a semiannual to quarterly basis, (2) upon revising the frequency of data collection a number of variables obtained on a semiannual basis were eliminated, and (3) new sets of variables, such as, Schedule H items were refined and added over the period from 1980 to 1986.

Selection of variables followed the same general format as the financial literature on bank failure (Altman (1977), Barth, Brumbaugh, Sauerhaft, and Wang (1985), Benston (1984), Rudolph and Hamdan (1988) and Sinkey (1978)), i.e., dividing them into categories related to liquidity, profitability, capital adequacy, deposit composition, asset quality and other ratios. Other ratios refer to a number of financial variables related to specific financing and investment activities S&Ls engaged in over the period from 1980 to 1986. Table 2 provides a list of variables used in this investigation.

### Methodology

This study uses unordered logistic regression analysis (multinomial logit) as the methodology to classify failed v. non - failed thrift institutions based on a set of independent transformed variables and thus, develops prediction models for FSLIC insured thrift failures. Logit analysis is a widely used parametric classification procedure in finance and economics. Logit analysis involves far fewer restrictive distributional assumptions than other parametric classification procedures such as multiple discriminant analysis (i.e., logistic regression does not require multivariate normality of independent variables). Even where all of MDA's restrictive assumptions are met, logit analysis provides equally efficient parameter estimates and predictive accuracies. The unordered logit model allows the relative importance of different independent variables to vary across classifications.<sup>7</sup>

If  $Y_i$  denoted the independent variable of the  $i^{\text{th}}$  observation, then a vector of independent variables of the  $i^{\text{th}}$  observation is denoted by  $(X_{i1}, X_{i2}, \dots, X_{ip})$ , where  $p$  is the number of predictor variables.

$$X_{ib} = X_{i1} * b_1 + X_{i2} * b_2 + X_{ip} b_p \quad (5)$$

Further, where  $b = (b_1, b_2, \dots, b_p)$  denotes the vector of regression parameters. Logistic regression analysis assumes that the probability of  $Y_i$ , the dependent variable being equal to 1 is given by

$$1/(1 + \exp(-a - X_{ib}))$$



where  $a$  is the intercept term of the model. If the dependent variable is binary with a range of values of  $i = 0, 1, 2, \dots, K$ , then the model assumes that the probability that  $Y_i \geq j$  is as shown in equation (5), for  $j = 1, 2, \dots, K$ . The logit model may be viewed as

$$Y_i = a + X_i b + u_i \quad (6)$$

for each classification  $i$ . Then observation  $j$  belongs to classification  $i$ , if and only if  $Y_{ji} > Y_{jk}$  for all  $i \neq k$ . Thus unordered logit model requires  $u_i$  to have a weibull distribution.

## EMPIRICAL RESULTS

Logit models are developed for the following contrasts of interest : (1) failed thrifts vs. healthy thrifts, (2) failed state chartered thrifts vs. failed federally chartered thrifts and (3) failed mutually owned thrifts vs. failed stock owned thrifts.

Financial ratio data (listed in table 2) is generated for 115 thrifts which failed during 1984 and 1985 and 515 thrifts which did not fail during 1984 - 1985. Further, the 515 non-failed thrifts have positive GAAP (generally accepted accounting practices) net worth and RAP (regulatory accounting practice) net worth. This ensured that the sample of non-failed thrifts used to develop logit models did not include any "living dead zombies", but included only healthy thrifts with positive net worth.

The coefficients of the variables, used to develop logit models for 1984 - 1985, are then used to explain thrift failures in general and by the various modes of charter and ownership during the first three quarters of 1986. The models developed for 1984-1985 are used to generate probabilities of failure of thrifts for three periods (i.e., fourth quarter of 1984, second quarter of 1985, and the fourth quarter of 1985) prior to actual failure during the first three quarters of 1986. Thus, the three sets of probabilities assess the likelihood of failure and insolvency occurring an average of 1 - 9 months, 7 - 15 months and 13 - 21 months before actual failure, where such probabilities are considered to be independent variables in logit analysis during validation.

A. Failed vs. Healthy Thrifts : Table 3 provides the coefficients for the logit model contrasting 115 failed thrifts during 1984 - 85 with 515 healthy thrifts with positive GAAP net worth during 1984 - 85.

The significance of the sign of the independent variables' coefficient may be explained as follows. Since "0" denotes failure and "1" denotes non-failure, a positive (negative) coefficient represents negative (positive) correlation with failure and a positive (negative) correlation with non-failure. An analysis of the coefficients of the significant variables listed in Table 3 reveals that failure of thrifts are positively correlated with COST, MFTA and FHLBA, and negatively correlated with MLTA and TA.

This implication that may be drawn from the above is higher the cost of borrowed capital, greater the levels of conventional mortgage foreclosures and short-term FHLB Board advances due, the higher is the probability of thrift failure. Conversely, higher the level of readily appraised mortgage loans and greater the magnitude of total assets, the probability of thrift failure is lower.

Details of classification results during model development and during model validation in the three periods (i.e., 1985 IV quarter, 1985 II quarter and 1984 IV quarter) prior to actual failures in the first 3 quarters of 1986 are provided in Table 4 Panel A. C and Somer's Dyx are the two relevant indices used to assess the predictive capability of the logit model developed and validated.

C denotes the fraction of the total pairs for which predicted and observed values are concordant and is used to test whether predicted probabilities for the group of true positives are different from the predicted probabilities for the group of true negatives. Somer's Dyx is an index of rank correlation between predicted probabilities and observed outcomes.

Table 4 shows that the logit model developed during 1984 - 1985 has an overall predictive accuracy of 97.77%, with a Type I error (error in misclassifying a failure as a non-failure) of 7.02% and a Type II error (error in misclassifying a non - failure as a failure) of 1.16%. Failed thrifts during 1984 - 1985 are correctly classified with 92.98% accuracy. This failure classification accuracy is superior to the failure accuracy achieved by Elmer and Borowski (1988) using the CAEL expert system framework and by replicating the logit models used by Altman (1977) and BBSW (1986). Further, this investigations failure accuracy is higher than the failure accuracies obtained by Elmer and Borowski (1988) by using a matched healthy S&Ls sample or the universe of healthy S&Ls.

The logit model outlined in Table 3 is then validated on financial data of 1985 IV quarter, 1985 II quarter and 1984 IV quarter for thrifts which failed during the first three quarters of 1986. The C indices are very high at 0.962 for 1985 IV quarter, 0.945 for 1985 II quarter and 0.940 for 1984 IV quarter. This indicates that the predictive capability of the logit model declines very marginally as the periods prior to actual failure in 1986 increase (i.e., 1985 IV quarter to 1984 IV quarter).

The overall accuracy of the model declines from 93.30% in 1985 IV quarter to 88.96% in 1984 IV quarter, with non-failure accuracies being in excess of 95% for 1985 IV quarter and 1985 II quarter and declining to 94.87% for 1984 IV quarter. Classification accuracies for 1986 failed thrifts is at 83.78% for 1985 IV quarter data, 76.58% for 1985 II quarter data and 70.27% for 1984 IV quarter data. Thus, the logit model developed in this study correctly classifies over 70% of all failures during 1986 I - III, using financial data 13 - 21 months prior to actual failure.

B. Failed State Chartered Thrifts vs. Failed Federally Chartered Thrifts : Table 3 shows that variables representing liquidity (i.e., LATA and LACL), deposit composition (JCDTL), asset quality (RATA and ITA) and other dimensions (i.e., COST, DOETE and DEFNI) have significant coefficients. While failure of state chartered thrifts is positively correlated with current ratio (LACL), amount of jumbo CD's in deposits received, levels of repossessed assets and total investments made (including direct investments and equity investments in service corporations), amount of expenditure incurred on directors and other employees, and amount of losses incurred on sale of assets, failure of federally chartered thrifts is positively associated with the percent of assets which are liquid or short - term in nature (i.e., LATA), and the cost of borrowed capital (COST).

Classification accuracies during estimation and holdout are provided in Panel B of Table 4. While classification of failed thrifts by the modes of charter is high during examination with an overall classification accuracy of 80.70 percent and individual accuracies for failed state chartered and federally chartered thrifts of 71.69 percent and 88.52 percent, respectively, the corresponding accuracies during holdout decline as the holdout period recedes from 1985 IV quarter to 1984 IV quarter. During 1985 IV quarter, failed thrifts on an overall basis and individually are classified correctly for more than 60% of actual failures in the first three quarters of 1986. However, 1986 failures are classified less accurately using failure data for 1985 II quarter (overall accuracy of 54.95 percent) and 1984 IV quarter (overall rate of 52.25 percent). However, the C statistic which is generally a better measure of a model's predictive ability, (since the prediction of failure for either group depends on relatively arbitrary cutoffs of the continuous predicted probability) is significant for all three holdout periods, ranging from 0.782 in 1985 IV quarter to 0.650 in 1984 IV quarter.

C. Failed Mutually Owned vs. Failed Stock Owned Thrifts : Finally, the third logit model developed compares failed thrifts by their modes of ownership (i.e., group "0" represents mutuals while group "1" represents stock thrifts). JCDTL, MFTA, TA and DOETE are the significant variables and the model fit is highly significant with a chi-square statistic of 78.01.

Failure of mutual thrifts is positively correlated with the size of the thrifts, while failure of stock owned thrifts is positively correlated with the amounts of jumbo CD's, acquisition and development loans, and level of expenditure incurred on directors and other employees.

Thus, reliance on non-traditional deposits, quality of assets (i.e., mortgage loans) acquired, size of the thrifts, credit risk (i.e., FHLBA) and interest - rate risk (i.e. INTINC) help in explaining the probability of failure of mutual and stock owned thrifts.

The classification accuracies of the three logit models during development (using 1984-1985 data) and validation in three periods (i.e., 1985 IV quarter, 1985 II quarter and 1984 IV quarter) prior to actual failure during the first three quarters of 1986 are provided in Table 4.

The logit model has very high classification rates and values for C and Dyx during estimation (i.e., 1984 - 1985). The model has an overall correct rate of 81.58%, correctly classifying 83.33% of failed mutuals and 79.63% of failed stock thrifts. The C value is well in excess of 0.90 indicating very high prediction accuracy for the model.

The validation results for the first three quarters of 1986 are also given in Table 4. However, the validation results for the model are less impressive 13 - 21 months before failure in 1986. While 1985 IV quarter financial data (for 1986 failures) is used by the model to correctly predict 70.00% of failed mutuals and 62.75% of failed stock thrifts, with a high C value of 0.748, corresponding validation accuracies obtained using 1984 IV quarter financial data are less impressive with failure accuracies of 52.54% and 54.90% for failed mutual and stock thrifts, respectively.

## VI - CONCLUSION

This investigation considers the failure of 212 thrift institutions during the post deregulation period of 1984 - 1986. This sample includes failed thrifts by the modes of charter (state vs. federal) and ownership (mutual vs. stock). A graded premium structure which can be used to cover S&Ls with varying risk characteristics is developed in Section III. Failed thrifts are compared with 867 healthy thrifts to develop a risk - factor logit model which can help in predicting thrift failure. Additionally, the modes of charter and ownership are considered as explanatory variables to help explain the incidence of failure among thrifts. Logit models are developed to identify the risk characteristics which help distinguish between failure of state chartered versus federally chartered thrifts, and also the failure of mutually owned versus stockowned thrifts. Finally, such models are used to predict actual thrift failures during 1986.

More research is proposed to develop graded premium structures to cover S&Ls based on the modes of charter and ownership. Further, it is proposed to empirically test the efficacy of such graded premium structures using data on failed and healthy thrifts.

## FOOTNOTES

1. Approximately 600 of the 700 plus thrift failures since 1934, when FSLIC was incorporated, occurred during 1980 to 1986. Given the financially distressed condition of several hundred more significant supervisory and management consignment cases, the Federal Home Loan Bank Board (See Gray, 1986) predicts additional S&L closures in the later part of 1980s with losses concentrated in the states of Arkansas, California, Florida, Louisiana, Oklahoma, Texas and Washington.
2. Congressional action includes the passage of the Depository Institutions Deregulation and Monetary Control Act in 1980, the Gam St. German Depository Institutions Act in 1982, and the 1987 Competitive Equality Banking Act. The 1987 recapitalization act authorizes the Bank Board to create a separate financing corporation to raise approximately \$10.8 billion over the next three years. The financing corporation will act as a conduit to provide funds to FSLIC for resolving S&L failures. The FHLBB as the main regulator of the thrift industry has modified regulations over the last five years with respect to net worth requirements, level of direct and equity investment, brokered deposits, and commercial real estate lending.
3. Although several insolvent thrift institutions were closed by FSLIC in the 1980 to 1986 period, over 200 S&Ls have been permitted to continue operations due to insufficient reserve funds needed to cover losses, see Gray (1986).
4. The Management Consignment Program (MCP) involves hiring outside management to manage the distressed thrift institution with the objective of (1) obtaining better accounting information on losses within the institution, (2) developing an independent business plan outlining the alternatives available for resolving the institution's problems and (3) seeking information on the possibilities of merging, rather than liquidating the institution. Currently, there are over 50 S&Ls under the management consignment program. See Gray (1986).

5. The moral hazard issue (refer Benston (1984)) provides an incentive to thrifts to undertake more risk, subject to the supervision of the regulator of thrifts.

6. Various other criteria, i.e., size, are not considered in selecting the control sample as the process may limit the generalizability of inferences which can be drawn from the results. For example, if size is used as the matching criterion, then the empirical results of this study may be valid only for healthy thrifts which are similar in size to the failed thrifts.

7. For a complete discussion of the properties of logit models, see Amemiya (1981). Further, Maddala (1986) provides a comparative analysis of the problems involved in using different parametric procedures in examining thrift failures.

Table 1

Annual Classification of Failed Institutions

Year	Number of Failures	Mode of Charter		Mode of Ownership	
		State	Federal	Mutual	Stock
1984	33	15	18	17	16
1985	82	38	44	43	39
1986	97	40	57	52	45
	212	93	119	112	100

Table 2

## List of Variables (=20)

Variable	Abbreviation
<b>LIQUIDITY</b>	
1. Ratio of liquid assets to total assets	LATA
2. Current Ratio (i.e., ratio of liquid assets to short-term liabilities)	LACL
<b>PROFITABILITY</b>	
1. Ratio of total expenses to total revenue	TETR
2. Return (i.e., net operating income) on total assets	PROF
3. Ratio of interest expenses (i.e., costs of various borrowed funds) to total assets	COST
<b>CAPITAL ADEQUACY</b>	
1. Ratio of Regulatory Net Worth to total assets	RNWT
<b>DEPOSIT COMPOSITION</b>	
1. Ratio of Jumbo CDs to total liabilities	JCDTL
2. Ratio of Brokered Deposits to total liabilities	BDTL
<b>ASSET QUALITY</b>	
1. Ratio of Repossessed Assets to total assets	RATA
2. Ratio of Slow loans & other items to total assets	SLTA
3. Ratio of readily appraised mortgage loans to total assets	MLTA
4. Ratio of conventional mortgage foreclosures to total assets	MFTA
5. Ratio of investments to total assets	ITA
6. Ratio of non-conforming loans made to total assets	NCLTA
<b>OTHERS</b>	
1. Ratio of FHLB advances due in <1 year to total assets	FHLBA
2. Ratio of acquisition & development loans to total assets	ADLTA
3. Ratio of director & other employee expenses to total expenses	DOETE
4. Total Assets	TA
5. Ratio of interest on mortgage loans to total revenue	INTINC
6. Ratio of loans incurred on sale of assets to net income	DEFNI

AN ACTUARIAL APPROACH TO THE ANALYSIS OF POST DEREGULATION THRIFT FAILURES 55  
IN THE U.S.A.

Table 3

Various Logit Specifications Explaining 1984-85 S&L Failures

Variable	Failed vs. Healthy Thrifts	Failed State Chartered vs. Failed Federally Chartered Thrifts	Failed Mutually Owned vs. Failed Stock Owned Thrifts
<b>LIQUIDITY</b>			
LATA		0.312**	
LACL		-0.286**	
<b>DEPOSIT COMPOSITION</b>			
JCDTL		-0.474**	0.549*
<b>ASSET QUALITY</b>			
RATA		-0.277**	
MLTA	1.060*		
MFTA	-0.694***		0.303***
ITA		-2.337*	
<b>SIZE</b>			
TA	0.001**		
<b>OTHERS</b>			
FHLBA	-2.59*		
COST	-0.206***	0.218***	
DOETE		-0.137***	0.164***
DEFNI		-0.256***	
CONSTANT	0.468*		
<b>SUMMARY STATISTICS</b>			
CHI-SQUARE	511.63*	67.31*	78.01*

- \* Significant at 0.01 level
- \*\* Significant at 0.05 level
- \*\*\* Significant at 0.10 level

Table 4

## Details of Classification Accuracies

	ESTIMATION (1984-85)	HOLDOUT#1 (1985IV)	HOLDOUT#2 (1985II)	HOLDOUT#3 (1984IV)
<b>A. Failed Thrifts vs. Healthy Thrifts</b>				
Failure Accuracy (%)	92.98	83.78	76.58	70.27
Non-Failure Accuracy (%)	98.84	96.31	95.42	94.87
Type I Error (%)	7.02	16.22	23.42	29.73
Type II Error (%)	1.16	3.69	4.58	5.13
Overall Accuracy (%)	97.77	93.30	90.87	88.96
C	0.991	0.962	0.945	0.940
Somer Dyx	0.983	0.924	0.889	0.880
<b>B. Failed State Chartered Thrifts vs. Failed Federally Chartered Thrifts</b>				
State Chartered				
Failure Accuracy (%)	71.69	64.58	52.00	44.23
Federally Chartered				
Failure Accuracy (%)	88.52	66.67	57.38	59.32
Type I Error (%)	28.31	35.42	48.00	55.77
Type II Error (%)	11.40	33.33	42.62	40.68
Overall Accuracy (%)	80.70	65.77	54.95	52.25
C	0.902	0.782	0.787	0.650
Somer Dyx	0.803	0.764	0.773	0.699
<b>C. Failed Mutually Owned Thrifts vs. Failed Stock Owned Thrifts</b>				
Mutually Owned				
Failure Accuracy (%)	83.33	70.00	54.24	52.54
Stock Owned Failure				
Accuracy (%)	79.63	62.75	50.00	54.90
Type I Error (%)	16.67	30.00	45.76	47.76
Type II Error (%)	20.37	37.25	50.00	45.10
Overall Accuracy (%)	81.58	66.67	52.25	53.15
C	0.917	0.748	0.685	0.417
Somer Dyx	0.833	0.596	0.469	0.367



## BIBLIOGRAPHY

- Altman, E.I. 1977. Predicting Performance in the Savings and Loan Industry. *Journal of Monetary Economics* 3(4) : 443 - 466
- Amemiya, Takeshi. December 1981. Quantitative Response Models : A Survey. *Journal of Economic Literature* : 1483 - 1536
- Avery, R.B. and Hanweck, G.A.. May 1984. A Dynamic Analysis of Bank Failures. In *Proceedings of a Conference on Bank Structure and Competition*, 380 - 395, Federal Reserve Bank of Chicago.
- Barth, J.R., Brumbaugh, D.R. Jr., Sauerhaft, D., and Wang, G.H.K. October 1986. Failure Costs of Government - Regulated Financial Firms : The Case of Thrift Institutions. Research Working Paper n°123, Office of Policy and Economic Research, Federal Home Loan Bank Board
- Barth, J.R., Brumbaugh, D.R. Jr., Sauerhaft, D., and Wang, G.H.K. May 1985. Thrift-Institution Failures : Causes and Policy Issues. In *Proceedings of a Conference on Bank Structure and Competition*, 184 - 216, Federal Reserve Bank of Chicago
- Benston, G.J. 1984. Financial Disclosure and Bank Failure. *Federal Reserve Bank of Atlanta, Economic Review* 69(3) : 5 - 13
- Benston, G.J. 1985. An Analysis of the Causes of Savings and Loan Association Failures. Monograph Series in Finance and Economics. Solomon Brothers Center for the Study of Financial Institutions
- Bloch, E. 1969. The Setting of Standards of Supervision for Savings and Loan Associations. In I. Friend, Editor, *Study of the Savings and Loan Industry*, 4 : 1619-1687. U.S. Government Printing Office
- Brickley, J.A. and James C.M. 1986. Access to Deposit Insurance, Insolvency Rules and the Stock Returns of Financial Institutions. *Journal of Financial Economics* 16(3) : 345 - 372
- Brigham, Eugene F., and Pettit, Richard. Effects of Structure on Performance in the Savings and Loan Industry. *Study of the Savings and Loan Industry*, Irwin Friend (Ed) : 1157 - 1209
- Carroll, E.F., Kalambodikis, N., and Kise, J. May 1986. Deposit Insurance, Capital Regulation and Bank Risk. *Proceedings of the Bank Structure and Competition Conference*, Federal Reserve Bank of Chicago : 287 - 310
- Elmer, P.J. and Borowski, D.M. Autumn 1988. An Expert System Approach to Financial Analysis : The Case of S&L Bankruptcy. *Financial Management* : 66 - 76
- Gray, E.J. March 13, 1986. Statement Before the Committee on Banking, Housing and Urban Affairs. United States Senate
- Jordan, B.D., Verbrugge, J.A., and Burns, R.M. Summer 1988. Returns to Initial Shareholders in Savings Institution Conversions : Evidence and Regulatory Implications. *Journal of Financial Research* : 126 - 136

- Kharandia, V.C. and Collins, R.A. 1981. Forecasting Credit Union Failures. *Journal of Economics and Business* 33(2) : 147 - 152
- Maddala, G.S. March 1986. Some Problems in the Econometric Analysis of Thrift Institution Failures. Mimeo
- Martin, D. 1977. Early Warning of Bank Failure : A Logit Regression Approach. *Journal of Banking and Finance* 1(2) : 249 - 276
- Masulis, R. March 1987. Changes in Ownership Structure : Conversions of Mutual Savings and Loan to Stock Charter. *Journal of Financial Economics* : 29 - 59
- Pantalone, C.C. and Platt, M.B. 1987. Predicting Failure of Savings & Loan Associations. *AREUEA Journal* 15(2) : 46 - 64
- Rose, P.S. and Kolari, J.W. 1985. Early Warning Systems as a Monitoring Device for Bank Condition. *Quarterly Journal of Business and Economics* 24(1) : 43 - 60
- Rudolph, P.M. and Hamdan, B. 1988. An Analysis of Post - Deregulation Savings - and Loan Failures. *AREUEA Journal* 16(1) : 17 - 33
- Scott, Kenneth E., and Hester, Donald D. 1987. Conversion of Mutual Savings and Loan Associations to Stock Form : Legal and Economic Issues. Federal Home Loan Bank Board, Washington, D.C.
- Simpson, W. Gary, and Kohers, Theodor. Fall 1979. The Effect of Organizational Form in the Savings and Loan Industry. *Financial Review* : 1 - 14
- Sinkey, J.F. Jr. 1975. A Multivariate Statistical Analysis of the Characteristics of Problem Banks. *Journal of Finance* 30(1) : 21 - 35
- Sinkey, J.F. Jr. 1978. Identifying "Problem" Banks : How do the Banking Authorities Measure a Bank's Risk Exposure ? *Journal of Money, Credit and Banking* 10(2) : 184-193
- Smith, C.W. 1986. Pricing Mortgage Obligations. *AREUEA Journal* 100 : 313 - 330
- Smith, David L., and Kaplan, William F. November 1977. Profitability : Why Some Associations Perform Far Above Average. *Federal Home Loan Bank Board Journal*, 10(11) : 7 - 10

# 1st INTERNATIONAL AFIR COLLOQUIUM

Paris, April 23 - 27, 1990

*organised by*

*Actuarial Approach for Financial Risks (AFIR)  
Financial section of International Actuarial Association (IAA)*

*Association des Actuaire  
diplômés de l'ISFA*

*Institut des Actuaire Français  
IAF*

*sponsored by*

CAISSE DES DEPOTS ET CONSIGNATIONS

CCF

CREDIT AGRICOLE

*Crédit Commercial de France*

*Ségespar Titres*

COMPAGNIE PARISIENNE DE REESCOMPTE

TECHNIQUES DE GESTION FINANCIERE

TGF

UNION DES ASSURANCES DE PARIS

GROUPE DES ASSURANCES NATIONALES  
GAN

GROUPE GMF

MATIF S. A.

ASSURANCES GENERALES DE FRANCE

ARTHUR ANDERSEN

ASSURANCES 92

BANQUE NATIONALE DE PARIS

BANQUE PARIBAS

BANQUE DE L'UNION EUROPEENNE

CAISSE NATIONALE DE PREVOYANCE

COMPAGNIE BANCAIRE

CREDIT LYONNAIS

FIMAGEST

GROUPEMENT FONCIER FRANÇAIS

SICOVAM