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Determinants of Thrift Institution Resolution Costs

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ABSTRACT

This paper provides a detailed examination of the cost imposed by thrift institutions resolved during the period 1980–1988. A simple model is presented to explain the cost of resolution. This model is tested empirically with a comprehensive data set that permits us to avoid some of the econometric problems present in earlier studies. The empirical evidence suggests that the model that explains resolution costs in the late 1980s is significantly different from the model for either the middle or early 1980s. This evidence is consistent with the changing nature of the thrift crisis and changes in the regulator's closure rule. Our econometric evidence, moreover, is consistent with the hypothesis that, for troubled institutions, tangible net worth systematically understates market-value net worth. In addition, the importance of including time effects as well as institution effects as determinants of the cost of resolution is revealed.

THE SHARP INCREASE IN market interest rates in late 1979 and early 1980 and the deregulation of deposit rates led to record losses in the thrift industry in the early 1980s and to a major erosion of the industry's capital. Many institutions never fully recovered from these problems, and most currently insolvent thrift institutions have been insolvent for quite some time.[1] Moreover, between January 1980 and December 1988, nearly 1,200 thrift institutions failed, some being closed and others still operating.[2]

The exceptional number of thrift failures and the unprecedented cost of failure resolution led to a major restructuring of the thrift regulatory framework. In August 1989, President Bush signed the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) into law. FIRREA is intended to resolve

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[1] Nearly 50 percent of those institutions that were insolvent at mid-year 1988 had been insolvent for 3 years or more.

[2] Four hundred eighty-nine thrift institutions, holding assets of $161 billion, were liquidated or merged with regulatory assistance between 1980 and 1988. Another 333 institutions were merged with supervisory assistance but at no cost to the insurer, and 364 institutions were insolvent but still open at year-end 1988. (See Barth and Bradley (1989), Kane (1985), and Kane (1989), for example.)

the crisis in the thrift industry and to place federal deposit insurance on a sound basis. FIRREA established a new corporation—the Resolution Trust Corporation—to contain, manage, and resolve failed thrift institutions by using funds from private and public sources.[3] The funding plan included in FIRREA is expected to cost taxpayers at least $50 billion.

To our knowledge, only eight studies exist that examine the costs to the insurance fund when an institution fails. Avery, Hanweck, and Kwast (1985), Bovenzie and Murton (1988), and James (1988) examine failure costs for commercial banks, while Barth et al. (1985), Benston (1986), Barth, Brumbaugh, and Sauerhaft (1986), Kormendi et al. (1989), and Barth, Bartholomew, and Labich (1989) examine failure costs for thrift institutions. Although these studies provide important contributions to the understanding of depository-institution failure costs, they inadequately address various econometric problems, including sampling problems, unobservable variables, and structural change.

This paper provides a detailed examination of the cost imposed on the Federal Savings and Loan Insurance Corporation (FSLIC) fund by thrift institutions that were resolved prior to the enactment of FIRREA. Barth and Bradley (1989) identified three distinct phases of this period of the thrift crisis: 1980–1982, 1983–1984, and 1985–1988. Evidence is presented that confirms this delineation. The data for this analysis are unequivocally the most comprehensive and highest quality that have been gathered to examine the costs to an insurer when a depository institution fails, including those studies that pertain to commercial banks. (See Appendices I and II in Barth, Bartholomew, and Bradley (1989).) These data allow us to address some of the potential econometric problems present in earlier studies.

I. Determinants of the Cost of Resolution

A. Institutional Considerations[4]

When the Federal Home Loan Bank Board (Bank Board) decided to act against a troubled thrift institution, the FSLIC resolved it by liquidation, by merger, or by providing financial assistance to permit the institution to continue operating. Table I presents information about thrift closures for the 1980–1988 period, classified by type of closure and according to whether the closure resulted in costs to the FSLIC. For comparison, the number of voluntary mergers—those arranged through private agreements with no potential FSLIC costs—is also presented. Given the turbulence in the thrift industry, it is not surprising that, as Table I shows, there have been a large number (nearly 800) of voluntary mergers since 1980. As can be seen, the number of liquidations is small. In contrast, since 1980, there have been 411 merger and other actions requiring

[3] See Kane (1990) for a discussion of the Resolution Trust Corporation. FIRREA also was intended to improve supervision, enhance enforcement, curtail risk-taking, and reform the federal deposit insurance system. (See Barth, Benston, and Wiest (1990) for a discussion.)

[4] The bulk of the information in this section draws upon *Purchasing an Insolvent Savings Institution through the Federal Savings and Loan Insurance Corporation*, Federal Home Loan Bank Board, Washington, D.C., 1988.

Table I

Attrition Among FSLIC-Insured Institutions: 1934–1988

	Number of Failed Institutions								Nonfailed Attrition of Institutions		All Institutions	
	FSLIC Assistance Involved						No FSLIC Assistance Involved					
	Liquidations			Mergers and Other Types of Assisted Resolutions								
Year	Number	Total Assets ($Millions)	Total Cost* ($Millions)	Number	Total Assets ($Millions)	Total Cost* ($Millions)	Management Consignment Cases	Supervisory Mergers	Voluntary Mergers	Total	Total Number	Total Assets ($Billions)
34–79	13	348.8	15.7	130	4,109.5	290.4	0	N/A	N/A	143	N/A	N/A
1980	0	0.0	0.0	11	1,457.6	166.6	0	21	63	95	3,998	621
1981	1	88.5	30.4	27	13,819.7	728.3	0	54	215	297	3,757	659
1982	1	36.1	2.9	62	17,626.0	800.4	0	184	215	462	3,295	700
1983	5	262.6	60.6	31	4,368.5	214.1	0	34	83	153	3,146	819
1984	9	1,497.7	583.3	13	3,582.5	159.3	0	14	31	67	3,136	978
1985	9	2,141.3	630.1	22	4,227.0	391.5	23	10	47	111	3,246	1,070
1986	10	583.8	253.7	36	11,871.3	2,811.3	29	5	45	125	3,220	1,164
1987	17	3,043.8	2,277.5	30	7,616.6	1,426.1	25	5	74	151	3,147	1,251
1988	26	2,965.2	2,831.7	179	97,694.7	28,347.8	18**	6	25	254	3,001	1,334
Total	91	10,967.9	6,685.9	541	166,373.4	35,335.8	95	333	798	1,858	N/A	N/A

* These figures represent the estimated present-value cost of resolution.

** Stabilizations—Total cost of about $7 billion.

Source: Barth and Bradley (1989).

financial assistance from the FSLIC. Table I also indicates that there have been 333 supervisory mergers between 1980 and 1988.

Troubled thrift institutions were identified by periodic examinations conducted by the regulatory field examination staff. A Supervisory Agent monitored institutions identified as troubled in an attempt to resolve their problems without recourse to the insurer. Institutions that were considered to have fewer than 24 months until they would no longer have positive regulatory net worth were candidates for supervisory mergers. The unique aspect of these particular resolutions is that they imposed no costs upon the FSLIC. Although the Bank Board could not force supervisory candidates to merge, there were a number of incentives for selected institutions to do so.[5] Of course, some troubled institutions resisted a supervisory merger. In such cases, the regulator could remove the management and appoint a conservator if any one of the following conditions existed: 1) the institution had net worth less than zero; 2) the institution was operating in an unsafe and unsound condition; 3) there was a substantial dissipation of assets; or 4) a cease-and-desist order had been violated.[6]

If the Supervisory Agent determined that an unassisted acquisition was unlikely, a request was submitted to the FSLIC for a transfer of the institution to the FSLIC caseload.[7] Each FSLIC case was analyzed to determine the most cost-effective solution for the FSLIC. The FSLIC began the analysis process by estimating the present value of the cost of liquidation. This estimate was calculated using quarterly reported financial data and provided the benchmark with which other resolution alternatives were compared. The following factors were considered in the liquidation analysis: reported tangible net worth; unreserved indicated losses; operating profit (loss); loss on off-balance-sheet items; value of off-balance-sheet items; and value of core deposits.

Once the FSLIC decided to market a failed institution, the potential acquirers were asked to submit bids identifying the amount and types of assistance required from the FSLIC for them to acquire the failed institution.[8] The FSLIC determined the cost of each bid and compared it with the cost of liquidating the institution. Consistency was maintained to allow for equitable comparisons between proposal costs and the cost of liquidation. The discount rate was probably the most important factor in the sell-or-liquidate decision because the cash flows differed so widely between the alternatives. Other important factors included the timing

[5] First, current management could be retained. Second, the institution was not required to publish notice of the merger, thereby eliminating delays that could otherwise occur. Third, antitrust constraints were often waived.

[6] The Management Consignment Program was introduced in 1985 and involved hiring outside management to run troubled institutions in the hope that a merger could ultimately be effected. (See Bisenius, Brumbaugh, and Rogers (1988) and Horvitz (1987b).)

[7] Three criteria had to be generally met for an institution to be placed in the FSLIC's caseload: a consent to merger must have been submitted to the thrift's Board of Directors; grounds for the appointment of a receiver must have existed; and a financially unassisted acquisition must have been unlikely. (See Barth, Bartholomew, and Elmer (1989).)

[8] An institution was generally considered a good candidate for acquisition/merger if it had many of the following attributes: desirable location; good branch network; significant tax benefits available; large volume of core deposits; lack of complicated asset problems, lack of significant contingent liabilities, claims and litigation; and good management.

of asset disposition and future interest rates. Assuming that at least one bid imposed less cost on the FSLIC than liquidation would, the FSLIC staff received permission to enter into final negotiations with the lowest-cost bidder.[9] Information about FSLIC's estimated cost of resolving failed institutions is presented in Table I. As can be seen, the insurer's cost-to-assets ratio was much higher for liquidations than for assisted mergers, reflecting the value of maintaining the going concern value of the typical institution.

B. Accounting Issues[10]

Insolvency was generally FSLIC's basis for closing institutions during the 1980–1988 period. Not all institutions were closed, however, at the time they became market-value insolvent. The FSLIC historically had based its closure rule on accounting measures that relied on historical values rather than on market-value measures of insolvency. This means that, as long as an institution was solvent in an accounting sense, it may not have been closed even when it was market-value insolvent. Furthermore, the FSLIC monitored an institution only at periodic intervals so that an absence of timely information may have separated the time between when an institution failed and when it was closed. Finally, since many thrift closures resulted in costs to the FSLIC, the FSLIC did not have sufficient reserves to close all market-value insolvent institutions. (See Barth, Brumbaugh, Sauerhaft, and Wang (1989).) Once a federally insured depository institution was closed, the FDIC and the FSLIC were expected to cover all closure costs out of their reserves.

The FSLIC's cost of closing was directly related to the institution's degree of economic insolvency. To contain its costs, the FSLIC, therefore, had to have a way to assess and, thus, periodically monitor the net worth of an institution. Three accounting measures of net worth were available to the Bank Board and to the FSLIC on a regular basis: 1) net worth based on regulatory accounting practices (RAP), 2) net worth based on generally accepted accounting principles (GAAP), and 3) tangible net worth (TAP). All three of these measures of net worth are based upon the value of the assets and liabilities when these balance sheet items were first entered on the books of the thrift institution. These book-value measures provided different reflections of the financial condition of thrift institutions, and such differences have increased over time.

Market and book-value measures of net worth may differ for numerous reasons even at the time the assets and liabilities are entered on the books. As Maisel (1981) explains, the value of such intangibles as information, customer relations, and goodwill may have considerable market value yet not be included in book-value net worth. Furthermore, reserves for loan losses may inaccurately reflect actual expected losses, and other reserves, such as those for contingencies and deferred taxes, may actually increase market-value net worth.

Although market-value net worth is extremely important, a measure is frequently not available. For this study, however, a measure of market-value net

[9] This policy of eliminating the other players to negotiate with one is criticized in Kormendi et al. (1989).

[10] This section draws heavily upon Barth, Brumbaugh, and Sauerhaft (1986).

worth is available. It is the cost incurred by the FSLIC when a thrift institution was closed. As discussed above, when a thrift was closed, it was either liquidated or merged. Whether or not an institution was liquidated depended on the bids the FSLIC received from financially healthy institutions. If a bid for an institution resulted in lower costs to the FSLIC than if the institution was liquidated, the bid was accepted and an assisted merger occurred. Otherwise, the thrift was liquidated. In either case, however, the FSLIC generally incurred costs to bring the market value of assets up to the market value of liabilities. In the case of a liquidation, the market value was based upon the unbundling of the assets and liabilities, whereas, in the case of a merger, the market value was based upon the assets and liabilities remaining intact. The market-value net worth for a closed thrift if liquidated, therefore, served as an upper-bound cost to the FSLIC. To the extent that a closed thrift generated additional value by remaining intact—for example, due to entry or geographical restrictions—a merger was the likely method of dealing with a troubled thrift and the costs to the FSLIC were accordingly lower. Since, in the case of thrift closures, one is talking about zero or negative values for net worth, the resolution costs reflected negative market-value net worth.

II. A Simple Model of Resolution Costs

Any model that purports to explain the cost to the insurer of resolving a failed institution should account for the institutional factors and the accounting conventions that we have reviewed. The model that we posit to explain the cost of failure builds upon earlier models of Barth, Brumbaugh and Sauerhaft (1986), Maddala (1986), James (1988), and Bovenzie and Murton (1988). Invoking Occam's Razor, our model consists of the following equations:

$$Z_i = \alpha' v_i + \omega_i \quad \{\text{Closure Rule}\}, \tag{1}$$

$$C_i = \delta' y_i + \xi_i \quad \{\text{Cost-of-Resolution Equation}\}, \tag{2}$$

where C is the cost of resolution, v and y are vectors of explanatory variables, α and δ are vectors of coefficients, ω and ξ are disturbance terms, and Z is a dummy endogenous variable, which is defined more fully below.

Although our interest centers on the cost of resolution, equation (2) cannot be correctly estimated in the absence of the first equation. Estimation of the cost-of-resolution equation requires that we confront several econometric issues, including sample selection bias, a limited dependent variable, structural change, and variable selection. We discuss each of these issues in turn.

A. Sample Selection Bias

The inclusion of nonfailed and failed institutions in our data allows us to avoid the obvious sample selection bias. However, a more subtle form of selection bias may remain. If institutions that were GAAP solvent or were acted upon by the regulator, and, therefore, for which we have realistic or observed values of the

dependent variable, differ systematically from open institutions that are expected to impose costs on the insurer, $\hat{\delta}$ may be biased.

Heckman (1979) models sample censoring as an omitted-variables problem and recommends a simple two-stage estimation procedure to eliminate the selectivity bias. When applied to the problem at hand, the first stage involves using probit to predict the probability that a particular institution remains in the data set, while the second stage computes a variable, λ, that is a proxy for the omitted variables.[11] The dependent variable in equation (1) takes the value of one for GAAP-solvent or resolved institutions, while GAAP-insolvent institutions receive a zero. Probit is then used to predict the probability that an institution is GAAP-solvent or resolved. The proxy variable, λ, is constructed using the probit coefficients, $\hat{\alpha}$, and the values of v_i for each institution that remains in the data set. Since the Heckman procedure is not fully efficient, a maximum-likelihood procedure (that uses the final values from the Heckman procedure as starting values) is used to estimate equation (1).

B. Limited Dependent Variable

The dependent variable in equation (2) is observed only if it is nonnegative; otherwise, it is not. Thus, the data are missing due to censoring. As such, ξ is not normally distributed, and the use of a least-squares procedure is inappropriate. The tobit model is a censored normal regression model that applies in such cases, and we will use it to estimate equation (2).

C. Structural Change

Thrift institutions failed in the early 1980s, in large part due to the squeeze on their net income attributable to a sharp decline in net interest income, reflecting the greater relative speed in which liabilities repriced. Relatively few institutions failed in 1983–1984 as thrift net income rebounded following a sustained decline in market interest rates and a policy of regulatory forbearance was pursued by the Bank Board. The "typical" inverse relationship between market interest rates and thrift profits broke down after 1985 as profits declined sharply despite continued declines in market rates of interest. The decline in industry net income since 1985 is largely the result of the sharp decline in net non-operating income, reflecting asset-quality problems at many institutions. In response to the sharp increase in the number of insolvent institutions in 1984, the Bank Board undertook efforts to reregulate capital-deficient thrifts. For example, changes in the minimum capital requirement in 1985 eliminated long phase-in procedures that allowed capital requirements to lag far behind the capital needs of rapidly growing institutions. In addition, the pace of formal enforcement actions increased sharply in 1985. (See Barth, Bartholomew, and Labich (1989).) Finally, nonbank banks became increasingly important after 1984. These institutions circumvented many of the barriers to interstate banking and, thus, indirectly lowered the value of the thrift charter.

[11] "λ_i" is the inverse of Mill's ratio. In particular, $\lambda_i = \phi(Z_i)/(1 - \Phi(Z_i))$, where ϕ and Φ are the density and distribution functions for a standard normal variable, respectively.

In short, it is unreasonable to presume that the coefficients in equations (1) and (2) remained stable throughout the 1980–1988 period. In recognition of the three phases of the thrift crisis, we estimate our model over two separate time periods: 1980–1982 and 1985–1988. The small fraction of the 1983–1984 sample above the zero limit value precluded estimation of the model for the middle phase of the thrift crisis.

D. *Variable Selection*

Since there is little theoretical justification for the variables that are to be included in v, we have decided to permit the data to determine which variables are important. In particular, we applied the Kruskal-Wallis test to a broad range of balance sheet items for selected groups of institutions. This test is a nonparametric procedure that enables one to determine whether different samples are drawn from the same population.[12] The test results were then used as the criterion for inclusion of the variable in the analysis. In deciding which variables should be included in the closure rule equation, we compared the balance sheets and selected income statement items of those institutions that had been resolved or that were GAAP solvent with those of GAAP-insolvent institutions that had been permitted to remain open. Those items that were clearly important—as determined by the Kruskal-Wallis test—in distinguishing between the groups were included in v.

In contrast to the first equation, Barth, Brumbaugh, and Sauerhaft (1986) provide some theoretical guidance for the variables to be included in y. Following their work, we posit the following form for equation (2):

$$COST_i = a_0 + a_1{*}TAP_i + a_2{*}DISCOUNT\ RATE_i + a_3{*}CONTINGENT\ LIABILITIES_i + a_4{*}ASSET\ QUALITY_i + a_5{*}LIQUID\ ASSETS_i + a_6{*}FRANCHISE\ VALUE_i + e_i. \quad (2')$$

Note that, in addition to a book-value measure of equity, equation (2′) includes factors that capture discrepancies between book- and market-value measures of net worth. Contingent liabilities, for example, impose costs on the insurer even though they are not reported on the books of the failed institution. Assets of low quality may not have been fully reserved for and may have remained on the books of a failed institution. As such, a book-value measure of net worth overstates the value of an institution's assets. To the extent that a failed institution had value as a going concern (franchise value), due to such factors as deposit base, customer relations, or geographic factors, there would have been a discrepancy between an institution's market- and book-value measures.

An interesting variable included in our model but in no previous empirical model is the discount rate. This variable is particularly important because the dependent variable is measured on a present-value basis due to the vast differences in the cash flow patterns of a liquidation versus an assisted merger. Moreover, differences in timing can importantly affect resolution costs. For example, a comparison of the cost of resolution of two *identical* institutions, one resolved in December 1987 and the other in December 1988, reveals that the

[12] A detailed description of this test appears in Conover (1980).

latter was much more costly due to the increase in market interest rates during the intervening period. The inclusion of the discount rate variable introduces time effects into the analysis as suggested by Maddala (1986).

III. Empirical Analysis

As mentioned earlier, we believe that the thrift crisis can be separated into three distinct periods: 1980–1982, 1983–1984, and 1985–1988. In addition to institutions that remained open at the end of each period, our data include: 350 institutions that failed between 1980 and 1982, 248 of which were supervisory mergers; 103 institutions that failed in 1983 and 1984, 45 of which were supervisory mergers; and 350 institutions that failed between 1985 and 1988, 21 of which were supervisory mergers. Data for all institutions are from their last quarter reported. In particular, for institutions that were resolved, the data are from the reporting date prior to resolution date; for institutions that remained open at the end of a period, the data are as of the end of the period.

Balance sheet and selected other information for institutions in our data set grouped by regulatory net worth ratio are presented in Tables II–IV. These balance sheet comparisons suggest that the behavior of RAP-insolvent institutions differed little from the actions of healthier institutions in the early 1980s, differed somewhat from those of healthier institutions in the mid-1980s, and were markedly different in the 1985–1988 period. Moreover, the increase in nonperforming assets for the different groups over time, especially for insolvent institutions, clearly documents the changing nature of the thrift crisis from an interest-spread problem to a credit-quality problem.

When compared with healthier institutions, and in contrast to the middle and last periods, those institutions resolved or insolvent at the end of the period held relatively more residential mortgages and fewer commercial mortgages in the 1980–1982 period. Moreover, these severely troubled institutions held more direct investments and relied to a much greater extent on brokered deposits since the middle period.

In addition, troubled institutions held relatively fewer mortgage-backed securities since the early 1980s. Mortgage-backed securities are increasingly important in the liquification of mortgage portfolios. They are more liquid than whole mortgage loans and may be used as collateral for mortgage-backed bonds, collateralized mortgaged obligations, and real estate investment securities. As such, mortgage-backed securities are often useful in decreasing an institution's exposure to interest-rate risk. Since many of the institutions that were troubled in the last phase of the thrift crisis had not been viable for quite some time (see, e.g., Barth and Bradley (1989)), these balance sheet comparisons, on balance, are consistent with the notion that "moral hazard" was an important cause of the thrift crisis. These comparisons, however, should be interpreted cautiously for at least two reasons. First, whether institutions continued to operate while they were insolvent depended on FSLIC's actions. Those actions affected the profile of continuing insolvent institutions. Second, specific balance sheet differences may not have been the sole "cause" of the thrift industry's problems but were a reflection of those problems. For example, since many of the troubled thrifts

Table II

Balance Sheets of the 1980–1982 Data Set by Regulatory Net Worth Ratio[a] (Last Quarter Reported)

Item/Regulatory Net Worth Ratio	Less Than 0 Percent	0–3 Percent	3 Percent or More	All Institutions
		Percent of Total Gross Assets		
Mortgage Assets, Total	83.7	78.2	78.5	78.5
Mortgage Loans	67.3	66.6	69.9	68.8
Residential Mortgage Loans	62.2	60.3	63.6	62.5
Commercial Mortgage Loans	5.1	6.3	6.3	6.3
Land Loans	0.8	0.9	0.9	0.9
Mortgage-Backed Securities	15.6	10.6	7.6	8.8
Nonmortgage Assets, Total	3.1	2.9	2.9	2.9
Consumer Loans	3.0	2.8	2.8	2.8
Commercial loans	0.2	0.1	0.1	0.1
Cash and Securities	6.4	10.3	11.7	11.1
Direct Investment[b]	1.7	1.0	1.1	1.1
Repossessed Assets	0.8	0.4	0.4	0.4
Other Assets	4.3	7.2	5.5	6.0
Total Assets (gross)	100.0	100.0	100.0	100.0
		Percent of Total Liabilities		
Deposits, Total	80.4	81.6	83.7	82.9
Insured Deposits	72.7	74.0	74.4	74.2
Uninsured Deposits	8.3	7.6	9.3	8.7
Managed Liabilities, Total	18.2	16.6	14.2	15.1
FHL Bank Advances	15.0	11.1	9.1	9.9
Other Borrowed Money	3.2	5.5	5.1	5.2
Other Liabilities	1.4	1.8	2.1	2.0
Total Liabilities	100.0	100.0	100.0	100.0
Memo Items:				
Number of Institutions	130	1048	2429	3607
Gross Assets ($billions)	17.2	254.9	487.6	759.7
Total Assets ($billions)	17.0	244.3	471.2	732.5
Total Liabilities ($billions)	17.3	239.6	450.2	707.2
		Percent of Total Assets		
Net Worth (RAP)	−2.0	2.0	4.6	3.6
Net Worth (GAAP)	−3.3	0.9	4.1	2.8
Net Worth (TAP)	−3.4	−2.2	2.1	0.6
Nonperforming Assets[c]	4.1	5.6	3.7	4.3
Junk Bonds	0.0	0.0	0.0	0.0
Real Estate Held	0.1	0.2	0.4	0.4
Service Corporations	1.6	0.8	0.7	0.8
Off Balance Sheet Items	0.3	0.9	1.0	1.0
Regulatory Liquidity	5.7	9.0	9.9	9.5
		Percent of Total Liabilities		
Brokered Deposits	1.2	1.2	1.3	1.3
Repurchase Agreements	1.9	2.8	1.4	1.9
Mortgage-Backed Bonds	0.2	0.3	0.6	0.5

Source: Thrift Financial Reports.

[a] Details may not add to totals as a result of rounding.

[b] Direct investments include equity securities (except Federal Home Loan Bank Stock), real estate investments, and investments in service corporations or subsidiaries.

[c] Nonperforming assets equals the sum of repossessed assets; deferred net losses (gains) on loans and other assets sold; goodwill and "other" intangible assets; and delinquent loans.

Table III

Balance Sheets of the 1983–1984 Data Set by Regulatory Net Worth Ratio[a] (Last Quarter Reported)

Item/Regulatory Net Worth Ratio	Less Than 0 Percent	0–3 Percent	3 Percent or More	All Institutions
		Percent of Total Gross Assets		
Mortgage Assets, Total	72.8	73.9	73.6	73.7
Mortgage Loans	60.6	58.0	61.6	60.3
Residential Mortgage Loans	47.9	48.7	53.7	51.9
Commercial Mortgage Loans	12.7	9.3	7.9	8.4
Land Loans	2.9	2.2	2.3	2.3
Mortgage-Backed Securities	9.3	13.6	9.8	11.0
Nonmortgage Assets, Total	4.1	4.5	4.4	4.4
Consumer Loans	3.2	3.4	3.4	3.4
Commercial Loans	0.9	1.1	1.0	1.1
Cash and Securities	10.6	12.2	13.7	13.1
Direct Investment[b]	4.4	2.0	2.0	2.1
Repossessed Assets	2.4	0.7	0.4	0.6
Other Assets	5.7	6.7	5.8	6.1
Total Assets (gross)	100.0	100.0	100.0	100.0
		Percent of Total Liabilities		
Deposits, Total	77.4	80.9	84.7	83.2
Insured Deposits	63.8	68.9	72.6	71.2
Uninsured Deposits	13.3	12.0	12.1	12.1
Managed Liabilities, Total	20.9	17.3	13.3	14.9
FHL Bank Advances	17.3	8.9	6.9	7.9
Other Borrowed Money	3.6	8.4	6.4	7.0
Other Liabilities	1.7	1.8	2.0	1.9
Total Liabilities	100.0	100.0	100.0	100.0
Memo items:				
Number of Institutions	125	884	2198	3207
Gross Assets ($billions)	24.5	332.9	683.1	1020.5
Total Assets ($billions)	23.3	316.1	633.1	972.5
Total Liabilities ($billions)	24.1	310.5	603.5	938.2
		Percent of Total Assets		
Net Worth (RAP)	−3.5	2.0	4.8	3.7
Net Worth (GAAP)	−5.2	0.6	3.9	2.6
Net Worth (TAP)	−6.0	−2.2	1.6	0.2
Nonperforming Assets[c]	9.6	6.4	4.5	5.2
Junk Bonds	0.0	0.0	0.0	0.0
Real Estate Held	1.8	0.8	0.4	0.6
Service Corporations	2.8	1.4	1.7	1.6
Off Balance Sheet Items	0.3	0.2	0.3	0.3
Regulatory Liquidity	7.2	9.4	11.3	10.6
		Percent of Total Liabilities		
Brokered Deposits	7.5	4.2	4.7	4.6
Repurchase Agreements	1.6	6.8	4.0	4.9
Mortgage-Backed Bonds	0.0	0.0	0.0	0.0

Source: Thrift Financial Reports.

[a] Details may not add to totals as a result of rounding.

[b] Direct investments include equity securities (except Federal Home Loan Bank Stock), real estate investments, and investments in service corporations or subsidiaries.

[c] Nonperforming assets equals the sum of repossessed assets; deferred net losses (gains) on loans and other assets sold; goodwill and "other" intangible assets; and delinquent loans.

Table IV

Balance Sheets of the 1985–1988 Data Set by Regulatory Net Worth Ratio[a] (Last Quarter Reported)

Item/Regulatory Net Worth Ratio	Less Than 0 Percent	0–3 Percent	3 Percent or More	All Institutions
		Percent of Total Gross Assets		
Mortgage Assets, Total	61.3	66.3	73.3	70.7
Mortgage Loans	42.7	46.0	56.7	53.4
Residential Mortgage Loans	32.3	38.3	49.3	45.5
Commercial Mortgage Loans	10.4	7.7	7.4	7.9
Land Loans	4.4	1.9	1.5	2.0
Mortgage-Backed Securities	14.1	18.4	15.1	15.3
Nonmortgage Assets, Total	5.2	7.5	6.2	6.2
Consumer Loans	3.2	5.7	4.3	4.3
Commercial Loans	2.0	1.8	1.9	1.9
Cash and Securities	12.5	13.7	12.3	12.5
Direct Investments[b]	5.2	2.4	2.2	2.7
Repossessed Assets	9.3	3.5	1.0	2.5
Other Assets	6.6	6.4	5.0	5.4
Total Assets (gross)	100.0	100.0	100.0	100.0
		Percent of Total Liabilities		
Deposits, Total	76.7	72.3	76.1	75.8
Insured Deposits	71.3	65.3	64.6	65.8
Uninsured Deposits	5.4	7.0	11.5	10.0
Managed Liabilities, Total	21.7	26.0	22.0	22.3
FHL Bank Advances	11.2	13.0	9.7	10.3
Other Borrowed Money	10.5	13.0	12.3	12.0
Other Liabilities	1.6	1.8	1.9	1.9
Total Liabilities	100.0	100.0	100.0	100.0
Memo items:				
Number of Institutions	564	227	2306	3097
Gross Assets ($billions)	217.4	137.9	1031.9	1387.3
Total Assets ($billions)	196.6	133.9	1001.9	1332.5
Total Liabilities ($billions)	227.3	132.1	943.6	1302.9
		Percent of Total Assets		
Net Worth (RAP)	−13.9	2.0	6.2	2.8
Net Worth (GAAP)	−17.4	0.5	5.3	1.4
Net Worth (TAP)	−20.0	−2.0	3.6	−0.4
Nonperforming Assets[c]	23.3	10.8	4.7	8.0
Junk Bonds	0.8	1.0	1.2	1.1
Real Estate Held	2.8	0.6	0.3	0.7
Service Corporations	2.8	1.7	1.6	1.8
Off Balance Sheet Items	2.8	3.8	5.5	4.9
Regulatory Liquidity	7.3	6.9	7.0	7.0
		Percent of Total Liabilities		
Brokered Deposits	7.1	4.2	5.6	5.7
Repurchase Agreements	8.3	7.4	7.3	7.5
Mortgage-Backed Bonds	0.8	2.1	1.4	1.3

Source: Thrift Financial Reports.

[a] Details may not add to totals as a result of rounding.

[b] Direct investments include equity securities (except Federal Home Loan Bank Stock), real estate investments, and investments in service corporations or subsidiaries.

[c] Nonperforming assets equals the sum of repossessed assets; deferred net losses (gains) on loans and other assets sold; goodwill and "other" intangible assets; and delinquent loans.

were located in geographically depressed regions, the more rapid decrease in mortgage assets at these thrifts may have been a reflection of lower mortgage demand rather than any desire to increase risk-taking.

Table V offers additional evidence of the changing nature of the thrift crisis as well as changes in the regulator's closure rule. The body of the table contains χ^2 statistics from Kruskal-Wallis tests of those items in Tables II–IV for selected groups of institutions. A (+) following a χ^2 statistic indicates that the first group listed in the legend had a higher mean score, while a (−) indicates the converse. For example, the comparison of the ranks assigned to individual RAP-solvent and RAP-insolvent institutions yielded a χ^2 of 10.31. Since this exceeds the critical value (7.88), the two groups are statistically different, with insolvent institutions being of smaller size. The χ^2 values listed in the first three columns of the table were used to rank variables to be included in the closure rule (equation (1)). To ensure a parsimonious specification, we were careful not to include variables that were highly correlated with each other. In the event that two variables with high χ^2 values were also highly correlated, that variable with the higher χ^2 value was included in the analysis.

Beyond the need for a criterion for variable selection, the results of the Kruskal-Wallis test are of interest in their own right. As can be seen, relative to individual RAP-solvent institutions, RAP-insolvent institutions have, over time, diversified away from residential mortgage assets and toward conventional mortgage loans, land loans, and commercial loans.

The last three columns of Table V are particularly interesting in that they reveal differences between open RAP-insolvent institutions and failed or resolved institutions. Although these two groups of institutions were somewhat different during the first two periods, they were remarkably similar during the last. With the exception of a few minor items, RAP-insolvent and failed institutions had similar portfolios during the 1985–1988 period. Of particular interest is the fact that, during the first two periods, institutions that were resolved tended to have relatively higher net worth, regardless of the accounting measure used. This result may, in part, reflect the fact that FSLIC had limited resources and could not adequately address many of the more serious problem cases. (See Barth, Brumbaugh, Sauerhaft, and Wang (1989).)

A. Sample Selectivity

Although we used several variants of equation (1) in our application of the Heckman procedure, our data proved to be obstinate and our estimates of the extent of sample selectivity were unusable. In addition to the fairly common problem of a value of $\hat{\rho}$ outside the unit interval, more serious computational problems developed. Since we do not feel comfortable with the results generated by the Heckman procedure, we will address the sampling issue more directly.

The most serious sampling selectivity occurs in those studies that include only resolved institutions in their analysis. Figure 1 illustrates the point. The dashed line in the figure indicates the "best fitting" line in the event that only resolved institutions are included. The conclusion is that more off-book activities increase

Table V

Kruskal-Wallis Chi-Square Statistics for Selected Balance Sheet and Income Statement Items

	RAP Insolvent Versus RAP Solvent Institutions			Open RAP Insolvent Versus Failed Institutions		
Period	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988
Variable						
Total Assets	10.31 (−)	3.51 (−)	1.45 (+)	1.03 (−)	1.35 (+)	0.67 (−)
Mortgage Assets	4.33 (+)	0.31 (+)	319.49 (−)	23.05 (−)	20.03 (−)	1.08 (+)
Residential Mortgages	0.00 (+)	0.58 (−)	336.66 (−)	14.62 (−)	15.94 (−)	1.13 (+)
Commercial Mortgages	0.62 (+)	12.65 (+)	130.87 (+)	1.94 (+)	1.01 (+)	0.26 (+)
Land Loans	1.48 (−)	2.91 (+)	155.27 (+)	1.13 (+)	9.45 (+)	0.18 (+)
Mortgage-Backed Securities	0.34 (−)	5.42 (−)	53.38 (−)	3.16 (−)	0.06 (+)	5.94 (+)
Nonmortgage Loans	14.88 (+)	5.12 (+)	10.66 (+)	8.28 (+)	4.42 (+)	0.04 (+)
Consumer Loans	14.24 (+)	5.63 (+)	0.01 (−)	6.22 (+)	3.13 (+)	0.00 (+)
Commercial Loans	0.57 (+)	0.01 (−)	50.83 (+)	1.37 (+)	12.77 (+)	0.91 (+)
Cash and Investment Securities	63.01 (−)	52.73 (−)	49.60 (−)	0.38 (−)	2.93 (+)	4.37 (−)
Direct Investments	5.21 (+)	13.21 (+)	87.37 (+)	1.58 (+)	0.85 (+)	0.15 (−)
Repossessed Assets	26.66 (+)	93.15 (+)	895.73 (+)	30.10 (+)	8.53 (+)	8.52 (+)
Other Assets	0.09 (+)	2.54 (+)	218.69 (+)	1.85 (+)	5.85 (+)	9.64 (−)
Junk Bonds	n.a.	n.a.	0.43 (−)	n.a.	n.a.	0.21 (+)
Real Estate Held	0.63 (+)	6.53 (+)	212.69 (+)	2.47 (+)	3.91 (+)	0.06 (−)
Service Corporations	4.04 (+)	11.09 (+)	40.31 (+)	1.38 (+)	0.06 (−)	0.00 (−)

Table V—*Continued*

Period	RAP Insolvent Versus RAP Solvent Institutions			Open RAP Insolvent Versus Failed Institutions		
	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988
Nonperforming Assets	20.05 (+)	86.77 (+)	966.05 (+)	38.50 (+)	26.80 (+)	0.01 (−)
Offbook Items	6.68 (−)	32.68 (+)	107.39 (−)	0.10 (−)	24.39 (−)	6.22 (+)
Liquid Assets	68.79 (−)	59.62 (−)	17.84 (−)	0.36 (+)	1.23 (+)	28.34 (−)
Reverse Repurchase Agreements	0.07 (−)	9.20 (−)	23.30 (−)	6.95 (−)	2.22 (+)	9.29 (+)
Mortgage-Backed Bonds	1.04 (−)	0.08 (−)	7.79 (−)	4.67 (+)	1.37 (−)	1.02 (+)
Total Deposits	56.03 (−)	53.46 (−)	97.92 (−)	0.08 (+)	0.08 (−)	6.67 (−)
Insured Deposits	74.93 (−)	53.28 (−)	9.84 (−)	3.25 (−)	0.73 (−)	4.54 (−)
Uninsured Deposits	28.32 (+)	0.44 (+)	247.21 (−)	3.25 (+)	10.04 (+)	0.00 (−)
FHL Bank Advances	58.25 (+)	72.38 (+)	153.73 (+)	0.00 (−)	0.15 (−)	5.09 (+)
Other Borrowings	0.80 (+)	0.34 (+)	0.03 (+)	4.01 (−)	1.78 (+)	0.75 (+)
Other Liabilities	6.17 (+)	0.14 (−)	1.02 (+)	0.49 (−)	0.14 (+)	0.91 (−)
Cost of Funds	68.49 (+)	144.53 (+)	418.95 (+)	12.46 (+)	53.32 (−)	0.02 (−)
Brokered Deposits	4.27 (+)	48.17 (+)	340.75 (+)	3.04 (+)	20.42 (+)	0.27 (+)
MMDA Accounts	n.a.	n.a.	76.67 (−)	n.a.	n.a.	11.44 (−)
Passbook Accounts	n.a.	n.a.	311.19 (−)	n.a.	n.a.	1.94 (−)
Cost of Advances	15.29 (+)	37.96 (+)	51.08 (+)	0.42 (+)	10.10 (−)	2.05 (+)
Net Operating Income	236.61 (−)	288.49 (−)	1,181.98 (−)	36.82 (−)	6.18 (+)	2.25 (−)
Compensation Expense	14.07 (+)	41.45 (+)	117.83 (−)	11.93 (+)	15.60 (−)	1.81 (+)
RAP Net Worth	375.84 (−)	360.27 (−)	1,383.42 (−)	143.06 (−)	18.64 (−)	0.07 (−)
GAAP Net Worth	338.82 (−)	300.50 (−)	1,364.91 (−)	140.27 (−)	23.49 (−)	0.32 (+)
TAP Net Worth	286.32 (−)	254.11 (−)	1,337.69 (−)	137.22 (−)	27.16 (−)	0.63 (+)

Note: See Conover (1980, pp. 229–237) for a detailed discussion of the Kruskal-Wallis Test. A (+) following a χ^2 statistic indicates that the first group listed in the legend has a higher mean score, while a (−) suggests the opposite. With $\alpha = .0005$, the χ^2 critical value is 7.88. For those variables in the table whose χ^2 values exceed this critical value, the null hypothesis that the two groups being compared come from the same population is rejected.

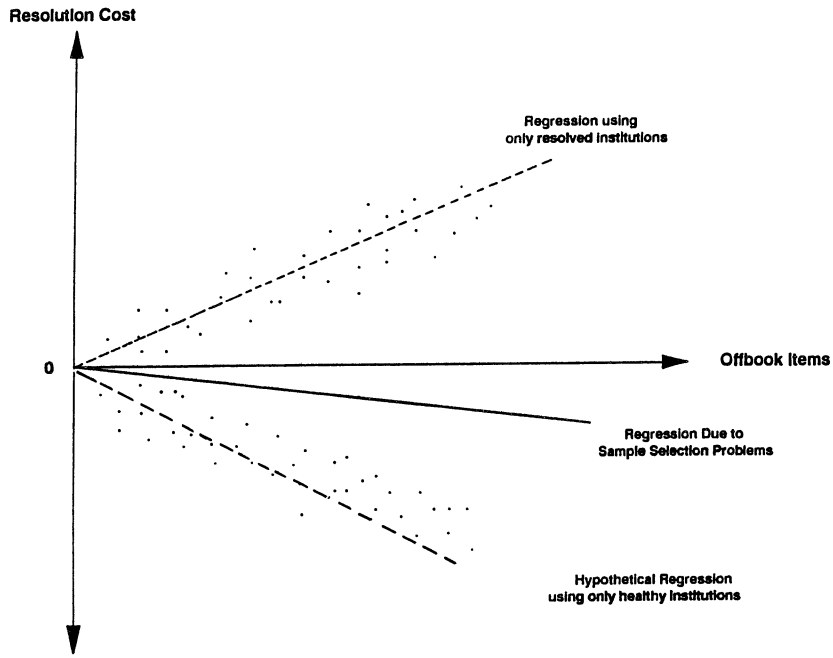

Figure 1. Hypothetical scatter diagram and regressions of resolution cost.

resolution cost. The dotted line presents the "best fitting" line were it possible to include only healthy institutions. Assuming, for ease of exposition, that the two groups of institutions—resolved and healthy—are equal in number, there is no true relationship between off-book items and resolution cost.

By including healthy as well as resolved institutions in our data set, we have been able to avoid this obvious sample selectivity bias. However, as mentioned earlier, a more subtle form of sample selectivity may remain. Many unresolved institutions are GAAP-insolvent and can be expected to impose costs on the deposit insurer. The dependent variable is missing for these institutions, but not because of the censoring that applies to healthy institutions. As such, unresolved GAAP-insolvent institutions need to be excluded from the analysis. If these institutions are systematically different from those that are included, sample selectivity problems exist. Figure 1 can again be used to illustrate this point. Assuming that unresolved GAAP-insolvent institutions are identical to those institutions that have been resolved, institutions that exhibit a positive relationship between off-book items and resolution cost are under-represented, and the regression line that results from using the remaining institutions will be somewhat below the axis (see the solid line) and the coefficients are biased downwards.

Table VI presents a series of Kruskal-Wallis tests in an attempt to discern whether those institutions that are excluded differ systematically from those that are included. On balance, the χ^2 statistics are much lower for the failed versus open GAAP-insolvent comparison than they are for the GAAP-solvent versus open GAAP-insolvent comparison. Hence, the GAAP-insolvent institutions that have been excluded because of an unobserved dependent variable are far more

similar to those institutions that have been resolved than they are to GAAP-solvent institutions, and our coefficients will be biased somewhat. We will return to this issue later.

B. Cost-of-Resolution Equation

Since the vast majority of thrift institutions have not imposed costs on the deposit insurer, tobit is the appropriate estimation technique for the cost-of-resolution equation. Tobit is designed to handle estimation problems where the underlying distribution is truncated at some particular value. It assumes continuous values above the cutoff point. The tobit estimates of the coefficients in equation (2) appear in Table VII. The limited number of costly resolutions during 1983 and 1984 made it impossible to estimate the model for these years. Moreover, when comparing the results of the early 1980s with those of the late 1980s, we feel more comfortable with the latter due to the much higher percentage of institutions with resolution costs above the truncation point, 11 percent versus 3 percent.

The marked changes in the estimated coefficients between the early 1980s and the late 1980s evident in the table are consistent with our belief in the different phases of the thrift crisis. In contrast to the 1985–1988 period, the coefficients for the early 1980s often have an unexpected sign and an implausible magnitude. In addition, OLS regression results for those institutions that imposed costs on the insurer do very poorly for the early 1980s. (See Appendix III in Barth, Bartholomew, and Bradley (1989).) As a result, we have elected to focus our attention on the 1985–1988 period.

The estimated coefficients in Table VII are biased due to the sample-selectivity problem discussed earlier. Since the Kruskal-Wallis results presented in Table VI suggest similarity between failed institutions and those GAAP-insolvent institutions that have been excluded, we have used an OLS regression model for resolved thrifts to predict a resolution cost for open GAAP-insolvent institutions. Equation (2′) was again estimated with tobit, where the dependent variable for each open GAAP-insolvent institution was its predicted value. The results from this exercise are presented in Table VIII, and the reported coefficients should not be subject to sample selectivity bias.

From Table VIII, TAP net worth is a very significant determinant of the cost of resolution and affects this cost in the expected way. The coefficients on the Discount Rate, Off-Book Items, Nonperforming Assets, and Core Deposits are also highly significant and have expected signs. The coefficients for Regulatory Liquidity, however, have the "wrong" sign and are statistically significant. We anticipated that, since liquid assets are marked-to-market regularly, the greater an institution's holdings of these assets the lower the wedge between market- and book-value measures of net worth, and the lower would be the resolution cost. The FSLIC, however, often takes regulatory control of an institution prior to resolving it. During the intervening period between control and resolution, some of the institution's assets may be liquidated prior to marketing the institution. To the extent that this occurs for severely troubled institutions, increased liquidity may signal higher rather than lower expected resolution costs.

Table VI

Kruskal-Wallis Chi-Square Statistics for Selected Balance Sheet and Income Statement Items

	Failed Versus Open GAAP Insolvent Versus GAAP Solvent			Failed Versus Open GAAP Insolvent			Open GAAP Insolvent Versus GAAP Solvent		
Period	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988
Variable									
Total Assets	22.17	36.58	4.86	19.61 (−)	28.42 (−)	0.01 (+)	17.59 (+)	24.29 (+)	2.62 (+)
Mortgage Assets	193.88	72.48	352.39	158.36 (+)	45.70 (+)	8.63 (−)	47.04 (−)	57.72 (−)	167.09 (−)
Residential Mortgages	110.04	115.29	369.51	97.09 (+)	45.94 (+)	7.88 (−)	64.82 (−)	106.32 (−)	183.20 (−)
Commercial Mortgages	9.04	14.90	118.67	4.02 (−)	0.01 (−)	1.22 (+)	8.84 (+)	12.54(+)	57.27 (+)
Land Loans	14.55	8.54	132.47	14.68 (−)	7.09 (−)	2.71 (+)	9.67 (+)	4.80 (+)	62.08 (+)
Mortgage-Backed Securities	12.57	57.90	44.99	2.97 (−)	20.17 (−)	23.22 (−)	11.35 (+)	53.47 (+)	0.07 (−)
Nonmortgage Loans	31.54	31.78	26.49	5.24 (−)	4.57 (−)	1.45 (−)	24.00 (+)	31.85 (+)	20.78 (+)
Consumer Loans	33.26	42.33	8.03	4.23 (−)	4.63 (−)	3.84 (−)	24.12 (+)	42.32 (+)	7.94 (+)
Commercial Loans	2.18	16.78	46.66	1.88 (−)	16.98 (−)	0.02 (+)	0.39 (+)	3.84 (+)	27.40 (+)
Cash and Investment Securities	213.23	56.01	30.66	36.04 (−)	21.52 (−)	0.09 (+)	17.73 (−)	14.73 (−)	19.48 (−)
Direct Investments	37.04	23.13	87.41	7.01 (−)	0.11 (−)	1.96 (+)	31.68 (+)	20.81 (+)	43.07 (+)
Repossessed Assets	37.27	125.41	884.11	20.70 (−)	2.62 (+)	4.28 (+)	37.54 (+)	93.42 (+)	454.63 (+)
Other Assets	181.69	472.48	380.21	137.01 (−)	92.72 (−)	0.45 (+)	176.77 (+)	471.04 (+)	226.01 (+)
Junk Bonds	n.a.	n.a.	3.01	n.a.	n.a.	2.03 (−)	n.a.	n.a.	2.64 (+)
Real Estate Held	5.97	3.46	178.61	4.43 (−)	0.93 (−)	7.09 (+)	0.25 (+)	3.38 (+)	70.01 (+)
Service Corporations	49.58	26.94	51.07	9.45 (−)	0.21 (+)	0.04 (+)	42.48 (+)	21.21 (+)	31.91 (+)

Table VI—*Continued*

Period	Failed Versus Open GAAP Insolvent Versus GAAP Solvent			Failed Versus Open GAAP Insolvent			Open GAAP Insolvent Versus GAAP Solvent		
	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988	1980–1982	1983–1984	1985–1988
Variable									
Nonperforming Assets	258.91	590.40	1,110.87	187.20 (−)	36.32 (−)	19.34 (+)	238.86 (+)	578.96 (+)	624.66 (+)
Offbook Items	15.87	138.59	120.82	8.35 (−)	94.25 (+)	18.20 (−)	0.09 (+)	0.01 (+)	29.54 (−)
Liquid Assets	301.18	80.74	56.05	52.66 (−)	16.66 (−)	32.35 (+)	26.69 (−)	36.23 (−)	54.75 (−)
Reverse Repurchase Agreements	68.99	32.84	27.68	1.21 (+)	22.53 (−)	21.20 (−)	20.47 (+)	19.86 (+)	0.21 (+)
Mortgage-Backed Bonds	8.06	60.29	7.06	9.09 (−)	8.73 (+)	3.65 (−)	0.15 (+)	0.00	0.30 (−)
Total Deposits	211.15	101.92	122.23	0.31 (−)	1.42 (−)	4.73 (+)	89.50 (−)	83.88 (−)	92.96 (−)
Insured Deposits	160.60	53.06	17.03	0.36 (+)	6.75 (−)	4.42 (+)	78.68 (−)	32.87 (−)	16.94 (−)
Uninsured Deposits	19.94	6.06	276.14	1.32 (−)	5.07 (−)	1.97 (−)	13.56 (+)	0.13 (−)	146.42 (−)
FHL Bank Advances	245.91	125.32	159.19	0.96 (+)	6.85 (+)	0.91 (−)	93.17 (+)	87.63 (+)	108.73 (+)
Other Borrowings	33.54	27.88	6.64	0.00 (+)	11.85 (−)	4.25 (−)	15.90 (+)	26.07 (+)	6.39 (+)
Other Liabilities	16.18	1.53	1.69	0.17 (−)	1.68 (−)	0.89 (+)	9.37 (+)	0.21 (+)	0.02 (+)
Cost of Funds	51.96	238.04	370.27	1.35 (−)	139.60 (+)	14.40 (+)	34.37 (+)	56.58 (+)	177.38 (+)
Brokered Deposits	7.91	7.48	282.97	4.49 (−)	0.78 (−)	5.85 (+)	7.83 (+)	7.49 (+)	121.93 (+)
MMDA Accounts	n.a.	n.a.	51.66	n.a.	n.a.	1.79 (+)	n.a.	8.29 (−)	40.51 (−)
Passbook Accounts	n.a.	n.a.	250.90	n.a.	n.a.	5.34 (−)	n.a.	1.03 (−)	116.96 (−)
Cost of Advances	97.06	105.55	68.05	3.44 (−)	20.65 (+)	1.61 (−)	53.45 (+)	56.64 (+)	50.08 (+)
Net Operating Income	560.33	412.35	1,215.55	6.35 (−)	130.95 (−)	20.95 (−)	170.76 (−)	208.50 (−)	631.10 (−)
Compensation Expense	3.17	90.09	64.95	3.23 (−)	91.07 (+)	2.61 (+)	2.27 (+)	9.39 (−)	23.80 (+)
RAP Net Worth	956.53	821.57	1,560.15	0.85 (+)	72.18 (−)	48.73 (−)	389.79 (−)	620.93 (−)	866.10 (−)
GAAP Net Worth	1,115.03	1,322.30	1,625.24	313.74 (+)	11.86 (+)	43.62 (−)	648.80 (−)	1,151.78 (−)	944.75 (−)
TAP Net Worth	903.22	1,077.12	1,578.89	311.68 (+)	19.86 (+)	44.20 (−)	555.19 (−)	947.12 (−)	901.69 (−)

Note: See Conover (1980, pp. 229–237) for a detailed discussion of the Kruskal-Wallis Test. A (+) following a χ^2 statistic indicates that the first group listed in the legend has a higher mean score, while a (−) suggests the opposite. With $\alpha = .005$, the χ^2 critical value is 7.88. For those variables in the table whose χ^2 values exceed this critical value, the null hypothesis that the two groups being compared come from the same population is rejected.

Table VII

Tobit Estimates of the Cost-of-Resolution Equation Basic Model

Asymptotic t-statistics are in parentheses. Dependent variable: cost of resolution.

	Estimated Coefficients (1980–1982)	Estimated Coefficients (1985–1988)
TAP Net Worth	−0.06	−1.47
	(−0.20)	(−48.95)
Discount Rate	9.44	40.97
	(6.36)	(11.04)
Off-Book Items	−0.04	0.62
	(−0.06)	(12.11)
Nonperforming Assets	−0.05	0.20
	(−0.19)	(9.89)
Regulatory Liquidity	−0.22	0.18
	(−0.63)	(6.55)
Core Deposits	—	−0.55
		(−9.70)
Cost of Funds	0.89	—
	(0.83)	
Constant	−102.85	−369.98
	(−5.52)	(−11.95)
Memo: Log Likelihood	−450.40	−1,969.70
Pseudo-R^{2a}	0.42	0.30

Note: All variables except the discount rate and those that are dummy variables are measured in millions of dollars.

[a] This is the pseudo-R^2 as developed by McFadden. That is, $R^2 = 1 - (\log L_U)/(\log L_R)$. See Maddala (1985, p. 40) for further discussion.

Several variants of the basic model are presented in Table VIII as a means of exploring the degree to which variables not included in the basic model help to explain the cost of resolution. Severe regional economic problems, for example, may have caused discrepancies between market-value and book-value measures of net worth to be larger than was typically the case. As can be seen, however, including the Texas dummy variable has little effect on the other coefficients, and the coefficient of the variable itself is insignificant, suggesting that Texas resolutions are indistinguishable from all others. Moreover, the institution's charter and ownership form have little to offer beyond what has already been captured by the basic model. This is not suggesting that these factors are unimportant. Stock-type institutions have proven to be more costly than mutuals, but most of the differences between these groups have already been captured in nonperforming assets and book-value net worth.

The tobit coefficients reported in Table VIII apply to the untruncated population and capture two distinct effects: first, the effect of each variable on the probability that an institution will be resolved; second, given that an institution is resolved, the amounts that each variable increases or decreases resolution costs. For example, each additional dollar of TAP net worth can be expected to decrease resolution costs by $1.56 for the entire population.

Table VIII

Tobit Estimates of the Cost-of-Resolution Equation When GAAP-Insolvent Institutions are Included: 1985–1988

Asymptotic t-statistics are in parentheses. Dependent variable: cost of resolution.

Variable	Estimated Coefficients		
	Basic Model	Regional Effects	Charter Effects
Constant	−347.07	−346.6	−364.04
	(−12.37)	(−12.34)	(−12.55)
TAP Net Worth	−1.56	−1.55	−1.55
	(−70.41)	(−68.15)	(−67.90)
Discount Rate	33.72	33.18	33.61
	(10.30)	(10.15)	(10.06)
Off-Book Items	0.82	0.81	0.80
	(26.73)	(26.07)	(26.32)
Nonperforming Assets	0.20	0.18	0.18
	(13.45)	(10.75)	(11.36)
Regulatory Liquidity	0.27	0.27	0.29
	(12.04)	(11.64)	(12.21)
Core Deposits	−0.67	−0.64	−0.65
	(−17.65)	(−17.09)	(−16.97)
Texas (=1 if in Texas, 0 otherwise)[a]	—	0.02	—
		(1.34)	
State (=1 if state-chartered, 0 otherwise)	—	—	15.11
			(0.98)
Stock (=1 if stock-owned, 0 otherwise)	—	—	26.75
			(1.83)
Memo: Log Likelihood	−3,439.30	−3,437.80	−3,432.30
Pseudo-R^{2b}	0.26	0.26	0.26

Note: All variables except the discount rate and those that are dummy variables are measured in millions of dollars.

[a] This variable has been multiplied by 1,000 to minimize convergence problems. Its coefficient should be interpreted accordingly.

[b] This is the pseudo-R^2 as developed by McFadden. That is, $R^2 = 1 - (\log L_U)/(\log L_R)$. See Maddala (1985, p. 40) for further discussion.

Given that institutions that have been or need to be resolved differ in important respects from healthy institutions (see Table VI), a decomposition to isolate the separate effects embedded in the tobit coefficients would be of interest. Such a decomposition is recommended by McDonald and Moffitt (1980). They advise that the tobit coefficients be multiplied by $[1 - zf(z)/F(z) - f(z)^2/F(z)^2]$, where $z = \bar{X}'\hat{\beta}/\sigma$ and f and F are the density and cumulative distribution functions of the unit normal distribution, respectively. The multiplication of the tobit coefficients reported in Table VIII by this factor yields coefficients that may be interpreted subject to the institution having been resolved at a cost to the insurer.

The conditional tobit coefficients are reported in Table IX and can be interpreted in the usual way.[13] For example, for those institutions that have been

[13] The conditional coefficients are evaluated at the fraction of the sample with positive resolution costs (17 percent), rather than at $\bar{X}$, since $\bar{X}$ may not represent a "typical" institution (see Table VI). Since $F[z] = .17$, $Z = -.955$, $f(z) = .253$, and the adjustment factor equals .21.

resolved at a cost to the insurer, the basic model suggests that each additional dollar of off-book items increases the resolution cost by 17 cents.

Recalling that the resolution cost is an institution's negative market value, the coefficients of TAP net worth reported in Table IX are consistent with the hypothesis that, for troubled institutions, tangible net worth understates market-value net worth.

IV. Summary and Conclusions

Our detailed analysis of thrift institutions that were resolved during the 1980s is intended to increase our understanding of the process of failure and the determinants of resolution costs. This knowledge is imperative if a recurrence of the thrift crisis is to be avoided and if the federal deposit insurance system is to be appropriately reformed. In addition, information about these issues will be useful in refining early warning systems and increasing the efficient use of examination resources.

The evidence that we have presented suggests that the model that explains failure and resolution costs in the late 1980s is significantly different from the model for either the middle or early 1980s. This finding is consistent with the notion that there were three distinct phases of the thrift crisis prior to FIRREA. The significance of the discount rate, in addition, reveals the importance of

Table IX

Conditional Tobit Coefficients

Variable	Conditional Coefficients[a]		
	Basic Model	Regional Effects	Charter Effects
Constant	−72.88	−72.79	−76.45
TAP Net Worth	−0.33	−0.33	−0.33
Discount Rate	7.08	6.97	7.06
Off-Book Items	0.17	0.17	0.17
Nonperforming Assets	0.04	0.04	0.04
Regulatory Liquidity	0.06	0.06	0.06
Core Deposits	−0.14	−0.13	−0.14
Texas (=1 if in Texas, 0 otherwise)[b]	—	0.004	—
State (=1 if state-chartered, 0 otherwise)	—	—	3.17
Stock (=1 if stock-owned, 0 otherwise)	—	—	5.62

Note: All variables except the discount rate and those that are dummy variables are measured in millions of dollars.

[a] The conditional coefficients in this table equal the coefficients in Table VIII multiplied by the adjustment factor, .21. The coefficients are evaluated at the fraction of the sample above the truncation point rather than at $\bar{X}$, since $\bar{X}$ may not represent a "typical" institution (see Table VI). See McDonald and Moffitt (1980) for further details.

[b] This variable has been multiplied by 1,000 to minimize convergence problems. Its coefficient should be interpreted accordingly.

including time effects as well as individual institution effects into the analysis. Although we are encouraged by these preliminary findings, further research is needed to explain why the model of thrift failure and resolution cost changed over time.

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