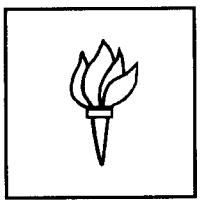

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If History Could be Re-Run: The Provision and Pricing of Deposit Insurance in 1933

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IF HISTORY COULD BE RE-RUN:

THE PROVISION AND PRICING OF DEPOSIT INSURANCE IN 1933 †

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THE PROVISION OF DEPOSIT INSURANCE IN 1933

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ABSTRACT

This paper examines cross-subsidy, moral hazard and bank liability issues related to the provision of federal deposit insurance by "re-running" its implementation, i.e., determining fair premium values, over the period 1927-1932. The pre-1933 period was characterized by historically high asset price volatility, a large number of bank failures and a weak federal safety net. In this economic context, we find a high degree of self-insurance on the part of the banks in our sample, both in terms of higher overall levels of capital and a strong correlation between capital levels and asset volatility. Potentially large, regionally-based, cross-subsidies among banks were found.

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List of Symbols:

B_1	the face value of insured bank deposits,
B_2	the face value of other bank liabilities,
B	$B_1 + B_2$ = the face value of total debt liabilities,
d	the insurance premium per dollar of insured deposits.
E	bank equity value,
f^*	equal to the quantity [1 - PV(Par)/B],
FV	denotes the future value operator
ln	natural logarithm,
max	maximum of the quantities enclosed in parentheses,
n	number of dividend payments per year
$N(\cdot)$	the cumulative density of a standard normal variable,
Par	total par value of the bank's outstanding equity,
PV	denotes the present value operator
T	time until the next bank audit,
$\sqrt{T}$	square root of T,
V	the unobserved value of bank assets,
y	argument in the option pricing model
δ	delta, dividends per dollar of bank assets,
σ_E	sigma, instantaneous standard deviation on bank equity,
σ_V	sigma, instantaneous standard deviation on bank assets,

Appendix B Symbols:

a	
a_2	
b_1	
c	the audit cost per dollar of deposit
g	
h	
m	
p	the premium value, per dollar of deposits,
p^*_1	equilibrium premium value for $x \geq 1$,
p_1	the premium value for $x \geq 1$,
p'_1	first derivative of p_1,
p''_1	second derivative of p_1,
p_2	the premium value for $0 \leq x \leq 1$,
p'_2	first derivative of p_1
Q	capital q
r	market interest rate
r_{12}	equal to $-[\phi + (\phi^2 + 2\mu\sigma_V^2)^{1/2}]/\sigma_V^2$,
r_{21}	equal to $[-\phi + (\phi^2 + 2(\mu+\lambda)\sigma_V^2)^{1/2}]/\sigma_V^2$,
s^2_d	deposit flow variance,
x	V/D, the ratio of asset value to total liabilities,
$x \to \infty$	as x increases to infinity
$\frac{1}{2}$	one-half
γ	gamma
μ	mu (=r-g) market interest rate minus deposit growth rate,
λ	lambda,
ϕ	small phi, = $r-\theta-g-\frac{1}{2}\sigma_V^2$,
ρ	rho
σ	sigma
θ	theta, dividend payout per unit time,

IF HISTORY COULD BE RE-RUN: THE PROVISION AND PRICING OF DEPOSIT INSURANCE IN 1933

Introduction

The passage of the Federal Deposit Insurance Improvement Act (FDICIA) of 1991 has focused renewed attention on issues concerning deposit insurance provision and pricing. Specifically, the risk-based deposit insurance premium system, implemented in 1993, is the first major deviation from the flat (non-risk based) premium schedule adopted when federal deposit insurance was introduced.[1] Similarly, the prompt corrective action (PCA) requirement[2] is a modification of the full limited liability rule that was legislated in 1933 and 1935.[3] These initiatives (undertaken with FDICIA) were in response to concerns regarding bank cross-subsidies and moral hazard incentives shown to be inherent with fixed-rate (premium) deposit insurance.

These cross-subsidy, moral hazard and bank liability issues were also actively debated when the federal deposit insurance contract was introduced in 1933.[4] At that time large money-center and Eastern U.S. banks opposed federal deposit insurance on the grounds that stronger banks would be forced to subsidize poorly managed and weaker banks. However, the final legislative outcome was the flat, or risk-insensitive, explicit premium schedule that existed up until 1993.[5] At the same time, limited liability on the part of bank owners replaced the double-liability system that had been in place since around the end of the Civil War.

Additional features that characterized the pre-1933 banking era included the high capital ratios maintained by banks compared to current capital adequacy standards, and the existence of double liability exposure for bank stockholders in national and most state banks.[6] These features were important determinants of the "fair" (bank-specific) value of the 1933 federal deposit insurance contract. Moreover, they also raise important public-policy issues regarding minimum bank capital adequacy standards and the maintenance of limited versus (partially) unlimited liability for bank stockholders. This latter issue - a deviation from fully limited liability - has been reflected in the recent debate over PCA and early closure rules.

This study examines the issues raised above through an analysis of bank-specific fair premium values for federal deposit insurance (i.e., by "re-running" its history) over the period: 1927-1932. This period just prior to the passage of the temporary deposit insurance plan in 1933 is of particular interest for several reasons. First, a relatively "clean" assessment of the issues can be made at this time, since the confounding effects of *in situ* mis-priced deposit insurance were not present. Second, given that the FDIC was established in the aftermath of the bank panics of the 1931-1933 period, when some 10,000 banks failed (see Benston (1989), Calomiris (1992) and Calomiris and Gorton (1990)), our analysis can examine the merits of the subsidy and pricing issues from the perspective of the 1933 legislative debate. Finally, the study's results from this period of volatile economic

conditions and large number of bank failures can provide useful insights into the current debate over the provision of deposit insurance.

To value the deposit insurance contract, the study employs the limited-term option pricing approach of Marcus and Shaked (1984, hereafter MS) and Ronn and Verma (1986, hereafter RV) and for comparison a modified unlimited-term approach, following Merton (1978) and Pennachi (1987). A correction is made to the original RV formulation so that "put-call" parity is now satisfied. In addition, Merton's (1978) unlimited-term model is extended to account for dividend payments to stockholders.

In Section I of the paper we briefly discuss the regulatory background, especially the bank "safety net", prior to the announced introduction of deposit insurance in 1933. Section II examines the relevant 1933 legislative debate. In Section III the methodology for estimating bank-specific deposit insurance premia is presented. In Section IV the data collection procedure is discussed. Section V then presents the empirical results regarding the cross-subsidy, double liability and deposit insurance pricing issues discussed above. A summary and conclusions follow in the final section.

I. REGULATORY BACKGROUND

Prior to the advent of federal deposit insurance there were three major "safety nets" available to banks, each with major operational defects that became apparent in the 1920's. The first

was the provision of state-sponsored deposit insurance. However, state insurance provision was selective (only eight states operated schemes in the 1920's, see Calomiris (1992, p. 96)), these schemes were invariably poorly funded and administered, and all collapsed by the end of the 1920's (FDIC, 1984).

The second was the informal arrangement and central bank-like behavior of local clearinghouses, such as the New York City Clearinghouse Association (NYCHA). In many previous panics such as in 1857 and 1907, these organizations had acted as de-facto central banks, providing liquidity and liability guarantees to troubled banks within the clearinghouse (Gorton, 1985a and 1985b). However, as cited in Kennedy (1973, p. 196), clearinghouse guarantees were selectively applied in the 1931-1933 period.[7] For example, the Harriman National Bank which belonged to the NYCHA failed to get other members of the clearinghouse, such as J.P. Morgan, to guarantee its deposits and thus went into liquidation.

The third aspect of the safety net was the lender of last resort facilities that had been available from the Federal Reserve for liquidity-constrained banks, since its establishment in 1914. However, as shown in Friedman and Schwartz (1963), the Federal Reserve increased high powered money at an annual rate of approximately 3.2% during the 1929-1933 period, which was not sufficient to prevent a large decline in the money supply occurring during this period.

In this environment of weak safety nets (and greater depositor and shareholder discipline) it is perhaps not surprising that bank

owners chose a greater level of self- (or co-) insurance, via holding more equity and maintaining relatively low leverage ratios compared to today's standards. For example, Calomiris (1992, p. 62, Table 1-5) shows that in June 1928 the (book value) ratio of capital plus surplus to assets of all U.S. banks belonging to the Federal Reserve system was 19%. This compares to average capital ratios of all U. S. banks of 6% in 1990 (see *Economic Review*, Federal Reserve Bank of Atlanta, July/August 1991).

The incentive for greater shareholder discipline was related not only to the weakness of the safety net and its system of guarantees, but was also a product of the wide-spread existence of bank stockholder double liability. For some 75 years, following the passage of the National Bank Act of 1863, up until 1935 national bank stockholders were subject to a system of double liability. In addition, beginning in the 1850's most state legislatures passed double liability laws for state-chartered banks (Macey and Miller, 1992), many of which remained in effect well into the 1940s. Under double liability, bank stockholders not only lost their original equity claim in the bank on failure (as under limited liability) but "each shareholder shall be liable to the amount of the par value of shares held by him, in addition to the amount invested in such shares" (National Bank Act, 1863, Ch 58, 12 Stat. 665). This meant that if a bank failed, the receiver could assess an additional liability for stockholders equal to the par value of stock they held. Not surprisingly, as capital became impaired bank stockholders would have greater incentives to engage in voluntary

mergers (or even self-closure), compared to the post-FDIC deposit insurance regime.

Thus in valuing deposit insurance guarantees at the time of the FDIC's creation, it is of interest to examine the effect of double liability versus limited liability on the value of deposit insurance to bank stockholders. In particular, it is worth recognizing, as a public policy issue, that double liability and deposit insurance are not necessarily mutually exclusive. Although Congress chose to eliminate double liability for national banks at the time deposit insurance came permanently into force in 1935, it nevertheless had the option to retain it. Moreover, the issue of resuscitating double liability has also been raised from time to time as a potential reform to ameliorate weaknesses in the current deposit insurance system (notwithstanding the recent modifications of limited liability rules under PCA).[8]

II. THE 1933 LEGISLATIVE DEBATE

An early version of federal deposit insurance was included in the Senate version of the Federal Reserve Act of 1914, but was latter eliminated in a joint House and Senate conference. The federal provision of deposit insurance was resuscitated in the early 1930s in response to the public outcry over the developing banking crisis. Nevertheless, resistance to the legislation from large banking interests impeded its serious consideration until the national banking crisis and nine day national bank holiday in March 1933 (one day after the Roosevelt inauguration).

Resistance to federal deposit insurance legislation centered on concerns that well-capitalized banks (and in particular large eastern U.S. and money center banks) would subsidize less well-capitalized and poorly managed banks elsewhere, i.e., the cross-subsidy issue.[9] In addition, a deposit-based assessment for funding deposit insurance was perceived as discriminating against healthy banks that had maintained, or even increased, their deposit bases during the 1930-1933 crisis.[10] As well, the scope of membership (e.g., Federal Reserve member versus non-member banks) was an additional point of controversy in the deposit insurance debate.[11]

In response to the cross-subsidy issue, Congressional supporters of the bill emphasized that the deposit insurance program was not intended to be a federal guarantee to depositors, but rather "was a mutual insurance system supported and maintained by the banks themselves" (Congressional Record, p. 3837). Congressman Steagall in particular felt that this cross-guarantee structure would give participating banks an incentive to cross-monitor the behavior of other member banks and report ill-managed or poorly capitalized banks to the examining authority. In this context the existence of potential cross-subsidies provided important monitoring incentives to help preclude risky and unorthodox banking practices.

The cost of providing deposit insurance was an additional legislative concern at the time. Steagall argued that historical depositor losses at national banks had averaged 0.14 percent or 14 bp since the passage of the 1863 National Banking Act, 19 bp since

the passage of the Federal Reserve Act and 70 bp in 1931, as a percentage of deposits (Congressional Record, p. 3839). In addition, he felt that these historical rates would have been much smaller had a system of federal deposit insurance been in place during these earlier periods. Therefore, the 8.33 bp assessment rate adopted in the Banking Act of 1935 likely reflected his (and others) optimism of increased banking stability under federal deposit insurance.

Finally, the advent of federal deposit insurance spelled the end of double liability for national bank stockholders. Congressional dis-enchantment with double-liability was three-fold. First, double liability had failed to bolster public confidence and thereby prevent bank panics. Second, bank stock became more widely held during the 1920s, and often by investors with little knowledge of the potential extended nature of their liability, and/or little inside connection with bank management. Finally, the double liability provision made bank recapitalization difficult during the 1930s. For these reasons, double liability on newly-issued shares of national bank stock was repealed in the Banking Act of 1933.

III. DEPOSIT INSURANCE PRICING METHODOLOGY

In valuing deposit insurance we utilize both the limited-term put-option model, developed in Merton (1977), Marcus and Shaked (MS, 1984) and Ronn and Verma (RV, 1986), as well as the ex-ante unlimited-term put-option model, developed by Merton (1978) and Pennacchi (1987).[12] As a special case we extend the limited-term

deposit insurance valuation model to account for stockholder double liability.

The limited-term model is appealing as a model of the initial federal deposit insurance contract, since at the time of its introduction it generated a great deal of controversy and heated debate. Indeed, the initial plan, set in 1934, was temporary and subject to revisions in the Banking Act of 1935, which then legislated the permanent plan. Therefore *ex-ante*, federal deposit insurance must have appeared *de facto* limited-term at the time of its introduction. Nevertheless, in hindsight the 8.33 deposit insurance rate set in 1935 did remain in effect without revision until 1950 when the partial rebate plan was introduced. In addition, capital ratios were mostly unregulated during this period.[13] Thus *ex-post*, federal deposit insurance has behaved much like an unlimited-term contract.[14] It is interesting then to compare the established 8.33 bp premium rate with fair premium values generated under both limited-term and unlimited-term contract assumptions.

Details of the formulas used for the limited-term model are given in Appendix A. In particular, a correction is made to the original RV formulation, so that a form of "put-call parity" is now satisfied.[15] Appendix B details the unlimited-term formulation used, which extends Merton's (1978) unlimited-term approach to account for dividend payments to stockholders.

IV. DATA

Weekly bank stock data for New York City banks is available from the *Commercial and Financial Chronicle*. Cash dividend, stock dividend and stock split data were collected from *Moody's Manual of Investments* for each bank and each year. Using the average of the weekly bid and ask prices, the data allowed the generation of a weekly stock return series for each bank, adjusted for dividends and stock splits. From the time series data, estimates were derived for σ_E, the annualized standard deviation of return on bank equity.

To analyze the cross-subsidy issue, an additional data sample was collected from the monthly stock price series reported in the *Bank and Quotation Record*.[16] This sample included major banks from each banking region in the country. This data source actually covers some 1900 banks in total, but lack of monthly trading causes most banks to be unusable for obtaining volatility estimates. To avoid thin trading problems, a subsample of 550 of the most actively traded banks was selected for data entry. Bank stock returns were then calculated for each study year, 1927-1932, and the final sample of banks for each year was selected under a criterion that their stock had actively traded (as evidenced by a non-zero return for any particular month) for at least 8 out of the 12 months in any particular year.

Annual data on bank deposits and other bank liabilities were collected from various issues of *Rand-McNally Bankers Directory*. Par values and the number of shares outstanding were also collected from *Moody's Manual of Investments*.

V. RESULTS

V A. SUMMARY STATISTICS

Table I lists the sample size of banks (N), total deposits (D, billions), average equity volatility (σ_E, %), average implied asset volatility (σ_A, %) and unweighted (κ_U) and weighted (κ_W) average market equity-to-asset ratios (%) by regional designation and for the total sample of banks. The sample size varied from 303 banks in 1929 to 122 banks in 1932 (RV used 43 bank holding companies for 1983.) Variations in bank numbers in the sample are due to changes in trading activity, which appeared to peak in 1929, and due to mergers, closures and voluntary liquidations that occurred during the depressionary post-1929 period.

Total deposits for the sample of banks varied across regions from the relatively large New York City (NYC) banks, with total sample deposits of $6.4 billion in 1929 to the District of Columbia (DC) sample of banks with total deposits of $0.20 billion. Total bank deposits for the sample in 1929 was $17.5 billion, representing 28.8% of total national deposits.[17]

Insert Table I about here.

V B. Equity And Asset Volatilities

One measure of bank risk-taking is given by the estimated equity volatilities and implied asset volatilities derived from the RV option pricing equity formula (see Appendix A). Average volatility estimates are shown in Table I for each banking region.[18]

For 1929, the year of the stock market crash, the highest regional weighted-average equity and asset volatilities are found in the industrial midwest (IMW) (61.3 and 13.2 %), the industrial northeast (INE) (61.0 and 13.4 %), the New York City (NYC) banks (48.6% and 15.5%), and finally the southeast (SE) region banks (39.0 and 8.66 %). Low volatility regions included west coast (WC) banks (27.4 and 5.84 %), District of Columbia (9.95 and 2.42 %) and other midwest (OMW) banks (13.5 and 4.20 %). Intermediate volatility regions in 1929 included Philadelphia (PHIL) (31.0 and 8.93 %), Chicago (31.8 and 9.77 %) and banks in the greater New York region (GNY, not including New York City banks) (22.4 and 5.88 %). The dispersion in regional volatility lends support to a potential cross-subsidy effect between banking regions.

As can also be seen from Table I, bank equity return volatility rose from 1927 to 1929 (the year of the stock market crash) and then abated until 1932. This pattern is consistent with that found for stocks in general over this period (see for example Wilson, Sylla and Jones, 1990). Furthermore, our estimates for σ_E in the non-crisis years of 1927 and 1928 are of a similar order of magnitude to those found by RV for 1983 (see RV, Table I). Finally, note that the largest asset volatility increases from 1927 to 1929 were realized by the New York City, industrial northeast, industrial midwest and southeast U.S. banks.

V C. Bank Capital Ratios

As noted in Section I, the weak bank safety net in place before the banking reforms of 1933 and 1935 gave banks incentives to self-insure to a greater extent through proportionately greater equity holdings (lower leverage ratios). Table I gives average market equity capital-to-asset ratios (κ_U), derived from the observed market equity values and the option-implied bank asset values for the 1927-1932 period. Deposit-weighted average market capital ratios (κ_W) are also listed in Table I for comparison. In 1929 the highest average capital ratios were associated with the New York City (29.4%), industrial midwest (29.0%) and Philadelphia (26.9%) banks. The lowest capital-to-asset ratios were associated with west coast (19.9%) and southeast (20.1%) banks. Not only are these ratios high by current standards, the averages indicate a tendency for banks in higher asset risk regions to hold higher levels of capital.

The average capital ratios presented in Table I mostly peaked in 1928 and 1929, and thereafter declined sharply to 1932. Cross-regional differences in capital ratios were still apparent in 1932, with average capital ratios for New York City, greater New York City and Philadelphia banks still in excess of 12%. In contrast, capital ratios of Chicago and industrial midwest banks had declined to 5.7% and 5.1%, respectively, in 1932, the lowest of the average regional values. Clearly, the midwest and industrial northeast banks were in the weakest capital positions by the end of 1932, in terms of surviving further economic shocks.

V D. Bank Capital Ratio/Asset Volatility Correlations

Table II shows contemporaneous correlations among individual bank asset volatilities and capital ratios by region. The correlations suggest that a strong positive correlation existed between individual bank asset volatilities and bank capital-ratios during the 1927-1932 period. Indeed, this correlation was positive and significant in most regions and sample years. This implies, at least contemporaneously, that the best capitalized banks in this period took the most (asset) risk. This is consistent with the general absence of moral hazard type risk-taking by banks, i.e., a high σ_i exhibited by the worst capitalized banks. Arguably the incentives to desist from moral hazard type risk-taking were reinforced by the potential post-failure assessments by receivers/depositors on bank stockholders under the double liability rules.

Insert Table II about here.

V E. Insurance Premium Estimates - Limited Liability

The average (fair-value) insurance premia calculated from the limited-term (RV) deposit insurance model are summarized in Table III.

Insert Table III about here.

Focusing on the results for 1929, the potential cross-subsidy

effects between regions become readily apparent. The highest average deposit insurance premia would have been generated by banks in the southeast, industrial midwest and industrial northeast banks, with average premia of 77.6 bp, 47.4 bp, and 21.7 bp, respectively. In contrast, very low average deposit insurance premiums were associated with other midwest (OMW) banks, District of Columbia (DC) banks and west coast (WC) banks, with premiums of 0.0 bp, 0.0 bp and 0.42 bp, respectively. The money-center and/or Eastern banking areas of Greater New York (GNY, outside New York City), Chicago (CHI) and Philadelphia (Phil) were associated with average premiums of approximately 1.0 bp. New York City banks were intermediate, with average value of 7.78 bp. These results appear to accord with the cross-subsidy concerns of the money-center and large Eastern banks. The cumulative distribution of deposit premia for 1929 are graphed in Figure 1.

In contrast, during the baseline years of 1927 and 1928 the regional average premia are mostly small in magnitude and reveal only small cross-regional differences. Therefore, any economic disparities affecting regional banking centers were not apparent in these years. In contrast, in 1929 the increase in stock market volatility and the developing economic crisis had the greatest adverse impact on those regions that were the least diversified, i.e., the highly specialized economies of the industrial midwest and northeast and the agricultural southeast U.S. As commented on above, these regions realized large increases in asset volatility over this period, but without compensating increases in capital,

resulting in their sharp increase in average deposit premia. In contrast, asset volatilities for New York City banks had increased over this period, as well, but were offset to a greater extent by capital increases.

However, cross-regional differences that became apparent in 1929 largely disappeared post-1929 for several reasons. First, the largest number of bank closures and mergers for our sample occurred in 1930 and 1931.[19] Therefore, weaker banks became progressively censored from the sample. As well, many of the more volatile stocks in 1929 were only thinly-traded after the sharp decline in value post-1929.[20] Finally, the decline in average premia also reflected the overall decline in asset volatility post-1929. However, perhaps more revealing concerning regional differences during 1930-1932 were the disparities in average capital ratios, particularly in 1932. By 1932 banks located outside of (greater) New York City and Philadelphia displayed the lowest capital ratios, with industrial midwest and Chicago banks in the weakest position at average capital ratios of 5.1 and 5.7, respectively

Of additional interest is how the flat-rate, 8.33 deposit insurance premium established in the Banking Act of 1935 compares with the average premia estimated for the entire sample of banks over the 1927-1932 period. Table III lists these averages as 0.91 bp, 1.48 bp, 18.4 bp, 4.50 bp, 6.92 bp and 11.1 bp, respectively, for 1927-1932. Except for 1929 and 1932, these average premium values are well below the 8.33 bp historical value. One major reason for these relatively low average premiums, despite the high

volatilities at the time, was the relatively high capital ratios maintained by banks. Indeed, even in 1932 the overall average market capital-to-assets ratio for the entire sample was still above 10.0%.

While 1929 was the stock market crash year and the 1932 estimates might be viewed as being biased due to special factors such as survivorship bias, it is arguable that 1927 represents a relatively normal year pre-1933 at least as far as asset and equity volatilities are concerned (see Wilson et al, 1990, Table 6)[21]. Moreover, equity volatility in 1927 was of a similar order of magnitude to that found in RV (see their Table I). In that year the (weighted) average premium was only 0.91 (0.37) bp, with only 3.3% (7 in number) of the 209 banks having premiums exceeding 8.33 bp.[22]

V F. Insurance Premium Estimates - Double Liability

The deposit insurance premia reported in Section V.E are calculated under the assumed existence of limited liability. These would be the appropriate premiums under rational expectations where stockholders viewed the probability that post-failure assessments could be collected as zero (due to evasion and abscontion) and/or that double liability provisions would be repealed should deposit insurance be introduced. In actuality, as already noted above, double liability was in effect at least until 1935 for national banks and well into the 1940s for many state-chartered banks. Moreover, the introduction of deposit insurance is not inconsistent with the retention of double liability or some other deviation from

(full) limited liability for shareholders.

As a result we also computed the fair value premiums under the assumptions of (i) double liability with fully enforced (or 100%) assessments against stockholders' par values in failed banks, i.e., no evasion or abscontions and (ii) double liability with partial (51%) assessments against stockholders' par values in failed banks. The 51% assessment represents the historical average dollar amount collected as a percent of par equity value during the double liability period (see Macey and Miller, 1992) -- and may reflect the rational expectations of stockholders regarding the cost of post-failure assessments. The results under the 100% and 51% additional assessments are shown in Table IV.

Insert Table IV about here.

As might be expected the fair value premiums are well below those under limited liability. Indeed, even in 1929 the year with the highest asset return volatility, the weighted-average premium were 9.84 bp (under 100% assessment) and 12.4 bp (under 51% assessments). For the relatively normal year of 1927, the weighted average deposit premia are respectively 0.16 bp and 0.23 bp.

V.G Impact of Deposit Insurance on Bank Capital Ratios - 1933-1940

The previous sections have focused on issues of cross-subsidies, double liability and fair deposit insurance pricing in

the period just prior to the Congressional debate in 1933 and operation phase-in of federal deposit insurance in 1934. In this section the analysis is extended to the post-1932 period, to examine the effects of deposit insurance introduction on bank capital levels. In particular, did the introduction of deposit insurance lead to a <u>further</u> decline in bank capital ratios? To examine this question, bank capital ratios were analyzed on a regional basis over the period 1933-1939, i.e., post-legislative debate and deposit insurance phase-in. The results of the analysis are listed in Table V.

The pattern that emerges from Table V is that bank capital ratios continued their decline in all regions analyzed up until 1936. Over this period New York City, greater New York and Philadelphia banks continued to be the best capitalized banks, particularly in comparison with banks located in the midwest U.S. In 1936 the capital ratio averages uniformly increased across regions and then declined again over the 1937-1939 period, which roughly mirrored the strong stock market recovery in 1936 and its subsequent decline over the rest of the decade. By 1939 cross-regional differences in bank capital ratios were still present, but at a greatly reduced magnitude compared to those observed during the pre-deposit insurance baseline years, 1927 and 1928.

Insert Table V about here.

V.H Unlimited-Term Contract Results

This section presents the comparative results of calculating fair premiums over this period based on the dividend-extended, Merton/Pennacchi unlimited-term model discussed in Section III. For the sake of brevity, attention is restricted to the sample of New York City banks. The resulting annualized fair-value premiums are shown in Table VI.

Insert Table VI about here.

As would be expected from the results of Pennacchi (1987, Table 3), the baseline 8.33 bp rate appears under-priced relative to the limited-term contract results in Table VI, in all years except 1932 when T-bond yields dropped below 1 percent. The resulting weighted-average fair premiums range from 11.41 bp in 1927 to 37.12 bp in 1929 and 14.50 bp in 1932. Also listed in Table VI for comparison are the weighted-average deposit insurance premiums from Table III, with the average auditing cost (1.34 bp) added in (the RV model does not take auditing costs into account).

VI. SUMMARY AND CONCLUSIONS

During the early 1930s large Eastern and money-center banks lobbied strongly against federal deposit insurance legislation on the grounds that better-capitalized banks would be forced to subsidize the "poor" management of weaker banks, i.e., the cross-subsidy issue. The cross-subsidy and related moral hazard issues

again attracted considerable interest as a result of the deposit insurance crises of the 1980s. These renewed concerns were addressed in part under FDICIA with the introduction of risk-based deposit insurance premiums and prompt corrective action (PCA). The initiatives taken under FDICIA were the first significant departures from the original flat (risk-insensitive) premium and limited liability rules that were legislated in the Banking Acts of 1933 and 1935.

This paper has sought to explore these cross-subsidy, fair pricing and bank liability issues through an analysis of deposit insurance in the period 1927-1932, just prior to its announcement and operational phase-in. This period is of particular interest for several reasons. First, a relatively "clean" assessment of the issues can be made at this time, since the confounding effects of *in situ* mis-priced deposit insurance were not present. Second, an evaluation can be made of the importance of the cross-subsidy issue which underlay much of the Congressional debate leading up to the deposit insurance plan in 1933 and 1935. Finally, an analysis of this period, characterized by high asset volatility and large number of bank failures, can yield insights into the economic role of bank capital and the importance of partially-unlimited liability in ameliorating moral-hazard incentives.

Our results suggest that large potential (regional-based) cross-subsidies did in fact exist in the period just prior to the inception of deposit insurance. Support for this view arises from two pieces of evidence. First, sharp differential increases in

regional asset volatilities occurred over this period, particularly in 1929. The second is the decline in capital ratios over the 1927-1932 period, particularly by banks outside of the large Eastern and money-center bank regions, resulting in historically low capital levels. These results are particularly striking given that our sample consisted primarily of large, actively-traded banks. We might expect to find even greater cross-subsidies arising from smaller local banks, since these failed in greater numbers than larger banks during the 1930-1932 period.

Of additional interest was the issue of whether federal deposit insurance was fairly priced at its inception. Our results show, assuming the limited-term European put option as the valuation model, that deposit insurance was over-priced on average during the 1927-1932 period, with the possible exception of the two highly volatile years 1929 and 1932. Using 1927 as a benchmark for a relatively "normal" year, the weighted-average, fair-value premium for that year was 0.37 bp. These findings of over-pricing appear to parallel the findings of Marcus and Shaked (1984) and Ronn and Verma (1986) for the 1980s.

Moreover, the prevalence of double liability for bank stockholders in this period allows an assessment of the effects of relaxing limited liability rules, both in terms of stockholder discipline (with respect to leverage and self-insurance) and regulators' exposure from the provision of deposit insurance. In particular, imposing a double liability provision in conjunction with deposit insurance is shown to significantly reduce the

resulting fair value deposit insurance premiums, in comparison with those found under limited liability.

Finally, relaxing the limited-term assumption for the deposit insurance contract, as with Merton (1978) and Pennacchi (1987), reverses the findings of overpricing, despite the high capital ratios and double liability of the period. Thus, whether the contract was over-priced or under-priced at its inception depends crucially on what depositors and stockholders rationally expected ex-ante at the time of the contract's introduction: (i) a limited term contract with frequent premium adjustments or (ii) an unlimited contract with no premium adjustments.

Appendix A: Limited-Term Deposit Insurance Pricing

Following Merton (1977), MS and RV, deposit insurance is assumed to be isomorphic to a one-period European put option on the bank's asset value before deposit insurance (see RV, p. 875), with maturity equal to one year which approximates the time to the next "bank audit".[23]

Also let:

V = the unobserved value of bank assets,
B_1 = the face value of insured bank deposits,
B_2 = the face value of other bank liabilities,
$B = B_1 + B_2$ = the face value of total debt liabilities,
E = bank equity value,
σ_E = the instantaneous standard deviation of the return on bank equity,
σ_V = the instantaneous standard deviation of the return on bank assets,
δ = dividends per dollar of bank assets, paid n times per year,
T = time until the next bank audit,
Par = total par value of the bank's outstanding equity,
d = the insurance premium per dollar of insured deposits.

RV show that in this options framework the fair value of d under limited liability and with no forbearance (i.e., the bank is closed if $V < B$ at the next bank examination) is given as follows.

$$d = N(y + \sigma_V\sqrt{T}) - (1-\delta)^n(V/B)N(y) \qquad (I.1)$$

where

$$y = \{\ln[B/V(1-\delta)^n] - \sigma_V^2T/2\}/\sigma_V\sqrt{T} \qquad (I.2)$$

and $N(\cdot)$ is the cumulative density of a standard normal random variable.

The bank's equity value, E, can be modeled as a European call

option, with the same maturity date as that of the bank's debt, B. The value of E can be derived, given that a bank's asset value must equal the value of the claims against it, as $E = V - B + dB_1$.[24] Substituting from (1) yields the following.

$$E = V - B + B_1N(y+\sigma_V\sqrt{T}) - (1-\delta)^nV(B_1/B)N(y) \qquad (I.3)$$
$$= V[1-(1-\delta)^n(B_1/B)N(y)] - B_2N(y+\sigma_V\sqrt{T}) - B[1-N(y+\sigma_V\sqrt{T})]$$
$$= [1-(1-\delta)^n(B_1/B)]VN(y) - B_2N(y+\sigma_V\sqrt{T}) + VN(-y) - BN(-y-\sigma_V\sqrt{T})$$

and

$$\sigma_V = \sigma_E E/VN(-y) \qquad (4)$$

Equation I.3 differs from the equity equation used by RV by the first two terms in I.3. The difference in formulations is that the RV approach does not satisfy the put-call parity condition outlined above.

DEPOSIT INSURANCE AND EQUITY VALUE UNDER DOUBLE LIABILITY

Under a double liability system, each bank owner bears a residual liability post-bank closure equal to the par value of the equity shares held. The deposit insurance liability is then defined as follows.

$$\max\{0,\ FV(B_1) - (V_T + Par)B_1/(B_1 + B_2)\} \qquad (5)$$

or

$$\max\{0,\ [FV(B_1)-Par\cdot B_1/(B_1 + B_2)] - V_TB_1/(B_1 + B_2)\} \qquad (6),$$

where FV denotes the future value operator. That is, the deposit insurance contract under double liability is priced as if the deposit liability of the insurer is given by

$$f^*B_1 = [1 - PV(Par)/B]B_1,$$

where PV denotes the present value operator. The per dollar value of deposit insurance under double liability is then given by:

$$d = N(y + \sigma_V\sqrt{T})f^* - (1-\delta)^n(V/B)N(y) \tag{7}$$

where

$$y = \{\ln[f^*B/V(1-\delta)^n] - \sigma_V^2T/2\}/\sigma_V\sqrt{T} \tag{8}$$

Thus, as expected, double liability reduces the cost of deposit insurance provision by increasing the residual payment received by the insurer (receiver) in the event that the bank is closed.

As in the previous section, equity value, E, can be derived under conservation of value, i.e., $E = V - B + dB_1$. Substituting from (7) yields the following:

$$\begin{aligned} E &= V - B + B_1f^*N(y+\sigma_V\sqrt{T}) - (1-\delta)^nV(B_1/B)N(y) \\ &= [1-(1-\delta)^n(B_1/B)N(y)]V - B_2f^*N(y+\sigma_V\sqrt{T}) - B[1-f^*N(y+\sigma_V\sqrt{T})] \\ &= [1-(1-\delta)^n(B_1/B)]VN(y) - B_2f^*N(y+\sigma_V\sqrt{T}) \\ &\qquad + VN(-y) - Bf^*N(-y-\sigma_V\sqrt{T})] - B(1-f^*) \end{aligned} \tag{9}$$

and

$$\sigma_V = \sigma_E E/VN(x) \tag{10}$$

Appendix B THE MERTON/PENNACCHI UNLIMITED-TERM MODEL

Merton (1978) derives a deposit insurance model that incorporates random auditing times and auditing costs, under the assumption that the bank's deposits are insured in perpetuity, or until the bank is found to be insolvent and closed. Pennacchi (1987) extends Merton's unlimited-term model by incorporating stochastic deposits and any existing deposit insurance premiums. The Pennacchi model simplifies to Merton's unlimited-term model under the assumption that no deposit insurance premium was in effect, as in the present case. We do extend Merton's formulation to include dividend payments to stockholders, since the RV model includes this feature.

The dividend-adjusted, unlimited-term model is derived as follows. First, the premium value, p, must satisfy the following set of differential equations,

$$\tfrac{1}{2}\sigma_V^2 x^2 p''_1 + (r-g-\theta)xp'_1 - (r-g)p_1 + \lambda c = 0 \qquad \text{(II.2a)} \quad x \geq 1$$

$$\tfrac{1}{2}\sigma_V^2 x^2 p''_2 + (r-g-\theta)xp'_2 - (r-g+\lambda)p_2 + \lambda[c+1-x] = 0 \qquad \text{(II.2b)} \quad x \leq 1$$

which are equivalent to Pennacchi's (1987) equations (A.2a) and (A.2b) with h=0 and γ=0, where in that paper's notation g≡p, a≡c, Q=σ_V^2 (under the assumption stated in II C. that s^2_d=0 and ρ=0) and m≡r-g.

The following boundary conditions, given in Merton (1978), must be satisfied.

$p_1(1) = p_2(1)$.

$p'_1(1) = p'_2(1)$.

$p_2(0) = \lambda[1+c]/(r+\lambda-g)$.

$p_1(x)$ is bounded as $x \to \infty$.

The resulting solutions are given as follows.

$$p_1(x) = \lambda c/\mu + a_2 x^{r12} \qquad x \geq 1$$

$$p_2(x) = \lambda(c+1)/(\mu+\lambda) - (\lambda/(\theta+\lambda))x + b_1 x^{r21} \qquad x \leq 1$$

where

$$a_2 = [\lambda/(r_{21}-r_{12})][(1-r_{21})/(\lambda+\theta) + r_{21}[(1+c)/(\mu+\lambda)-c/\mu]]$$

$$b_1 = [\lambda/(r_{21}-r_{12})][(1-r_{12})/(\lambda+\theta) + r_{12}[(1+c)/(\mu+\lambda)-c/\mu]]$$

$$r_{21} = [-\Phi + (\Phi^2+2(\mu+\lambda)\sigma_V^2)^{1/2}]/\sigma_V^2,$$

$$r_{12} = -[\Phi + (\Phi^2+2\mu\sigma_V^2)^{1/2}]/\sigma_V^2,$$

$$\mu = r-g,$$

$$\Phi = r-\theta-g-\tfrac{1}{2}\sigma_V^2$$

With free entry into banking and fair deposit insurance pricing, then $\mu=\lambda c$ and the premium value, $p^*_1(x)$, of the unlimited term contract is then given as follows.

$$p^*_1(x) = 1 + \lambda(1-r_{21})x^{r12}/(\theta+\lambda)(r_{21}-r_{12}) \qquad \text{(II.1)}$$

where

$x = V/D$,

$=$ the ratio of asset value to total liabilities,

$r_{21} = [-\Phi + (\Phi^2+2(\mu+\lambda)\sigma_V^2)^{1/2}]/\sigma_V^2$,

$r_{12} = -[\phi + (\phi^2 + 2\mu\sigma_V^2)^{1/2}]/\sigma_V^2$,

$\phi = r - \theta - g - \frac{1}{2}\sigma_V^2$,

μ = r-g = market interest rate minus the deposit growth rate,

θ = the dividend payout per unit time, paid continuously,

$\lambda\, dt$ = the probability of an audit over the next instant, and

c = the audit cost per dollar of deposit incurred at each audit, assumed to be constant.

Merton's (1978) formulation results if the dividend payout rate, θ, equals zero.

Assuming that bank liabilities were limited-term in nature prior to federal deposit insurance, estimates for x and σ_V in the Merton/Pennacchi model (16) are taken from the limited-term analysis presented previously. Auditing costs, c, are set equal to 0.000134 which is equal to the 1935 value of FDIC administrative expenses of $2.7 million divided by the 1935 value of total insured deposits of $20,158 million. Auditing frequency, λ, is set equal to 1.0. Since (16) gives the lump-sum present value of the unlimited-term contract, the resulting values were treated as lump-sum perpetuities and multiplied by the Treasury bond yield[25] of the period to derive an equivalent annual payment amount.

Table I: Summary Statistics
Aggregated By Region And Total Sample

	NYC	PHIL	CHI	GNY	INE	IMW	OMW	DC	SE	WC	TOTAL
						1927					
N	47	8	33	20	11	20	10	12	30	18	209
D	5.3	0.29	1.59	0.77	1.04	1.04	0.33	0.17	0.56	0.90	12.0
σ_E	22.8	14.7	20.5	21.8	17.0	20.2	8.59	11.2	13.0	15.7	20.0
σ_A	3.9	4.40	5.05	5.66	3.70	3.64	1.74	2.79	2.45	2.76	3.92
κ_U	18.2	34.1	18.2	24.5	21.4	21.9	20.8	24.1	20.2	16.0	20.5
κ_W	18.1	30.3	24.3	24.5	20.4	17.5	20.3	24.0	18.3	16.6	19.8
						1928					
N	45	15	17	25	16	26	10	12	44	19	229
D	5.4	0.44	0.94	0.55	1.51	1.58	0.28	0.19	0.95	0.65	12.5
σ_E	33.8	21.1	31.2	17.3	18.3	16.8	13.3	7.03	14.5	22.1	25.4
σ_A	8.1	7.05	10.4	4.91	3.90	3.49	3.62	1.75	2.74	3.96	6.20
κ_U	23.8	32.9	27.5	29.6	19.6	26.5	28.0	23.6	21.7	15.6	24.4
κ_W	24.7	31.5	32.8	29.8	21.6	20.1	27.8	24.4	19.4	17.1	24.1
						1929					
N	34	28	48	45	22	24	18	14	46	24	303
D	6.4	1.16	2.26	1.07	1.84	1.40	0.34	0.20	1.00	1.80	17.5
σ_E	48.6	31.0	31.8	22.4	61.0	61.3	13.5	9.95	39.0	27.4	42.1
σ_A	15.5	8.93	9.77	5.88	13.4	13.2	4.20	2.42	8.66	5.84	11.6
κ_U	29.4	26.9	22.5	25.1	21.6	29.0	25.2	23.2	20.1	19.9	24.1
κ_W	31.4	28.0	30.3	25.3	22.9	24.4	27.6	23.8	18.2	20.0	27.1
						1930					
N	29	32	29	21	17	12	10	11	36	23	220
D	5.6	1.37	2.22	0.69	1.51	0.72	0.33	0.20	0.82	1.89	15.4
σ_E	31.4	20.4	25.2	15.6	29.9	19.6	14.5	21.7	35.0	15.4	25.8
σ_A	10.6	4.20	5.02	3.36	4.90	3.27	3.09	4.55	5.35	2.18	6.43
κ_U	27.4	22.2	17.2	20.7	18.9	23.8	21.9	20.6	17.2	13.7	20.1
κ_W	34.0	20.9	20.3	20.5	16.6	17.2	20.3	20.6	14.2	14.3	23.8
						1931					
N	34	20	20	18	19	14	2	8	21	17	173
D	5.6	1.01	1.56	0.59	1.45	0.48	0.04	0.16	0.61	1.66	13.8
σ_E	35.9	38.7	46.7	33.5	47.5	30.6	23.0	12.2	30.7	24.7	36.1
σ_A	8.0	5.09	4.83	4.10	4.74	1.70	3.08	2.28	3.20	2.82	5.49
κ_U	18.5	14.0	12.4	12.7	10.5	17.9	13.3	19.4	14.1	11.4	14.5
κ_W	22.5	14.1	10.4	12.9	9.95	6.98	12.9	18.6	11.2	11.4	15.6
						1932					
N	19	23	10	15	19	2	2	-	14	18	122
D	4.1	1.06	1.43	0.61	1.40	0.45	0.06	-	0.32	1.61	11.0
σ_E	40.0	62.2	61.7	48.2	64.6	103	11.6	-	53.5	46.0	51.8
σ_A	5.6	8.85	5.33	5.51	4.52	0.99	0.87	-	3.85	4.51	5.37
κ_U	14.1	13.4	5.7	12.3	7.7	5.1	7.5	-	10.3	9.4	10.7
κ_W	14.0	15.1	8.63	11.4	8.64	1.27	7.51	-	8.06	9.70	11.2

Note. For each region and each year Table I lists the sample size (N), total deposits (D, billions), the estimated equity (σ_E) and Ronn-Verma option-implied asset (σ_A) volatilities (%), and unweighted (κ_U) and weighted (κ_W) average market equity-to-asset ratios (%), derived from the observed equity values and the Ronn-Verma option-implied bank asset values.

Table II: Correlations Between
RV Option-Derived Asset Volatilities and Capital Ratios
By Region and Sample Total

	1927	1928	1929	1930	1931	1932
NYC	0.46	0.33	0.85**	0.63**	0.33	0.52**
PHIL	0.63	0.68**	0.67**	0.72**	0.91**	0.87**
CHI	0.66**	0.61**	0.68**	0.24	0.64**	0.95**
GNY	0.34	0.56**	0.56**	0.67**	0.38	0.78**
INE	0.98**	0.49	0.83**	0.24	0.63**	0.62**
IMW	0.24	0.70**	0.58**	0.91**	0.87**	-
OMW	0.73*	0.39	0.82**	0.97**	0.88	-
DC	0.74**	0.63*	0.78**	0.24	0.77*	-
SE	0.36*	0.39**	0.56**	0.55**	0.63**	0.77**
WC	0.72**	0.61**	0.85**	0.26	0.79**	0.34
TOTAL	0.55**	0.52**	0.57**	0.63**	0.53**	0.75**

** significant at the 1% level

* significant at the 5% level

Table III: RV Fair-Value Deposit Insurance Premium

Under Limited Liability of Bank Stockholders

Unweighted/Weighted Average - bp

	1927	1928	1929	1930	1931	1932
NYC	2.10/0.57	4.22/3.48	7.78/9.96	0.60/0.15	30.2/3.84	14.3/2.13
PHIL	3.75/0.45	0.31/0.17	1.59/1.85	0.27/0.04	2.10/1.71	11.9/22.6
CHI	0.25/0.18	3.08/5.80	0.96/1.42	4.74/0.61	1.33/3.77	7.81/11.6
GNY	2.41/0.94	0.48/0.30	0.50/0.36	0.00/0.00	0.33/0.66	5.86/7.31
INE	0.00/0.00	0.06/0.04	21.7/25.9	0.09/0.07	2.58/4.69	15.7/11.8
IMW	0.11/0.05	1.29/0.11	47.4/44.5	0.00/0.00	0.08/0.17	4.06/7.41
OMW	0.00/0.00	0.00/0.00	0.00/0.00	0.00/0.00	0.07/0.05	0.00/0.00
DC	0.00/0.00	0.00/0.00	0.00/0.00	12.9/4.68	0.00/0.00	-/-
SE	0.06/0.15	0.23/0.15	77.6/103	16.4/23.2	2.53/1.49	3.95/7.69
WC	0.04/0.08	1.96/1.70	0.42/0.45	4.03/0.34	0.00/0.00	15.6/9.70
TOTAL	0.91/0.37	1.48/2.06	18.4/16.2	4.50/1.49	6.92/2.71	11.1/8.24

Table IV: RV Fair-Value Deposit Insurance Premium

Under 100%/51% Double Liability Of Bank Stockholders

Weighted-Average DI Premiums - bp

	1927	1928	1929	1930	1931	1932
NYC	0.30/0.40	1.74/2.42	5.73/7.51	0.01/0.04	0.05/0.21	0.04/0.25
PHIL	0.00/0.02	0.00/0.04	0.83/1.21	1.74/0.21	0.04/0.07	0.86/0.9
CHI	0.03/0.08	3.45/4.46	0.56/0.88	1.74/0.21	0.04/0.07	0.86/0.9
GNY	0.29/0.52	0.03/0.10	0.06/0.14	0.00/0.00	0.00/0.00	0.36/0.58
INE	0.00/00.0	0.00/0.01	10.4/15.3	0.00/0.00	0.03/0.14	1.80/0.58
IMW	0.00/0.01	0.02/0.05	25.8/34.0	0.00/0.00	0.00/0.00	0.00/0.00
OMW	0.00/0.00	0.00/0.00	0.00/0.00	0.00/0.00	0.00/0.00	0.00/0.00
DC	0.00/0.00	0.00/0.00	0.00/0.00	3.05/1.11	0.00/0.00	-/-
SE	0.01/0.04	0.03/0.07	77.7/88.6	9.53/10.1	0.19/0.09	0.06/0.13
WC	0.00/0.01	0.64/1.05	0.03/0.12	0.88/14.3	0.00/0.00	1.38/1.00
TOTAL	0.16/0.23	1.04/1.44	9.84/12.4	0.60/0.91	0.05/0.28	1.04/2.40

Table V

Evolution of Average Market Capital Ratios (%):

Post-Federal Deposit Insurance: 1933-1939

	1933	1934	1935	1936	1937	1938	1939
NYC	10.7	10.4	11.6	11.8	9.5	8.8	7.7
PHIL	12.0	11.5	11.8	14.8	12.9	10.0	9.0
CHI	4.1	3.6	2.7	10.3	6.8	6.2	6.3
GNY	8.5	8.0	7.6	9.5	9.7	8.0	8.0
INE	5.9	5.8	5.3	8.7	7.8	6.7	7.4
IMW	2.6	2.1	1.8	5.3	4.8	5.2	4.5
OMW	6.0	6.2	5.2	7.6	7.1	7.6	6.6
DC	-	-	-	-	-	-	-
SE	11.7	8.4	6.5	8.0	8.7	8.4	8.6
WC	7.7	6.8	6.2	9.0	7.9	7.3	6.7

Table VI: Unlimited-Term Fair-Value Deposit Insurance Premium

Merton/Pennacchi Model Results

	1927	1928	1929	1930	1931	1932
Aver (bp)	14.52	21.79	31.57	22.62	28.44	16.50
WtAv (bp)	11.41	21.85	37.12	26.68	25.80	14.50
RV† (bp)	1.91	4.82	11.30	1.49	5.18	3.47

† indicates the weighted-average deposit insurance premiums for the RV limited-term model of Table III with average auditing costs of 1.34 bp added in.

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Endnotes

(1) Under the 1993 risk-based pricing plan there is a 9 basis point (bp) difference per $100 of deposits in the deposit premium charged to those banks judged to be in the highest and lowest quality categories.

(2) Under PCA a bank must be placed into conservatorship when its (book value) capital-to-assets ratio falls below 2%, i.e., before book capital value is fully dissipated.

(3) Double liability was eliminated, and limited liability established, in 1933 for new shares of national banks, and starting in 1935 for existing national bank shares. State legislatures phased out most double liability plans by 1953. Macey and Miller (1992) provide a review of the legislative and legal history of double liability.

(4) Section 8 of the Banking Act of 1933 created the Federal Deposit Insurance Corporation through an amendment to the Federal Reserve Act. A temporary plan went into effect January 1, 1934. Initial coverage was limited to $2,500, but increased to $5,000 on July 1, 1934. The initial assessment rate was set at 50 bp of insurable deposits. The temporary plan remained in effect until a permanent plan was legislated in the Banking Act of 1935. The Act set the premium at one-twelfth of one percent of total (adjusted) deposits or 8.33 bp.

(5) As will be discussed in Section II, the 8.33 bp premium was likely based on historical deposit loss rates in the pre-1933 period. (The authors are

grateful to Brian Gendrau of J.P. Morgan for providing this explanation.) The 8.33 bp risk premium (with or without rebates) was in effect until 1989. However, Buser, Chen and Kane (1981) assumes that a risk-sensitive "implicit" deposit insurance premium was in existence for most of this period.

(6) Under double liability, bank stockholders of national and most state banks lost not only their original equity claim in the bank upon its failure (as under limited liability), but in addition were liable up to the par value of shares held. In the case of failure, the bank's receiver would assess additional amounts from each stockholder until the claims of creditors were satisfied, or until an amount equal to the par value of the stock had been assessed on each stockholder.

(7) This might be expected since clearinghouses also played a role in disciplining errant members (Gorton, 1985).

(8) However, as Winton (1993) indicates, unlimited or partially- limited liability systems such as double liability can suffer from adverse selection effects and costs associated with monitoring other stockholders' personal wealth.

(9) Eastern banking fears that federal deposit insurance would result in cross-subsidies to weaker banking regions were perhaps exemplified by the Michigan banking crisis in the early 1930s. Indeed, the eight-day Michigan bank holiday declared on February 14, 1933 has been credited as the regional banking crisis that contributed directly to the ensuing national banking

collapse in March 1933.

Michigan's banking problems stemmed in part from the state's heavy economic dependence on the automotive industry. Auto makers had been hit harder than any other major industry in the 1930s recession. The resulting high unemployment rate in Detroit resulted in unpaid municipal taxes, which then forced Detroit into default of its outstanding municipal bonds.

A long standing feud between Michigan Senator James Couzens and industrialist Henry Ford prevented much needed assistance from the RFC at several critical points in Michigan's banking crisis. In the end a proposed re-organization involving Ford failed and General Motors agreed to put up $12.5 million in capital to organize the National Bank of Detroit that subsequently acquired as sole stockholder the remaining interests of the two banking systems (Kennedy, p. 194).

Until Michigan's banking collapse regional banking panics were mostly localized. However, Michigan's bank holiday was followed in quick succession by bank holidays in other states. On February 25 1933, Maryland announced a three-day state-wide banking holiday. On February 28, 1933, state holidays were proclaimed in Nevada, Alabama, Kentucky & Tennessee. Finally, New York and Illinois declared bank holidays on Inauguration Day, March 4, 1933.

(10) Indeed, of the $200 million initially assessed from member banks to capitalize the FDIC fund, 28.0 percent was assessed against New York City banks. However, congressional supporters of deposit insurance argued that savings from the elimination of interest on demand deposits would more than offset the banks' cost of deposit insurance.

(11) Restricting membership to Federal Reserve member banks in part reflected a desire on the part of large banking interests to eliminate the dual banking system, in favor of a unified national system. However, as argued in the Congressional debate, uninsured banks post-deposit insurance would have likely suffered the loss of much of their deposit base.

(12) Under a limited-term contract, the deposit insurer resets premiums to a fair level at the start of each contract period, or forces an equivalent change in a bank's capital ratio, given that the bank was not insolvent at the end of the previous period. In contrast, with an unlimited-term contract the deposit insurer forgoes this level of control and charges a single, time-invariant deposit insurance rate over the life of the contract.

(13) However, to qualify for a charter, national banks were required to have at least $50,000 in paid-in capital. State bank requirements differed, but $15,000 and $20,000 minimums were typical. As well, minimum reserve requirements were in place over this time period, which can influence optimal bank capital structure decisions, as discussed in Taggart and Greenbaum (JMCB, 1978, pp. 158-169).

(14) As with RV, our interest is in the fair premium value of deposit insurance, post implementation of federal deposit insurance. As observed by RV (p. 873), it is the future stochastic behavior of the assets that determines the fair value of deposit insurance. Accordingly, it is unlikely that historical deposit loss rates (pre-FDIC) would have been a good

predictor of post-FDIC loss rates, since the historical rates reflected the risk exposure of depositors before the guarantee.

(15) We are indebted to George Pennacchi for pointing out this deficiency in the earlier study of Ronn and Verma (1986). The equity value given in (A.3) corrects their equity value formulas (2) and (2'), so that conservation of value now holds. Equation (A.3) differs from RV equity equations (2) or (2') due to the first two terms in (A.3) and the $(1-\delta)^n$ term multiplying V in the expression for y which does not occur in the corresponding RV formula.

(16) CRSP data is unavailable for banks at this time, since CRSP covers only NYSE listed stocks prior to 1962.

(17) The national deposit base, as given in Rand McNally Bankers Directory (1927-1932), was 58.1, 61.0, 60.7, 59.0, 50.1 (billions) in 1927-1932, respectively. Therefore, the sample total deposits listed in Table I, represented 45.7%, 20.7%, 20.5%, 28.8%, 26.1%, 27.5% and 24.1%, respectively, of the national deposit base for the years 1927 through 1932.

(18) The cities included in each regional designation are as follows: GNY included Bayonne, Brooklyn, Elizabeth, Hartford, Hoboken, Jamestown, Jersey City, Newark, New Brunswick, New Rochelle, Port Chester, Providence, Union City, Wilmington and Yonkers; INE included banks in Binghamton, Boston, Buffalo, Rochester and Syracuse; IMW included Cleveland, Detroit, Grand Rapids, Milwaukee, Minneapolis and Scranton; OMW included Allentown, Columbus, Cincinnati, Erie, Indianapolis, Pittsburgh, Wilkes-Barre and

Youngstown; SE included Atlanta, Baltimore, Birmingham, Charleston, Greenville, Knoxville, Louisville, Lynchburg, Memphis, Montgomery, Nashville, New Orleans, Norfolk, Richmond, Shreveport, Spartanburg, Wilmington (Del.) and Winston-Salem; WC included Dallas, Houston, Los Angeles, Oakland, Omaha, Portland, Salt Lake City, San Francisco, Seattle, Spokane and St. Louis. Regional designations were selected partly in terms of similar asset volatilities, particularly with the division between IMW and OMW.

(19) For the study's sample of banks, bank failures numbered 3, 5, 18 and 9 and bank mergers numbered 1, 29, 18 and 5, respectively, in the years 1929, 1930, 1931 and 1932.

(20) For the three years, 1929-1931, comparing banks that failed with banks that did not fail in the subsequent year, failed banks traded in that year less frequently (6.3 versus 7.2 months with price changes per year on average), had lower market capital ratios (13.6% versus 18,0%) and lower asset volatilities (2.9% versus 4.4%), all significant at the 0.01 significance level. Therefore, distressed banks were less likely to be included in the data sample, under the sampling criterion stated in the text. For the baseline years, 1927 and 1928, censoring was not a problem, due to the very small number of bank closures in the sample before 1930.

(21) This shows that no month in 1927 appears among the 100 months of highest return volatility over the 1831 - 1988 period.

(22) RV find that 15 out of 43 banks (or 34.9%) had fair premiums exceeding

8.33 bp, and Marcus and Shaked (1984) find that 35% and 30% of banks in their sample of 40 bank holding companies had fair premiums exceeding 8.33 bp in 1979 and 1980, respectively.

(23) This assumes that bank audits were conducted with approximately the same frequency in the 1930s. Klebaner (1990) indicates that national and most state bank examinations were annual until the Federal Reserve Act of 1913, when biennial examinations were instituted for national banks.

(24) The Solver Routine of Microsoft Excel was used to solve for implied asset value, V and asset volatility, σ_V. The Solver routine uses standard Gauss-Newton procedures for solving simultaneous equations. No convergence problems were encountered with the routine.

(25) Long-term government bond yields were taken from Ibbotson Associates (1991), Exhibit A-9, page 154. Corresponding yields for corporate bonds are not available for comparison.

FIGURE 1: CUMULATIVE PREMIA - 1929