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Author(s): Douglas O. Cook and Lewis J. Spellman
Published by: University of Washington School of Business Administration
Stable URL: http://www.jstor.org/stable/2331182
Accessed: 05/04/2013 10:18

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Firm and Guarantor Risk, Risk Contagion, and the Interfirm Spread among Insured Deposits

Douglas O. Cook and Lewis J. Spellman*

Abstract

We develop a model of third party guaranteed debt and show that interest rate premiums are multiplicatively related to firm and guarantor risk. We apply the model to thrifts issuing CDs guaranteed by the FSLIC and then estimate firm probabilities of insolvency and guarantor risk across 20 observed months. This time period spans the insolvency of the guarantor followed by two recapitalizations. The relative stability in firm risk across time offers no evidence of generalized risk contagion among firms. We attribute elevated CD premiums and rate spreads to increases in guarantor risk rather than changes in firm risk.

I. Introduction

On third party guaranteed debt, the risk of both the issuing firm and guarantor determines the interest rate. We show that the interest premium above the riskless Treasury rate for guaranteed debt is multiplicatively related to two factors: the probability of firm insolvency, and the expected cost of an incomplete guarantor payoff. We demonstrate that the presence of the guarantor obscures firm risk. Despite this, our model provides the basis for measuring firm risk as well as guarantor risk. We explain how different rates can exist on different firms' debt with the same guarantor and how spreads among the different firms' rates widen when the guarantor becomes riskier. Only a riskless guarantor causes the spreads to disappear.

Our model fits nicely the case where savings and loans issue certificates of deposit (CDs) and the guarantor is the government's deposit insuring agency, the Federal Savings and Loan Insurance Corporation (FSLIC). In this case, the debt instrument, the guarantor, and the guarantee are the same for all the firms. We apply the model over a 20-month period beginning in January 1987 when, following hundreds of thrift failures, the FSLIC announced its own insolvency. The

*Cook, School of Business Administration, University of Mississippi, Oxford, MS 38677; Spellman, College of Business Administration, University of Texas at Austin, Austin, TX 78712-1179. The research was supported in part by the McAllister Centennial Chair for Savings Institutions. Some of this research was completed while Cook was at the Financial Institutions Center at the Wharton School of the University of Pennsylvania. The authors thank Dale Osborne, Robert Duvic, JFQA Referee Andrew Chen, an anonymous referee, and Jonathan Karpoff (the editor) for their helpful comments. The authors also thank David Senft of the Office of Thrift Supervision for providing data.
time period spans the insolvency of the guarantor and two subsequent recapitalizations. These extraordinary events affected the risk perception of the FSLIC both positively and negatively. We find that despite the FSLIC being a government guarantor and assumed by some to be riskless, when the market perception of its credit quality declined, interest premiums on CDs increased.\footnote{For example, Shoven, Smart, and Waldfogel (1992) consider the guarantee to be riskless and as a result all CDs are assumed to be perfect riskless substitutes. Whether the market considers a government guarantor to be riskless is explored in this paper.}

The high premium CDs in the market at the time were a matter of public policy concern because it was assumed that risky firms spread risk to other firms, resulting in high premiums throughout the industry (Federal Home Loan Bank Board Journal (1989), Kane (1987), and White (1991)). To prevent this, the FSLIC moved to resolve the institutions issuing these CDs.\footnote{The FHLBB attempted to restrain deposit premiums and apply rate ceilings by regulating brokered deposits for firms with low capital. Resolution took a number of forms, including assisted mergers, acquisitions, receiverships, and liquidation.} We find, however, that it was the risk perception of the guarantor, not risk contagion among firms, that caused high premiums to emerge.

We proceed by presenting a general model of rates on third party guaranteed debt that examines how the market prices both firm and guarantor risk. Firm risk is measured by the probability of firm insolvency and guarantor risk by the depositor’s expected cost of an incomplete guarantor payoff. In Section II, we state two propositions that summarize the influence of guarantor risk on both CD rate premiums and the interfirm spreads in CD premiums. In Section III, we use a cross-section time-series model to provide estimates of firm and guarantor risk. In Section IV, we derive for each month the probabilities of insolvency for what we define as junk, median, and prime firms, and examine the evidence of risk contagion among these firms. We also examine changes in guarantor risk over time and the relationship of risk to movements in premiums and spreads. Section V contains the summary and conclusions.

II. The Model of Deposit Premiums

We develop a model of guaranteed or insured debt and demonstrate how the firm’s and guarantor’s risk interact to produce a premium rate above the riskless rate. Although the third party is a government-sponsored agency, rates on an insured deposit reflect the probability that the federal government will not make a complete payout of principal and interest.

Under the assumption of risk neutrality, we express the one-period rate on guaranteed debt paid by a given firm as

\[
\frac{1}{1 + i} = (1 - p_f) \frac{1}{1 + R} + p_f \left( p_{c|f} \right) \frac{1}{1 + R} + p_f \left( p_{l|f} \right) \left( 1 - \bar{L}_{l|f} \right) \frac{1}{1 + R},
\]

where \( i \) is a firm’s one-period guaranteed debt rate, \( R \) is the one-period risk-free rate, \( f \) is the event that the firm becomes insolvent, and \( c|f \) is the event that a complete/costless guarantor payoff is made following an insolvency and nonpayment by the firm. \( p_f \) is the discrete probability of firm insolvency, \( p_{c|f} \) and \( p_{l|f} \) are
the discrete probabilities of the guarantor either making complete or incomplete payoffs, and $L_{ilf}$ is the investor's expected cost per dollar of deposits in the event of firm insolvency and an incomplete guarantor payoff. The probabilities $p_{clf}$ and $p_{ilf}$ sum to one.

Equation (1) indicates that the investor receives the promised one dollar when the firm or institution is solvent (term 1) or when the guarantor makes a complete/costless payoff (term 2). When the firm is insolvent and the guarantor makes an incomplete payoff, the investor receives a net payment of one dollar less the expected loss, $L_{ilf}$ (term 3).

Since we analyze insolvency risk, measured by the rate premium over the riskless rate, we reformulate the model. Taking logs and simplifying equation (1) results in the following,

$$\ln(1 + i) = \ln(1 + R) - \ln \left[1 - p_f^P \left(p_{ilf}^f \bar{L}_{ilf}^f\right)\right].$$

Substituting into (2) the approximation $\ln(1 - x) = -x$ for small values of $x$, where $x$ is first $p_f^P(p_{ilf}^f)\bar{L}_{ilf}^f$ and then $1 - [(1 + i)/(1 + R)]$, yields an expression that we shall refer to as the absolute premium $i - R$,

$$\ln(1 + i) = (1 + R)p_f \left(p_{ilf}^f \bar{L}_{ilf}^f\right).$$

(2)

In order to collect the common $R$ terms, we divide through by the return $(1 + R)$. The combination of terms $(i - R)/(1 + R)$ adjusts the absolute premium for the level of rates. We shall subsequently refer to it as the relative premium, which reflects greater risk when interest rates are low as compared to when interest rates are high,

$$\frac{(i - R)}{(1 + R)} = p_f \left(p_{ilf}^f \bar{L}_{ilf}^f\right).$$

(3)

The relative premium depends on the firm's insolvency risk $p_f$ and terms having to do with the CD investor's losses if there is an incomplete guarantor payoff. By combining terms, the relative premium has the desirable property of being defined only in terms of firm and guarantor risk. Following a firm insolvency, the government guarantor controls whether there will be an incomplete payment by the guarantor, $p_{ilf}$, and, if so, how large a loss per deposit dollar the depositor will incur, $L_{ilf}$. We condense the combined effect of the contingent probability of an incomplete settlement and the contingent expected loss into an expected cost per deposit dollar, $g_{ilf}$, a variable that ranges from zero to one. The expression is consistent with terms of the deposit insurance contract. In this contract, the insolvent firm does not settle with the depositor. Instead, the guarantor impounds the remaining assets of the firm in order to make payment to the depositor. Since investors look solely to the guarantor for compensation, $g_{ilf}$ represents the risk of a loss imposed by the guarantor.

It is reasonable to assume that the guarantor treats the insured losses of all firms' guaranteed deposits the same. Therefore, the guarantor risk term (while

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3 An example of difference in treatment by size is a policy known as “too big to fail.” This policy may have affected the pricing of uninsured deposits and nondeposit debt of some commercial banks at the time. However, in this study, we analyze insured deposits issued by thrifts with a maximum deposit size of $80,000, within the $100,000 deposit insurance coverage limit.
still being contingent on firm insolvency) would be common to all firms. We define the common guarantor risk term as \( \Psi \) and, for notational simplicity, refer to the firm’s relative premium \((i - R)/(1 + R)\) as \( r_f \). Restating equation (3a) accordingly, 

\[
(3b) \quad r_f = p_f \Psi.
\]

Equation (3b) indicates that the firm’s relative premium relates multiplicatively to the risks of both the firm and the guarantor. A multiplicative relationship magnifies the larger risks of the firm and guarantor. We summarize the behavior of the relative premium in the following propositions.

**Premium Level Proposition.** For a given level of firm (guarantor) insolvency risk, \( p_f \), the firm’s relative premium is proportional to guarantor (firm) risk, \( \Psi \).

Proportionality of the observed relative premium to the risks of the guarantor or firm implies that if either risk were fixed, a doubling of the other risk would double the relative premium. In addition, if either risk were equal to one, the observed relative premium would reflect the other risk alone. For example, in the case of an insolvent firm, \( p_f \) equals 1 so the observed premium reflects \( \Psi \) alone. In the case of a completely worthless guarantor, \( \Psi \) equals 1 and the premium reflects firm risk alone.

Generally, the guarantor is neither completely worthless nor perfectly riskless. However, if it were riskless, \( \Psi \) would be 0 and the CDs of all firms would be priced in the same risk(less) class despite differences in firms’ probabilities of insolvency. In the typical case, \( \Psi \) assumes a small but positive value and there is a spectrum of premiums corresponding to different levels of firm risk.

Before we can discuss implications for the interfirm spread in premiums, we need to identify a “junk” firm and “prime” firm. We define the “junk” firm as a firm for which there is a relatively high probability of insolvency \( (p_j) \), and a “prime” firm as one with a relatively low probability of insolvency \( (p_p) \). We state the spread relationship between the junk and prime firms’ premiums in the following proposition.

**Premium Spread Proposition.** For a constant difference in firm probabilities of insolvency \((p_j - p_p)\), the spread in the relative premium between the prime and junk firm is proportional to guarantor risk.

We demonstrate the proposition in the following manner: any two levels of guarantor risk are given by \( \Psi_r \) and \( \Psi_{kr} \) such that \( \Psi_{kr} \) is \( k \) times the level of \( \Psi_r \). The relative premium spread for the first level of guarantor risk is given by \((p_p - p_j)\Psi_r\). For the second level of guarantor risk, the relative premium spread is \((p_p - p_j)\Psi_{kr}\), which is equal to \( k(p_p - p_j)\Psi_r\). Thus, the spread in the relative premium between the prime and junk firms is proportional to guarantor risk.

The absolute premium is also proportional to both firm and guarantor risk because \( 1 + R \) is a constant and the same across all firms for each point in time. Therefore, the propositions apply also for the absolute premium. An implication of the two propositions is that premium levels and premium spreads are proportional to each other so that as guarantor risk increases, the premium levels and spreads both rise simultaneously. We will address this issue in the empirical section of the paper.
III. The Regression Model of Firm and Guarantor Risk

In order to estimate firm risk, $p_f$, and guarantor risk, $\Psi$, we develop a regression model that relates both effects to observed relative premiums. The relative premium, defined in equation (3b), depends on the multiplicative relationship between firm and guarantor risk. To capture this relationship, we similarly constrain the estimating equation and employ the maximum likelihood procedure.

To account for the financial institution’s risk, we draw from two groups of literature. The first uses institution-specific risk variables commonly employed in the measurement of CD default premiums. This group includes Baer and Brewer (1986), Avery, Belton, and Goldberg (1986), and Hannan and Hanweck (1988). The risk variables include CAP, measured as one minus the capital ratio, RET, the return on average assets, and variables intended to measure the downside risk of the asset portfolio. These latter variables are FOR, the percentage of total assets invested in foreclosed loans, and GOOD, the intangible asset goodwill allocated by regulators to an acquirer of an insolvent institution.

The second group of literature uses variables that have bankruptcy prediction power for non-bank firms. These variables, summarized in Ohlson (1980), are SIZE, measured by the log of total assets, TLTA, the ratio of total liabilities to total assets, WCTA, working capital divided by total assets, CLCA, current liabilities divided by current assets, ENEG, a dummy variable set equal to 1 if the observation involves a bank already book value insolvent, NITA, net income divided by total assets, FUTL, funds provided by operations divided by total liabilities, CHIN, the change in net income over the previous period divided by the sum of the absolute values of net income for the last two periods, and INTWO, a dummy variable equal to 1 if net income was negative in either of the past two years or zero otherwise. Since our objective is to control for institution risk as completely as possible and not to interpret the individual institution risk coefficients, we use a comprehensive set of variables from the two literature classes. Holding institution risk constant, the coefficients of the monthly dummy variables capture $\Psi$, the investors’ conjecture of FSLIC risk that applies to all firms for that time period.

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4 There is some lack of clarity in the literature regarding insolvency and closure of an insolvent institution. Typically, they are equated. The empirical literature has made estimates of “failure” based on logit or probit procedures that relate accounting data to actual insolvencies (Sinkey (1979), Martin (1977), Barth, et al. (1985), and Gajewski (1989)). We measure ex ante market probabilities of the event occurring whether or not the event subsequently occurs. In addition, we differentiate between insolvency and closure. The derived estimates of the firm’s probability of insolvency, $p_f$, reflect the depositor’s assessment that the deposit insurer will judge the firm to be insolvent. At that juncture, the deposit insurer will garnish the firm’s assets and accept the obligation of satisfying the insured depositors. The guarantor will then choose to either close, liquidate, sell, or subsidize the firm. Since the choice of the method of resolution might inflict different costs on the depositor, the prospect for closure as a method of resolution should be reflected in the $\Psi$ term.

5 The data are primarily from the state of California but also include other states in the FHLB region, all of which allow statewide branching. Market structure variables are not essential because the state is, effectively, a market.

6 Instead of using the monthly dummy variable to measure guarantor risk, it would be possible to attempt to account for the factors that affect guarantor risk. This could be done by first measuring guarantor risk with a dummy variable. Then, other variables that measure the government’s willingness and ability to honor the guarantee might be introduced as regressors on the dummy variable. Alternatively, we could substitute macro or other variables for the dummy variables, thereby, producing sets of monthly coefficients against each macro variable.
In order to capture the multiplicative nature of the theoretical model and express it in reduced form, we specify the empirical model for the relative premium as follows,

\[ r_n = [a_0 + a_1 \text{CAP} + \ldots + a_{13} \text{INTWO}] (b_k D_k) + e_n, \]

where \( r_n \) is the \( n \)th institution’s relative premium, the \( a_n \) with \( n = 0, 13 \) are the firm risk regression coefficients, the \( b_k \) with \( k = 1, 20 \) are coefficients of the monthly dummy variables \( D_k \), and \( e_n \) is the error term. Specifying the model in this manner produces a relative premium that is the product of the variables measuring firm risk and monthly FSLIC risk in the cross-section time-series regression.

The Federal Home Loan Bank of San Francisco and the Office of Thrift Supervision provided deposit rate and firm variable data for FHLB District 11. (These data are also available from the Federal Deposit Insurance Corporation and the Wharton Financial Institutions Center.) FHLB District 11 spans a wide region with member institutions in California, Arizona, and Nevada. The deposit rate data are “the interest rates paid on selected types of new deposits received,” reported monthly between January 1987 and August 1988. The category is “maturities of more than six months up to twelve months and a deposit size of under $80,000.” Since we utilize a single deposit-size class and common origination date, we are able to hold constant a number of variables that other CD deposit rate studies did not control. To eliminate differences in the frequency and method of compounding interest, we converted all rates into 365-day, annualized, continuously compounded rates.

The resulting sample is relatively large with 233 institutions’ deposit rates reported in January 1987 and monthly observations declining to 210 by August 1988 primarily as a result of mergers and liquidations. Since the observations are monthly and since firm risk does not change dramatically from month to month, any omitted risk variables could be serially correlated. Thus, we correct the regression equation for first-order auto correlation and use the Quasi-Newton algorithm to perform the maximum likelihood estimation.

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7 That is, we place all the \( R \) terms on the left-hand side.
8 The original data source for deposit rates was FHLBB Form 1313, Federal Home Loan Bank Board Thrift Financial Report. The confidential deposit rate data are contained in Section F. Balance sheet data are on a GAAP basis.
9 In addition to regressing the same time period’s rates and financial variables, we examined various time lag structures. Only the contemporaneous empirical regression results showed statistical significance. However, there is some lag implicit in the measurement since the reported rates are for the average of the last seven calendar days prior to the end of the reporting period.
10 Typically, the lack of control occurs when researchers use interest expense to construct an average cost of deposits, thus aggregating deposits of different maturities, size, and origination date.
11 The quoted Treasury rate is based on a 365-day year semiannual coupon; the CD is based on a 360-day year. To make the method of rate calculation comparable, we convert both the CD and Treasury rates to a continuously compounded rate based on a 365-day year. If there are lags in the CD rate adjustment, they will affect the measurement of the deposit premium. However, the speed of adjustment in the CD market is rapid. Financial institutions typically compare their rates to Treasury bill rates and reprice their CD for the opening of business each Tuesday after the results of the Monday Treasury auction are revealed.
Table 1 presents the maximum likelihood estimates of CD relative premiums covering the 20 months from January 1987 through August 1988. The 20 monthly dummy variables measure the effect over time of changes in FSLIC risk. Nineteen of the 20 dummy variables are significantly different from zero at the 0.01 level while the smallest coefficient is not. We use institution risk to measure the probability of firm insolvency. The variables CAP, RET, GOOD, WCTA, and INTWO are significant at the 0.01 level while SIZE and TLTA are significant at the 0.05 level. The variables FOR, CLCA, ENEG, NITA, FUTL, and CHIN are not significant. The signs of the significant variables correspond to a priori expectations.

IV. Guarantor and Firm Risk

A. Guarantor Risk

Equation (3b) provides a basis for decomposing observed CD premiums into firm and guarantor risk. The multiplicative regression coefficients, $b_k$, correspond to the monthly guarantor risk variable $\Psi$, while the bracketed terms $[a_0 + a_1 \text{CAP} + \ldots + a_3 \text{INTWO}]$ measure the probability of firm insolvency. The statistical significance of the set of dummy coefficients ($F = 197$, prob. = 0.0001) indicates that CD rates generally move up and down together from month to month. The dummy coefficients represent the depositor’s expected cost of an incomplete deposit insurance payoff. This includes the cost of transacting with the guarantor and the loss of interest not covered by deposit insurance following a firm insolvency. The monthly estimates of $\Psi$, contained in Table 2, average 3.7 cents per dollar of deposits (or 3.7 percent) over the time period. This level of expected cost is reasonable given the high degree of concern regarding the guarantor’s financial condition and the questions surrounding the recapitalization.

The monthly estimates of $\Psi$ vary over a considerable range from 0.1 percent to 10.3 percent. Over the entire 20-month period, renewed confidence in the guarantee followed two waves of pessimism. On January 21, 1987, Federal Home Loan Bank Board Chairman Edwin Gray declared that the FSLIC lacked funds to cover loans to thrifts. Shortly thereafter, the GAO declared the FSLIC to

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12Deposit premiums should measure the difference between the risky and riskless CD yield. Therefore, we rescale the Treasury security yield to reflect the same special features as a riskless CD. The model calls for measuring the difference or premium between the firm’s risky CD rate and the rate on a riskless CD. One observes the pricing of riskless Treasury securities but not riskless CDs. The riskless CD has greater convenience, lower transaction costs, and a smaller minimum size and divisibility than the Treasury. The CD also contains a put option. That is, though the CD is a term instrument with fixed maturity, the holder has the right to put the CD back to the issuer prior to its maturity date at face value, sometimes with a penalty. The riskless CD advantages are partially offset by Treasury tax shields from state income tax exclusions.

To adjust the Treasury yield, we impose the constraint that a risky CD yield should not be less than the riskless CD benchmark. Through a process of iteration, we adjust the Treasury yield downward one basis point at a time and reestimate the regressions and the derived results for each iteration. The bottom row of Table 4 shows the smallest estimated premiums which are 1 basis point for the Prime and Median firm for February 1988. The minimum downward adjustment in the Treasury rate that results in nonnegative estimated CD premiums is 15 basis points, a relatively small adjustment to the premiums, on average.

13Kamara (1988) uses the CD premium as a measure of default risk but acknowledges that the CD premium may capture some liquidity premium.
### TABLE 1

**MLE of Firm Risk Variables on Relative Premiums**<sup>a,b</sup>

**Under-$80,000 Deposit Class**

Eleventh Federal Home Loan Bank District

January 1987–August 1988

<table>
<thead>
<tr>
<th>Cnst.</th>
<th>CAP</th>
<th>RET</th>
<th>FOR</th>
<th>GOOD</th>
<th>SIZE</th>
<th>TLTA</th>
<th>WCTA</th>
<th>CLCA</th>
<th>ENEG</th>
<th>NITA</th>
<th>FULTL</th>
<th>CHIN</th>
<th>INTWO</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1491</td>
<td>0.1065</td>
<td>-0.00891*</td>
<td>0.00002</td>
<td>-0.0020*</td>
<td>-0.0019**</td>
<td>-0.0459**</td>
<td>-0.0406*</td>
<td>0.0060</td>
<td>-0.0053</td>
<td>-0.6978</td>
<td>1.8631</td>
<td>0.0001</td>
<td>0.0123*</td>
</tr>
<tr>
<td>(6.641)</td>
<td>(9.153)</td>
<td>(-5.815)</td>
<td>(0.058)</td>
<td>(-2.964)</td>
<td>(-2.507)</td>
<td>(-1.998)</td>
<td>(-2.865)</td>
<td>(1.586)</td>
<td>(-0.649)</td>
<td>(-0.409)</td>
<td>(0.950)</td>
<td>(0.645)</td>
<td>(3.127)</td>
</tr>
</tbody>
</table>

<sup>a</sup>The Relative Premium is $(1 - R)/(1 + R)$. RET is the return on average assets, FOR represents the proportion of total assets invested in foreclosed loans, GOOD is the proportion of goodwill to total assets, SIZE is the log of total assets, TLTA is total liabilities divided by total assets, WCTA is working capital divided by total assets, CLCA is current liabilities divided by current assets, ENEG is a dummy variable equal to one if total liabilities exceed total assets, NITA is net income divided by total assets, FULTL is funds provided by operations divided by total liabilities, CHIN is equal to the change in net income over the previous period divided by the sum of the absolute values of net income for the last two periods, and INTWO is a dummy variable equal to one if net income was negative either of the last two years, otherwise it is equal to zero. There are initially 233 firms, declining to 210 firms over the 20-month period.

<sup>b</sup>Figures in parentheses are t-values.

*Denotes significance at the 0.01-level, **denotes significance at the 0.05-level.

### TABLE 1A

**MLE of Monthly Dummy Variables on Relative Premiums**<sup>a</sup>

**Under-$80,000 Deposit Class**

Eleventh Federal Home Loan Bank District

January 1987–August 1988

<table>
<thead>
<tr>
<th>JAN 87</th>
<th>FEB 87</th>
<th>MAR 87</th>
<th>APR 87</th>
<th>MAY 87</th>
<th>JUN 87</th>
<th>JUL 87</th>
<th>AUG 87</th>
<th>SEP 87</th>
<th>OCT 87</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0392*</td>
<td>0.1034*</td>
<td>0.0465*</td>
<td>0.0399*</td>
<td>0.0300*</td>
<td>0.0220*</td>
<td>0.0446*</td>
<td>0.0463*</td>
<td>0.0456*</td>
<td>0.0235*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOV 87</th>
<th>DEC 87</th>
<th>JAN 88</th>
<th>FEB 88</th>
<th>MAR 88</th>
<th>APR 88</th>
<th>MAY 88</th>
<th>JUN 88</th>
<th>JUL 88</th>
<th>AUG 88</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0578*</td>
<td>0.0589*</td>
<td>0.0466*</td>
<td>0.0007</td>
<td>0.0491*</td>
<td>0.0371*</td>
<td>0.0290*</td>
<td>0.0068*</td>
<td>0.0094*</td>
<td>0.0088*</td>
</tr>
</tbody>
</table>

<sup>a</sup>Figures in parentheses are t-values.

*Denotes significance at the 0.01-level.
Guarantor risk, $\Psi$, is the depositor’s expected costs from an incomplete guarantor pay-off. These expected cost estimates are derived from the set of dummy variables in the regression equation, $r_n = [a_0 + a_1 CAP + \ldots + a_{13} INTWO](b_k D_k) + e_n$, where $r_n$ is the $n$th institution’s relative premium, the $a_n$ with $n = 0, 13$ are the firm risk regression coefficients, the $b_k$ with $k = 1, 20$ are coefficients of the monthly dummy variables $D_k$, and $e_n$ is the error term. We calculate firm probabilities of insolvency monthly from the value of the firm variables for that month (the bracketed terms of the regression equation). Then, for each cross-section, we generate a frequency distribution of the probability of firm insolvency in order to distinguish the junk, median, and prime firms for the industry for that month. For a given month, we define the firm at the bottom one percentile of insolvency risk to be the prime firm, and the firm at the 99th percentile to be the junk firm. Additionally, we define the firm at the 50th percentile to be the median (or representative) firm.

be insolvent. Following this, the first wave of pessimism reached its peak with a $\Psi$ of 10.3 percent. After the insolvency announcement, the Administration proposed a FSLIC recapitalization of $25$ billion, and Congress expeditiously moved the legislation forward. As thrift insolvencies accumulated, it became clear by Summer 1987 that the proposed FSLIC bailout bill was inadequate (see White (1991)). During the public debate of this problem, $\Psi$ rose from 2.2 percent in June to 4.5 percent in July and 4.6 percent in August 1987. In late August, both Houses of Congress passed a FSLIC Recapitalization Bill that allowed up to only $5$ billion of borrowing authority over a three-year period to meet a recorded FSLIC insolvency of $24$ billion. In response to the threat of a Presidential veto due to insufficient funding, Congress raised the borrowing authority contained in

### TABLE 2

Estimates of Guarantor Risk, Firm Probabilities of Insolvency, and Interfirm Spread Probabilities

<table>
<thead>
<tr>
<th>Month</th>
<th>Guarantor $\Psi$</th>
<th>Junk $P_J$</th>
<th>Median $P_M$</th>
<th>Prime $P_P$</th>
<th>Junk – Median $P_J - P_M$</th>
<th>Junk – Prime $P_J - P_P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-87</td>
<td>0.039</td>
<td>0.227</td>
<td>0.178</td>
<td>0.131</td>
<td>0.049</td>
<td>0.096</td>
</tr>
<tr>
<td>Feb-87</td>
<td>0.103</td>
<td>0.227</td>
<td>0.178</td>
<td>0.133</td>
<td>0.049</td>
<td>0.094</td>
</tr>
<tr>
<td>Mar-87</td>
<td>0.049</td>
<td>0.235</td>
<td>0.178</td>
<td>0.130</td>
<td>0.057</td>
<td>0.105</td>
</tr>
<tr>
<td>Apr-87</td>
<td>0.040</td>
<td>0.233</td>
<td>0.178</td>
<td>0.131</td>
<td>0.055</td>
<td>0.102</td>
</tr>
<tr>
<td>May-87</td>
<td>0.030</td>
<td>0.231</td>
<td>0.178</td>
<td>0.127</td>
<td>0.053</td>
<td>0.104</td>
</tr>
<tr>
<td>Jun-87</td>
<td>0.022</td>
<td>0.239</td>
<td>0.179</td>
<td>0.127</td>
<td>0.060</td>
<td>0.112</td>
</tr>
<tr>
<td>Jul-87</td>
<td>0.045</td>
<td>0.235</td>
<td>0.179</td>
<td>0.131</td>
<td>0.056</td>
<td>0.104</td>
</tr>
<tr>
<td>Aug-87</td>
<td>0.046</td>
<td>0.234</td>
<td>0.179</td>
<td>0.132</td>
<td>0.055</td>
<td>0.102</td>
</tr>
<tr>
<td>Sep-87</td>
<td>0.046</td>
<td>0.244</td>
<td>0.179</td>
<td>0.130</td>
<td>0.065</td>
<td>0.114</td>
</tr>
<tr>
<td>Oct-87</td>
<td>0.024</td>
<td>0.237</td>
<td>0.178</td>
<td>0.133</td>
<td>0.059</td>
<td>0.104</td>
</tr>
<tr>
<td>Nov-87</td>
<td>0.058</td>
<td>0.243</td>
<td>0.178</td>
<td>0.132</td>
<td>0.065</td>
<td>0.111</td>
</tr>
<tr>
<td>Dec-87</td>
<td>0.059</td>
<td>0.245</td>
<td>0.179</td>
<td>0.131</td>
<td>0.066</td>
<td>0.114</td>
</tr>
<tr>
<td>Jan-88</td>
<td>0.049</td>
<td>0.246</td>
<td>0.178</td>
<td>0.131</td>
<td>0.068</td>
<td>0.115</td>
</tr>
<tr>
<td>Feb-88</td>
<td>0.001</td>
<td>0.246</td>
<td>0.179</td>
<td>0.131</td>
<td>0.067</td>
<td>0.115</td>
</tr>
<tr>
<td>Mar-88</td>
<td>0.049</td>
<td>0.252</td>
<td>0.179</td>
<td>0.129</td>
<td>0.073</td>
<td>0.123</td>
</tr>
<tr>
<td>Apr-88</td>
<td>0.037</td>
<td>0.248</td>
<td>0.179</td>
<td>0.132</td>
<td>0.069</td>
<td>0.116</td>
</tr>
<tr>
<td>May-88</td>
<td>0.029</td>
<td>0.251</td>
<td>0.179</td>
<td>0.132</td>
<td>0.072</td>
<td>0.119</td>
</tr>
<tr>
<td>Jun-88</td>
<td>0.007</td>
<td>0.250</td>
<td>0.180</td>
<td>0.129</td>
<td>0.070</td>
<td>0.121</td>
</tr>
<tr>
<td>Jul-88</td>
<td>0.009</td>
<td>0.260</td>
<td>0.179</td>
<td>0.129</td>
<td>0.081</td>
<td>0.131</td>
</tr>
<tr>
<td>Aug-88</td>
<td>0.008</td>
<td>0.265</td>
<td>0.180</td>
<td>0.131</td>
<td>0.085</td>
<td>0.134</td>
</tr>
<tr>
<td>Average</td>
<td>0.037</td>
<td>0.242</td>
<td>0.179</td>
<td>0.131</td>
<td>0.063</td>
<td>0.112</td>
</tr>
</tbody>
</table>
the bill to $10.8 billion in late August of 1987, which the President signed into
law. With added resources in the Fall of 1987, the FSLIC began to recognize
additional insolvencies. It became apparent as the list of admitted insolvent thrifts
continued to grow that bailout funding was inadequate to meet the needs of the
FSLIC. Consequently, \( \Psi \) rose to 5.9 percent by December 1987.

From this second low ebb, reflected in \( \Psi \), confidence rebounded, this time
in response to the Federal Home Loan Bank Board (FHLBB) announcement of
its Southwest Plan, which intended to resolve all insolvent thrifts (see Federal
Home Loan Bank Journal, January 1989, p. 6–8). The Plan would fund full
resolution by the issuance of FHLBB Notes claimed by the FHLBB to be full-
faith-and-credit obligations of the U.S. Government (see Wall (1988)). Following
the announcement, \( \Psi \) declined in February 1988 to nearly zero. The guarantor
risk values for \( \Psi \) then rose somewhat until May when the FSLIC Notes were
actually sold in the market. The demonstrated ability to place the notes resulted
in an additional decline in \( \Psi \) to less than 1 percent. In the ensuing year, the note
issuance provided the FHLBB with over $20 billion in funds.

The recapitalization of an insolvent federal deposit guarantor was unprece-
dented in U.S. deposit insurance history. Given this circumstance, one could expect
a reassessment of government guaranteed CDs, especially since the crisis was not
handled quickly and became increasingly more costly. The value of the dummy
coefficients reacted consistently to changes in guarantor risk. It is conceivable,
however, that the coefficients could have been responding to other disturbances
also impacting premiums on nonguaranteed debt.

If there were common debt market disturbances strongly influencing \( \Psi \), then
these also should have affected premiums on nongovernment guaranteed debt.
Consequently, a regression of \( \Psi \) values on the nonguaranteed debt market premi-
ums should be statistically positive. We test this by regressing the \( \Psi \) values on
Aa commercial paper premiums of similar maturity for the same months. The
regression coefficient reported in Table 3 is a negative \(-3.14\) at a significance
level of 0.15. The result is inconsistent with the premise that common debt market
factors have a strong influence on \( \Psi \).

If the \( \Psi \) values reflect government guarantor risk, then we would expect a
positive relationship between the \( \Psi \) values and premiums on other government
guaranteed CDs. There is precedence for this in the literature. For example,
Cooperman, Lee, and Wolfe (1992) show that the insolvency of the Ohio Deposit
Insurance Guarantee Fund in 1985 resulted in elevated premiums for a period of
time for both FSLIC and Federal Deposit Insurance Corporation (FDIC) guaran-
teed deposits.

We test this by regressing \( \Psi \) on CD premiums guaranteed by the FDIC and
the Credit Union National Association (CUNA). Both premiums should reflect the
government’s (or taxpayers’) willingness to provide a recapitalization if the insur-
ance reserves of the guarantor became depleted (Bovenzi (1992) and Brumbaugh
and Litan (1990)). \(^{14}\) We find that FDIC premiums, while lower (thus reflecting less
risk than FSLIC guaranteed CDs), still have monthly variation that is highly corre-
lated with the values of \( \Psi \) obtained from the FSLIC data. We report the regression

\(^{14}\) The authors' indicate, “The FDIC’s actual reserves at year-end 1988 were overstated by about
$10 billion and thus closer to $4 billion than the official figure of $14.3 billion.”
### TABLE 3
Various Non-FSLIC Premiums Regressed on Guarantor Risk, $\Psi^{a,b}$
January 1987–August 1988

<table>
<thead>
<tr>
<th>Cnst</th>
<th>Comm. Paper</th>
<th>Cal. Banks</th>
<th>U.S. Banks</th>
<th>Savings Banks</th>
<th>Credit Unions$^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.063*</td>
<td>-3.141</td>
<td>4.881*</td>
<td>5.493*</td>
<td>5.241*</td>
<td>4.933*</td>
</tr>
</tbody>
</table>

$^a$ $\Psi$ is the estimate of depositors' expected costs in the event of an incomplete guarantor payoff. Comm. Paper represents the premiums for short-term commercial paper. Cal. Banks, U.S. Banks, and Savings Banks are the respective premiums for the twelfth Federal Reserve District banks (which include the California banks), United States banks, and United States savings banks for the under-$100,000 deposit category. Credit Unions represents the premiums for the United States credit unions for the under $100,000 category. The source of the bank rate data was the Federal Reserve Board's Division of Research and Statistics. The source for the credit union rates was the Economics and Statistics Division of the Credit Union National Association (CUNA). The sources for the commercial paper rates were various issues of the Federal Reserve Bulletin. There are 20 data points for each of these premia.

$^b$ Figures in parentheses are t-values.

$^c$ CUNA began collecting credit union rate data in January 1988. Thus, there are eight Credit Union data points. * Denotes significance at the 0.01 level.

results of $\Psi$ on the non-FSLIC CD premiums in Table 3. The results are consistent for banks in the same geographical region as the sample S&Ls, for banks across the country, and for savings banks that are largely out of the operating region of the sample S&Ls. Similarly, the premiums for CDs insured by the CUNA for a more limited time period of available data have a positive and statistically significant relationship to the monthly $\Psi$ values. The t-value for the regression coefficients ranges from 10.60 to 16.30 for the three FDIC CD categories and is 8.26 for the CUNA category. Thus, the regression relationship among the CD guarantees is consistent with the common government guarantor effects found by Cooperman, Lee, and Wolfe.

Given these additional tests, we reject the premise that common debt market factors influence the dummy coefficients. We conclude that guarantor risk is the primary driver of the dummy coefficients. We now turn to the analysis of firm risk and the spreads in CD premiums.

### B. The Insolvency Risk of Junk, Median, and Prime Firms

In this section, we report the firm risk component of the relative premium. We calculate firm probabilities of insolvency monthly from the value of the firm variables for that month (the bracketed terms of the regression equation). Then,

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for each cross-section, we generate a frequency distribution of the probability of firm insolvency in order to distinguish the junk, median, and prime firms for the industry for that month. For a given month, we define the firm at the bottom one percentile of insolvency risk to be the prime firm and the firm at the 99th percentile to be the junk firm. Additionally, we define the firm at the 50th percentile to be the median (or representative) firm. Table 2 shows the firm probabilities of insolvency for our three categories.

The results are plausible and interesting. The insolvency probabilities for the industry’s prime firm are trendless and average 0.131 or 13.1 percent per year over the 20 monthly cross-sections. The industry’s median firm insolvency probability is also trendless from cross-section to cross-section at 0.179 or 17.9 percent. The junk firm’s insolvency probability averages 0.242 or 24.2 percent, but varies between 22.7 percent and 26.5 percent, drifting upward over time as firm losses become more evident to CD investors. It is notable that the model captures oscillating but improving guarantor risk over time, while it also captures the declining risk status of the junk firms. The stability in the prime and median firm insolvency probabilities is interesting because it occurs despite great shocks to the confidence of the industry reflected in wavering guarantor risk. The range of the estimated market-priced a priori probabilities of insolvency corresponds to the actual insolvencies that materialized in these years. Between 1987 and 1990, the failures of the institutions cumulatively were approximately 20.4 percent.16

C. Risk Contagion

The insolvency probabilities in Table 2 reveal much about the contagion that occurs between low risk and high risk firms. If there is contagion, the increasing riskiness of the junk firm should affect the market’s evaluation of the risk of the median and prime firm. However, with virtual month-by-month stability in the median and prime firm insolvency probabilities, there is no evidence of firm-to-firm contagion. We corroborate this result by analyzing the Pearson Correlation Coefficients between junk and prime insolvency probabilities. They are –0.06 and statistically insignificant. We also explore a firm-to-guarantor contagion effect. The correlation between the junk firm’s insolvency risk and guarantor risk is negative and statistically significant (Pearson Correlation Coefficient = –0.52, p = 0.05). Hence, the data do not exhibit contagion either from the junk firm to the guarantor or vice versa.

To demonstrate visually the lack of risk contagion, Figure 1A shows the junk, median, and prime firm insolvency probabilities as well as the guarantor risk variable \( \Phi \). To illustrate more clearly, the relationship of guarantor risk to junk firm risk, we have ordered the monthly observations in descending levels of guarantor risk (rather than by time). There is a considerable range of guarantor risk but no correspondence to junk firm risk. Figure 1A also demonstrates visually the almost constant prime and median firm’s probabilities of insolvency across the

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16 At year-end 1986, there were 3,130 insured institutions. In 1987, 47 failed institutions required FSLIC or RTC assistance. In the following three years, assistance was provided to 205, 37, and 350 institutions each year (Congressional Budget Office, 1993, p. 88).
20 sample months irrespective of the junk firm’s insolvency probability and the level of guarantor risk.

D. Absolute Premiums, Spreads, and Guarantor Risk

Table 4 reports the calculated absolute premiums for the junk, median, and prime firms as well as the spreads across these premiums. We calculate the absolute premium as the product of the firm probability of insolvency and the cost of an incomplete guarantor payout as specified in equation (3). The average premiums over the 20 reported months round to 90, 67, and 49 basis points while the junk-prime and junk-median spreads are 41 and 23 basis points. Figures 1B, 2A, and 2B illustrate these data.
The absolute premiums and spreads vary considerably over the 20 reported months. Since the firm probabilities of insolvency remain relatively stable, variations in guarantor risk are largely responsible for the changes in both the premium levels and spreads (see Figures 1B and 2B and Table 2).

Furthermore, the changes in premiums and spreads occur concurrently. Since the junk firm probability coefficient (0.242) is 85 percent higher than the prime firm probability coefficient (0.131), any increase in guarantor risk increases the junk premium 85 percent more than the prime premium. Figures 1B and 2B demonstrate the correspondence of the absolute premiums and spreads to guarantor risk. Additionally, Figure 3 shows the premium (for the median firm) and the junk-prime spread in descending order of guarantor risk by month. The close correspondence of the premiums and spreads illustrates the extent to which the...
TABLE 4  
Calculated Absolute CD Premiums for Junk, Median, and Prime Firms and Interfirm 
Spreads Ranked in Descending Order of Guarantor Risk 
Eleventh FHLB District Savings Institutions 
January 1987–August 1988 
(Basis Points)

<table>
<thead>
<tr>
<th>Month</th>
<th>Junk Firm</th>
<th>Median Firm</th>
<th>Prime Firm</th>
<th>Junk – Median Spread</th>
<th>Junk – Prime Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb-87</td>
<td>235</td>
<td>184</td>
<td>135</td>
<td>51</td>
<td>100</td>
</tr>
<tr>
<td>Dec-87</td>
<td>144</td>
<td>105</td>
<td>77</td>
<td>39</td>
<td>67</td>
</tr>
<tr>
<td>Nov-87</td>
<td>140</td>
<td>103</td>
<td>76</td>
<td>37</td>
<td>64</td>
</tr>
<tr>
<td>Mar-87</td>
<td>124</td>
<td>88</td>
<td>63</td>
<td>36</td>
<td>61</td>
</tr>
<tr>
<td>Mar-87</td>
<td>114</td>
<td>86</td>
<td>63</td>
<td>28</td>
<td>51</td>
</tr>
<tr>
<td>Jan-88</td>
<td>120</td>
<td>87</td>
<td>64</td>
<td>33</td>
<td>56</td>
</tr>
<tr>
<td>Aug-87</td>
<td>108</td>
<td>83</td>
<td>61</td>
<td>25</td>
<td>47</td>
</tr>
<tr>
<td>Sep-87</td>
<td>111</td>
<td>82</td>
<td>59</td>
<td>29</td>
<td>52</td>
</tr>
<tr>
<td>Jul-87</td>
<td>105</td>
<td>80</td>
<td>59</td>
<td>25</td>
<td>46</td>
</tr>
<tr>
<td>Apr-87</td>
<td>93</td>
<td>71</td>
<td>52</td>
<td>22</td>
<td>41</td>
</tr>
<tr>
<td>Jan-87</td>
<td>89</td>
<td>70</td>
<td>51</td>
<td>19</td>
<td>38</td>
</tr>
<tr>
<td>Apr-88</td>
<td>92</td>
<td>66</td>
<td>49</td>
<td>26</td>
<td>43</td>
</tr>
<tr>
<td>May-87</td>
<td>69</td>
<td>53</td>
<td>38</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td>May-88</td>
<td>73</td>
<td>52</td>
<td>38</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>Oct-87</td>
<td>56</td>
<td>42</td>
<td>31</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Jun-87</td>
<td>53</td>
<td>39</td>
<td>28</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Jul-88</td>
<td>24</td>
<td>17</td>
<td>12</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Aug-88</td>
<td>23</td>
<td>16</td>
<td>12</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Jun-88</td>
<td>17</td>
<td>12</td>
<td>9</td>
<td>5</td>
<td>8</td>
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<tr>
<td>Feb-88</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>89.6</td>
<td>66.9</td>
<td>48.9</td>
<td>22.7</td>
<td>40.7</td>
</tr>
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</table>

We calculate the absolute premium as the product of the firm probability of insolvency and the cost of an incomplete guarantor payout.

guarantor simultaneously generated the premiums and spreads during our sample period.

V. Summary and Conclusions

We show that the premiums on guaranteed debt are multiplicatively related to firm risk and guarantor risk. When firm risk is constant, the premiums as well as spreads are proportional to guarantor risk. Our model and data indicate that homogeneous debt issued by different issuers with the same guarantor are not perfect substitutes in market pricing except in the special case of a riskless guarantor. In this special case, differences in firm risk do not affect market pricing. However, a rate spread should generally exist in the market for guaranteed debt. Empirical evidence of rate spreads attests to the presence of guarantor risk, even in the case of a federal government guarantor.

The empirical evidence demonstrates that the risk of the industry’s prime and median firm held steady over the 20 cross-sections examined, while the risk of the industry’s junk firm increased over time. Guarantor risk varied over a wide range and embodied two waves of pessimism. We found the pattern of FSLIC guarantor risk to be common to other government guarantees. Deterioration in guarantor risk had, on average, an 85 percent greater effect on the industry’s junk firm premium.
than on the prime firm’s premium. This caused premiums and interfirm spreads to increase.

Acting on the government’s contagion thesis, the federal guarantor restrained junk firms from paying high CD premiums and resolved them quickly in order to prevent the large junk CD premiums from infecting the prime firms’ CDs. We find no statistical evidence of a relationship between the industry’s junk and prime firms’ probabilities of insolvency. The contagion thesis is predicated on the mistaken appearance of junk-prime contagion resulting from the simultaneous increase of junk and prime premiums in response to the common influence of the unobserved but elevated guarantor risk. The evidence does not reveal generalized contagion of risk pricing among firms.

References


