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Department of Economics  
South Dakota State University  
Brookings, South Dakota

## **Bank Risk Ratings and the Pricing of Agricultural Loans**

Nick Walraven and Peter Barry\*

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\*Nick Walraven, Economist, Federal Reserve Board, Washington, DC 20551. Telephone: 202-452-2655. E-mail: [Nick.A.Walraven@frb.gov](mailto:Nick.A.Walraven@frb.gov) Peter Barry is Professor at the Department of Agricultural and Consumer Economics at the University of Illinois at Urbana-Champaign.

## **Bank Risk Ratings and the Pricing of Agricultural Loans**

This paper reviews the use of risk ratings by commercial banks when making new agricultural loans using data from the Federal Reserve's Survey of the Terms of Bank Lending to Farmers (STBLF). This is accomplished both by assessing the incidence of risk rating systems across the STBLF panel of banks and, when ratings are employed by the bank, by estimating the relationship of the risk ratings to interest rates and other terms of the loans reported in the survey.

The use of risk ratings to summarize multiple features of a bank's customer or a loan has been spreading through the banking system for at least a decade, first among larger banks, and gradually its use has spread to medium and small-sized banks (English and Nelson (1998), Treacy and Carey (1998)). According to English-Nelson (EN), virtually all large banks rated business loans in the August 1998 Survey of Terms of Business Lending, and most medium and small banks in their survey rated business loans, although many of the medium-to-small banks assigned all the loans in the survey to a single rating category.

### **The prevalence of risk rating in the STBLF panel**

About 1/4 of the banks in the panel (47 of 186) for the August 1998 STBLF did not rate the farm loans that they closed, and almost as many (37 of 186 banks) assigned the same risk rating to all of the survey loans that were reported. Similar to the EN findings, almost all of the banks in the 1998 survey that either did not assign risk ratings or gave all loans the same risk rating were small banks (less than \$1 billion in assets), and as a group, these banks reported 743 of 4072 total farm loans in the August 1998 survey.

Although anecdotes suggest that the use of risk rating systems has been spreading for all types of loans, according to the STBLF panel, the proportion of banks that assigned risk ratings was little changed during the five years following the EN business loan survey. In the August 2002 survey, about 1/5 of the panel (38 of 172 banks) did not rate farm loans, and about 1/4 (42 of 172 banks) reported no variation in risk ratings (440 of 5105).

Most of the banks remain on the survey from one quarter to the next; indeed, 120 of the banks that reported closing at least one loan in the August 1998 survey also reported a loan in August 2002. Among this group of banks, about 50 assigned loans to multiple risk categories in both 1998 and 2002, and this set of banks reported about 2/3 of the number of sample loans (3231 of 5105) in the most recent survey. Another 10 banks that reported in both periods did not rate farm loans in 1998, but had begun to report ratings by 2002. A set of 22 banks that did not rate farm loans in 1998 still did not rate farm loans in 2002, and another 10 banks had discontinued rating farm loans by 2002. These 32 banks reported 245 loans in the August 2002 survey. The remaining 29 banks that reported loans in both 1998 and 2002 assigned all the loans the same risk rating, which is not particularly surprising given that, on average, each of this last set of banks reported closing fewer than 5 loans during the August 2002 sample week.

### **Description of risk rating categories**

Banks participating in the survey are asked to map their internal risk ratings into a set of five rating categories that are described in detail in the reporting instructions. The loans are characterized in terms of the probability of a loss to the bank, rather than the probability of a default by the borrower. As a result, requirements for compensating balances or collateral can lower the risk rating of an otherwise more risky loan. Loans placed in Category 1, the "minimal" risk category should bear virtually no chance of loss to the bank. Loans in Category 2 are

described as “very unlikely” to result in a loss to the bank. Category 3 loans were termed “moderate risk” and were intended to be an average loan to a typical borrower under average economic conditions. The survey was designed with the intention that most loans would fall in Category 3. Loans placed in Category 4, although still bearing an “acceptable” degree of risk, were in some sense substandard. Category 5 loans were described as “Special mention” loans, such as work-out loans--new loans typically would not fall in this category. Two additional rating categories were provided, the first for banks that rated some loans, but not a particular one that was reported, while the final designation was for banks that did not rate loans.

### Farm loan characteristics by risk rating

#### August 1998 Survey

In order to compare the EN averages for business loans to the STBLF data, we computed averages by bank size and risk category that were weighted by the size of the loan and by a stratum blowup factor that reflects the volume of farm loans outstanding at the panel bank to the volume outstanding at banks not in the survey. In general, the panel banks in 1998 seemed to adjust banks rates according to the riskiness of the loans, as may be seen in Table 1. However, for large banks, which following the definitions used by EN are those banks with more than \$1 billion in assets, loans with a risk rating of 3 tended to carry lower rates of interest than those with less risky ratings. For medium-sized banks (assets between \$1 billion and \$100 million) and small banks (assets less than \$100 million) loans in Category 4 tended to carry lower rates than loans in Category 3. EN found a somewhat closer correspondence between reported riskiness of C&I loans and the average interest rate than these averages suggest for farm loans.

Table 1  
Average Loan Rate by Risk Rating  
(Weighted by Loan Volume)  
August 1998 Survey of Terms of Bank Lending to Farmers

	Risk Rating					
	1	2	3	4	5	All
All	9.32	9.45	8.68	8.93	9.49	9.06
Large Bank	7.98	8.83	7.96	8.77	9.10	8.44
Medium Bank	9.39	9.68	10.22	9.92	10.16	10.00
Small Bank	9.33	9.42	10.14	9.86	10.95	9.62

To the extent that reported rates of interest fail to increase with the reported risk rating, it is likely that other characteristics of the loan compensate the lender for bearing the risk. As a result for the August 1998 survey discussed above, it is instructive to look at other reported features of the loans, broken out by risk ratings (Table 2). On average, farm loans in the survey were fairly small; the overall weighted average amount for each loan was \$27.3 thousand, with the weighted-average amount increasing uniformly with the size of the loan from \$15.6 thousand for the least risky loans to \$79.3 thousand for the most risky loans. In general, less risky loans were more likely to have collateral associated with them, consistent with the (BERGER) hypothesis of the collateral offsetting some of the risk of the loan. Furthermore, less risky loans tended to carry provisions allowing the bank to call the note at some time before maturity, likely

affording the bank some protection from post-closing changes in the pattern of interest rates in the general economy. As the reported riskiness of the loans increased, they were more likely to be made under some sort of prior commitment, which is consistent with Morgan (1998) who hypothesized that, as economic conditions worsen (i.e. the general riskiness in the economy increases), lenders tend to gravitate away from loans not under a prior commitment. Prepayment penalties, although fairly rare overall, tended to become a little more prevalent as the reported risk of the loan increased. The average maturity of the loans increased with reported riskiness, perhaps suggesting some concerns about interest rate risk or repayment capability that were not sufficiently assuaged by call provisions, collateral requirements, and other terms of the loan.

Table 2  
Loan Characteristics by Risk Rating  
Weighted by Loan Volume  
August 1998 Survey of Terms of Bank Lending to Farmers

	Risk Rating					
	1	2	3	4	5	All
Amount (thousand \$)	15.6	16.7	31.2	53.7	79.3	27.3
Percent With Collateral	94.9	94.8	61.0	36.9	48.0	66.8
Percent Under Commitment	57.0	70.0	85.1	92.1	94.7	80.0
Percent Callable	18.4	24.3	14.5	5.9	9.8	14.0
Percent with Prepayment Penalty	0.1	0.1	3.5	0.8	0.5	1.6
Average Maturity (months)	21.3	18.6	12.4	5.8	9.4	12.8

### August 2002 Survey

Despite the multitude of changes between 1998 and 2002 among agricultural lenders, the agricultural sector, and the economy as a whole, we examined the August 2002 survey data within the same framework as the one from four years earlier (August 1998, shown above). Rates of interest at all sizes of banks tended to increase with the reported riskiness of loans, perhaps reflecting a somewhat better use of nonprice terms to adjust the riskiness of the loans. For instance, the proportion of loans that were secured rose to more than 90 percent in the August 2002 survey, well above the 67 percent that were secured in the survey four years earlier. In addition, loans in the riskier categories were much more likely to be secured in the more recent survey. The proportion of survey loans that the bank can call prior to the maturity date rose substantially for loans that were of average or lower risk (risk ratings 1 to 3).

August 2002 Survey of Terms of Bank Lending to Farmers  
(weighted by loan volume)

	Risk Rating					
Rates by bank size	1	2	3	4	5	All
Large Bank	4.30	4.40	4.72	5.11	6.09	4.99
Medium Bank	5.91	6.89	7.19	7.48	7.63	7.11
Small Bank	7.04	7.01	7.78	8.19	9.46	7.36
All banks	6.75	6.86	6.00	5.39	6.54	6.05
Loan Characteristics						
Amount	15.5	19.0	24.0	37.6	34.0	24.9
Percent With Collateral	95.0	96.2	88.6	95.1	98.8	92.7
Percent Under Commitment	76.4	73.3	74.7	93.1	92.2	80.3
Percent Callable	27.0	28.2	30.3	3.9	3.3	20.6
Percent with Prepayment Penalty	1.8	0.4	1.1	3.5	0.5	1.8
Average Maturity	21.3	18.6	12.4	5.8	9.4	12.8

**Controlling for variations in terms via a simple regression**

In this section we use regression analysis to examine the effect of various terms on the rate of interest charged by the bank. We included data from all the quarterly surveys from August 1998 through May 2002, which provided 84265 loans. Roughly following EN, we include either quantitative or qualitative measures of all the nonprice terms of the loan as explanatory variables for the rate of interest. Our regression is slightly different from EN in that we try to control for bank-specific factors that might affect loan pricing by adding to the regression bank-level variables that might influence the terms offered on the loan. Table 3 gives a list of the variables along with the mean and standard deviation for each, which contrary to the previous tables, are calculated on raw, unweighted data. For instance, the mean of the 0-1 indicators shows that 5.4 percent of the sample loans fell in the first (least risky) category, while 41.7 percent were rated in the third (typical risk) category.

Table 3  
Summary of Regression Variables

Variable	Mean	Std Dev.
Risk Rating 1 (least risk) (1=yes, else 0)	.054	.227
Risk Rating 2 (1=yes, else 0)	.135	.341
Risk Rating 3 (average risk) (1=yes, else 0)	.417	.493
Risk Rating 4 (1=yes, else 0)	.224	.417
Risk Rating 5 (most risk) (1=yes, else 0)	.059	.235
Risk Rating 7 (bank does not rate farm loans) (1=yes, else 0)	.080	.271
Days until loan may be repriced	92.6	327.
Days until loan matures (0 if no stated maturity)	307.	515.
Call provision (1=yes)	.190	.392
Prepayment penalty (1=yes)	.020	.141
Loan made under commitment (1=yes)	.854	.353
Loan secured (1=yes)	.907	.290
Loan secured by farm real estate (1=yes)	.085	.278
Loan made in partnership with another bank (1=yes)	.019	.136
Loan insured by federal agency (1=yes)	.040	.195
Ln (loan amount)	2.44	1.55
Ln (bank assets)	14.8	3.18
Bank: ROA (percent)	1.40	.730
Bank: farm loans/total loans (percent)	23.4	24.7
Bank: interest expense/assets (percent)	2.99	.784
Bank: all loans/all deposits (percent)	85.4	21.8
Bank: all delinquencies/total loans (percent)	5.77	6.67
Bank: all net charge-offs/total loans (percent)	0.35	0.45

The remainder of the paper refers to materials from the conference that are included in the appendix. Although several useful suggestions from discussions at the conference appear likely to improve the analysis, the work is not yet completed, so for this conference proceedings publication we have kept the tables as they originally were presented.

The regression results for the entire sample are shown in the first page of the appendix. In general, after one controlled for both the nonprice terms of the loan and the bank-specific



differences, the coefficients for the risk rating indicators suggested a plausible and consistent pricing of loans according to their reported riskiness. For instance, a loan with the least risky rating, other things equal, carried a rate of interest that was 1.3 percentage point less than a loan rated the most risky (coefficient on Risk 1 - Risk 5).

Coefficients on most other loan level variables (with the possible exception of whether the lender could call the loan before maturity, which is examined in a bit more detail below) were of a plausible magnitude. Loans with a prepayment penalty, issued under a prior commitment, issued in participation by more than one bank, or with federal insurance were priced lower than other loans. Secured loans tended to carry a significantly higher rate of interest, which is consistent with results from Berger and Udell (1990), and as they hypothesized, may reflect a tendency of banks to extend unsecured loans only to their least risky customers. However, the subset of secured loans that were secured by farm real estate carried significantly lower rates of interest.

Among the bank level variables, higher returns on assets and concentration of farm loans both were associated with lower loan rates, while a higher average cost of funds, as proxied by the ratio of interest expense to bank assets, tended to boost the rates charged on new loans. Greater bank liquidity, as measured by the ratio of loans to deposits, was associated with lower rates on new loans. Rates varied inversely with the incidence of problem loans—the higher the rate of delinquency or charge-off, the lower the rate reported in the survey.

To examine quarter to quarter changes in the terms of lending, we fit the regression described above separately to each quarter. In general, the magnitude of the parameters and their statistical significance were stable over the survey dates from August 1997 to May 2002. After controlling with the regression for as many terms of the loan as possible and for variation in performance across banks in the sample, one can examine the quarterly spreads for loans of different riskiness. As may be seen in the exhibit titled “Spreads Over Risk Rating One”, the markup for loans in either the third or fourth risk rating category moved very closely together, and for the entire sample period averaged about 70 basis points over loans in the least risky category. As might be expected, fluctuations in the markup for the most risky loans were much wider than those on other loans, with noticeable spikes in 1999, 2001, and 2002.

As may be seen in the exhibit titled “Risk Spreads”, movements in the estimated spread between survey loans that received the most risky rating and those with the least risky rating tended to track reasonably well the movements in the spread of speculative-grade issues and those rated BAA in the corporate credit markets.

In examining the quarterly parameter estimates, it was apparent that as interest rates fell sharply during 2001 in the broader economy, the coefficients on the variables associated with the duration of the loan: the dummy for whether the loan could be called; the dummy for whether the loan could be prepaid; and the number of days until the loan could be repriced; each switched sign (the quarterly estimates for these variables are shown at the end of the appendix). While this change could reflect lender concerns about the capacity of borrowers to repay their loans in the softening economy, it also could be that the survey data do not capture adequately lenders’ assessments of loan risk or the non-price tools that they use to manage it.

The conference provided a useful forum for discussing this ongoing research, and several suggestions elicited there appear likely to sharpen the initial results that are presented here. Chief among these improvements is the adjustment of the dependent variable (the effective rate charged on the loan) to a spread over each survey bank’s “prime” rate. Another possible improvement is

differential treatment of data from banks that report all of their loans fall into a single rating category. Results from these and other refinements likely will be included in a later version of the paper.

## **References**

- Berger, Allen, and Greg Udell (1990), "Collateral, Loan Quality, and Bank Risk", Journal of Monetary Economics.
- English, William, and William Nelson (1998), "Bank Risk Rating of Business Loans", Finance and Economics Discussion Series, 1998-51, Federal Reserve Board
- Morgan, Donald (1998), "The Credit Effects of Monetary Policy: Evidence Using Loan Commitments," Journal of Money, Credit, and Banking
- Treacy, William, and Mark Carey (1998), "Credit Risk Rating at Large U.S. Banks", Federal Reserve Bulletin, November 1998

**Appendix**  
**Selected Exhibits from the Conference**

**Dependent Variable:** Effective Interest Rate of Loan

**R<sup>2</sup> = .3060**

**N. of Obs. = 84265**

<b>Variable</b>	<b>Parameter</b>	<b>St. Error</b>	<b>t-Value</b>	<b>Pr &gt;  t </b>
Intercept	7.55683	0.08535	88.54	<.0001
<b>Loan Level Variables</b>				
Risk = one (least risky)	0.02854	0.03817	0.75	0.4547
Risk = two	0.22215	0.03327	6.68	<.0001
Risk = three (typical risk)	0.72353	0.03054	23.69	<.0001
Risk = four	0.69926	0.03128	22.35	<.0001
Risk = five (most risky)	1.34214	0.03620	37.08	<.0001
Risk = seven	0.78282	0.03535	22.15	<.0001
Repricing interval (days)	-0.00025076	0.00001988	-12.62	<.0001
Days until maturity	0.00003955	0.00001263	3.13	0.0017
Call option	0.24991	0.01462	17.10	<.0001
Prepay, penalty	-0.32798	0.03643	-9.00	<.0001
Commitment	-0.29993	0.01626	-18.44	<.0001
Secured	0.12710	0.01810	7.02	<.0001
Secured by real estate	-0.43762	0.01934	-22.63	<.0001
Participation	-0.50161	0.03767	-13.22	<.0001
Insurance	-0.16893	0.02717	-6.22	<.0001
In (Loan amount)	-0.10782	0.00347	-31.04	<.0001
<b>Bank Level Variables:</b>				
In (Bank assets)	0.00420	0.00418	1.01	0.3139
ROA	-0.21017	0.00775	-27.11	<.0001
Farm loans/total loans	-0.00720	0.00038949	-18.48	<.0001
Interest expense/bank assets	1.05467	0.00949	111.14	<.0001
Loans/deposits	-0.01510	0.00030608	-49.34	<.0001
Delinquency rate	-0.01932	0.00080039	-24.13	<.0001
Net charge offs	-0.38291	0.01279	-29.95	<.0001

CALLABLE ONLY

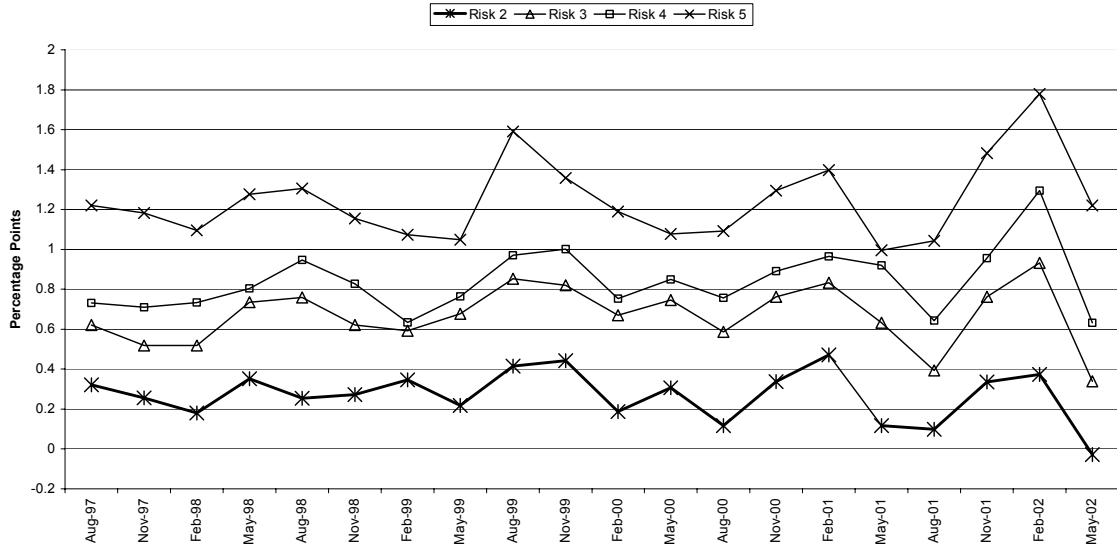
Percent Rated As Percent of Total Category

Purpose of Loan	Percent of Total Loans					As Percent of Total Category				Floating Rate Replicating <sup>1</sup> Maturity	Days to Average
	1	2	3	4	5	Secured Commitment	Under Commitment	with Prepayment Penalty	Rate		
Feeder Livestock	1.78	8.92	25.70	40.01	7.26	97.20	74.62	2.20	0.45	12.15	225.95
Other Livestock	1.06	4.35	27.85	38.14	8.39	96.21	70.12	7.94	0.40	29.65	230.01
Current Operating Expenses	12.06	7.77	15.25	45.09	10.72	94.26	88.57	2.41	0.82	8.11	256.78
Farm Machinery	0.82	9.14	14.71	41.86	6.14	94.86	49.29	2.14	0.27	75.67	794.41
Farm Real Estate	0.44	6.78	19.78	32.06	11.38	88.89	67.48	2.44	0.58	188.13	1222.32
Other Loans	1.80	2.37	9.08	39.70	17.51	80.12	74.92	5.12	0.69	20.14	226.14

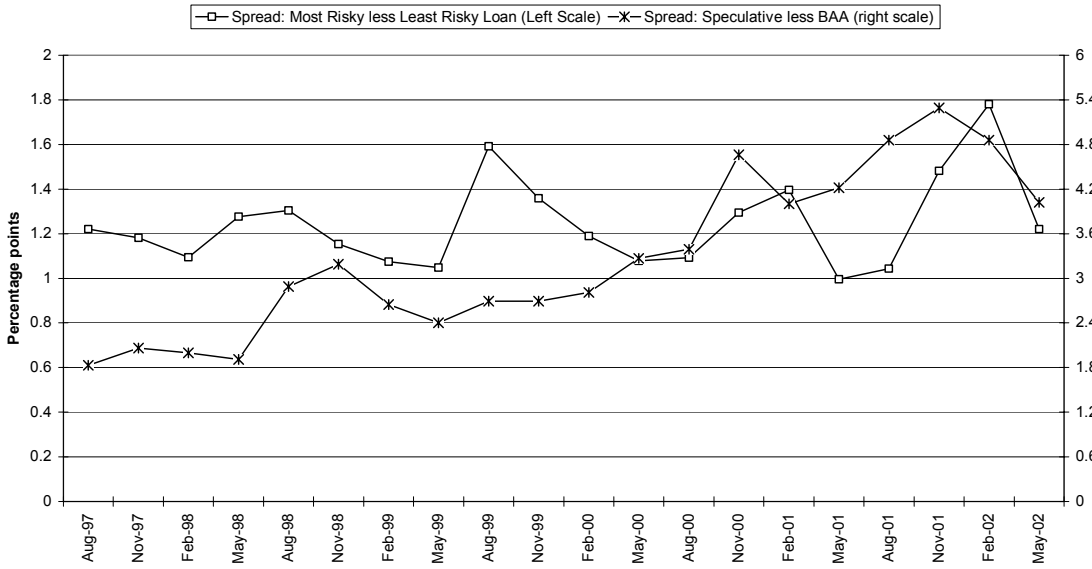
Notes:

1. Average for floating-rate loans.

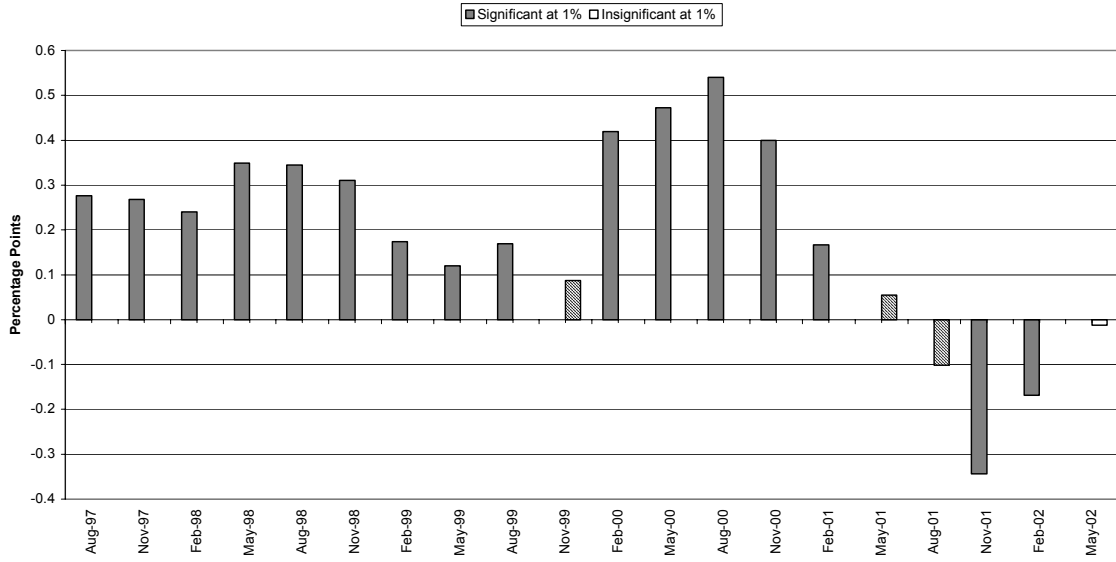
### Spread over Risk Rating One



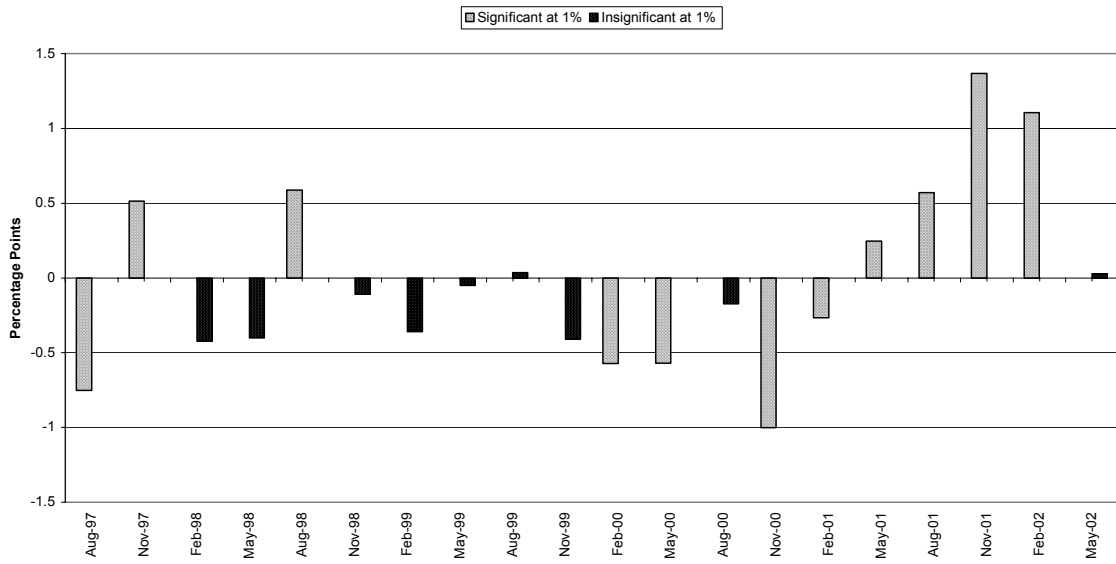
### Risk Spreads



### Coefficient on Call Option Dummy



### Coefficient on Prepayment Penalty Dummy



### Coefficient on Days to Repricing

