R E V I E W

Vol. 74, No. 4 July/August 1992

THE FEDERAL RESERVE BANK of ST. LOUIS

Federal Reserve Bank of St. Louis
Review
July/August 1992

In This Issue . . .

In the first article in this *Review*, "The Effects of Legislating Prompt Corrective Action on the Bank Insurance Fund," R. Alton Gilbert investigates whether recent legislation is likely to reduce the losses of the Bank Insurance Fund (BIF). The Federal Deposit Insurance Corporation Improvement Act of 1991 mandates prompt corrective action by the federal supervisors of insured depository institutions when the capital ratios of these institutions fall to relatively low levels. The mandate for prompt corrective action is intended to reduce the losses of the BIF.

Gilbert examines whether this legislation is likely to have such an effect. The prompt corrective action mandate is based on the assumption that, the longer a bank remains in operation with a low capital ratio before it fails, the larger the ratio of BIF loss to total assets. Gilbert shows that the data do not support this assumption. His evidence indicates that there is no relationship between the length of time banks operated with low capital ratios before they fail and the BIF's loss ratios. These results raise doubt about whether the recent legislation will reduce the BIF's losses.

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In the second article in this issue, "Targeting M2: The Issue of Monetary Control," Daniel L. Thornton investigates the controllability of M2. Thornton notes that the existing structure of reserve requirements is such that the Fed has direct control over only the M1 portion of M2, and he provides evidence that the Fed's ability to control the other components of M2 indirectly, say, through interest rates, has been essentially nil. Consequently, the Fed can control M2 only through its control over M1. Because M1 accounts for only 25 to 30 percent of M2, this means that, at times, M2 control can only be achieved with very large and potentially destabilizing changes in M1 and reserves. While not endorsing such actions, Thornton outlines changes in the Federal Reserve's system of reserve requirements that could enhance significantly the Fed's ability to control M2.

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The role of interest rates in the economy has recently attracted a great deal of attention. One question that comes up frequently when interest rates are discussed is: How are short-term and long-term rates related? The relationship between long- and short-term interest rates is called the "term structure." In the third article in this issue, "Understanding the Term Structure of Interest Rates: The Expectations Theory," Steven Russell describes the most popular theory of the term structure, the expectations theory.

After laying out the building blocks of the expectations theory, Russell shows how the expectations of participants in financial markets and the

decisions they make create linkages between the market interest rates on short- and long-term securities. Finally, Russell shows how the expectations theory can be used to explain two important empirical features of the interest rate term structure.

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Federal deposit insurance is a defining feature of our nation's financial landscape. For many years, deposit insurance was regarded as a tremendous success. By protecting individual depositors, it discouraged banking panics, thus contributing greatly to monetary stability. The painful experiences of the 1980s have soured this cheery assessment. Recent legislation has made significant changes in deposit insurance, and many are calling for further reforms.

As we assess the various options for reform, we can recall that federal deposit insurance was extremely controversial at its inception in the Banking Act of 1933. In the fourth article in this *Review*, "The Great Deposit Insurance Debate," Mark D. Flood re-examines the debate that surrounded the adoption of federal deposit insurance, first to see what the issues and arguments were at the time and, second, to see how those issues were treated in the legislation. Flood finds that the legislators of 1933 both understood the difficulties with deposit insurance and incorporated in the legislation numerous provisions designed to mitigate those problems.

* * *

Market interest rates sometimes respond to discount rate changes, while other times they do not. Policymakers, of course, would like to know why. In the final article in this *Review*, "The Response of Market Interest Rates to Discount Rate Changes," Michael Dueker finds empirical evidence to suggest that the response of the three-month Treasury bill rate to a discount rate change varies with the magnitude of the discount change, the Federal Reserve's operating procedure and the unemployment rate. The latter factor, says the author, indicates that the market has come to expect active policy steps from the Fed to counteract high unemployment.

Dueker also investigates whether the market can anticipate discount rate changes. His evidence suggests that the timing of discount rate changes is not easily predicted, so anticipations of discount rate changes do not appear to have much of an effect on market interest rates.

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R. Alton Gilbert

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The Effects of Legislating Prompt Corrective Action on the Bank Insurance Fund

THE FEDERAL DEPOSIT Insurance Corporation Improvement Act of 1991 (hereafter, FDICIA) authorized more federal government funds for the Federal Deposit Insurance Corporation and made major changes in the supervision and regulation of depository institutions. One section of FDICIA requires supervisors to take prompt corrective action when an institution's capital ratio falls below the required level.[1] Banks that are classified as well-capitalized or adequately capitalized are subject to the fewest constraints on their activities (see table 1). Supervisors are required to impose limits on the activities of banks with relatively low capital ratios and to close them promptly if their capital ratios fall below some critical level. Some examples of the constraints on poorly capitalized banks include limits on their asset growth, dividends and various insider transactions.

As FDICIA states, the purpose of prompt corrective action is "to resolve the problems of insured depository institutions at the least possible long-term loss to the deposit insurance fund." The legislation is based on the assumption that losses to the Bank Insurance Fund (BIF) would have been lower in recent years if supervisors had acted as required by FDICIA. This paper investigates whether the evidence is consistent with the assumptions that underlie the case for this legislation.

THE CASE FOR LEGISLATING PROMPT CORRECTIVE ACTION

A few years ago, as part of a program to reform the supervision and regulation of depository institutions, several economists began promoting proposals for prompt corrective action (PCA) by supervisors.[2] The report on financial reform by the Treasury Department in February 1991 included a version of these early proposals.[3] The General Accounting Office recommended a su-

[1]The legislation applies to the supervisors of commercial banks and thrift institutions. This paper refers exclusively to commercial banks and the effects of their failure on the Bank Insurance Fund. The Federal Deposit Insurance Corporation (FDIC) insures the deposits of banks and savings and loan associations but maintains a separate fund for banks. Banks pay their premiums into the Bank Insurance Fund which then covers any losses when a bank fails.

[2]Brookings Institution (1989) and Shadow Financial Regulatory Committee (1989).

[3]Department of the Treasury (1991), pp. 39-41.

Table 1

Supervisory Actions Applicable to Depository Institutions under Provisions of the FDICIA for Prompt Corrective Action[1]

Capital Category	Mandatory Actions
Well capitalized or adequately capitalized	May not make any capital distribution or pay a management fee to a controlling person that would leave the institution undercapitalized.
	Discretionary Actions
	None
Undercapitalized	**Mandatory Actions**
	Subject to provision applicable to well capitalized and adequately capitalized institutions.
	Subject to increased monitoring.
	Must submit an acceptable capital restoration plan within 45 days and implement that plan.
	Growth of total assets must be restricted.
	Prior approval from the appropriate agency is required prior to acquisitions, branching, and new lines of business.
	Discretionary Actions
	Subject to any discretionary actions applicable to significantly undercapitalized institutions if the appropriate agency determines that those actions are necessary to carry out the purposes of PCA.
Significantly undercapitalized	**Mandatory Actions**
	Subject to all provisions applicable to undercapitalized institutions.
	Bonuses and raises to senior executive officers must be restricted.
	Subject to at least one of the discretionary actions for significantly undercapitalized institutions.
	Discretionary Actions
	Actions the institution is presumed subject to unless the appropriate agency determines that such actions would not further the purposes of PCA: Must raise additional capital or arrange to be merged with another institution. Transactions with affiliates must be restricted by requiring compliance with section 23A of the Federal Reserve Act as if exemptions of that section did not apply. Interest rates paid on deposits must be restricted to prevailing rates in the region. Other discretionary actions: Severe restriction on asset growth or reduction of total assets may be required. Institution or its subsidiaries may be required to terminate, reduce, or alter any activity determined to pose excessive risk. May be required to hold a new election of its board of directors.

Table 1 (continued)

Supervisory Actions Applicable to Depository Institutions under Provisions of the FDICIA for Prompt Corrective Action[1]

Capital Category	Discretionary Actions
Significantly undercapitalized (continued)	Other discretionary actions (continued) Dismissal of any director or senior executive officer and their replacement by new officers subject to agency approval may be required. May be prohibited from accepting deposits from correspondent depository institutions. Controlling bank holding company may be prohibited from paying dividends without prior Federal Reserve approval. May be required to divest or liquidate any subsidiary in danger of becoming insolvent and posing a significant risk to the institution. Any controlling company may be required to divest or liquidate any nondepository institution affiliate in danger of becoming insolvent and posing a significant risk to the institution. May be required to take any other actions that the appropriate agency determines would better carry out the purposes of PCA.
Critically undercapitalized	**Mandatory Actions** Must be placed in receivership within 90 days unless the appropriate agency and the FDIC concur that other action would better achieve the purposes of PCA. Must be placed in receivership if it continues to be critically undercapitalized, unless specific statutory requirements are met. After 60 days, must be prohibited from paying principal or interest on subordinated debt without prior approval of the FDIC. Activities must be restricted. At a minimum, may not do the following without the prior written approval of the FDIC: Enter into any material transaction other than in the usual course of business. Extend credit for any highly leveraged transaction. Make any material change in accounting methods. Engage in any "covered transactions" as defined in section 23A of the Federal Reserve Act, which concerns affiliate transactions. Pay excessive compensation or bonuses. Pay interest on new or renewed liabilities at a rate that would cause the weighted average cost of funds to significantly exceed the prevailing rate in the institution's market area. **Discretionary Actions** Additional restrictions (other than those mandated) may be placed on activities.

[1]This description of the mandatory and discretionary supervisory actions under PCA is derived from a proposal by the Board of Governors of the Federal Reserve System in July 1992 to implement the PCA provisions of FDICIA. Other regulations to be adopted by supervisors will make distinctions among institutions based on their capital category, including regulations on brokered deposits and interbank deposits.

pervisory system in which supervisors would be required to act based on certain indicators of the performance and behavior of depository institutions, as well as capital ratios.[4]

Proponents of legislating PCA, including the Treasury and others, have based their case for PCA largely on the *incentive* for banks to assume risk, not on evidence of the behavior of poorly capitalized banks. The recent behavior of savings and loan associations provided most of the evidence that depository institutions assumed greater risk as their capital ratios declined.[5] The following quote illustrates the thinking of PCA advocates:

> As banks approach the point of economic insolvency, they have less and less to lose from pursuing aggressive, high-risk investment strategies in an attempt to return to profitability. The supervisory free rein given undercapitalized thrifts during the 1980s is widely recognized as a leading factor contributing to the cost of resolving insolvent thrifts. Some argue that commercial bank supervision has been far from perfect, too. In this view, banks are allowed to carry assets on their books at unrealistically optimistic values and are not appropriately restrained from high-risk behavior and irresponsible dividend policy.[6]

EVIDENCE ON THE UNDERLYING ASSUMPTIONS

The direct method of determining whether PCA legislation will reduce the BIF's losses is to enact the legislation, then observe BIF losses for several years. Waiting several years to form an opinion about the effectiveness of PCA legislation, however, does not seem the best way. If PCA legislation turns out to be ineffective, we will have wasted valuable time during which more effective reforms could have been doing their job.

This paper takes an indirect approach, specifying the assumptions that underlie PCA legislation and determining whether the behavior of banks before FDICIA's passage supports these assumptions. The case for PCA legislation rests on the assumption that, in recent years, depository institutions assumed greater risk as their capital ratios declined. As poorly capitalized institutions assumed greater risk and failed, they added to the losses of the deposit insurance funds. Advocates of PCA legislation also assume that constraints on bank behavior mandated by PCA legislation will constrain the risk assumed by poorly capitalized institutions.

The evidence that savings and loan associations assumed greater risk as their capital ratios declined, of course, does not necessarily indicate that PCA legislation will reduce the BIF's losses. Commercial bank supervisors may simply have been more effective than the supervisors of savings and loan associations in constraining the risk assumed by poorly capitalized institutions.[7]

Recent studies examine whether poorly capitalized banks have violated the types of constraints that will be imposed under PCA. Gilbert (1991) reported that the behavior of most of the banks with capital ratios below the minimum required level in 1985-89 did not violate such constraints.[8] Large majorities of the banks reduced their assets while undercapitalized, refrained from paying dividends, and restrained loans to insiders. Recent studies of the "capital crunch" report a positive association between the lagged capital ratios of banks and the growth rates of their assets in the current period. These results are consistent with the view that supervisors effectively constrained the asset growth of poorly capitalized banks.[9]

French (1991) found that, through reports by banks and examinations, supervisors were able to detect the weakness of most failed banks several years before failure. In addition, the incidence of paying dividends was lower at poorly capitalized banks than at other banks, and the incidence of capital injections was higher. Horne (1991) presented additional evidence on the association between capital ratios and dividends.

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[4]U.S. General Accounting Office (1991), pp. 59-71.

[5]Barth, Bartholomew and Labich (1989) and Garcia (1988).

[6]Department of the Treasury (1991), pp. X-1 to X-2.

[7]Several studies examine the incentive for poorly capitalized institutions with deposit insurance to assume risk. See Buser, Chen and Kane (1981), Chirinko and Guill (1991) and Keeley and Furlong (1990).

[8]Gilbert (1991) does not report observations on the banks that reduced their assets while undercapitalized. About 53 percent reduced their assets by more than 10 percent while undercapitalized, and about 22 percent reduced their assets by more than 25 percent.

[9]Bernanke and Lown (1991) and Peek and Rosengren (1992a, b).

Some banks paid dividends while their earnings were negative and capital ratios were below required levels, but the proportion of banks paying dividends is positively related to their capital ratios.[10] These studies are consistent with the view that, in recent years, supervisors of commercial banks influenced the behavior of most undercapitalized banks in ways that will be required under PCA legislation. The exceptional cases may be eliminated by PCA legislation.

One argument for PCA legislation is that the sanctions to be imposed on poorly capitalized banks will induce other banks to maintain their capital ratios above minimum required levels, to reduce the chance that they will be subject to the sanctions. The evidence, however, implies that most poorly capitalized banks were subject to the sanctions prior to PCA legislation. That legislation, therefore, is not incentive for banks to raise their capital ratios.

THE EFFECTS OF CAPITAL RATIOS BEFORE FAILURE ON BIF LOSS RATIOS

Even if PCA legislation has a limited impact on the behavior of banks while undercapitalized, it may achieve its basic objective of reducing BIF losses by reducing the length of time banks *remain* poorly capitalized. The length of time a bank operates with a low capital ratio may influence the risk it assumes because it takes time for some non-marketable bank assets to mature before the proceeds can be reinvested in higher-risk categories. By shortening the time banks are permitted to operate with low capital ratios, supervisors will limit their opportunities to act on incentives to assume greater risk.[11] This argument rests on the assumption that there is a positive association between the length of time banks were poorly capitalized before failure and the BIF losses resulting from their failure.

Measuring Capital Ratios Before Failure

To test the hypothesis that ratios of BIF losses to total assets are positively related to the length of time banks were poorly capitalized prior to their failure, one must specify the following: first, a measure of capital, second, a criterion for classifying banks as poorly capitalized, and third, the lag between changes in capital ratios and changes in risk assumed by poorly capitalized banks.[12]

The paper uses two measures of capital: equity and an alternative measure, which adjusts equity for the market value of securities and for nonperforming loans. The criterion for an adequately capitalized bank is specified initially as a capital-to-asset ratio of 5 percent or more. This level is based on the maximum leverage ratio under the new risk-based capital requirements. For banks with relatively poor asset quality, supervisors may specify a minimum ratio of Tier 1 capital (essentially the same as equity for most banks) to total assets as high as 5 percent. The

[10]Horne (1991) reported the results of an equation for predicting the ratio of dividends to assets. In that model, profit rates and capital ratios have positive coefficients.

[11]This paper does not consider all the possible effects of PCA legislation on BIF losses. It is possible that closing banks with low but positive capital ratios will increase BIF losses, for the following reasons: First, some banks eventually would recover with no losses to BIF. It is difficult to estimate the size of this effect with data for periods before FDICIA, since a change in the closure rule may change the behavior of other parties. Shareholders of the banks that ultimately recover may realize that their banks have good prospects and inject capital more quickly than they would have in the past. Second, some theoretical models indicate that an increase in the capital threshold at which banks are closed causes banks with certain characteristics to assume greater risk. See Levonian (1991).

[12]See Bovenzi and Murton (1988) for a description of loss estimates and an analysis of the determinants of FDIC losses from individual bank failures. The sample in this paper excludes savings banks insured by the BIF. Since savings banks hold different types of assets than commercial banks, the determinants of BIF losses for failed savings banks are likely to be different than for failed commercial banks. Thus, the sample includes only failed commercial banks.

A few banks are excluded because they did not report total assets one year before failure and because of other problems with missing data. Sixteen banks are excluded from the sample because they were involved in mergers within two years of their failure dates. Six bank holding companies in Texas had all of their bank subsidiaries closed at the same time, for a total of 88 failed banks. BIF losses attributed to at least some of these banks reflect problems at their affiliates. These 88 banks are excluded from the sample to avoid problems in relating BIF losses to the characteristics of individual failed banks.

Thirty-nine banks were in existence less than three years when they failed. Since new banks tend to have relatively high capital ratios and rapid asset growth, these banks might distort the analysis as outliers in some comparisons. These 39 banks are retained in the sample. Effects of deleting these banks are noted where the difference would affect the description of the data.

analysis in this paper is modified to consider other capital ratios as well.[13]

Advocates of PCA legislation do not specify how quickly they assume poorly capitalized institutions increase their risk after their capital ratios decline. Rather than picking an arbitrary lag, we divide banks into three groups based on the length of time their equity capital ratios were below 5 percent before failure (table 2). Banks in group one had equity capital ratios below 5 percent for five or more consecutive quarters before failure. The choice of this period reflects seasonal patterns in bank accounting practices and capital injections. (Capital injections and accounting entries that recognize loans as losses tend to be clustered in the fourth quarter.) A bank with a relatively low capital ratio for five or more quarters would have a relatively low capital ratio in more than one calendar year, no matter when in the year a bank is declared a failed bank.

Suppose, for instance, that a bank failed in February 1990. If the equity capital ratio of the bank was below 5 percent for five or more consecutive quarters, its ratio would have been below 5 percent at least as early as the fourth quarter of 1988. Thus, as early as then, the shareholders of the bank exhibited their inability or unwillingness to inject the capital necessary to raise the ratio to 5 percent and did not eliminate the capital deficiency in subsequent quarters.

Table 2 also includes an intermediate group of banks that had relatively low equity capital ratios between two and four consecutive quarters before failure (group two). If the groups in table 2 reflect relevant time periods, the arguments for PCA legislation would imply that the BIF loss ratios would be highest for banks in group 1 and lowest for banks in group 3. A comparison of average ratios of BIF losses to total assets at the failure dates does reflect this pattern, but the differences in the mean BIF loss ratios are not statistically significant.

Adjustment for Changes in Assets in the Last Year

The comparisons of the ratios of BIF losses to total assets on the dates of their failure are subject to a bias. The longer capital ratios of banks were below 5 percent before failure, the larger the percentage decline in assets in their last year. Banks with equity capital ratios below 5 percent for five or more consecutive quarters had asset declines, on average, of more than 14.5 percent. The average percentage decline in assets was more than 11 percent for banks with equity capital ratios below 5 percent for two to four consecutive quarters. The other banks, in contrast, had average asset *growth* of about 2.5 percent.

These differences appear to reflect the influence of supervisors, based on the following assumptions. First, supervisors rate the financial strength of banks largely on the basis of capital ratios derived from the report of condition. Second, banks respond to directives from their supervisors to raise capital ratios by reducing assets. And third, the longer a bank is subject to pressure from its supervisor to raise its capital ratio, the larger the percentage decline in its assets.

Data on banks that paid dividends in the year ending on their failure date also appear to reflect the influence of supervisors, adding support to the view that supervisors influenced the asset growth of undercapitalized banks in their last year. Bank regulations restrict dividend payments whenever capital is below the required level.[14] While some undercapitalized banks have violated these regulations, most have foregone dividend payments. Less than 7 percent of the banks with equity capital ratios below 5 percent for five or more consecutive quarters before failure paid dividends in their last year. The proportion of failed banks that paid dividends in their last year is significantly higher for groups of banks with higher capital ratios in their last year.

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[13]Spong (1990), pp. 64-71, and Keeton (1989) describe the risk-based capital requirements and maximum leverage ratios.

[14]See Spong (1990), pp. 64-71, for a description of the regulation of bank dividends in the years covered by this study. In general, banks were prohibited from withdrawing or impairing their capital through excessive dividend payouts or other means. Member banks (national banks and state-chartered banks that are members of the Federal Reserve System) were required to obtain regulatory approval to pay dividends that exceeded the sum of net profits for a year and retained earnings for the preceding two years. For any banks with federal deposit insurance, dividend payments that could endanger a bank could be restricted under the general enforcement and cease and desist powers of the federal supervisors. See Gilbert (1991), French (1991) and Horne (1991) for additional information on dividend payments by poorly capitalized banks.

Table 2

Distribution of BIF Loss Ratios by the Length of Time Before Failure That Capital Ratios Were Below 5 Percent, 1985-90

Group number	Characteristics of failed banks	Number of banks	Loss to BIF divided by total assets		Percentage change in total assets in the year ending on failure date	Percentage of banks that paid dividends in the year ending on failure date
			Total assets as of failure date	Total assets one year before failure date		
1	Equity capital ratio below 5 percent for five or more consecutive quarters before failure	374	0.2736 (0.1365)	0.2196 (0.1171)	−14.52 (14.40)	6.42%
2	Equity capital ratio below 5 percent in the last two quarters before failure and up to four consecutive quarters before failure	302	0.2693 (0.1184)	0.2145 (0.1022)	−11.15 (14.07)	25.17
3	Failed banks other than those in groups 1 and 2	178	0.2629 (0.1320)	0.2522 (0.1536)	2.45 (23.47)	44.94
4	Alternative capital ratio below 5 percent for five or more consecutive quarters before failure	546	0.2716 (0.1313)	0.2200 (0.1142)	−13.21 (14.54)	11.17
5	Alternative capital ratio below 5 percent in the last two quarters before failure and up to four consecutive quarters before failure	219	0.2752 (0.1226)	0.2247 (0.1078)	−8.09 (15.97)	33.79
6	Failed banks other than those in groups 4 and 5	89	0.2456 (0.1320)	0.2649 (0.1807)	12.26 (28.23)	50.56

NOTE: Standard deviatons are in parentheses under means.

t-statistics, in absolute value, for differences between means for groups:

1 and 2	0.438	0.604	3.064*	6.695*[1]
1 and 3	0.880	2.506*	8.884*	9.782*
2 and 3	0.533	2.916*	7.023*	4.406*
4 and 5	0.360	0.536	4.110*	6.521*
4 and 6	1.724	2.271*	8.333*	7.203*
5 and 6	1.820	1.962*	6.397*	2.046*

[1]t-statistics, in absolute value, for differences in proportions

*Statistically significant at the 5 percent level.

The observations in table 2 are consistent with the view that supervisors forced most banks with persistently low capital ratios before failure to reduce their assets and refrain from paying dividends. Supervisors may have been less aware of the troubles of banks with capital ratios above 5 percent during most or all of their last year, and, therefore, placed less constraint on their behavior.

The higher average BIF loss ratios of the banks undercapitalized for longer periods may reflect sharp declines in assets in their last year, rather than losses on investments in riskier assets. BIF loss ratios can be adjusted for this bias by dividing the losses to BIF by assets one year *before* failure. Average ratios of BIF losses to total assets one year before failure for banks in groups 1 and 2 are significantly *lower* than the average BIF loss ratio of those in group 3. After adjusting for the effects of this bias, the evidence does not indicate a positive association between the length of time banks were undercapitalized before failure and BIF loss ratios.

An Alternative Capital Measure

Advocates of PCA legislation have emphasized the need for improvements in measuring the value of bank capital. Perhaps a positive relationship between BIF loss ratios and the length of time bank capital ratios were low before failure is evident only with an improved measure of bank capital.

Alternative capital measures often are described as "market value" capital, with assets and liabilities marked to market values.[15] Berger, King and O'Brien (1991) indicate the various meanings attached to the term "market value" and the practical difficulties in deriving accurate measures of the market values for some categories of assets and liabilities. The authors suggest, however, the following adjustments to the value of bank assets: adjust marketable assets to market values, and adjust the value of loans for anticipated losses on nonperforming loans.

The following calculations yield an alternative capital measure which reflects these adjustments. The difference between the book and market value of securities is subtracted from equity. Adjustments to equity for anticipated loan losses involve comparisons of allowances for loan and lease losses to the values of nonperforming loans (past due 90 days or longer or nonaccrual). The allowance for loan losses is accumulated earnings of a bank set aside to absorb loan losses.[16] Evidence in Berger, King and O'Brien indicates that a $3 increase in nonperforming loans tends to increase loan losses by $1. If a bank's allowance for loan losses equals or exceeds one-third of its nonperforming loans, there is no adjustment to its equity for anticipated loan losses. The other banks need larger allowances for loan losses to meet this standard. Increases in their allowances would come out of equity. The adjustment to equity involves subtracting one-third of their nonperforming loans and adding their allowance for loan losses.

The results in table 3 add support to use of the three-to-one ratio of nonperforming loans to the allowance for loan losses in deriving the alternative capital measure. Table 3 presents this ratio for banks in various size categories, from one quarter to eight quarters before failure. The ratio is around three for banks of different size and for different lengths of time prior to failure.

Table 3 also has implications for the supervisory treatment of banks as they approach failure. As indicated above, the case for PCA legislation is based on the argument that in recent years supervisors should have done their job differently. For example, supervisors should have forced banks to make their balance sheets reflect more accurately the value of their assets. Supervisors may have allowed troubled banks to show higher equity on their balance sheets than justified by the quality of their assets, by permitting their allowance for loan losses to lag behind the rise in their nonperforming loans as they approached failure. Additions to the allowance for loan losses (called provisions for loan losses) are bank expenses. Thus, additions to the allowance for loan losses reduce earnings and possibly equity, if earnings are negative.

Table 3 shows that, while the ratio of nonperforming loans to total assets rose as banks ap-

[15]Mondschean (1992) discusses the issues raised by proposals for market value accounting.

[16]See the appendix for a more thorough discussion of the role of the allowance for loan losses in bank accounting principles.

Table 3

Average Ratios of Nonperforming Loans to the Allowance for Loan and Lease Losses and to Total Assets[1]

Size category of banks (millions of dollars as of failure date)	Quarters before failure							
	1	2	3	4	5	6	7	8
Assets < $25								
NPL ÷ ALLL	2.89	3.07	3.26	3.08	2.93	3.09	2.94	2.95
NPL ÷ TA	0.0777	0.0720	0.0677	0.0608	0.0540	0.0504	0.0431	0.0390
$25 ≤ Assets < $50								
NPL ÷ ALLL	2.68	3.19	3.19	3.03	2.83	2.87	2.72	2.82
NPL ÷ TA	0.0892	0.0803	0.0703	0.0618	0.0539	0.0487	0.0443	0.0392
$50 ≤ Assets < $100								
NPL ÷ ALLL	3.40	2.81	3.06	3.14	3.18	3.02	3.16	3.13
NPL ÷ TA	0.0949	0.0789	0.0717	0.0665	0.0587	0.0552	0.0487	0.0438
$100 ≤ Assets								
NPL ÷ ALLL	3.30	3.21	3.72	3.80	3.41	3.58	3.53	3.55
NPL ÷ TA	0.1049	0.0906	0.0808	0.0704	0.0595	0.0526	0.0495	0.0426

NPL — Nonperforming loans (past due 90 days or more plus nonaccrual)
ALLL — Allowance for loan and lease losses
TA — Total assets

[1]In total, 836 banks filed reports of condition for the quarter ending one quarter before failure and for the preceding seven quarters. The ratios are calculated as the sum of the item in the numerator divided by the sum of the item in the denominator for a given group of banks.

proached failure, their allowances for loan losses also rose proportionately. These results are inconsistent with one type of forbearance by supervisors: a general tendency to permit the allowance for loan losses to lag behind the rise in nonperforming loans, to avoid large charges against equity.

Table 2 presents average BIF loss ratios based on this alternative measure of capital. The adjustments to equity reduce the capital ratios for many of the failed banks in their last year. For instance, the number of banks with capital ratios below 5 percent for five or more consecutive quarters before failure rises from 374 with equity as the measure of capital (group 1) to 546 with the alternative measure (group 4).

BIF loss ratios adjusted for changes in assets in the last year (BIF losses divided by total assets one year before failure) are lower for banks with adjusted capital ratios below 5 percent for longer periods. Use of the alternative capital measure *does not* yield a positive association between the length of time banks operated with low capital ratios before failure and BIF loss ratios.

Alternative Levels of Capital Ratios

Perhaps the difficulty in finding an inverse relationship between capital ratios before failure and BIF loss ratios is that all the results in table 2 are based on a 5 percent capital ratio. The relevant ratio for purposes of the hypothesis tested here may be higher or lower than 5 percent. Table 4 examines the relationship between capital ratios and BIF loss ratios, for a fixed lag of one year between the observation of capital ratios and failure dates. The hypothesis that poorly capitalized banks assume relatively high

Table 4

Distribution of BIF Loss Ratios by the Ratio of Capital to Assets One Year Before Failure

		Equity as the measure of capital		Alternative capital measure	
Group number	Range of capital ratio	Number of banks	BIF loss divided by total assets one year before failure	Number of banks	BIF loss divided by total assets one year before failure
1	$0.10 < C/A$	30	0.2861 (0.2141)	23	0.2898 (0.2364)
2	$0.08 < C/A \leq 0.10$	75	0.2306 (0.1346)	40	0.2523 (0.1575)
3	$0.06 < C/A \leq 0.08$	211	0.2214 (0.1116)	109	0.2179 (0.1064)
4	$0.04 < C/A \leq 0.06$	214	0.2290 (0.1189)	203	0.2281 (0.1112)
5	$0.02 < C/A \leq 0.04$	175	0.2177 (0.1181)	178	0.2344 (0.1300)
6	$0.00 < C/A \leq 0.02$	109	0.2129 (0.1120)	154	0.2000 (0.1054)
7	$-0.01 < C/A \leq 0.00$	15	0.1842 (0.0796)	54	0.2078 (0.1201)
8	$C/A \leq -0.01$	25	0.2458 (0.1034)	93	0.2399 (0.1051)

NOTE: Standard deviations are in parentheses under means.

risk, which imposes large losses on BIF if they fail, implies higher BIF loss ratios for banks with capital ratios below some critical level before failure.

Table 4 indicates that the banks with the highest BIF loss ratios are those with the highest and the lowest capital ratios one year before failure. Among other banks, there is no systematic relationship between the capital ratios of banks one year before failure and their BIF loss using either measure of capital. These results do not support the hypothesis that banks with capital ratios below some critical capital ratio have higher BIF loss ratios.[17]

Extreme Cases — A few banks that engaged in extreme behavior may have imposed large losses on BIF. Thus, PCA legislation could contribute to reducing BIF losses by constraining the extreme behavior of a small minority of failed banks. The data are examined for such extreme cases in two ways. The first approach involves determining whether BIF loss ratios

[17]Banks in existence less than three years when they failed account for the relatively high average BIF loss ratio for banks with capital ratios in excess of 10 percent one year prior to failure. Eight of the 30 banks with equity capital ratios in excess of 10 percent one year prior to failure were in existence less than three years when they failed. Excluding these eight banks reduces the average BIF loss ratio for the remaining 22 banks to 23.72 percent, which is much closer to the average BIF loss ratios for the banks with capital ratios below 10 percent one year prior to failure. Eliminating the banks in existence less than three years when they failed has a similar effect on the average BIF loss ratio of banks with ratios of the alternative capital measure to total assets in excess of 10 percent one year prior to failure.

Table 5
Characteristics of Banks with Relatively High BIF Loss Ratios

Characteristics	Banks with BIF loss ratios above 50 percent	All banks in the sample
Number of banks	44	854
Mean percentage change in total assets in their last year	−9.13%	−9.79%
Percentage that paid dividends in their last year	20.45	21.08
Percentage with equity capital ratio below 5 percent for five or more consecutive quarters before failure	54.55	43.79
Percentage in the West South Central region	75.00	56.21
Percentage supervised by the Office of the Comptroller of the Currency	56.82	37.70

were relatively high among banks that engaged in extreme behavior. These banks would have the following characteristics: equity capital ratio below 5 percent for five or more consecutive quarters before failure, and asset growth and dividend payments in their last year. No banks in the sample had this combination of characteristics.

The second approach involves examining the characteristics of banks with relatively high BIF loss ratios, to determine whether they exhibited extreme behavior that will be constrained under PCA. Table 5 presents some of the characteristics of 44 banks with BIF loss ratios that exceed 50 percent. Their mean asset growth and the proportion paying dividends in their last year are almost identical to those for the entire sample. The banks with relatively high BIF loss ratios do have a somewhat higher percentage with equity capital ratios below 5 percent for relatively long periods before failure. It is possible, however, to find other ways in which these banks are even more distinct from the entire sample. Their relatively high loss ratios may reflect regional effects: three-fourths were located in the West South Central region of the nation, compared with about 56 percent for the entire sample.[18] A relatively high proportion were supervised by the Comptroller of the Currency. Thus, an examination of extreme cases does not provide clear evidence of the effectiveness of PCA in reducing BIF losses.

REGRESSION ANALYSIS

Loss ratios vary substantially within each of the groups of banks in tables 2 and 4; standard deviations are about half as large as their means. Perhaps an inverse relationship between capital ratios before failure and BIF loss ratios is evident only if other factors are held constant in regression analysis.

A Description of Banks in the Regression Analysis

The 854 banks in the sample failed in the years 1985-90 (table 6). Most banks were relatively small: about 60 percent had total assets

[18]States in this region are Arkansas, Louisiana, Oklahoma and Texas.

Table 6

Characteristics of Failed Banks in Regression Analysis

Year of failure	Number of banks	Percentage
1985	112	13.1%
1986	132	15.5
1987	175	20.5
1988	146	17.1
1989	149	17.4
1990	140	16.4
Total	854	100.0
Asset size on failure date (millions of dollars)		
Assets < $25	508	59.5
$25 ≤ Assets < $50	209	24.5
$50 ≤ Assets < $100	90	10.5
$100 ≤ Assets	47	5.5
		100.0
Region		
New England (NE)	5	0.6
Middle Atlantic (MA)	9	1.1
South Atlantic (SA)	19	2.2
East South Central (ESC)	17	2.0
West South Central (WSC)	480	56.2
East North Central (ENC)	16	1.9
West North Central (WNC)	174	20.4
Pacific Northwest (PNW)	34	4.0
Pacific Southwest (PSW)	100	11.7
		100.1
Federal supervisor		
OCC	322	37.7
Federal Reserve	68	8.0
FDIC	464	54.3
		100.0
Method of resolving failure		
Purchase and assumption	667	78.1
Transfer of insured deposits	115	13.5
Liquidation	72	8.4
		100.0

NOTE: States in census regions:

New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont

Middle Atlantic: New Jersey, New York and Pennsylvania

South Atlantic: Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia and West Virginia

East South Central: Alabama, Kentucky, Mississippi and Tennessee

West South Central: Arkansas, Louisiana, Oklahoma and Texas

East North Central: Illinois, Indiana, Ohio, Michigan and Wisconsin

West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota

Pacific Northwest: Alaska, Idaho, Montana, Oregon, Washingon and Wyoming

Pacific Southwest: Arizona, California, Colorado, Hawaii, Nevada, New Mexico and Utah

less than $25 million, and about 95 percent had total assets less than $100 million. The failed banks were heavily concentrated in certain regions. About 56 percent were in the West South Central region. About 78 percent of the cases were resolved when other banks bought some of the assets of the failed banks and assumed their liabilities. In another 14 percent of the cases, the FDIC transferred the insured deposits of failed banks to other banks. In these cases, the FDIC liquidated the failed banks' assets and made partial payments to uninsured depositors, based on the proceeds of liquidated assets. Failed banks were liquidated in the remaining cases.

Identifying the Variables

The dependent variable is the ratio of BIF loss to total assets as of failure date.[19] Independent variables are described in table 7.

Capital Ratios — The case for applying PCA legislation to the supervisors of commercial banks implies negative, significant coefficients on the capital ratios lagged one year, EC_{-4} and AC_{-4}.

Asset Growth — The coefficient on GROWTH is assumed to have a negative sign: an increase (decrease) in assets in the last year is assumed to increase (decrease) the denominator of the BIF loss ratio, while having little, if any, effect on the size of the BIF loss.

Dividends — Arguments for legislating PCA imply a positive sign for the coefficient on DIV: dividends in the last year, divided by total assets as of failure date. The coefficient on DIV may be positive for two reasons. First, dividends are payments of capital to shareholders, leaving less capital to absorb reductions in the value of assets. Second, dividends may be a signal that the shareholders saw little reason to attempt to prevent failure. Instead, they may have paid out capital in anticipation of failure. These reasons, however, do not account for possible influences of supervisors over which banks paid dividends or the size of their dividend payments.

Quality of Bank Loans — One measure of loan quality is the value of loans that are past due or nonaccrual. A second measure is the value of interest accrued on loans that was not collected. When borrowers fall behind on their scheduled payments, banks continue to accrue the interest due from them as income until their loans are classified as nonaccrual.[20]

These measures of loan quality may help explain the BIF losses from the failure of individual banks. The following two measures of asset quality are included as independent variables:

1. NPL — the ratio of nonperforming loans to total assets.
2. ACCRUED — interest accrued on loans that was not collected, divided by total assets.

The coefficients on these variables will have positive signs under the following assumptions: First, these measures accurately reflect loan quality. Second, the allowance for loan losses is not large enough to cover the gap between the book value of these loans and their value to the FDIC as the receiver of failed banks.[21]

Market Value of Securities — Securities (various types of bonds) are reported on bank balance sheets at book values (purchase prices plus any amortized changes in value), not at their current market values. Thus, the book value of equity reflects the book value of securities. Banks also report information on the market value of their securities on the report of condition. The following independent variable is a measure of the gap between the book and

[19]Avery, Hanweck and Kwast (1985) report the results of regressions with the same dependent variable. It is difficult to compare the results in this paper to those, since their objective was to predict FDIC losses from bank failures, not to test hypotheses about coefficients on independent variables. They do not attempt to adjust the specification of equations for possible collinearity. In Bovenzi and Murton (1988) and James (1991), the dependent variable is the loss on assets of failed banks, a concept that is related to BIF loss. Some of the independent variables in Bovenzi and Murton and in James are included, with slight modifications, in this study; the major difference involves measures of asset quality derived from examination reports, which are not included in this study. Barth, Bartholomew and Labich (1989) and Barth, Bartholomew and Bradley (1990) estimate the coefficients of equations designed to explain the cost to the Federal Savings and Loan Insurance Corporation of resolving cases of failed savings and loan associations. Results in Barth, Bartholomew and Bradley are not comparable to those in this study, since they include observations for failed and surviving associations and use a different statistical technique (Tobit regression analysis).

[20]Accrued interest that was not collected may not reflect default by borrowers on scheduled loan payments. In some loan contracts, such as construction loans, the original loan contract specifies a delayed schedule of interest payments.

[21]See the appendix for a discussion of accounting principles which features the role of the allowance for loan losses.

Table 7
Identification of Independent Variables

EC_{-4}	Ratio of equity capital to total assets four quarters before failure.
AC_{-4}	Ratio of the alternative capital measure to total assets four quarters before failure.
GROWTH	Change in total assets of failed bank in its last year, divided by total assets as of failure date.
DIV	Dividends on common stock paid in the year ending in failure, divided by total assets as of failure date.
NPL	Loans and leases past due 90 days or more, plus nonaccrual loans, divided by total assets as of failure date.
ACCRUED	Interest on loans that was accrued but not received on the last report of condition, divided by total assets as of failure date.
MARKET	Book value of securities in the investment account as of the last report of condition, minus the market value of the securities, divided by total assets as of failure date.
IDR	Last observation available on deposits in accounts up to $100,000 each, divided by total assets as of failure date.
P&A	Dummy variable with a value of unity if a failed bank case was resolved through purchase and assumption, zero otherwise.
TID	Dummy variable with a value of unity if a failed bank case was resolved through transfer of insured deposits to another bank, zero otherwise.
OCC	Dummy variable with a value of unity if the bank was a national bank, supervised by the Office of the Comptroller of the Currency, zero otherwise.
FR	Dummy variable with a value of unity if a bank was supervised by the Federal Reserve, zero otherwise.
lnA	Natural log of total assets as of failure date.
1985-1989	Dummy variables for the years in which the banks failed.
NE, MA, SA, ESC, ENC, WNC, PNW, PSW	Dummy variables for the regions in which failed banks were located.

market value of securities: MARKET — the book value minus the market value of securities, divided by total assets.

The expected sign of the coefficient on MARKET depends on the conditions under which supervisors close banks. Suppose they close banks when the book value of equity is zero or negative, without adjustments to the book value of equity for the market value of assets. Under this assumption, the expected sign on MARKET is positive: BIF losses would be related positively to the gap between the book value and the market value of securities.

Methods of Resolving Failed Banks — When a bank fails, the FDIC becomes the receiver. As receiver, the FDIC must dispose of the failed bank's assets and make payments to its creditors. The options chosen to resolve each case may affect the BIF's losses. Those choices, in turn, may reflect additional information about failed banks not captured by the other independent variables, such as characteristics of the

customers of failed banks that make them valuable to other banks.[22]

One method of resolving failed bank cases is *liquidation*. Failed banks are closed and depositors are paid off up to the insurance limit per account. The FDIC liquidates the assets and makes payments to uninsured depositors and other creditors of the failed bank. Shareholders generally get nothing.

Resolution methods other than liquidation may be less expensive to BIF. In many cases, a solvent bank purchases some of the assets of a failed bank and assumes its liabilities. The FDIC provides cash to cover the gap between assets purchased and liabilities assumed. This is called a *purchase and assumption* (P&A) transaction. The FDIC solicits bids from solvent banks for the assets and liabilities. Banks bid by offering premiums; the cash payment by the FDIC to the bank with the winning bid is net of the premium. The FDIC generally disposes of failed banks through P&A transactions if its staff estimates that the losses would be lower than under liquidation.[23] As a result, the variable P&A (dummy variable for banks resolved through P&A transactions) is expected to have a negative coefficient.

In some cases, the FDIC liquidates the assets of failed banks but solicits bids from other banks to assume their insured deposits. Bidders may anticipate long-term profits on the accounts of customers who choose to keep their deposits with the winning bidder. This method of disposing of failed banks is called *transfer of insured deposits* (TID). The independent variable TID (dummy variable for bank failure cases resolved through TID) is expected to have a negative coefficient.

Share of Deposits Fully Insured — James (1991) found a positive association between the premiums paid by the winning bidders in P&A cases and the shares of deposits of failed banks that were fully insured (accounts in denominations of $100,000 or less). The smaller accounts tend to be more profitable to banks because banks pay less than market interest rates on them.[24]

The variable IDR (fully insured deposits divided by total assets) is included to reflect the composition of deposits. It is expected to have a negative coefficient because premiums paid to the FDIC by winning bidders are assumed to be positively related to IDR. An increase in the premium reduces the loss to BIF.

Federal Supervisory Agency — The primary supervisor of nationally chartered banks is the Office of the Comptroller of the Currency (OCC). For state-chartered banks that are members of the Federal Reserve System, the Federal Reserve is the primary federal supervisory agency, while, for other state banks, it is the FDIC. Differences in supervisory practices among these agencies may affect BIF losses. Dummy variables (OCC and FR) are used to capture such effects.

Bank Size — BIF loss ratios may be higher for smaller banks for two reasons. First, James (1991) finds that FDIC administrative costs are higher, per dollar of assets, for smaller failed banks.[25] Second, smaller banks may be subject to less frequent examination and less thorough surveillance between examinations than larger banks. When supervisors discover that relatively small banks are bankrupt, the percentage losses on assets may be larger than when larger banks fail. The bank size variable is the natural log of total assets as of failure date.

Location and Year of Failure — The remaining independent variables are dummy variables for the regions of failed banks and the years in which they failed, since BIF loss ratios may vary systematically by region and year of failure.

Regression Results

Table 8 presents the regression results. The equations use different measures of capital in the lagged capital ratio.

Lagged Capital Ratios — The coefficients on capital ratios four quarters before failure are not statistically significant. Other measures yield the same result. In other regressions not reported here, the coefficients on dummy variables

[22]The appendix examines in more detail how resolution methods affect BIF losses.

[23]For a discussion of the conditions for disposing of failed banks through P&A transactions, see Federal Deposit Insurance Corporation (1984), pp. 81-108, Bovenzi and Muldoon (1990) and Department of the Treasury (1991), pp. I-30 through I-51.

[24]See Brunner, Duca and McLaughlin (1991) for information on the rates banks pay on various types of deposit accounts.

[25]James (1991), pp. 1234-36.

for banks with capital ratios below 5 percent for various lengths of time before failure also are not statistically significant.[26]

The coefficients on the variables designed to reflect capital ratios before failure may be biased toward zero by including independent variables that reflect the quality and market value of bank assets. To illustrate, suppose the banks with persistently low capital ratios shifted their assets to high-risk categories as they approached failure, resulting in high ratios of nonperforming loans to total assets on their last reports of condition. In addition, suppose these banks sold securities with capital gains and kept securities with capital losses to boost the book value of equity as they approached failure. This selective pattern of securities sales would make values of the variable MARKET relatively high at the banks with persistently low capital ratios. The effects of low capital ratios before failure on BIF loss ratios would be captured to some extent in the coefficients on NPL, ACCRUED and MARKET. To test for this bias, equations 1 and 2 of table 8 were estimated without the variables NPL, ACCRUED and MARKET. In results not reported here, the coefficients on capital ratios before failure were not statistically significant.

Other Independent Variables — The coefficient on GROWTH is negative, as hypothesized. The coefficient on DIV is negative and insignificant; advocates of PCA legislation implied it would have been positive.

The coefficients on NPL and ACCRUED are significant with the positive signs, as hypothesized. The coefficient on MARKET is significant but the sign is opposite of that hypothesized: a wider gap between the book value and market value of securities is associated with a lower BIF loss.

The negative, significant coefficient on IDR indicates that failed banks with higher ratios of fully insured deposits to total assets are more valuable to potential bidders, thus tending to reduce BIF loss ratios. The coefficient on P&A indicates that BIF loss ratios are lower in P&A cases than in liquidation cases, holding other variables constant.[27] BIF loss ratios are not significantly lower in TID cases. The coefficient on OCC is positive and statistically significant. Holding constant the influences of the other independent variables, BIF loss ratios are about 2 percentage points higher for failed banks with national charters.[28] The coefficient on FR indicates that, among state-chartered banks, there is no significant effect of Federal Reserve membership on loss ratios, holding constant the other independent variables.

The coefficient on the natural log of assets is not statistically significant. In other regressions not reported here, dummy variables for banks in various size ranges also were not significant. The results do not support the hypothesis that BIF loss ratios are larger for smaller banks, holding constant other determinants of BIF loss ratios.

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[26]The most comparable results for S&Ls are in Barth, Bartholomew and Labich (1989). In a regression equation with costs of resolving failed S&Ls as the dependent variable, tangible net worth on the last quarter reported is a highly significant variable. The coefficient is negative unity (a $1 increase in capital reduces resolution costs by $1), with a t-statistic of 13.9. Another significant variable is the number of months an association was insolvent before failure, which has a positive coefficient. The contrast of the results in this paper to those in Barth, Bartholomew and Labich is consistent with the view that the supervisors of commercial banks were more effective in limiting the risk assumed by poorly capitalized institutions than the supervisors of S&Ls.

[27]Bovenzi and Murton (1988) find that, without holding other factors constant, BIF loss ratios were about 7 percentage points lower in P&A cases than in liquidation cases in 1985-86. The coefficient on P&A in table 8 indicates about the same effect.

[28]Gilbert (1991) found differences in the behavior of banks in Texas with national charters and those with state charters that could be interpreted as evidence of differences in practices among the federal supervisory agencies. National banks were allowed to operate with capital ratios below the minimum capital requirement for longer periods than state-chartered banks, and national banks accounted for almost all of the Texas banks that operated at least a year with negative equity. The undercapitalized banks in Texas with rapid assets growth and those with higher insider loans while undercapitalized tended to be national banks. Most of these differences between national and state-chartered banks were not statistically significant outside Texas.

These contrasts might indicate that the positive, significant coefficients on OCC in table 8 reflect differences between national and state-chartered banks in the Southwest. To test for such a regional effect, the regressions in table 8 were estimated separately for banks in the states covered by the Dallas office of the OCC (Arkansas, Louisiana, New Mexico, Oklahoma and Texas) and for banks in other states. In each regression, the coefficient on OCC was positive but not significant at the 5 percent level. The coefficient on OCC was larger, however, in the regressions for banks in states outside the Southwest and significant at the 10 percent level. Thus, the effect on BIF loss ratios of supervision by the OCC is not restricted to the Southwest.

Table 8

Determinants of Bank Insurance Fund Losses Due to Individual Bank Failures

Dependent variable: Bank Insurance Fund loss divided by total assets as of failure date

Independent variables	Regression Number 1	Regression Number 2	Independent variables	Regression Number 1	Regression Number 2
Intercept	0.3539 * (5.69)	0.3495 * (5.69)	1985	−0.0207 (1.18)	−0.0200 (1.16)
EC_{-4}	−0.0324 (0.22)		1986	−0.0028 (0.18)	−0.0034 (0.22)
AC_{-4}		−0.0021 (0.02)	1987	0.0054 (0.38)	0.0048 (0.33)
GROWTH	−0.0442 * (2.64)	−0.0451 * (2.73)	1988	0.0214 (1.53)	0.0211 (1.50)
DIV	−1.4038 (1.34)	−1.42 (1.37)	1989	0.0255 (1.87)	0.0255 (1.87)
NPL	0.3554 * (4.74)	0.3533 * (4.69)	NE	−0.0544 (1.04)	−0.0550 (1.05)
ACCRUED	3.2125 * (6.22)	3.2210 * (6.24)	MA	−0.0732 (1.86)	−0.0732 (1.86)
MARKET	−1.3307 * (2.31)	−1.2988 * (2.25)	SA	−0.0693 * (2.53)	−0.0689 * (2.51)
IDR	−0.0855 * (3.50)	−0.0848 * (3.46)	ESC	−0.0883 * (3.04)	−0.0877 * (3.02)
P&A	−0.0656 * (4.40)	−0.0651 * (4.35)	ENC	−0.1069 * (3.60)	−0.1066 * (3.60)
TID	−0.0024 (0.13)	−0.0021 (0.12)	WNC	−0.0904 * (7.29)	−0.0904 * (7.30)
OCC	0.0218 * (2.39)	0.0222 * (2.45)	PNW	−0.0497 * (2.36)	−0.0498 * (2.37)
FR	0.0179 (1.13)	0.0178 (1.12)	PSW	−0.0659 * (4.99)	−0.0662 * (5.03)
lnA	−0.0014 (0.29)	−0.0012 (0.25)	$\bar{R}^2$	0.2290	0.2291
			N	854	854

*Statistically significant at the 5 percent level.
NOTE: t−statistics are in parentheses under regression coefficients.

The coefficients on dummy variables for individual years are not statistically significant. Coefficients on several regional dummy variables are negative and significant. The excluded region is the West South Central region. The negative coefficients on some of the regional dummy variables indicate that, holding constant other independent variables, loss ratios are significantly lower for banks in several regions than for banks in the West South Central region.

CONCLUSIONS

The main reason for legislating prompt corrective action (PCA) is to reduce losses to deposit insurance funds. The case for such legislation rests on the following assumptions:

First, depository institutions have an incentive to assume greater risk as their capital ratios decline. Second, the longer an institution operates with a low capital ratio, the greater its opportunity to act on incentives to assume risk. Third, supervisors have been ineffective in limiting the risk assumed by poorly capitalized institutions. Fourth, the insurance fund losses due to the failure of individual institutions reflect, to some extent, the risk assumed by these institutions after they became poorly capitalized. And fifth, the actions mandated for supervisors in the legislation will constrain the risk assumed by poorly capitalized institutions, thereby limiting insurance fund losses if they fail.

This paper considers the likely effects of PCA legislation on BIF losses resulting from the failure of commercial banks. The method involves examining whether the evidence about commercial bank behavior and BIF losses support the assumptions that underlie the case for PCA legislation. The assumptions imply that the longer a bank operates with a low capital ratio before failure, the larger the BIF loss.

The evidence does not support this hypothesis. The evidence, instead, is consistent with the hypothesis that, in recent years, supervisors have been effective in constraining the risk assumed by poorly capitalized banks. These results raise doubts about whether PCA legislation will reduce BIF losses.

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Appendix
An Introduction to Bank Accounting and the FDIC's Practices in Resolving Failed Banks

The text assumes a basic understanding of bank accounting principles and the methods used by the FDIC in resolving failed banks. This appendix provides an introduction to these topics.

The accounting principles can be illustrated by referring to the balance sheets of a hypothetical bank. Items in table A1 reflect book rather than market values. For instance, the book value of loans is the sum of the outstanding balances that borrowers owe the bank, other than the loans that have been declared losses. Values of marketable securities are book values, not current market values.

One of the key balance sheet items for our purposes is the allowance for loan and lease losses, which represents an accumulation of past earnings set aside to absorb anticipated future losses on loans that become uncollectable. In accounting statements filed with bank supervisors, the allowance for loan losses is reported on the asset side of the balance sheet as a deduction from loans. Thus, net loans are net of anticipated losses, as reflected in the allowance.

When a bank cannot collect from a borrower, accounting principles indicate that management is to declare the loan a loss and charge the loss against the allowance for loan losses. The accounting entries involve reductions in both loans and the allowance.[1]

Increases in the allowance for loan losses come out of current earnings. The relevant item in the income statement is called the "provision for loan losses," which is included among bank expenses. If a bank must make a large provision for loan losses in a given period, because of actual or anticipated loan losses, current earnings may be negative. When current earnings are negative, equity is reduced.

The top half of table A1 presents the balance sheet of a solvent bank, based on book value accounting. Securities are recorded at their book value of $40. The allowance for loan losses is one-third of nonperforming loans, which the text indicates is about average for the banks in the study up to two years before their failure. The bank could absorb loan losses up to $2 without reducing equity. The ratio of equity to total assets is above 5 percent.

The financial condition of the bank would look worse if securities were marked to their market value of $35. Net worth actually would be zero.

The bottom half of table A1 is the balance sheet of the same bank after it recognizes some loan losses. All $6 of the nonperforming loans turn out to be uncollectable, and an additional $1 of other loans is charged off as a loss. These losses reduce the allowance and equity to zero. At this point, the bank is closed and the FDIC becomes the receiver. The duties of a receiver of a bankrupt firm are to dispose of its assets and make payments to its creditors from the proceeds.

The FDIC's loss depends on the method used to resolve this case. Under the *liquidation* method, the FDIC would pay the fully insured depositors $70 and liquidate the assets, sharing the proceeds of the assets with the uninsured depositors.[2] Equation A1 indicates the determinants of the loss to BIF under the liquidation method.

$$\begin{aligned}(A1)\ \text{BIF loss} &= \$70 \text{ (payment to fully insured depositors)} \\ &\quad - (70/(70 + 19))\,[\$5 \text{ (cash)} \\ &\quad + \$35 \text{ (market value of securities)} \\ &\quad + \$33 \text{ (liquidation value of loans)}] \\ &= \$12.58.\end{aligned}$$

The present value of payments to the uninsured depositors, on deposits of $19, would be

$$(A2) \qquad (19/89)[\$73] = \$15.58.$$

Another method of resolving failed banks is called *purchase and assumption*. The FDIC solicits bids from other banks to purchase some of the assets of the failed bank and to assume its liabilities. In this illustration, the bank with the winning bid purchases the $5 of cash and pays $35 for the securities. Whether this bid would result in a lower loss to BIF than under

[1] See Walter (1991) for a thorough discussion of the allowance for loan losses.

[2] When the FDIC liquidates a bank, it becomes a creditor of the failed bank for the amount of its payment to the insured depositors. The claim of the FDIC against the assets of the failed bank has equal priority to the claims of the uninsured depositors.

Table A1
Balance Sheet of a Hypothetical Bank

PRIOR TO CHARGE-OFF OF LOAN LOSSES

Assets			Liabilities	
Cash		$ 5	Insured deposits	$70
Securities		40	Uninsured deposits	19
Loans				
Nonperforming	6			
Other	45			
Allowance for loan losses	2	49	Net worth	5
		$94		$94

Memo: Market value of securities is $35

AFTER CHARGE-OFF OF LOAN LOSSES

Assets			Liabilities	
Cash		$ 5	Insured deposits	$70
Securities		40	Uninsured deposits	19
Loans				
Nonperforming	0			
Other	44			
Allowance	0	44	Net worth	0
		$89		$89

Memo: Market value of securities is $35.

The present value of loans in liquidation, net of liquidation costs, is $33.

liquidation depends on the size of the premium paid by the winning bidder, as indicated in the followed equation:

(A3) BIF loss = $49 (payment by the FDIC to cover the gap between $40 of assets purchased and $89 of liabilities assumed
– $33 (liquidation value of loans)
– premium.

The premium would have to exceed $3.42 to make the purchase and assumption transaction less costly to the FDIC than liquidation.

A third resolution method is called *transfer of insured deposits*. The FDIC solicits bids from other banks to assume the insured deposit liabilities of the failed bank, but the FDIC liquidates the assets. The FDIC shares with the uninsured depositors the premium paid by the bank that assumes the insured deposit liabilities of the failed bank. Equation A4 presents the loss to BIF:

(A4) BIF loss = $70 (cash to the bank that assumes the insured deposit liabilities)
– (70/89) [$73 (liquidation value of assets) + premium].

A comparison of equations A1 and A4 indicates that the BIF loss is smaller under the transfer of insured deposits than under liquidation for any positive premium.

Daniel L. Thornton

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Targeting M2: The Issue of Monetary Control

IDEALLY, AN INTERMEDIATE monetary policy target should be both reliably associated with the goals of monetary policy and readily controlled.[1] In the 1970s and early 1980s, M1 was the Federal Reserve's principal intermediate monetary aggregate target because of its close and stable relationship with nominal GDP. The principal issue then was how well M1 could be controlled. As an outgrowth of the controversy over M1 control, Congress passed the Monetary Control Act of 1980 (MCA) and the Federal Reserve replaced lagged reserve accounting (LRA) with contemporaneous reserve accounting (CRA). A principal objective of both the Act and the return to CRA was to enhance M1 control.[2]

The breakdown of the relationship between M1 and nominal GDP in the 1980s, however, caused the Federal Reserve to shift its emphasis away from M1. In 1986, the Fed dropped M1 from its list of intermediate policy targets and M2 became the Fed's principal monetary aggregate. As with M1, the decision to focus on M2 was made on the basis of the long-run stability of its relationship with nominal GDP.[3] The issue of M2's controllability, however, has received scant attention.

While the Federal Open Market Committee currently sets target growth rate ranges for M2, it is not the only aggregate that the Committee targets. Moreover, its growth is but one of many factors that the Committee considers in formulating and implementing monetary policy. Nevertheless, M2 does receive considerable attention both in the Committee's deliberations and in the press. Consequently, this article analyzes the issue of M2 control.

Under the existing system of reserve requirements, the Fed can successfully target and control M2 only by implicitly targeting and controlling M1. At times, M2 control may require relatively large open market operations. Other things the same, such large operations are potentially destabilizing for financial markets. Moreover, if M1 or total reserves grow very rapidly while M2 grows slowly, the market may have difficulty in interpreting the thrust of monetary policy or the Fed's intentions.

To mitigate these problems requires some changes in the existing structure of reserve requirements that, evidence suggests, would enhance significantly the Fed's ability to control M2. These changes should have a minimal effect

[1]For modern survey of this literature, see Friedman (1990).

[2]The MCA extended Federal Reserve requirements to all depository institutions, removed differential reserve requirements by type of bank (Reserve City or Country) and removed reserve requirements from a large category of non-transaction deposits, not included in M1.

[3]The empirical basis for focusing on M2 is established by Hallman, Porter and Small (1991).

on the operation of the reserve market and can be accomplished without extending reserve requirements to non-depository institutions or increasing the so-called "reserve tax" on depository institutions.

THE MONETARY CONTROL PROBLEM: AN OVERVIEW OF THE CENTRAL ISSUES

Issues in monetary control are often framed in terms of target variables, targets and instruments. For purposes of this analysis the target variable is taken to be M2, and the target is taken to be a specific level or growth rate for it.[4] The instrument is the tool the policymakers use to guide the target variable to the target.

The degree of monetary control is defined by the strength of the relationship between the target variable and the policy instrument: the stronger this relationship, the more precise the control. Two possibilities exist. First, there could be a *direct* relationship between the instrument and the target variable, in which changes in the instrument directly affect the target variable. Second, there could be an *indirect* link between the instrument and the target variable. In this case, changes in the instrument affect the target variable by affecting other variables, for example, the interest rate.

Monetary control is more precise the smaller the role of factors other than the policy instrument in determining the target variable. Indeed, control is best when there are no such "leakages." If the relationship between the target variable and instrument is indirect, precise control tends to be more difficult; factors other than the policy instrument affect not only the target variable, but also the relationship between the instrument and the target variable. Such leakages exist when the relationships between the instrument and the other variables or between the other variables and the target variable are neither strong nor precise. In any event, more and larger leakages imply less control.

Furthermore, when control is indirect, the relationship between the policy instrument and the target may be unreliable and may change from time to time, in response to such things as financial innovation and regulatory change. Hence, the ability to control monetary aggregates through such indirect channels may vary in ways that are both difficult to explain and impossible to predict.[5]

Implementing a monetary control procedure is complicated by other factors, such as the availability of information, the time horizon over which the policymaker wishes to affect control, possible "feedback" effects between other variables and the instrument and the ability to predict factors that affect the aggregate that cannot be controlled either directly or indirectly. Since the purpose of this paper is simply to point out the fundamental issues in controlling M2, the question of how best to implement a practical control procedure for M2 is not considered.

Controlling M2

M2 consists of M1 plus an array of savings-type deposits that are called the non-M1 components of M2 (NM1M2).[6] The Fed's ability to control M2 depends on its ability to control both M1 and NM1M2. If there were a direct link between both of these M2 components and both could be controlled equally well, there would be no difference between the Fed's ability to control M1 and its ability to control M2. But this is not the case.

Historically, the Fed has established direct control over the non-currency components of the monetary aggregates through a system of

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[4]Currently, the Federal Open Market Committee (FOMC) sets long-run target ranges for the growth rate of M2 from the fourth quarter of one year to the fourth quarter of the next. These growth rate ranges imply target ranges for the levels of the variables over the planning period. The FOMC also sets short-run growth rate ranges for M2 for the period between meetings, that is, the "intermeeting period." The growth rate ranges, in turn, imply targets for the level of M2. Hence, there is a one-to-one correspondence between targets for the growth rate and targets for the level of M2.

[5]For example, the uncharacteristically slow growth recently of the non-M1 components of M2 was unanticipated and is, as yet, not understood. See Bullard (1992) and Carlson (1992) for a discussion of this issue.

[6]The non-M1 components of M2 consist of savings deposits (including money market deposit accounts), small denomination time deposits, general purpose broker/dealer money market mutual funds, overnight RPs issued by all commercial banks and overnight Eurodollars issued to U.S. residents by foreign branches of U.S. banks. See Hafer (1980) for a more detailed discussion of each component of M2 except money market deposit accounts.

reserve requirements.[7] In 1959, NM1M2 consisted primarily of time and savings deposits, most of which were subject to the Federal Reserve's reserve requirements. The MCA, however, eliminated reserve requirements on a broad class of NM1M2 and the remainder were eliminated in December 1990. Consequently, currently there is no direct relationship between the Fed's actions and NM1M2. In contrast, the MCA enhanced significantly the relationship between the Fed's instrument and M1.[8] Essentially, M2 now consists of one component, M1, which the Fed can influence directly, and another component, NM1M2, over which the Fed has no direct influence.

A detailed model of M2 control is presented in the appendix to this article; three conclusions emerge from it. First, the Fed's ability to control M2 is better the stronger the direct relationship between its policy instrument and M1 and the stronger the indirect effects of policy actions on NM1M2. Second, because there is a strong direct link between policy actions and M1, other things the same, M2 control is better the larger the proportion of M1 in M2. Finally, M2 control will be better the larger the indirect effects of policy actions on NM1M2 and, in particular, the larger such effects are relative to the total effect of policy actions on M1.

To see why this last point applies, suppose policy actions have no effect on NM1M2, either direct or indirect. In this case, M2 can be controlled only by manipulating M1 to completely offsett undesired movements in NM1M2. Since NM1M2 is large relative to M1, the required manipulation of M1 could be quite large. If the indirect effect of policy actions on NM1M2 were large and positive, that is, if an open market purchase results in an increase in NM1M2, the required manipulation of M1 would be much smaller. If, however, the indirect effects of policy actions on NM1M2 were negative, so that an open market purchase results in a decrease in NM1M2, open market operations would have to be pursued even more aggressively. In other words, the required change in M1 would have to be larger to offset the decline in NM1M2.[9]

THE RECENT BEHAVIOR OF M2

The empirical analysis of the basic issues raised above begins with a simple analysis of the behavior of M2 relative to that of M1. Figure 1 shows the share of M1 in M2 during the period of the official published series on the monetary aggregates, January 1959 to March 1992. The proportion of M1 in M2 declined through the late 1970s, decreasing from nearly 50 percent in 1959 to about 25 percent in 1977. Since then, the ratio has changed relatively little on average but has been somewhat variable. Moreover, the proportion of M2 growth accounted for by NM1M2 growth increased significantly between 1959 and 1977. This is illustrated in figure 2, which shows the growth rates of M2 and NM1M2 since 1959. Before the late 1970s, the growth rate of NM1M2 was consistently higher than the growth rate of M2. Since then, however, the growth rates of M2 and NM1M2 have been very similar.

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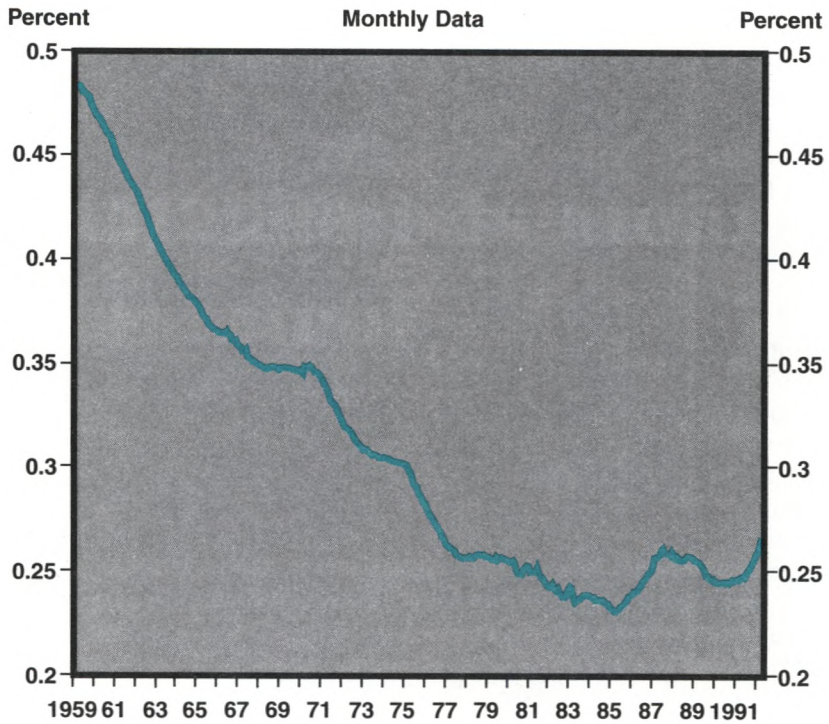
[7]Some analysts point out that depository institutions would maintain vault cash to service deposit inflows and outflows from such deposits so that the money supply could be controlled even in the absence of official reserve requirements. In effect, such institutions would be maintaining reserves equal to some fraction of these deposit balances, so effectively they would be imposing reserve requirement on themselves. Indeed, currently a significant number of depository institutions hold vault cash in excess of their reserve requirement. While it is no doubt true that depository institutions would hold cash for some purposes, there is no guarantee nor evidence that this "implicit reserve ratio" would be stable or systematically related to the level of deposits. Under the present system of reserve requirements, depository institutions attempt to economize on their holdings of excess reserves. This is what makes reserve requirements an effective tool of monetary control.

[8]The MCA required other changes that enhanced control over M1. Prior to the MCA, Federal Reserve reserve requirements applied only to member banks. Hence, some components of both M1 and NM1M2 were not directly linked to the Fed's policy actions and, therefore, were not under the Fed's direct control. This constituted a potential source of leakage of monetary control for both M1 and M2. In addition, the reserve requirements on different deposits were different, hence, the relationship between the policy instrument and a particular monetary aggregate would change with shifts in the public's preference for certain types of deposits or financial innovations. See Garfinkel and Thornton (1989, 1991a).

[9]In the extreme and very unlikely case in which the negative indirect effects of policy actions on NM1M2 were larger than the sum of the positive direct and indirect effects of policy actions on M1, the process would be dynamically unstable.

Figure 1
The Ratio of M1 to M2



The Link Between Policy Actions and M1 and NM1M2

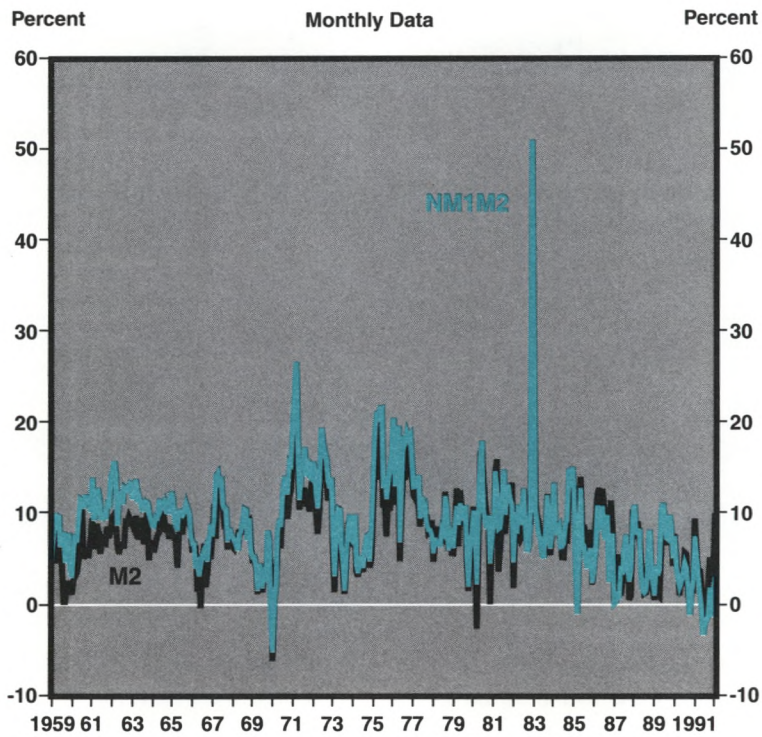
Estimates of the direct and indirect effects of policy actions on M1 and NM1M2 can be obtained by regressing these variables on total reserves. Total reserves (TR) is taken as the policy instrument because currency is supplied on demand and because changes in total reserves are closely related to open market operations.[10] The equations are estimated with all variables in first-differences (Δ).[11] Table 1

[10]Note that the regression analysis here takes the view that total reserves are exogenous. If that is not the case, then the correlation between reserves and say NM1M2 could be due to the effect of shifts in NM1M2 on reserves, rather than the other way around. For example, if NM1M2 declined the Fed might offset some of the effect of the decline in M2 by increasing total reserves and, consequently, M1. Note, however, that this would result in a negative relationship between NM1M2 and TR.

[11]The question of stationarity naturally arises when monetary and reserve aggregates are used. Such variables tend to grow over time at widely variable growth rates. Therefore, the null hypothesis of non-stationarity is frequently not rejected when applied to such univariate time series. The null hypothesis of non-stationarity may not be rejected even when first differences of such variables are used. Of course, reserve requirements establish a link between reserves and checkable deposits. This is certainly the case for reserves and total checkable deposits since the elimination of reserve requirements on nontransaction accounts. As a result, these variables should be cointegrated. This does not necessarily imply that there is a stationary linear relationship between reserves and the other monetary aggregates like M1 (currency is non-stationary) and NM1M2 or M2.

Furthermore, the first-difference of variables that are growing over time is not necessarily stationary. For example, if a variable grows at a constant 5 percent rate, then first-differences of the variable will get larger and larger over time. In short samples like the one used here, however, such non-stationarity is not very important. Indeed, the null hypothesis of a unit root in the first differences of total reserves is rejected at the 5 percent significance level. Because of this and because the coefficients are more difficult to interpret when growth rates are used, all the equations are estimated using first-differences of the levels of the variables. See Dickey, Jansen and Thornton (1991) for a discussion of stationarity and cointegration.

Figure 2
The Growth of M2 and NM1M2



shows the results of regressing first-differences of the various monetary aggregates on ΔTR.[12] The regression of ΔM1 on ΔTR shows that there is a strong relationship between ΔM1 and ΔTR, with ΔTR explaining about 80 percent of the variation in ΔM1. Moreover, the estimated coefficient on ΔTR is not statistically different from 8.33, that is, 1/.12, where .12 is the marginal reserve requirement on transaction deposits.[13] This suggests both that total checkable deposits (TCD) and currency are uncorrelated and that there are no indirect effects of

[12]The period begins with the effective implementation of the MCA in March 1984; see Garfinkel and Thornton (1989). Following the removal of reserve requirements on non-transaction accounts, excess reserves rose significantly above their pre-December 1990 level for about three months, then declined to about their previous level as depository institutions were surprised by this action. Consequently, dummy variables are included for January, February and March of 1991.

[13]This is not precisely correct because some reserves are held in the form of excess reserves and because reserve requirements on government and certain foreign deposits are not included in either other checkable deposits (OCD) or M1. Hence, the multiplier is smaller than 8.33. The amount of excess reserves or reserves needed to support these other deposits, however, is not large relative to total reserves, so the difference between the effective multiplier and 8.33 is quite small.

Also, this result simply could be due to the fact that the reserve series has been adjusted for reserve requirement changes so the coefficient is biased toward 8.33, the reciprocal of the marginal reserve requirement, .12. However, the Board of Governors uses the average rather than the marginal reserve requirement to adjust its series for reserve requirement changes. See Garfinkel and Thornton (1991b) and Meulendyke (1990). Nevertheless, an equation involving TCD and total reserves not adjusted for reserve requirement changes was estimated. These data are available only on a not seasonally adjusted basis. When the seasonal dummy variables were excluded, the adjusted R-square was .89 and the estimated coefficient was 8.80—not significantly different from 8.33 at the 5 percent significance level. When monthly seasonal dummy variables were included, the adjusted R-square was .96 and the estimated coefficient was 7.44. In this case the hypothesis that the coefficient was equal to 8.33 is rejected at the 5 percent significance level—the t-statistic is 2.52. As a practical matter, however, this qualification does not appear to be particularly important as the degree of the bias is not large.

Table 1

Estimates of the Effect of Policy Actions on Various Monetary Aggregates, Monthly Data, March 1984 - March 1992

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	1.863*	10.342*	8.469*	0.619*
	(7.85)	(12.38)	(10.41)	(2.76)
ΔTR	8.293*	8.690*	0.397	8.250*
	(19.37)	(5.77)	(0.27)	(20.37)
D.W.	1.784	0.727	0.612	1.853
Adj. R^2	.802	.265	.000	.820

*indicates statistical significance at the 5 percent level.

policy actions on M1. This conclusion is reinforced by the fact that the adjusted R-square for the regression of the ΔTCD on ΔTR is nearly identical to that of the ΔM1 regression, and the fact that the coefficients on ΔTR are nearly identical in the two equations. Consequently, all of the effect of ΔTR on ΔM1 comes through the direct relationship between TR and TCD that results from the Federal Reserve's system of reserve requirements.[15]

The results for ΔNM1M2 show that the indirect effect of policy actions on this component of M2 are nil.[16] The adjusted R-square is zero and the coefficient on ΔTR, which captures both the direct and indirect effects of policy actions, is statistically insignificant. The lack of an effect on NM1M2 is reflected in the coefficient of ΔTR in the M2 equation. This coefficient too is not statistically different from 8.33, suggesting that the marginal effect of policy actions on M2 comes solely through their effect on M1.

It could be argued that the indirect effects of policy actions on M2, say, through interest rates, take time to work so that the potential for indirect control of M2 is not adequately reflected in the monthly data. This issue is investigated first by using lower frequency (quarterly) data and second by including a six-month distributed lag of ΔTR. The results using quarterly data, presented in table 2, are similar

[14]This coefficient measures both the direct and indirect effects of policy actions on M1. See the appendix for details. Because the total effect is not significantly different from the direct effect, the indirect effect must be insignificantly different from zero. See Garfinkel and Thornton (1991a) for an analysis of the relationship between currency and TCD.

[15]The lack of any significant serial correlation in the residuals of the estimated equation suggests that the remaining error is simply "control error" and seasonals.

[16]Note that the D.W. statistic indicates significant first-order serial correlation in all but the equation involving TCD. This is to be expected because, in these cases, a simple regression of the changes in these variables on the change in total reserves does not adequately reflect the process generating these variables. See the appendix to Garfinkel and Thornton (1991a) for an illustration of this point using M1. This merely confirms the fact that the behavior of NM1M2 and, hence, M2 is not adequately explained by Fed policy actions. The presence of positive, first-order serial correlation does tend to bias the estimates of the standard errors downward. Hence, the reported t-stastistics may overstate the statistical significance of the change in total reserves in these equations.

Table 2

Estimates of the Effect of Policy Actions on Various Monetary Aggregates, Quarterly Data, 1984.2 - 1992.1

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	4.790*	32.270*	27.481*	0.988
	(7.21)	(8.48)	(6.99)	(1.62)
ΔTR	9.683*	8.353*	−1.330	9.657*
	(18.27)	(2.75)	(0.42)	(19.85)
D.W.	1.394	1.065	0.917	1.684
Adj. R^2	.917	.162	.000	.930

*indicates statistical significance at the 5 percent level.

Table 3

Long-Run Effects of Policy Actions on Various Monetary Aggregates, Monthly Data, March 1984 - March 1992

	ΔM1	ΔM2	ΔNM1M2	ΔTCD
Constant	1.471*	11.352*	9.881*	0.170
	(5.27)	(10.95)	(10.07)	(0.66)
β	7.976*	10.728*	2.752	7.874*
	(16.23)	(5.87)	(1.59)	(17.35)
θ	9.878*	3.567	−6.311*	9.958*
	(13.32)	(1.29)	(2.42)	(14.53)
μ	1.902*	−7.160*	−9.062*	2.084*
	(2.32)	(2.35)	(3.15)	(2.76)
D.W.	1.622	0.750	0.09	1.733
Adj. R^2	.823	.275	.043	.847

*indicates statistical significance at the 5 percent level.

to those using monthly data. Again, policy actions have no effect—direct or indirect—on NM1M2; their effect on M2 comes only through their effect on M1.[17]

The estimates including a six-month distributed lag of total reserves, presented in table 3, give a broadly similar picture. The coefficient β measures the contemporaneous relationship

[17]One difference is that the coefficient of the change in total reserves in both the M1 and TCD equations is larger than 8.33, and the difference is statistically significant. This result is puzzling. It appears, however, that it is due to the fact that the Board of Governors uses the average rather than the marginal reserve requirement when adjusting reserves for changes in reserve requirements. The average reserve requirement is significantly smaller than the marginal. This means that the coefficient of a regression of the change in TCD on a change in total reserves so adjusted will be substantially larger than 8.33. At high frequencies, however, the change in total reserves so adjusted is likely to reflect the actual change in reserves so that the coefficient is approximately equal to the reciprocal of the marginal reserve requirement. At lower frequencies or in distributed lag specifications that capture the long-run effect of a change in constructed total reserve series, the estimated coefficient better reflects the reserve requirement used in the constructed series.

between the changes in the dependent variable and ΔTR; θ measures the total effect of current and past changes in total reserves on changes in the dependent variable; and μ measures the sum of the lagged effects of ΔTR.[18] There is a significant association between changes in NM1M2 and changes in total reserves, as the adjusted R-square is statistically different from zero. The R-square is very small however, and all of the statistical significance is associated with the subsequent negative effect of total reserves on NM1M2.

The contemporaneous effect of a change in total reserves on M2 is larger in this specification than in table 1; note, however, that this is simply the sum of statistically significant and statistically insignificant effects (the coefficient for M1, 7.976, plus the coefficient for NM1M2, 2.752). For both ΔM1 and ΔTCD, the results are similar to those using quarterly data.[19]

For M2 and NM1M2, the subsequent effect of policy actions largely offsets the initial effect. That the subsequent effect is negative and statistically significant is somewhat surprising. If this result were robust and not merely the artifact of the particular sample period, it would create a potentially difficult problem for M2 control.[20] To see this, assume that M2 is currently below its target level and the Fed increases reserves to nudge M2 upward. This action would set in motion changes that would eventually lead to a reduction in NM1M2, creating a need for additional policy action. Anticipating this, policymakers would have to be more aggressive in increasing M1 to hit their M2 target.

The Recent Behavior of NM1M2 and Monetary Policy

The above analysis suggests that, if the Fed has been targeting M2, there should be more instability in the behavior of the policy instrument, and there should be an inverse relationship between the policy instrument and NM1M2. Data from the latter part of the 1980s is broadly consistent with M2 targeting. Figure 3 shows a 12-month moving average of the growth rate of total reserves and M1 since January 1959. Two things are evident from the figure: the relationship between M1 and total reserves improves dramatically following the effective implementation of the MCA, and the volatility of the growth rate of total reserves increases pretty dramatically in the 1980s.

Figure 4 shows the 12-month moving averages of total reserve growth and NM1M2 growth for the same period. The growth rates of total reserves and NM1M2 are not negatively correlated as strict M2 targeting would suggest they should be in the latter part of the 1980s. While there are periods since the mid-1980s when sharp accelerations in reserve growth are associated with significant decelerations in the growth rate of NM1M2, a pattern of compensating variations in the growth rates of these variables does not emerge.[21] Hence, these data do not appear to support the idea that the large, persistent swings in total reserve growth are associated directly with targeting M2.[22]

Nevertheless, as table 4 shows, reserve growth was much faster on average since the mid-1980s, and this faster reserve growth is associated with a significant slowing in NM1M2 growth.

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[18]Note that the estimated coefficients satisfy the restriction, $\beta = \theta - \mu$. The coefficients were estimated from a simple reparameterizaton of the change in the appropriate monetary aggregate on a constant term and the contemporaneous and six lags of the actual change in total reserves.

[19]It could be argued that the results are sensitive to the choice of the policy instrument. To investigate this possibility, two other policy instruments were considered, the adjusted monetary base and non-borrowed reserves. The evidence of monetary policy actions on short-term interest rates generally is strongest if non-borrowed reserves is used as the policy instrument [see Thornton (1988) and Christiano and Eichenbaum (forthcoming)]. Moreover, it is generally argued that the Fed controls M2 through its influence on short-term interest rates and the connection between these rates and the demand for M2. Consequently, non-borrowed reserves is a particularly important alternative policy instrument to consider. The results, however, indicate that the general conclusions drawn above are insensitive to the variable chosen as the policy instrument.

[20]One explanation for this result stems from the fact that the first difference of NM1M2 has a statistically significant, negative linear time trend during the period. It appears that the negative lagged effect of the change in total reserves on the change in NM1M2 in table 3 merely reflects the negative trend in the latter variable over the sample period. The trend coefficient is −.102 with a t-statistic of −4.59.

[21]For example, as M2 growth slipped to the bottom of the Fed's target range during the latter half of 1991, total reserve growth accelerated sharply.

[22]The fact that the estimate of μ in table 3 is negative, however, could be evidence of this behavior. See footnote 11 for a discussion of this point.

Figure 3
12-Month Moving Average of the Growth of M1 and Total Reserves

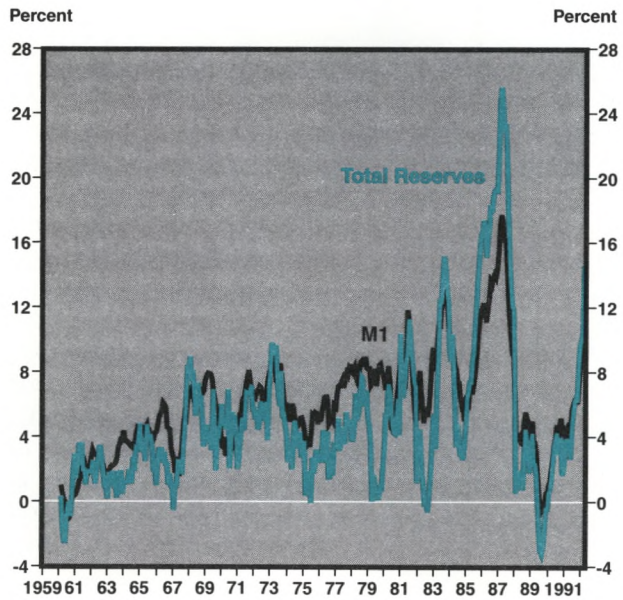

Figure 4
12-Month Moving Average of the Growth of the Non-M1 Components of M2 and Total Reserves

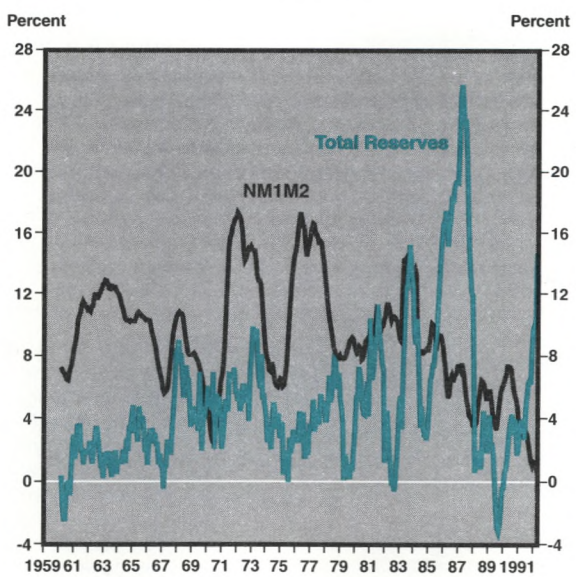

Table 4

Average Growth Rates of Various Monetary and Reserve Aggregates

Aggregate	1959.1-1984.1	1984.2-1992.1
TR	3.53%	8.37%
NM1M2	10.29	5.26
M2	8.57	5.78

Consistent with the Fed's objective for M2 growth during the period, M2 growth has slowed significantly since the mid-1980s.[23] Hence, while the evidence suggests that the Fed has not been attempting to target M2 closely over periods of up to a year, it is consistent with the Fed's targeting of M2 over a somewhat longer time horizon. Indeed, the experience on average over the latter half of the 1980s is broadly consistent with the Fed's paying increased attention to M2 and with the Fed's objectives for M2 growth.

ENHANCING M2 CONTROL

The analytical and empirical analyses above suggest that M2 can be controlled only by pursuing monetary policy actions to offset movements in NM1M2 over which the Fed has little or no control. While such actions are not necessarily destablizing, they could be, especially when actions are required to offset large, undesired movements in NM1M2. Moreover, such large changes in policy actions could be misinterpreted.

If the Fed wishes to target M2, changes in the structure of reserve requirements could be made that would significantly enhance its controllability. Such changes would eliminate the need for large swings in the policy actions of the Fed.

The empirical results here and elsewhere suggest that reserve requirements, like those imposed on the checkable deposits in M1, can be an effective way to establish a direct link over the deposit components of the monetary aggregates.[24] In other words, M2 control could be enhanced substantially by extending reserve requirements to the financial assets that make up NM1M2.

Most effective monetary control would be obtained if the percentage reserve requirement were the same for all assets that make up the aggregate. This would prevent shifts in the aggregate that are simply due to shifts in the public's preference between deposits with "high" marginal reserve requirements and those with "low" marginal reserve requirements. Control would also be best if the timing of reserve requirements on all categories of deposits were the same. As long as the timing is the same, this issue is of little consequence, especially if the objective is to control the monetary aggregate over a period of a quarter or more.[25]

The Problem of the Reserve Tax

Reserve requirements are often thought of as a "reserve tax" because they force depository institutions to hold a portion of their assets in the form of non-interest-bearing deposits at the Federal Reserve and because the marginal interest income from these funds, which the Fed invests in interest-bearing U.S. government securities, is rebated to the U.S. Treasury.[26] Imposing the current reserve requirement on transaction accounts to the non-transaction components of M2 would significantly increase the reserve tax on depository institutions.[27] This would put them at a competitive disadvantage and, undoubtedly, give rise to tax avoidance schemes and increased competition from other

[23]The Federal Open Market Committee's target range for M2 decreased in a series of steps from 6 to 9 percent in 1984 to 2.5 to 6.5 percent by 1992.

[24]See Garfinkel and Thornton (1989, 1991a).

[25]See Thornton (1983) for a discussion of the timing issue as it applied to LRA and CRA.

[26]Of course, depository institutions can also hold reserves in the form of non-interest-bearing vault cash. Since many institutions are currently holding vault cash in excess of their required reserves, it may not be correct to suggest that such holdings impose a tax on these institutions.

[27]The reserve tax is only part of the net tax on depository institutions resulting from government supervision and regulation, and it may not be large relative to the other taxes and subsidies. For example, currently over three-fourths of the depository institutions satisfy their reserve requirements with vault cash, which they would probably hold in the absence of reserve requirements. Second, depository institutions are insured by the government at a fraction of the cost. On net, institutions probably receive a net subsidy from the government.

financial intermediaries. The adverse effect of extending reserve requirements to NM1M2 could be offset, however, by paying interest on required reserve balances held with Federal Reserve banks.[28]

Another problem would remain: requiring depository institutions to hold a significant portion of their assets as reserves might alter significantly the composition of their assets away from loans. This would further reduce the role of depository institutions in supplying credit to the economy.[29] Because of this, it would seem desirable to set the percentage reserve requirement on the components of M2 at a level that would leave the amount of total reserves held at their current level. Unfortunately, part of NM1M2—general purpose broker and dealer money market mutual funds—are not held at depository institutions. Hence, either these deposits would have to be exempt from reserve requirements or reserve requirements would have to be extended to non-depository institutions. The former option seems the most desirable for at least two reasons. First, extending reserve requirements to non-depository institutions would set a precedent and would raise other issues, such as whether deposit insurance should be extended to such institutions or whether they would be permitted to borrow at the Federal Reserve's discount window. Second, because such deposits account for only about 10 percent of M2, they constitute a relatively minor source of leakage for M2 control.

Exempting money market mutual funds from reserve requirements and imposing uniform requirements on the remaining non-currency components of M2 would require an average reserve requirement of about 2 percent.[30] Monetary control would be best if the marginal and average reserve requirements were the same, that is, if no deposits are exempt from reserve requirements. Logic suggests and the empirical evidence above supports the notion, however, that this is not a major consideration as long as changes in the quantity of deposits that are exempt from reserve requirements are infrequent and relatively small.

The Effect on Bank Lending Rates of Funds Obtained by Managed Liabilities

It has been increasingly the case that depository institutions have relied on "managed liabilities" to meet changes in loan demand. During periods when loan demand is strong, institutions are more aggressive in setting higher rates on large and small time deposits and money market deposit accounts (MMDAs) to attract additional funds. Bank loan rates are equal to the rate paid on these deposits plus a spread that is determined by the competitive conditions in the market. If such funds were subjected to a 2 percent reserve tax, it would raise the marginal cost of funds obtained from managed liabilities by about 2 percent (1/.98). Whether this would harm the competitive position of depository institutions further, given that the total tax would be unchanged, is unclear. In any event, depository institutions have a competitive advantage because their deposit liabilities are federally insured, while their competitors' are not.[31] Nevertheless, any adverse effects of extending reserve requirements to most of NM1M2 could be mitigated by paying interest on required reserve balances with the Fed. The interest rate paid on these balances could be tied to market rates and set close enough to such rates to reduce the reserve tax to the point at which it plays an insignificant role in allocating credit.[32]

If these changes were made, the evidence suggests that M2 could be controlled without large swings in the use of the Fed's policy instrument. Moreover, increased M2 control could be achieved without increasing the reserve tax and with little or none of the other adverse effects commonly associated with reserve requirements.

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[28]Of course, it would require an act of Congress for the Federal Reserve to pay interest on reserves.

[29]See Kaufman (1991).

[30]The exact estimate of 1.76 percent is based on not-seasonally-adjusted data and total reserves not adjusted for reserve requirement changes for April 1992.

[31]It should be noted, however, that insurance premiums paid by depository institutions have increased significantly.

[32]For example, it could be paid in arrears and at a rate that is one-quarter of a percent below the rates depository institutions paid on their managed liabilities in M2 over the maintenance period. This would all but eliminate the reserve tax. If this were done on the basis of the average rate paid on such deposits, such a scheme would result in a slight subsidy to institutions that pay below average rates and a net effective cost to those paying above average rates. This might have the effect of tempering slightly the incentive of some institutions to bid aggressively for such funds.

SUMMARY AND CONCLUSIONS

Among other variables, the Fed currently sets target ranges for the M2 monetary aggregate. Without considering its desirability, this paper analyzes the controllability of M2 under existing institutional arrangements. Both the analysis and the data suggest that, currently, M2 can be controlled only through the Fed's control of M1. The evidence also suggests that M2 control is difficult and that hitting an M2 target may, at times, require very large changes in open market operations.

To counteract these problems, the paper suggests several ways in which the Fed could enhance M2 controllability while virtually eliminating the large changes in policy actions that can be required under the current system of reserve requirements. Enhanced M2 control could be achieved without increasing the reserve tax on depository institutions and without forcing depository institutions to shift their asset portfolios away from loans.

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Appendix
A Simple Model of M2 Control

This appendix presents a simple model of M2 control. In the following analysis, the policy instrument is taken to be the change in total reserves, $\dot{TR}$. The general results, however, do not depend on the use of total reserves. Other policy instruments such as the monetary base or non-borrowed reserves would yield similar results.

M2 consists of M1 and some savings-type deposits called the non-M1 components of M2, NM1M2. That is,

$$(1)\quad M2 = M1 + NM1M2.$$

Thus, changes in M2 per unit of time can be written as

$$(2)\quad \dot{M}2 = \dot{M}1 + N\dot{M}1M2.$$

M1 consists of currency, C, and total checkable deposits, TCD. Consequently, by definition $\dot{M}1$ can be written as

$$(3)\quad \dot{M}1 = (1+k)\dot{TCD},$$

where k is the ratio of currency to TCD. For the purpose of this illustration, k is assumed to be constant.[1]

The quantity of TCD is directly related to the Fed's policy instrument through the Fed's system of reserve requirements. That is,

(4) $\dot{TCD} = (1/r)\dot{TR}$,

where r is the proportion of additional TCD that must be held in the form of reserves (vault cash and deposit balances at the Federal Reserve). Combining (3) and (4), yields

(5) $\dot{M1} = ((1+k)/r)\dot{TR}$,

which establishes a direct link between M1 and TR.

It may be that policy actions also affect M1 indirectly, through their effect on other variables, X. That is,

(6) $M1 = h(X)$,

and

(7) $X = j(TR)$.[2]

Together, they imply that

(8) $\dot{M1} = f' \dot{TR}$.[3]

Allowing for the possibility of both direct and indirect effects of policy actions on M1 and the possibility of an additive stochastic control error, u, that is independent of both the direct and indirect effects, the total effect of policy actions on

$\dot{M1}$ can be summarized as

(9) $\dot{M1} = [(1+k)/r) + f']\dot{TR} + u$.

Since, by construction, policy actions have no direct effect on NM1M2, the effect of such actions on $\dot{NM1M2}$ can be expressed as

(10) $\dot{NM1M2} = g'\dot{TR} + v$,

where g' is obtained in a manner analogous to that used to obtain f', and v denotes the stochastic part of $\dot{NM1M2}$ that is unrelated to policy actions.

The control problem for M2 can be illustrated most easily by considering the general condition that the effects of policy actions on NM1M2 are some proportion of their total effect on M1. That is,

(11) $g' = \lambda[(1+k)/r + f']$.

While there are no constraints on the value of λ, the fact that policy actions have no direct effect on NM1M2 makes it likely that $|\lambda| < 1$.

Combining equations 1 and 9-11 yields the following equation for $\dot{M2}$:

(12) $\dot{M2} = [1 + \lambda][(1+k)/r + f']\dot{TR} + u + v$.

Several aspects of equation 12 are worthy of note.

First, M2 control is generally better the smaller the control error and the stronger the indirect effects of policy actions on NM1M2, that is, the smaller are u and v.

Second, control will be better the larger the proportion of M1 in M2. This is not the case if $u > v$, but that appears to be extremely unlikely. This conjecture is supported by the empirical analysis in the paper.

Third, control will be better the larger the indirect effect of policy actions on $\dot{NM1M2}$ relative to their total effect on $\dot{M1}$, that is, the larger the value of λ. This is so because the proportion of $\dot{M2}$ related to $\dot{TR}$ is larger in proportion to u and v the larger the value of λ. Indeed, if $\lambda = 0$ (which implies that $g' = 0$), then the only direct control over M2 would come through the Fed's control over M1. Control of M2 could be obtained only by offsetting shifts in v by manipulating M1. Since NM1M2 are large relative to M1, this could require relatively large changes in M1. If λ were negative, M2 control would require even more aggressive M1 policies.

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[1]This assumption is not critical to the major findings of the analysis. See Garfinkel and Thornton (1991a) for a recent criticism of this common assumption.

[2]In the case of M1, one could think of it as a situation in which M1 was equal to the money multiplier (mm) times total reserves, where the multiplier is some function of X. That is, $M1 = mm(X)TR$.

In this case, $\dot{M1} = mm(X)\dot{TR} + [\partial mm/\partial X)(\partial X/\partial TR)\dot{TR}]$. In the case of NM1M2, however, there is no direct relationship between these deposits and total reserves. Hence, there is nothing equivalent to a money multiplier for NM1M2.

[3]The function f is equal to h(j(TR)) which implies that $TR = p(t)$, where t denotes time. These functions are written in their general form, however, in the empirical section of the paper, it will be assumed that they are linear.

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Understanding the Term Structure of Interest Rates: The Expectations Theory

THE INTEREST RATES on loans and securities provide basic summary measures of their attractiveness to lenders. The role played by interest rates in allocating funds across financial markets is very similar to the role played by prices in allocating resources in markets for goods and services. Just as a relatively high price of a particular good tends to draw physical resources into its production, a relatively high interest rate on a particular type of security tends to draw funds into the activities that type of security is issued to finance. And just as identifying the factors that help determine prices is a key area of inquiry among economists who study goods markets, identifying the factors that help determine interest rates is a key area of inquiry for those who study financial markets.

Economic theory suggests that one important factor explaining the differences in the interest rates on different securities may be differences in their *terms*—that is, in the lengths of time before they mature. The relationship between the terms of securities and their market rates of interest is known as the *term structure* of interest rates. To display the term structure of interest rates on securities of a particular type at a particular point in time, economists use a diagram called a *yield curve*. As a result, term structure theory is often described as the theory of the yield curve.

Economists are interested in term structure theory for a number of reasons. One reason is that since the actual term structure of interest rates is easy to observe, the accuracy of the predictions of different term structure theories is relatively easy to evaluate. These theories are usually based on assumptions and principles that have applications in other branches of economic theory. If such principles prove useful in explaining the term structure, they might also prove useful in contexts in which their relevance is less easy to evaluate. One theory of the term structure that will be described here, for example, suggests that a behavioral trait called *risk aversion* may play a major role in determining the shape of the yield curve. If subsequent research lends credence to this theory, economists may give more emphasis to risk aversion in constructing theories of other aspects of financial market operation.[1]

A second reason why economists are interested in term structure theories is that they help explain the ways in which changes in short-term interest

[1]Examples include the role of financial intermediaries and the pricing of claims to physical assets (such as stocks).

rates—rates on securities with relatively short terms—affect the levels of long-term interest rates. Economic theory suggests that monetary policy may have a direct effect on short-term interest rates, but little, if any, direct effect on long-term rates. It also suggests that long-term rates play a critical role in a number of important economic decisions, such as firms' decisions about investment, and households' decisions about purchases of homes and other durable goods. Theories of the term structure may help explain the mechanism by which monetary policy affects these decisions.[2]

A third reason economists are interested in the term structure is that it may provide information about the *expectations* of participants in financial markets. These expectations are of considerable interest to forecasters and policymakers. Market participants' beliefs about what may happen in the future influence their current decisions; these decisions, in turn, help determine what actually happens in the future. Thus, knowledge of participants' expectations is critical to forecasting future events or determining the effects of different policies.

Many economists believe that the people best able to forecast events in a market are in fact the participants in that market. If this is true, interest rate forecasting and inferring the nature of financial market participants' expectations amount to the same thing. The term structure theory that will be described in this article, which is called the *expectations theory,* suggests that the observed term structure can indeed be used to infer market participants' expectations about future interest rates—and through them, what actual future rates might be, and how events that tend to influence these rates may unfold. These events could include changes in the rate of economic growth or changes in monetary policy, for example.

The goal of this article is to provide a simple but thorough description of the expectations theory. The first section of the article lays the groundwork by explaining the basic concept and principles of interest rates and securities pricing. The presentation emphasizes issues that are particularly relevant to understanding how the financial market goes about assigning different interest rates to securities with different terms. The second part of the article presents the expectations theory itself. The presentation is oriented around two widely noted observations about the term structure: (1) that yield curves are usually upward-sloping, and (2) that the steepness and/or direction of their slopes tends to change systematically as interest rates rise and fall.

BUILDING BLOCKS OF THE TERM STRUCTURE

Prices, Interest Rates and Time

Since the expectations theory tries to explain certain aspects of the way interest rates are determined, it is impossible to understand the theory without a thorough understanding of the nature and role of interest rates. A good starting point is the analogy we drew earlier between the prices of goods and services and the interest rates on securities. In our economy, purchasers of goods or services almost always pay with money, so the "price" of a given quantity of goods is simply the number of dollars paid for it. In markets where the goods are readily divisible and more or less uniform in quality, such as markets for agricultural commodities, the price is usually thought of as a number of dollars *per unit* of goods. This way of thinking about prices reflects what economists call the Law of One Price: when information is readily available and the number of buyers and sellers is large, each transaction involving a particular good tends to take place at the same unit price, regardless of the quantity of the good exchanged.

Discount and Return Ratios—In the securities market, one can think of lenders as buyers, and of future payments as the items they purchase. People lend to the federal government, for instance, by buying U.S. Treasury securities, which are government promises to repay the loans by making one or more future payments. The direct securities market counterpart of a price in a goods market would be the number

[2]Term structure theories are traditionally stated in terms of nominal or money interest rates. Economic theory predicts, however, that it is primarily real interest rates—interest rates net of expected inflation—that influence the decisions of households and firms. It is possible to formulate versions of most term-structure theories, including the theory described in this article, that apply specifically to real interest rates. Since we cannot observe inflation expectations, however, we cannot measure real interest rates directly. This makes it difficult to describe real-interest-rate versions of the theories in terms non-economists are likely to understand.

of dollars lent (paid) today per dollar repaid in the future (future dollar purchased).[3] A security that cost $10,000 and returned $12,500 at a later date, for example, would have a unit price of 0.80. This price might be called a *discount ratio.*[4]

Economists usually conform to financial market practice by thinking about securities in terms of return rather than discount ratios—that is, ratios of amounts repaid to the amounts lent, rather than the reverse. We can define the *return ratio* on a single-payment security as the ratio of its maturity payment to its price (that is, the amount lent). The return ratio on the security just described would be 1.25—the reciprocal of its discount ratio.

Accounting for the Time Dimension—The return ratio, it turns out, is not a very good analogue to the market price: it suffers from a serious problem that is directly connected to the topic of this article. In a competitive market, we think of the unit price as capturing all the price information a prospective buyer needs to allow him to decide whether to buy a particular good. Stated differently, a buyer should be indifferent between two purchases that take place at the same price.[5] This raises the question of whether a lender will actually be indifferent between making two loans (purchasing two securities) that have the same return ratio. Suppose, for instance, that a lender has a choice between making a $10,000 loan that repays $12,500 at the end of two years, and a $10,000 loan that repays $12,500 at the end of five years. Each of these loans has the same return ratio. Which is he likely to choose?

It seems fairly obvious that our hypothetical lender will prefer the former of these loans to the latter: the former loan repays the same amount at an earlier date. The fact that the two loans have identical return ratios is not enough to make this lender indifferent between them.

The return ratio is flawed because it neglects an important aspect of securities transactions that is absent from most goods transactions. This aspect is the *time dimension.* A securities transaction is an exchange that takes place over an interval of time, and the length of the interval is important to the parties in the transaction. Lenders are likely to be less interested in the total amount to be repaid than in the amount to be repaid per unit of time.

How can we adjust the return ratio to take the time dimension into account? If all loans had the same term, no adjustment would be needed. Fortunately, any loan with a term of more than one period can be expressed as a sequence of one-period loans with identical one-period return ratios. A five-year loan, for example, can be expressed as a sequence of five one-year loans with a common annual return ratio. We can use these annual-equivalent return ratios to compare the returns on loans with different terms.

In order to be more concrete about this statement, we need to define some notation. Let's call the current date "date 0" and the maturity date of a given security "date N," so that the term of the security is N periods. From now on we will think of the periods as years; this is convenient, but not essential. Let V_0 represent the amount lent and V_N the amount repaid. The return ratio on the loan is thus V_N/V_0, and the *per-period* (usually annual) *return ratio* is:[6]

$$R \equiv \sqrt[N]{\frac{V_N}{V_0}}$$

We can compute this ratio for any single-payment loan, as long as we know the amount lent, the amount repaid and the term. It provides us with exactly what we are looking for: a numerical yardstick that can be used to

[3]For the moment, we will make the (inaccurate) assumption that all loans/securities return a single payment at a fixed maturity date.

[4]Since prospective lenders always have the option of storing their money, the discount ratio should always be less than one. (No lender with this option will make a loan that returns less money than he lent.)

[5]We must assume that the goods do not differ in quality, and that price information is freely available. We must also assume that the goods are readily divisible, so that any quantity can be purchased at the given unit price. These are standard assumptions in the theory of competitive markets.

[6]The symbol "≡" should be read "is equal, by definition, to."

compare the returns on any two loans, regardless of their terms.[7]

To conform to financial market practice, we must modify the annual return ratio a little further. Market participants like to divide the repayment on loans into two components: one equal to the amount lent, which is called the *principal,* and another representing the remainder, which is called the *interest.*[8] They measure the return on loans as ratios of the interest to the principal. In our notation, market participants think of these returns in terms of *net return ratios*

$$r \equiv \frac{V_N - V_0}{V_0} = \frac{V_N}{V_0} - 1.$$

Unfortunately, the net return ratio suffers from the same problems of term comparison as the return ratio. However, we can define a *net per-period* (again, usually annual) *interest rate* by

$$r \equiv \sqrt[N]{\frac{V_N}{V_0}} - 1 = R - 1,$$

which is a per-period version of *r*. The annual interest rate serves as the financial market's basic measure of the attractiveness of the returns on securities. Very often it is converted into a percentage by multiplying it by 100.

If the annual interest rate truly serves as the analogue of the market price for securities, we can expect that in a competitive market it will be determined by the interaction of supply and demand. Financial market participants will face a *market interest rate* r^*, which they will view as beyond their power to influence, and will make their borrowing and lending decisions accordingly.[9]

Pricing Securities

The annual interest rate formula can be used to determine the price of a security: the amount a person who comes to the market offering to make a fixed repayment, at a fixed date in the future, will be able to borrow. If we let V_N represent the repayment a borrower promises to make exactly N years in the future, then he will be able to borrow (sell his security for) an amount V_0, where

$$V_0 = \frac{V_N}{(1+r^*)^N}.$$

This is the basic formula for "pricing" (or discounting) securities.

So far, we have assumed that all loans/securities return a single payment at a fixed maturity date. We know that in practice, however, most securities return multiple payments at multiple future dates. As long as the amounts and dates of these payments are known, we can simply price them separately and sum them to obtain the security's total price, or *present value*

$$V_0 = \frac{V_1}{1+r^*} + \frac{V_2}{(1+r^*)^2} + \ldots + \frac{V_N}{(1+r^*)^N} = \sum_{t=1}^{N} \frac{V_t}{(1+r^*)^t}.$$

The present value of a sequence of future payments is the current market value of those payments, where the market value is determined by discounting the future payments back to the present at the market interest rate. Here, V_t represents the payment at the end of any date t (if there is no payment at a particular date $\hat{t}$, we say that $V_{\hat{t}} = 0$) and $1/(1 + r^*)^t$ represents the discount factor applied to that payment.

Secondary Market Pricing—We are now ready to confront a pair of questions that are crucial in understanding the term structure. First, suppose the owner of a security wants to sell it before it comes due—that is, in the *secondary* market. How much can he expect to receive for it?

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[7]Suppose we construct a sequence of one-period loans $\{(V_0, V_1), (V_1, V_2), \ldots, (V_{N-1}, V_N)\}$, where V_j represents the amount lent at date j, and V_{j+1} the amount repaid one period later. This sequence has the properties that (1) the amount lent at date 0 is V_0, (2) the amount repaid at date N is V_N and (3) the amount repaid on the t^{th} loan in the sequence, at any intermediate date t + 1, is identical to the amount lent on the $t+1^{st}$ loan, which is extended at the same date. (Thus, the loans are "rolled over" from date to date.) Properities (1) through (3) guarantee that, from the lender's point of view, this sequence of one-period loans is identical to the multiperiod loan. It turns out that only one sequence of loans satisfies these three properties and is consistent with our requirement that the return ratios on each loan be identical. This is the sequence produced when each successive one-period loan is extended at a return ratio of R, as defined above.

[8]Part of the reason for this is that, as was noted above, anyone contemplating making a loan has the option of "lending to himself" by simply storing the money. As a result, people are unlikely to make loans unless the dollar repayment exceeds the dollar principal—that is, unless they receive interest.

[9]Hereafter, the "*" superscript signifies that this particular value of the annual interest rate r is the one selected by the market.

The key to answering this question is to recognize that from a lender's point of view, a security purchased in the secondary market is essentially identical to (is a perfect substitute for) a security he might purchase in the *primary* or new issue market. The primary-market substitute would have a term equal to the *remaining term* on the secondary security—the number of years the security has left to run. It would return payments in the same amounts, and at the same dates, as the remaining payments on the secondary security—those that have yet to be made and would consequently be collected by the security's purchaser.

We can use this substitution principle, along with what we have just learned about primary-market pricing, to price a security sold in the secondary market. We will call the date at which the security is sold date T, and the price of the security at that date V_T. The remaining term of the security is then N-T, and its remaining payments are due at dates $T+1$, $T+2$, ... , $N-1$, N.[10] The payments are consequently due 1, 2, ..., $N-T-1$, $N-T$ periods in the future, relative to date T. (We'll assume that the payment due at date T has already been made.) Continuing our notational convention that subscripts represent dates, we'll let r_T^* denote the market interest rate at date T. We can then write

$$V_T = \frac{V_{T+1}}{1+r_T^*} + \frac{V_{T+2}}{(1+r_T^*)^2} + \ldots + \frac{V_N}{(1+r_T^*)^{N-T}}$$

$$= \sum_{t=1}^{N-T} \frac{V_{T+t}}{(1+r_T^*)^t}.$$

It is important to note that r_T^*, the market rate on the date when the security is sold, may be different from the market rate when the security was issued (which we will call r_0^*). If r_T^* is relatively low then the secondary market price V_T will be relatively high, and vice versa. This dependence of current secondary market prices on current interest rates (and of future secondary market prices on future interest rates) will play a key role in our ultimate explanation for the slope of the yield curve.

Interest Rates and Yields—The securities pricing formula just presented can be used to help us tackle a second important question. Suppose we have a multiple payment security that is selling in the market at a known price. This could be either a newly issued security or a security sold in the secondary market. What is the annual interest rate on the security?

Since this security returns multiple payments, we cannot apply the annual interest rate formula that was presented on page 39. We can, however, exploit the fact that the annual interest rate on this security must be the rate that gives it its current market price—that is, the rate that makes the present value of its stream of future payments equal to its market price. Consequently, the market interest rate r_T^* must solve the equation

$$V_T = \frac{V_{T+1}}{1+r_T} + \frac{V_{T+2}}{(1+r_T)^2} + \ldots + \frac{V_N}{(1+r_T)^{N-T}}.$$

Here, V_T is the price of the security—which we are now assuming that we know—and V_{T+1}, V_{T+2}, ... , V_N are the remaining payments on the security.

Since this equation has only the single unknown r_T, we might expect to be able to solve it to obtain r_T^*.[11] This is usually accomplished using numerical methods. These methods proceed by starting with a guess for r_T^*, computing the associated present value, and adjusting the guess according to the sign and size of the difference between this value and the actual market price. An annual interest rate computed in this manner—that is, as the solution to a present value equation—is called a *yield.*[12]

We have now—finally!—learned enough to begin investigating the term structure of interest rates. One way to start is by constructing a *yield curve:* a diagram which, as noted above, displays the relationship between the remaining terms of, and the yields on, different securities.

[10]Some of these payments may be zero. In the case of a single-payment security, for example, there is only one remaining payment; it is received at date N.

[11]The fact that this equation is not linear rules out standard algebraic solution methods. If the security in question has only two payments remaining (if $N-T=2$), the equation can be transformed into a second-order polynomial equation and solved using the quadratic formula.

[12]For most of the rest of this paper the terms "interest rate" and "yield" will be used interchangeably. Unfortunately, participants in financial markets compute what they call interest rates on securities in a variety of ways, and some of them are significantly different from yields. These differences can be particularly important for securities with terms of less than a year. For details, see Mishkin (1989), pp. 82-92.

A problem we must confront in doing this is that many factors other than different remaining terms can cause differences in the yields on securities. These include differences in credit risk (that is, in the likelihood of default by the borrower) and in tax treatment. To isolate yield differences that are due solely to term differences, we need to compare the yields on securities that do not differ in these other characteristics. One simple way to do this is to compare the yields on securities issued by the U.S. Treasury. Treasury securities are issued with a wide variety of terms and are traded in a large and active secondary market—a fact that makes it possible to obtain a secondary market yield quotation for virtually any term. Treasury securities can also be thought of as essentially riskless, since the federal government is the only organization in the United States that can legally print money to cover its debts. Finally, the interest on all these securities is taxed on the same basis.

THE EXPECTATIONS THEORY

What does economic theory have to say about the term structure? As with most questions in economics, there are a number of differing views. The theory described below, however, is accepted, at least in part, by most economists interested in monetary and financial issues. It is called the expectations theory.[13]

A basic challenge for term structure theory is to explain two empirical regularities, or "stylized facts," of the interest rate term structure. These regularities can be described as facts about the slope or steepness of the yield curve at different points in time. One of them involves the direction the yield curve usually slopes: most of the time, the yield curve is gently upward-sloping. Another involves circumstances that seem to produce curves with unusual slopes: when short-term interest rates are relatively high, the yield curve is often downward-sloping; when short-term rates are relatively low, the curve is often steeply upward-sloping.

Linking Short-Term and Long-Term Interest Rates

A point of departure for the expectations theory is the role of secondary markets in transforming the effective terms of securities. Suppose, for example, that a lender owns a five-year Treasury bond which he purchased in the primary market. The bond is maturing, but the lender now wishes he had lent for 10 years. If he takes the maturity payment on his five-year bond and uses it to purchase a second five-year bond, he will, in effect, have lent for 10 years. The only difference between this and the single 10-year loan is that the rate of return the lender receives over the coming five years will be determined by current market conditions, rather than conditions five years ago.

Suppose, conversely, that this lender owns a 10-year Treasury bond which he purchased five years ago. He has now decided that he needs his money and would have preferred to have lent for five years. If there were no secondary market, he would be stuck: he would not be repaid by the Treasury until the bond matured five years in the future. The secondary market allows him to receive early repayment indirectly, by selling his bond to another lender. If he chooses to sell the bond, he will, in effect, have lent for five rather than 10 years. The only difference between this and a true five-year loan is that the amount of the repayment (the sale price of the bond) will depend on current market conditions, rather than conditions five years ago.

Now suppose (rather unrealistically) that there is no uncertainty about future interest rates, so that lenders today know exactly what market yields on securities with different terms will be five years in the future. Suppose further that they know that the future five-year Treasury yield will be identical to the current five-year yield—say, 7½ percent. How will this affect the current yield on 10-year Treasury securities?

[13]Early statements of the expectations theory include various works of Irving Fisher [see the citations listed by Wood (1964), p. 457, footnote 1]. The theory was elaborated by Keynes (1930), Lutz (1940) and Hicks (1946); these authors proposed a variant of the expectations theory that has become known as the liquidity premium theory. This variant will be described at some length below. The most prominent alternative to the expectations theory is the market segmentation theory of Culbertson (1957). Another variant of the expectations theory, which combines elements of both the liquidity premium and market segmentation theories, is the preferred habitat theory of Modigliani and Sutch (1966).

We can answer this question by process of elimination, ruling out possibilities that are clearly wrong until we are left with a single one that must be right. Suppose first that the current yield on 10-year Treasury bonds is higher than 7½ percent. We have seen that if a lender sells such a bond after five years, the yield to maturity its buyer will receive must be exactly the same as the yield on a newly issued five-year bond he might purchase instead. This future five-year yield, we have assumed, will be exactly 7½ percent. Consequently, the (five-year) yield the original lender will receive when he sells the 10-year bond, after holding it for five years, must be higher than 7½ percent: otherwise, the bond's 10-year yield, which is the average of its yields for the first and second five years, could not exceed that figure. But if it is possible to obtain a five-year yield of more than 7½ percent by purchasing a 10-year bond and selling it after five years, why would any current lender buy a newly issued five-year bond, or a secondary bond with five years left to run—each of which, according to our assumptions, will yield exactly 7½ percent? Clearly, if five-year bonds are to survive in the current market, the current yield on 10-year bonds must not in fact be higher than 7½ percent.

Now suppose that the current yield on 10-year bonds is lower than 7½ percent. Then if a lender buys a five-year bond today, he will receive a yield over five years that is higher than the 10-year yield. If he wants to lend for 10 years, he can use the maturity payment on the first five-year bond to purchase a second five-year bond. Since we have assumed that the yield on this second bond will be exactly 7½ percent, the average yield he receives over the 10-year period will also be exactly 7½ percent. This average yield is higher than the 10-year bond yield, however; consequently, no current lender will buy a 10-year bond. If 10-year bonds are to survive in the current market, their yields must not in fact be lower than 7½ percent.

We have just seen that if five- and 10-year bonds are to coexist in the market, the 10-year bond yield can be neither higher nor lower than the five-year bond yield. This means, of course, that it must be equal to the five-year yield. An argument of the same sort could be applied, with equal ease, to any long term, and any pair of short terms that sum to it. Thus, under these assumptions, *if lenders know that short-term rates will remain constant in the future, current long-term rates must be equal to current short-term rates,* so that the yield curve will be perfectly flat.

Now suppose that instead of knowing the five-year rate will remain constant for the next 10 years, we know it will remain constant (at 7½ percent) for five years, and then rise to 10 percent. What must the current rate on a current 10-year security be? Notice that if a lender purchases a five-year bond yielding 7½ percent today, and rolls it over for a second five-year bond yielding 10 percent, he will receive an average annual rate of 8¾ percent over the 10-year period. Under the circumstances, he would be foolish to lend for ten years at any rate lower than 8¾ percent. Conversely, suppose that the U.S. Treasury wishes to borrow for a period of 10 years. If it borrows by issuing a five-year bond and then rolls the loan over for a second five years, it pays an average annual rate of 8¾ percent. Clearly, it would be foolish to offer more than 8¾ percent on its 10-year bonds.

Extending this argument to different long terms and different combinations of short terms that sum to them leads to the following prediction: *if there is no uncertainty about future interest rates, current long-term rates must be an appropriately weighted average of current and future short-term rates.*

Notice that, for the purposes of this prediction, a "long" term does not have to be long by conventional standards. A two-year rate, for instance, must be a weighted average of current and future one-year rates, while a six-month rate must be a weighted average of current and future three-month rates, etc. Clearly, it would be helpful to have a baseline "very short-term" rate to organize these sorts of predictions around. A natural candidate would be the rate on a riskless security with a term of zero.

What kind of security has a zero term? One example would be a security on which you can get your money back at any time. We have securities like this in the form of *demand deposits* or checking accounts. While these deposits are not issued by the U.S. Treasury, the fact that they are insured by the federal government makes them virtually as safe as Treasury securities.[14] We can consequently

[14]Strictly speaking, this is true only for personal deposits, and only up to a maximum of $100,000 per deposit.

define the baseline interest rate, r^0, as the rate on a perfectly safe zero-term security and identify it in practice with the market rate on federally insured bank deposits.[15]

We can now state a mathematical rule for determining the rate of interest on a security with a term of N as a function of the base rate r^0. (We must continue to assume that financial market participants know the levels of future rates.) Let r_0^0 represent the current rate of interest on a federally insured demand deposit. Let r_K^0 represent the value of this same rate beginning at date K, when there will be a one-time, permanent change in the rate. Let r_0^N represent the current rate on a security with a term of N. (We will refer to r_0^N as a term-adjusted rate; the rationale for this usage will become clear later in the paper. Notice that we are letting subscripts represent dates, and superscripts terms to maturity.) Then

$$(*)\quad r_0^N = r_0^0,\ 0 < N \leq K, \text{ and}$$

$$r_0^N = \frac{r_0^0 K + r_K^0 (N-K)}{N},\ N > K.$$

The coefficients K of the current base rate r_0^0, and N−K of the future base rate r_K^0, are the appropriate weights referred to in the italicized prediction on page 42. Here, K is the number of years at which the base rate will stay at its original level r_0^0, and N−K is the number of years at which it will stay at its new level r_K^0. While this formula has been stated for the case in which market rates will change only once, it is easy to generalize to cover the case of multiple base rate changes.[16]

A yield curve drawn under the assumption that lenders know that the base rate will fall in the near future (that K is not very large, and that $r_K^0 < r_0^0$) is displayed in figure 1.[17]

The assumption that lenders have complete and perfect knowledge about future interest rates is not very realistic. A more reasonable assumption might be that there is some uncertainty about future rates, but that lenders know their *expected values*—that is, their best forecasts, given the information available. If lenders base their decisions entirely on these best forecasts, then formula (*) is still a valid description of the expectations theory provided that the rate r_K^0 is interpreted as the expected value of the term-zero rate at date K. People who behave like this—those who base their decisions entirely on the forecast provided by the expected value—are said to be *risk neutral.*

Systematic slope changes—We can now explain one of the two empirical regularities identified in the introduction: the fact that yield curves tend to be steeply upward-sloping when when short-term interest rates are low and often slope downward when short-term rates are high. Before we can do this, however, we need to consider what we mean when we say that interest rates are "low" or "high." Is a 20 percent short-term rate high, for example? In the United States, the answer to this question is almost certainly "yes." In Israel, or Argentina, however, the answer to the same question would almost certainly be "no." This is because in recent U.S. history interest rates have rarely risen as high as 20 percent and, when they have done so, have quickly returned to lower levels. In recent Israeli or Argentinian history,

[15]A complication arises because demand deposit accounts do not pay interest, while functionally equivalent checkable accounts [negotiated order of withdrawal (NOW) accounts and money market deposit accounts (MMDAs), for example] are interest-bearing. Most economists believe that demand deposits pay interest indirectly, since banks that issue them typically do not charge fees that cover the costs of maintaining the accounts and providing funds transfer (checking, etc.) services. These issues are discussed and the implicit interest rates on demand deposits estimated by Klein (1974) and Dotsey (1983), among others. We will interpret r^0 as this implicit demand deposit rate, or, equivalently, as the explicit interest rate on NOW accounts or MMDAs issued by institutions that do charge cost-covering fees. Under this interpretation, r^0 will be a positive number.

[16]Suppose we know that the base rate will change at future dates $K_1, K_2, \ldots, K_J$, and that the new base rates at these dates will be $r_{K_1}^0, r_{K_2}^0, \ldots, r_{K_J}^0$. For notational convenience, call the current date (heretofore date 0) date K_0. Then the current term-adjusted rate on a security with a term of N ($N > K_J$) will be given by

$$(**)\quad r_0^N = \frac{\left[\sum_{i=0}^{J-1} r_{K_i}^0 (K_{i+1} - K_i)\right] + r_{K_J}^0 (N - K_J)}{N}.$$

Both formulas (*) and (**) are approximations of the exact formulas. For details, see the shaded insert on the following page.

[17]Along the horizontal axis in figure 1, N′ represents a particular term longer than K, and $r_0^{N'}$ the term-adjusted rate on a security with that term. Since N′ is fairly close to K, the weighted average that determines $r_0^{N'}$ is strongly influenced by the K years at which the base rate will remain at its original, high level r_0^0. As the term lengthens, the influence of this period wanes and the term-adjusted rate gets closer and closer to the new, lower base rate r_K^0.

The Exact Formula Linking Short- and Long-Term Rates

Both formula (*) and the generalized version presented in footnote 16 are linearized approximations of the exact formula. The exact version of formula (*) states that, if r_0^0 is the current base rate, and r_K^0 is the base rate at date K, then the current N-period term-adjusted rate r_0^N satisfies the relationship

$$(1+r_0^N)^N=(1+r_0^0)^K\ (1+r_K^0)^{N-K},$$

which implies

$$r_0^N=\sqrt[N]{(1+r_0^0)^K\ (1+r_K^0)^{N-K}}-1.$$

If we know the base rate will change at future dates $K_1, K_2, \ldots, K_J$, and that the new base rates at these dates will be $r_{K_1}^0, r_{K_2}^0, \ldots, r_{K_J}^0$ [again, for notational convenience, calling the current date (date 0) date K_0, and the terminal date (date N) date K_{J+1}], then the current term-adjusted rate on a security with a term of N ($N > K_J$) satisfies the relationship

$$(1+r_0^N)^N=\prod_{i=1}^{J+1}(1+r_{K_{i-1}}^0)^{K_i-K_{i-1}}$$

[here $\prod$ is the multiplicative analogue of $\sum$].

This implies

$$r_0^N=\sqrt[N]{\prod_{i=1}^{J+1}(1+r_{K_{i-1}}^0)^{K_i-K_{i-1}}}-1.$$

Fortunately, the approximations given by the linearized formulas are adequate for most purposes. In the case described on pp. 42 of the text, for instance, the yield given by the exact formula is 8.743 percent, compared to the linearized figure of 8.750 percent.

The expectations theory can also be shown to imply that, if r_0^N is the current N-period term-adjusted rate, and r_0^K is the current K-period rate, then r_K^{N-K}, the term-adjusted rate on (N−K)-period securities that is expected to prevail at date K, satisfies the relationship

$$(1+r_K^{N-K})^{N-K}=(1+r_0^N)^N/(1+r_0^K)^K,$$

which implies that

$$r_K^{N-K}=\sqrt[N-K]{(1+r_0^N)^N/(1+r_0^K)^K}-1.$$

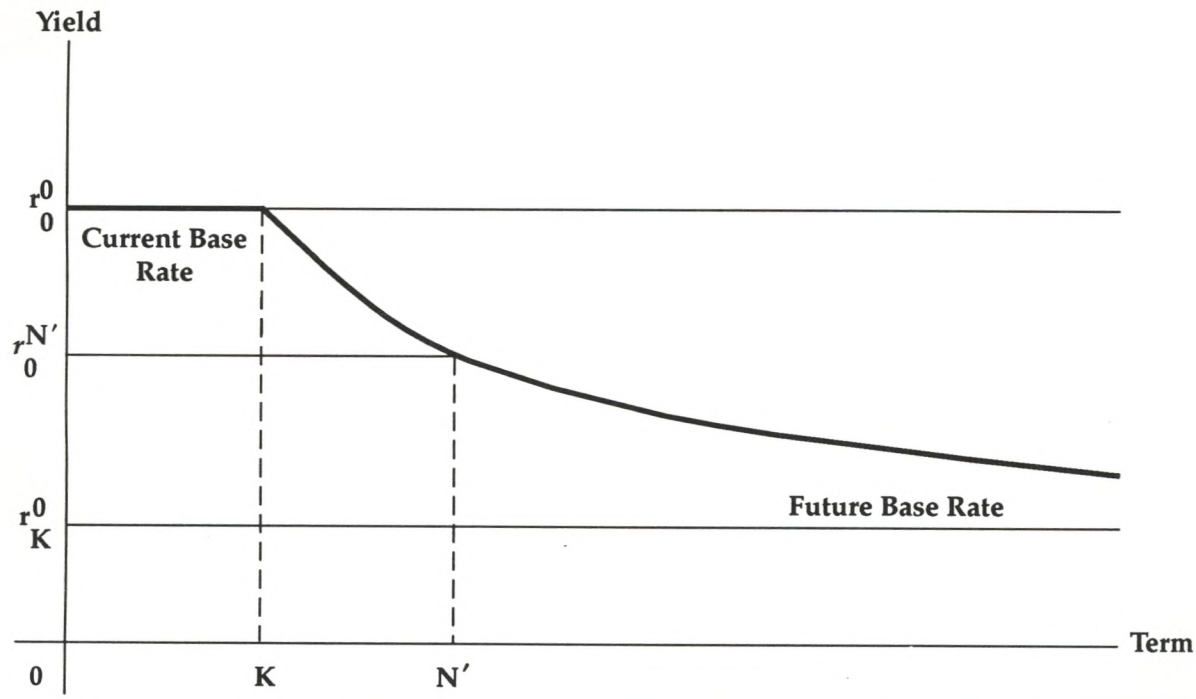
The rate r_K^{N-K} is often referred to as the "K-period forward rate" on a security with a term of N−K. The expectations theory is often described as a theory that identifies the forward rate with the expected future spot rate.

by contrast, rates have rarely fallen as low as 20 percent and, when they have done so, have quickly returned to higher levels.

When we say that interest rates are high or low, what we usually mean is that they are high or low relative to recent historical experience, and that we feel this experience gives us a good deal of guidance about the level of interest rates in the future. Thus, when we say interest rates are high we usually expect them to fall in the future, and vice versa. As we have just seen, the expectations theory predicts that when we expect rates to fall the yield curve will slope downward, and that when we expect them to rise the curve will slope upward.

The simple expectations theory has the virtue of great flexibility: if you are willing to make sufficiently artful assumptions about lenders' expectations about the pattern of future interest rates, you can use this theory to explain the shape of virtually any yield curve. The theory provides an explanation for one basic empirical regularity about yield curves that is rather difficult to believe, however. The regularity in question is that most of the time, during the last century at least, yield curves have been distinctly

Figure 1
Term-adjusted Yield When the Base Rate Will Fall in the Future



upward-sloping.[18] The simple expectations theory could explain this only by assuming that lenders usually expect rates to rise persistently over time. This assumption does not seem plausible, unless you believe that lenders were extremely poor forecasters. While interest rates have varied considerably during the past century, there is little evidence that they have increased on average, or that market participants had any reason to expect them to do so. Indeed, the evidence suggests that people usually expect future short-term interest rates to remain near current levels.[19] What we need, then, is a modified version of the theory that will predict an upward-sloping yield curve under this assumption.

Interest Risk, Term Premia and the Slope of the Yield Curve

Any alternative explanation for the fact that yield curves are normally upward-sloping must be based on something about long-term securities that makes them systematically less attractive to lenders than short-term securities. As we have just seen, the expectations theory predicts that, if lenders know for certain that short-term interest rates will remain constant, they should

[18]See Malkiel (1970), pp. 5-6, 12; Kessel (1965), pp. 17-19; and Shiller (1990), p. 629. It is sometimes asserted that yield curves were usually downward sloping during the late nineteenth and early twentieth centuries: see Meiselman (1962), appendix C, and Homer and Sylla (1991), pp. 317-22, 403-09 for descriptions and explanations of this phenomenon.

[19]The simple statiscal models of interest rate behavior that explain the data best are based on the assumption that rates have a long-run average or mean level and tend to return toward that level, rather slowly, after departing from it. These models imply that, if short-term interest rates are currently near their mean level (where they should be most of the time), they should be expected to stay near the current level in both the short and the long run, and that, even if they are far from the mean level, they should be expected to stay near the current level in the short run.

be indifferent between lending by purchasing short-term securities and lending by purchasing long-term ones. Long- and short-term interest rates should consequently be equal, and the yield curve should be flat. This prediction implies that any alternative explanation for the upward slope of the curve must be based on the effects of uncertainty about future interest rates.

Interest Risk and Capital Losses—One reason why uncertainty about interest rates may influence the behavior of lenders is that unanticipated changes in interest rates affect the value of their securities in the secondary market. Suppose, to return to an earlier example, that a lender buys a 10-year security that returns a yield of 7½ percent and sells it in the secondary market after five years. If interest rates have remained unchanged in the interim, the secondary market price of his security will give him a five-year yield of 7½ percent. If they have risen, the price will be lower, and he will receive a lower yield.

As we have already noted, the reason for these price and yield changes is that a security sold in the secondary market must compete with primary market securities with the same term as its remaining term. If the market interest rate on primary securities has risen, the yield on secondary securities must rise to the same level; since the remaining payments on these securities are fixed, this rise can be arranged only through a decline in the securities' market price. A formal way to see this is by inspecting the secondary market pricing formula for a single-payment security:

$$V_T = \frac{V_N}{(1+r_T^*)^{N-T}}.$$

If $r_0^* = r_T^*$, so that interest rates have not changed since this security was issued, its price will be

$$\hat{V}_T = \frac{V_N}{(1+r_0^*)^{N-T}}.$$

It is easy to check, by applying the annual interest rate formula, that both the T-year *ex post* yield on this security (the yield from date 0, when it was issued, to date T, when it is sold) and the N-T year *ex ante* yield (the yield from date T, when it is sold, to date N, when it will mature) are equal to the initial rate r_0^*.

We will call $\hat{V}_T$ the anticipated price of this security. If the actual price V_T exceeds the anticipated price $\hat{V}_T$, we say the original lender has experienced a *capital gain*. The amount of the gain is simply $V_T - \hat{V}_T$. If the anticipated price falls short of the actual price, the lender has experienced a capital loss in the amount $\hat{V}_T - V_T$. It is clear from our pricing formula that capital gains occur if r_T^* falls short of r_0^* (if market interest rates have fallen), and vice versa. This means that lenders' expectations about future capital gains and losses must be tied to their expectations about future interest rates.

What should we assume about expectations regarding future interest rates? As we noted toward the end of the previous section, it seems reasonable to assume that market participants recognize that interest rates may change, but expect them to remain constant on average.[20]

[20]The expectations theory offers no explanation for the reasons market participants might expect short-term rates to change. It is a theory that attempts to explain the levels of long-term interest rates relative to the current levels of short-term rates, not one that attempts to explain their absolute levels. Stated differently, the expectations theory is not a true theory of the *determination* of interest rates. Market participants may expect short-term interest rates to change because they expect changes in any of the innumerable factors economic theory predicts might influence them.

Economic theory suggests that interest rates of the sort discussed in this article (money or *nominal* interest rates) are sums of real interest rates (rates expressed in terms of the purchasing power of the dollar amounts lent and repaid) and expected rates of inflation. This is the so-called Fisher equation. As a result, the question of interest rate determination is sometimes thought of as two questions: what determines real interest rates, and what determines inflation expectations. Most economists believe that nominal factors (such as changes in the levels or growth rates of monetary aggregates) play the principal role in driving inflation expectations, while real factors (such as technological changes, changes in the perceived attractiveness of investment opportunities, changes in demographic structure or changes in the nature of financial regulation) play the principal role in real interest rate determination. There is, however, considerable disagreement about the degree of interaction between nominal and real factors, and especially about whether changes in nominal factors can have persistent effects on real interest rates.

Under this assumption, the expected capital gains on future secondary market sales of securities are approximately zero.[21]

It seems conceivable that this situation might not bother lenders. Economists usually assume, however, that the satisfaction a person derives from an extra dollar's worth of expenditures declines as the total value of his expenditures increases. If this is so, he will find the gain in satisfaction provided by the extra goods he can purchase if his returns exceed his expectations to be smaller than the loss in satisfaction from the goods he will have to refrain from purchasing if his returns fall short of his expectations. This should cause actuarially fair (zero expected loss) uncertainty about the future returns on his securities to upset him. A person who behaves like this is said to be *risk averse.*

Since buying term securities exposes lenders to actuarially fair return uncertainty, while buying securities with zero terms (such as demand deposits) does not, risk averse lenders will be reluctant to buy term securities. They will insist on higher expected yields on term securities than on demand deposits to compensate themselves for the uncertainty. The notion that financial decisionmakers are risk averse is widely accepted by economists, and we will adopt it without further discussion.

Interest Risk and the Term Structure—We have just explained why term securities tend to have higher yields than demand deposits when both are default-free: term securities carry interest risk, but demand deposits do not. We have not yet explained why securities with longer terms tend to have higher yields than those with shorter ones. Our discussion certainly suggests a possible explanation, however: longer-term securities may carry more interest risk than shorter-term ones. But why should this be the case?

We will begin our investigation of this question by posing another question that is closely related. Suppose we have two single-payment securities with different terms, but the same original (date 0) prices and yields. If market interest rates remain unchanged, their current (date T) prices will also be identical, even though their maturity payments will not be. But suppose that the market interest rate—specifically, the market "base rate" r^0—rises by a fixed amount from date 0 to date T (so that $r^0_T = r^0_0 + \Delta r$, with $\Delta r > 0$). Which security will fall furthest in price?

Notice that the remaining term of the short-term security will be smaller than that of the long-term security; if we call the short term N_s, and the long term N_l, then the remaining terms of these securities are $N_s - T$ and $N_l - T$, respectively. Since market yields have risen, the short-term secondary security must generate extra interest to compete with newly-issued short-term securities. The amount of extra interest will be approximately $\Delta r V_T(N_s - T)$; this is the rate increase Δr, applied to the (common) secondary market price V_T, for each year of the remaining term $(N_s - T)$. The long-term security must also generate extra interest; in this case, the amount is $\Delta r V_T(N_l - T)$. This is the same rate increase, applied to the same base price, but continued for $N_l - N_s$ additional years.

Of course, neither security can really produce "extra interest" in the conventional sense. The interest is paid indirectly, as part of the maturity payment, and the time and date of that payment are fixed. Instead, the price of each security must decline far enough so that it can increase at the new (and higher) annual rate r^0_T, while still reaching the fixed maturity payment V_N at the maturity date N. Since the price of the long-term security will have to increase at this rate for a much longer time, it will have to fall much further than the price of the short-term security. The relative sizes of the two price declines will be approximately equal to the relative sizes of the securities' remaining terms. A security with four years left to run will suffer a price decline approximately double that of a security with the same secondary market price but only two years left to run, and so on.

The Term Premium—If the risk of capital loss on securities tends to increase in proportion to their remaining terms, lenders who demand interest compensation for bearing this risk will demand more compensation on long-term

[21]Since the secondary market price is computed by dividing the maturity payment by the gross interest rate 1 + r, an increase in the rate by a given percentage causes a fall in the price that is slightly smaller than the rise in the price caused by an equal percentage decrease in the rate. As a result, the expected price change is slightly positive. Although this effect is never very strong, it becomes more pronounced as the remaining term of the secondary security increases.

securities than on short-term securites.[22] This will tend to make the yields on longer-term securities higher than those on securities with shorter terms—that is, it will tend to make the yield curve upward-sloping.[23]

We can define the *term premium* on Treasury securities of a given term as the difference between the yield on those securities and the yield on federally insured demand deposits. That is,

$$\tau^N = r^N - r^0, \text{ or equivalently } r^N = r^0 + \tau^N,$$

where r^N represents the yield on N-term Treasury securities, and τ^N represents their term premium. We now have a theory that predicts that the term premium should increase systematically with the remaining term, and, more specifically, that it should increase *in proportion* to the remaining term. We can formalize this by writing

$$\tau^N = \tau(N) \equiv mN,$$

where m is a positive constant of proportionality. A plot of the sort of yield curve consistent with this prediction is displayed in figure 2.

We might refer to the number m as the *coefficient of risk aversion.* Different values of m can be thought of as indicating different degrees of lenders' risk aversion. If m is relatively high, a small increase in the term and, thus, in the risk of capital loss, will cause lenders to demand a good deal of compensation in the form of a large increase in the term premium. This is the kind of behavior we would expect from very risk-averse lenders. If m is low, on the other hand, it will take a large increase in the term, and, thus, the risk to cause lenders to demand much additional compensation. This is the kind of behavior we would expect from lenders who are not very risk-averse.[24]

It was pointed out earlier that lenders may not always expect the level of short-term interest rates—in particular, the level of the term-zero rate—to stay constant on average. When they do not, the base rates to which the term premia must be added will also depend on the term. These term-dependent base rates have been referred to as *term-adjusted rates,* and their current values have been denoted r_0^N. The actual yield should be the sum of the term-adjusted rate and the term premium:

$$r_0^N = r_0^N + \tau^N.$$

Abnormal Yield Curves—This latest addition to the expectations theory allows us to consider the role of the term premium in determining the shape of abnormal yield curves—the sort that appear when lenders expect interest rates to change in the future. In this case, the actual yield should be given by the sum of the term-adjusted rate (that is, the weighted-average base rate) and the appropriate term premium. This can produce curves that slope in one direction along one part of their range, but in the opposite direction along another part. If lenders expect interest rates to remain constant for a short period, and then fall sharply, for example, the yield curve will appear humped, sloping upward at very short terms, peaking near the term corresponding to the date at which rates are expected to decline, and sloping downward for a range of terms thereafter (see figure 3).[25] Curves with this shape are frequently observed shortly before economic recessions begin, presumably because interest rates tend to fall sharply during recessions.

---

[22]In reality, the increase in risk is slightly less than proportional to the term, but the deviation from exact proportionality is very small. We are implicitly assuming that the change in the base rate, if any, will occur at a known future date, and that the rate, having changed, will remain at its new level permanently. We are also assuming that T, the date of sale, is fixed and known.

[23]Early statements of the liquidity premium theory include Keynes (1930), Hicks (1946) and Meiselman (1962). The term "liquidity premium" is based on the notion that liquidity—the ability to sell an asset rapidly and without loss—is valuable to lenders, and lenders will charge interest premia on assets that are relatively illiquid. Since the risk of capital loss is the risk that an asset may ultimately be saleable only at a loss, the premium for capital loss risk is in a sense a liquidity premium.

[24]If $m = 0$, lenders do not require any compensation for the risk of capital loss. As noted earlier, lenders who behave in this manner are said to be risk-neutral.

[25]Note that if a normal yield curve (a hypothetical curve observed when interest rates are expected to remain constant, on average) is upward-sloping, the expectations theory does not always interpret an upward-sloping yield curve as an indication that the market expects interest rates to rise. To obtain the right directional signal, the slope of the observed yield curve must be compared to the slope of a normal curve. The theory now interprets an observed yield curve that is upward-sloping, but flatter than normal, as a signal that the market expects interest rates to fall slightly.

Figure 2
Yield Curve When the Base Rate Is Constant

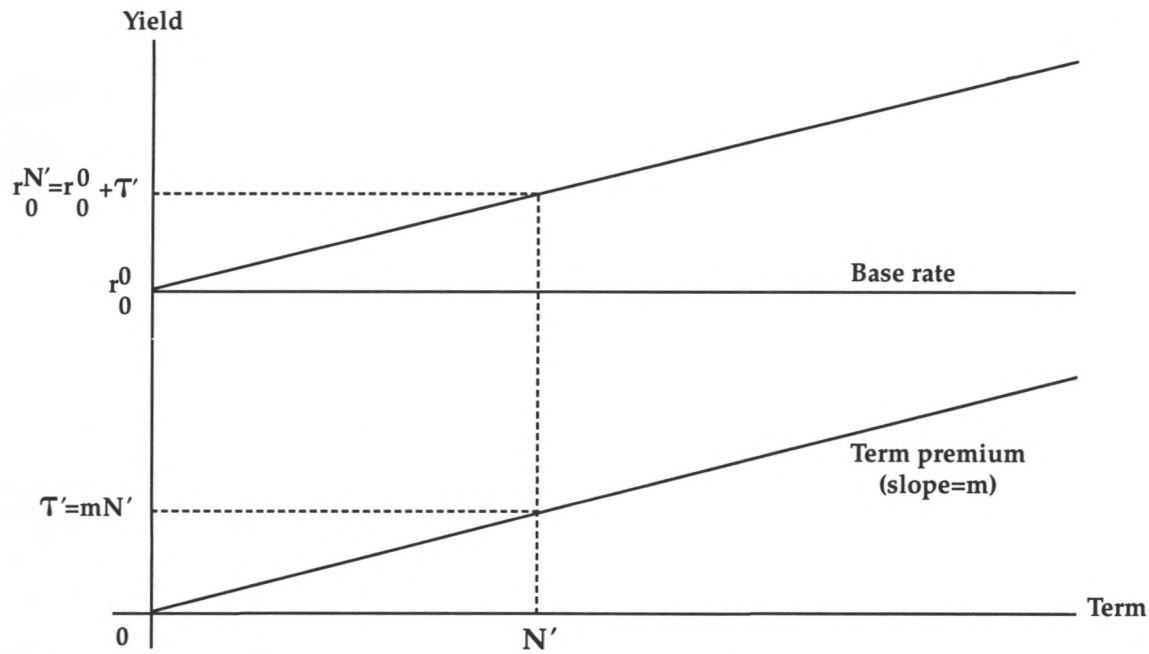
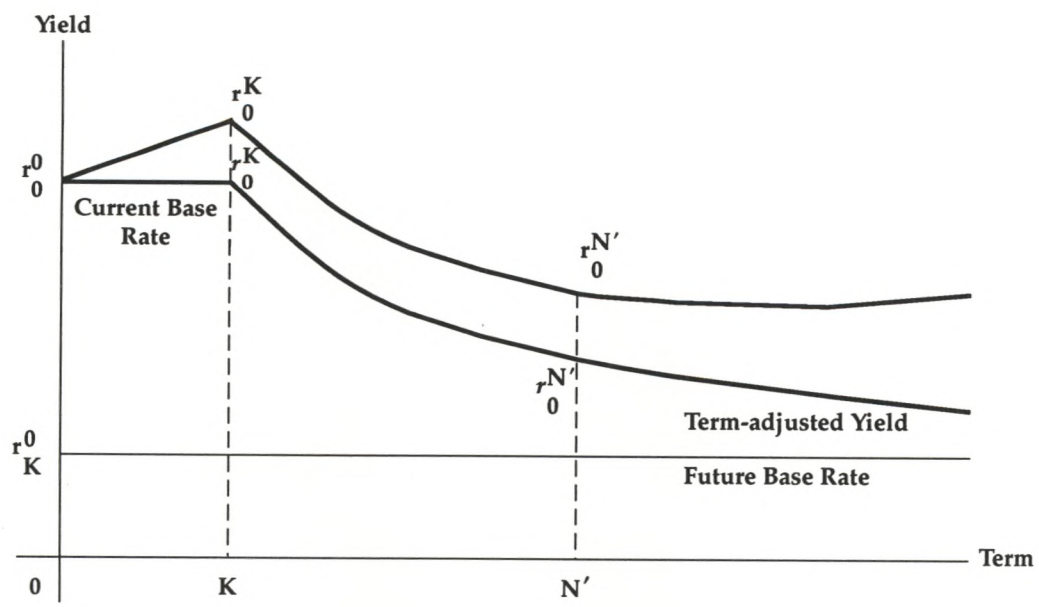


Figure 3
Yield Curve When the Base Rate Will Fall in the Future



CONCLUDING REMARKS

This article presents a basic description of the concepts and issues involved in the study of the term structure of interest rates. It has also presented a simple version of the expectations theory of the term structure. This theory predicts that the shape of the yield curve is determined by the expectations of financial market participants about the level of future interest rates and by their uncertainty about the accuracy of their expectations.

The analysis presented here suggests that the expectations theory can help explain two important "stylized facts" about yield curves: the fact that the steepness and direction of their slopes tend to vary systematically with the level of short-term interest rates, and the fact that they are usually upward-sloping. The explanation for the former fact is that forward-looking lenders will refuse to purchase term securities unless long-term interest rates are averages of the short-term interest rates that the lenders expect at various points in the future. The explanation for the latter fact is that the interest risk on securities tends to increase with their terms; this causes risk-averse lenders to demand amounts of interest compensation that also increase with the terms.

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The Great Deposit Insurance Debate

In the stress of the recent banking crisis ... there was a very definite appeal from bankers for the United States Government itself to insure all bank deposits so that no depositor anywhere in the country need have any fear as to the loss of his account. Such a guarantee as that would indeed have put a premium on bad banking. Such a guarantee as that would have made the Government pay substantially all losses which had been accumulated, whether by misfortune, by unwise judgment, or by sheer recklessness, and it might well have brought an intolerable burden upon the Federal Treasury.

—Sen. Robert Bulkley (D-OH),
Address to the U. S. Chamber of Commerce, May 4, 1933.[1]

The only danger is that having learned the lesson, we may forget it. Human nature is such a funny thing. We learn something today, it is impressed upon us, and in a few short years we seem to forget all about it and go along and make the same mistakes over again.

—Francis M. Law (1934), p. 41.

THE ONGOING PROLIFERATION of bank and thrift failures is the foremost current issue for financial regulators. Failures of federally insured banks and thrifts numbered in the thousands during the 1980s. The problem is especially important for public policy, because of the potential liability of the federal taxpayer. For example, by 1989, the Federal Savings and Loan Insurance Corporation (FSLIC) was so deeply overextended—on the order of $200 billion—that only the U. S. Treasury could fund its shortfall. The significance of insurance is seen elsewhere as well: economists are quick to point to flat-rate deposit insurance as a factor in causing the high failure rates. Flat-rate deposit insurance is said to create a moral hazard: if no one charges

[1]Quoted by Sen. Murphy (D-IA) in *Congressional Record* (1933), p. 3008.

bankers a higher rate for assuming risk, then bankers will exploit the risk-return trade-off to invest in a riskier portfolio.

Why, then, do we have taxpayer-backed, flat-rate deposit insurance?[2] A simple answer would be that the legislators who adopted federal deposit insurance in 1933 did not understand the economic incentives involved. This simple answer seems wrong, however. It has been pointed out that certain observers articulated the problems with deposit insurance quite clearly in 1933. In this view, the fault lies with the policymakers of 1933, who failed to heed those warnings.

This fails to answer why policymakers would ignore these arguments. Moreover, it does not explain why it should have taken almost 50 years for the flaws in deposit insurance to take effect. This paper examines the deposit insurance debate of 1933, first to see precisely what the issues and arguments were at the time and, secondarily, to see how those issues were treated in the legislation. Briefly, I conclude that the legislators of 1933 both understood the difficulties with deposit insurance and incorporated in the legislation numerous provisions designed to mitigate those problems.

The Banking Act of 1933 separated commercial and investment banking, limited bank securities activities, expanded the branching privileges of Federal Reserve member banks, authorized federal regulators to remove the officers and directors of member banks, regulated the payment of interest on deposits, and increased minimum capital requirements for new national banks, among numerous lesser provisions. It also established a temporary deposit insurance plan lasting from January 1 to July 1, 1934, and a permanent plan that was to have started on July 1, 1934.[3] Although this paper focuses on deposit insurance, it is important to bear in mind that both the deposit insurance provisions of the bill and the debate that surrounded them each had a larger context. The various provisions of the Banking Act of 1933 constituted an interdependent package.

The deposit guaranty provisions of the bill were initially opposed by President Roosevelt, Carter Glass (Senate sponsor of the bill and Congress's elder statesman on banking issues), Treasury Secretary Woodin, the American Bankers Association (ABA), and the Association of Reserve City Bankers, among others.[4] Despite this opposition, on June 13, 1933, the bill passed virtually unanimously in the Senate, with six dissents in the House, and was signed into law by the President on June 16.[5] Not surprisingly then, the public debate preceding and surrounding the adoption of federal deposit insurance was active and far-reaching.

This paper is organized around the major themes of the debate: the actuarial questions concerning the effects of deposit insurance, the philosophical and practical questions of fairness to depositors and of depositor protection as an expedient means to financial stability, and the political and legal questions surrounding bank chartering and supervision. Much of the debate

[2]The Federal Deposit Insurance Corporation (FDIC) has recently announced a move toward risk-adjustment of its insurance premia.

[3]The Act is often called the Glass-Steagall Act. It is referred to here as the Banking Act of 1933 to avoid confusion with the separate Glass-Steagall Act of 1932. Significantly, it also has the longer official title: "An Act to provide for the safer and more effective use of the assets of banks, to regulate interbank control, to prevent the undue diversion of funds into speculative operations, and for other purposes."

The temporary plan was later extended, and the permanent plan delayed, for one year (to July 1, 1935) by the Act of June 16, 1934. The Banking Act of 1935 substantially emended the permanent plan to resemble closely the temporary plan. See the shaded insert on page 72 for further details of the various plans.

[4]The Federal Reserve did not adopt an official position, although there is some evidence of opposition: "Deposit guaranty by mutual insurance is not part of the Presidential program, nor is it favored by Federal Reserve authorities," "Permanent Bank Reform" (1933); see also Kennedy (1973), pp. 217-18. Comptroller O'Connor favored deposit insurance; former Comptroller Pole opposed it.

[5]The Senate did not record a vote, although even Sen. Huey Long (D-LA), who had been a flamboyant detractor, rose to speak in favor of the bill. Cummings (1933) claims that the Senate vote was unanimous. The House dissenters included Reps. McFadden (R-PA), McGugin (R-KS), Beck (R-PA) and Kvale (Farmer/Labor-MN). See "Congress Passes and President Roosevelt Signs Glass-Steagall Bank Bill as Agreed on in Conference" (1933), p. 4192. Rep. McGugin's request for a division revealed 191 ayes and 6 noes; a quorum of 237 was reported present; *Congressional Record* (1933), p. 5898.

was motivated by economic and political self-interest and was structured rhetorically in terms of morality and justice. Considerable attention is paid here to rhetorical detail.[6] As much as possible, I have attempted to report the debate in its own terms—liberal use is made of quotations and epigraphs—rather than risk misconstruing the meaning through inaccurate paraphrase.

BACKGROUND TO THE DEBATE

The banking debate in 1933 covered not only deposit insurance and the separation of commercial and investment banking, but the full catalogue of financial matters: the gold standard, inflation, monetary policy and the contraction of bank credit, interstate branching, the relative merits of federal and state charters, holding company regulation, etc. By 1933, nearly anything to do with banks or banking was an important political issue.

The Great Contraction

> *The people know that the Federal Reserve octopus loaned ... to the gamblers of this Nation in 1928 some sixty billion dollars of credit money—bank money—hot air ... and then when the crisis came in the last 3 months of 1929, cut that credit money—bank money—hot air—down to thirteen billion.*
>
> *No nation, no industry, can survive such an expansion and contraction of money and credit. Give to me the power to double the money at will, and then give me the power to cut it square in two at will, and I can keep you in bondage.*[7]

It is reasonable to begin a recollection of the debate over deposit insurance with the price collapse on the New York Stock Exchange of October 29, 1929. The stock market crash was popularly recognized as the start of the Great Depression. The remainder of the Hoover administration's tenure witnessed historic declines in national economic activity. By the beginning of 1933, industrial production and nominal GNP had both been cut in half; unemployment had topped 24 percent. Bank failure rates, which had already been high throughout the 1920s, had increased fourfold, while both money supply and velocity had plummeted. The price level fell accordingly.

For contemporary economic commentators, the stock market crash was more than a marker between historical eras. For many, there was a causal relationship between the stock market's collapse and subsequent real economic activity. In most cases, this causality was more elaborate than *post hoc ergo propter hoc*. A prescient Paul Warburg, for example, warned in March 1929:

> If orgies of unrestrained speculation are permitted to spread too far, however, the ultimate collapse is certain not only to affect the speculators themselves, but also to bring about a general depression involving the entire country.[8]

The logic was that stock market speculation "absorbs so much of the nation's credit supply that it threatens to cripple the country's regular business."[9] A more radical theory was advanced by the "liquidationists," who held sway in influential circles of government and the academy.[10] For them, the cyclical contraction was a good thing: it reflected the liquidation of unsuccessful investments that crept in during the boom years, thus freeing economic resources for a more efficient redeployment elsewhere.

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[6]Most of what remains of the debate is formalized oratory: prepared speeches, Congressional debate, letters to the editor, etc. Because the debate was a cacophony of voices, rather than an orderly dialogue, no attempt has been made to present the arguments in chronological order. A time line of the significant events of 1933 is provided in the shaded insert on page 55.

In terms of the written record, academic economists entered the debate late, for the most part after the Banking Act of 1933 had already been signed into law. See H. Preston (1933), Westerfield (1933), Willis (1934), Willis and Chapman (1934), Taggart and Jennings (1934), Fox (1936) and Jones (1938). Phillips (1992) reports that Frank Knight and several colleagues at the University of Chicago advocated federal guaranty of deposits as part of comprehensive bank reforms proposed during the banking crisis in March 1933. Willis had been an advisor to Carter Glass since the debate over the Federal Reserve Act in 1912. Guy Emerson, who published in the *Quarterly Journal of Economics*, was not an academician, but an officer at Bankers Trust Co. and the 1930 president of the Association of Reserve City Bankers; Emerson (1934) is largely a paraphrase of Association of Reserve City Bankers (1933), which he co-authored.

[7]Rep. Lemke (R-ND), *Congressional Record* (1933), p. 3908.

[8]Warburg (1929), p. 569.

[9]Ibid., p. 571.

[10]De Long (1990) provides a valuable review of the liquidationist perspective. The liquidationists included Secretary of the Treasury Andrew Mellon, as well as the economists Friedrich von Hayek, Lionel Robbins, Seymour Harris and Joseph Schumpeter. More recent economic analyses have discounted the role of the crash in causing the Depression, emphasizing instead other forces, both monetary and non-monetary; see Wheelock (1992a) and the references therein.

Crisis and Unlimited Possibility

We are confused. We grasp, as at straws, for the significance of events and of proposed government action. Never before in our lives have we had such great need for someone to interpret underlying movements for our guidance.[11]

By 1933, the correlation between economic activity and bank credit was lost on no one. During the interregnum between Hoover's electoral loss in November 1932 and Roosevelt's inauguration in March 1933, what had been a debilitating banking malaise became a desperate crisis. Starting with Michigan, on Valentine's Day, whole states began to declare official bank holidays; elsewhere, individual banks in scores were suspending withdrawals. By inauguration day, March 4, most states had declared a holiday.[12] Even much earlier, bank failures had left whole towns without normal payment services, relegating them to barter.[13]

Theories of the connection between bank failures, monetary contraction and the more general macroeconomic torpidity were widespread and varied. Roosevelt, in his inaugural address, suggested that the set of people who correctly understood the nation's economic problems did not overlap with the set of people who had held the reins:

> Their efforts have been cast in the pattern of an outworn tradition. Faced by failure of credit they have proposed only the lending of more money. Stripped of the lure of profit by which to induce our people to follow their false leadership, they have resorted to exhortations, pleading tearfully for restored confidence. They know only the rules of a generation of self-seekers. They have no vision, and when there is no vision the people perish.[14]

To some extent, such a suggestion was accurate; Treasury Secretary Mellon and the liquidationists had initially refused even to admit that there was a problem.

Some proposed that complex intrigues were at work to sap the nation's wealth. Rep. Lemke (see the quote referenced in footnote 7), for example, advanced a monetarist thesis that both the boom of 1929 and the Depression were the intentional result of Federal Reserve policy. More conspiratorial still was Rep. McFadden's belief, advanced on the House floor, that "money Jews" lay behind the banking crisis.[15] Rep. Weideman, offering the metaphor that "the most dangerous beasts in the jungle make the softest approach," claimed that "international money lenders" had duped the Congress into creating a system for skimming bank gold reserves into a central pool "to feed the maw of international speculation."[16]

Alarm generated by the crisis and frustration at the lack of a remedy combined to expand the political horizons. Radical solutions were suggested. Informed by the political experiments under way elsewhere, relatively sober proposals were submitted to scrap the inefficient bureaucracies of representative democracy in favor of a fascist dictatorship or state socialism.[17] More

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[11]Love (1932), p. 25.

[12]Before deposit insurance, banks in financial trouble were generally treated like any other business. Closure might be declared by supervisors or the directors of the bank. One option was then to seek protection from depositors and other creditors by declaring bankruptcy and accepting a court-appointed receivership. In the case of a temporary liquidity problem, a bank might instead suspend withdrawals or close to the public until the problem could be resolved. In practice, the terms "failure" and "suspension" were often used interchangeably. In the period 1921-32, roughly 85 percent of failed banks—holding 76 percent of the deposits in failed banks—were state banks (including mutual savings banks and private banks). See Bremer (1935), especially footnote 1 and pp. 41-49.

See Federal Reserve Board (1934a), Colt and Keith (1933) or Friedman and Schwartz (1963) for a chronology of the banking crisis and the bank holidays. In a sense, Roosevelt had stage-managed the crisis. By refusing to participate with the outgoing administration over the banking situation, he projected the image of making a clean break with the past. At the same time, however, the resulting uncertainty surrounding his policy toward banking and the gold standard helped to provoke the crisis. See Kennedy (1973), pp. 135-55, or Burns (1974), pp. 31-51.

[13]See "What'll We Use for Money?" (1933).

[14]Roosevelt (1938), p. 12.

[15]McFadden lost his House seat over the incident. Scandalized by his comments, the Republican and Democratic parties, both of which had endorsed him in 1932, repudiated him in the 1934 elections. See Martin (1990), p. 249, and Rep. McFadden (R-PA), *Congressional Record* (1933), pp. 6225-27.

[16]Rep. Weideman (D-MI), *Congressional Record* (1933), pp. 3921-22. Weideman, in a conspiracy theory shared by the radio priest, Fr. Coughlin [see Chernow (1990), pp. 381-82], also claimed that the Great War had been orchestrated by international financiers, noting: "Six months after the Federal Reserve Act was passed the war began."

[17]See, for example, Ogg (1932), Calverton (1933) and Schlesinger (1960). Indeed, for many, the New Deal was state socialism. One must bear in mind that 1933 predated most of the failures and atrocities of the various European dictatorships. Although the collectivization of Soviet agriculture was largely complete, Stalin's great political purges did not begin until the mid-1930s. Mussolini was still widely respected as the man who had brought order and unity to Italy; the invasion of Abyssinia was not until 1935. In Germany, Hitler was only beginning to wrest control from the notoriously ineffectual Weimar republic; he became Chancellor in late January 1933, and the Nazis burned the Reichstag four weeks later.

A Chronology

1/10/33	Sen. Huey Long's filibuster of the Glass legislation begins.
1/21/33	Senate filibuster ends.
1/30/33	Hitler becomes Chancellor of Germany.
2/20/33	Prohibition repealed.
3/4/33	Franklin D. Roosevelt is inaugurated. 72nd Congress 2nd session ends. Senate of the 73rd Congress convenes in special session.
3/6/33	President Roosevelt declares a nation-wide bank holiday, lasting nine days.
3/9/33	Congress convenes in extraordinary session (first session of the 73rd Congress). The Emergency Banking Act is introduced, passed and signed into law.
5/15/33	Carter Glass introduces S. 1631.
5/17/33	Henry Steagall introduces H. R. 5661.
5/19/33	Arthur Vandenberg introduces an amendment to the Glass bill.
5/23/33	House passes Steagall bill.
5/26/33	Senate passes Glass-Vandenberg bill.
5/27/33	The Securities Act of 1933 signed.
6/12/33	World Monetary and Economic Conference opens in London.
6/13/33	Conference committee submits a conference report on the Banking Act to Congress. Banking Act of 1933 is approved by Congress.
6/16/33	President Roosevelt signs the Banking Act of 1933. First session of the 73rd Congress adjourns.
9/4/33	ABA Convention begins in Chicago (ends 9/7/33).
9/17/33	ABA President Frank Sisson dies.
1/1/34	Federal Deposit Insurance Corporation is chartered. Temporary deposit insurance begins.

popular was a flirtation with government by "technocracy," a small panel or cabinet of experts to replace the congressional and executive branches. Relative to alternatives such as these, federal deposit insurance—which had failed in Congress more than 150 times in the preceding 50 years—was a remarkably moderate option.[18]

Moral Overtones to the Debate

The money changers have fled from their high seats in the temple of our civilization. We may now restore that temple to the ancient truths. The measure of the restoration lies in the extent to which we apply social values more noble than mere monetary profit.[19]

Both proponents and opponents of the deposit guaranty features of the Banking Act took the rhetorical high ground in arguing their point. Indeed, recourse to morality in public debate was widespread. The "noble experiment" with the prohibition of liquor was still an issue in the 1932 election.[20] Oratory was laden with biblical imagery. Sen. Vandenberg (R-MI) referred to

[18]See FDIC (1951) and Paton (1932); Paton also cites H. R. 7806, introduced by Rep. Cable (R-OH) on January 15, 1932, and later revised as H. R. 10201. H. R. 7806 is omitted from the FDIC (1951) digest.

[19]Roosevelt (1938), p. 12.

[20]Prohibition was widely recognized as having failed by this time; see Kent (1932), p. 261. The Eighteenth Amendment was repealed in 1933.

"B. C. days—which is to say, Before the Crash. ..."[21] A. C. Robinson saw fit to lecture subscribers to the *ABA Journal* on the "Moral Values of Thrift," advising bankers of the need for "an unshakeable conviction of these ideals [truth and morality] and their ultimate triumph. 'If thou faint in the day of adversity, thy strength is small.' "[22]

For many, the Depression represented an atonement for the excesses of the bull market. By all accounts, 1929 was characterized by stock market speculation.[23] As the extent of the avarice became clear with hindsight, the notion of economic depression as punishment for economic transgression took hold:

> We are passing through chastening experiences, as severe for the banker as for anyone else, many of the illusions have disappeared and the trappings of a meretricious prosperity have been stripped from most persons.[24]

The notion of recession as a necessary purgative unfortunately extended to policymakers as well. Mellon's advice to Hoover exposes the pious foundations to the liquidationist view of the Depression:

> It will purge the rottenness out of the system. High costs of living and high living will come down. People will work harder, live a more moral life. Values will be adjusted, and enterprising people will pick up the wrecks from less competent people.[25]

This fluency with righteousness revealed itself on all sides of the deposit insurance debate. Both proponents and detractors of the deposit guaranty provisions of the Banking Act argued that their position was ultimately a matter of simple justice, which dare not be denied. The bankers declared that well-managed banks should not be forced to subsidize poorly run banks. Supporters of the legislation maintained that depositors should not have to bear the losses accruing to their bankers' mistakes. Those who felt that deposit insurance was a ploy to destroy the dual banking system painted a picture of the unit bank as the pillar of the national economy, untainted by corruption. The remainder of the paper is organized around these three loosely defined constituencies.

ACTUARIAL DIFFICULTIES

Opposition to deposit insurance can be roughly organized into two classes: objections on technical actuarial grounds, and objections to its anticipated impact on bank structure. The core constituency in the former category consisted of the money-center banks, with ABA President Francis Sisson, himself a Wall Street banker, taking the lead.[26] The economic motivation for their opposition was the belief that insurance meant a net transfer from big banks, where the bulk of deposits lay, to state-chartered unit banks, where they expected the bulk of the losses.

Insurance and Guaranties

> *In the law as written the guaranty plan is referred to not as a guaranty of bank deposits, but as an insurance plan. There is nothing in this plan that entitles it to be classed as insurance.*[27]
>
> *I think you gentlemen are all wrong to call this a guarantee of deposits. There is not a thing in the bill that talks about guarantee. It is an insurance of deposits.*[28]

The actuarial correctness of the term "deposit insurance" as a description of the proposed legislation was a point of contention. The alternative label, offered by opponents, was "deposit guaranty." One's choice of terms usually revealed where

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[21]Vandenberg (1933), p. 39.

[22]Robinson (1931), p. 209.

[23]"Orgy of speculation" was the catch phrase that captured the popular sentiment. For example, "Our Orgy of Speculation" (1929), p. 907, quotes Chancellor of the Exchequer Philip Snowden: "There has been a perfect orgy of speculation in New York during the last twelve months."

[24]Robinson (1931), p. 209.

[25]Hoover, quoted in De Long (1990), p. 5. *Bankers Magazine* offered it as a modern paradox, "that depressions are sent by heaven for the chastening of mankind." See "Modern Paradoxes" (1933). The liquidationists drew a sardonic retort from Keynes, who identified it as sanctimony masquerading as economics: "It would, they feel, be a victory for the mammon of unrighteousness if so much prosperity was not subsequently balanced by universal bankruptcy." See Keynes (1973), p. 349.

Mellon's advice also offers an example of a common tendency to anthropomorphize the economy, in this case as a system to be purged. For a more extreme example, see Taussig (1932), who draws an elaborate analogy between physicians and economists.

[26]The ABA (1933a) dissected the failure of the various state insurance schemes. The Association of Reserve City Bankers (1933) published a monograph late in the debate outlining the actuarial objections to deposit insurance.

[27]Association of Reserve City Bankers (1933), p. 27.

[28]C. F. Dabelstein, in ABA (1933b), p. 58. For similar remarks, see Rep. Beedy (R-ME), *Congressional Record* (1933), p. 3911; Sen. Glass (D-VA), ibid., p. 3726-27; and Donald Despain, quoted by Sen. Schall (R-MN), ibid., p. 4632.

one stood on the issue, and the semantic controversy became a microcosm of the actuarial issues involved.[29] By labeling the various schemes as plans to "guaranty" deposits, opponents were able to associate the plans immediately with the infelicitous recent experience with state deposit guaranty schemes (discussed in the next subsection). The natural response for supporters was to insist on a different label.

Both proponents and opponents devoted energy to identifying the desirable "insurance principle," which then either accurately described or failed to describe the proposed legislation.[30] Like blind men describing an elephant, however, few agreed on a definition for the insurance principle. This was so, despite Rep. Steagall's claim that the principle of insurance was "the most universally accepted principle known to the business life of the world."[31]

Deposit insurance was clearly similar in many respects to other types of insurance, which had been in widespread use in the United States for decades. Even the most ardent detractor recognized some resemblance:

> The general argument employed to promote the guaranty plan began with the premises that property can be insured and bank deposits are property. It travelled to the broad assumptions that the principle of the distribution of risk through insurance could be applied to bank deposits.[32]

The salient principles here, espoused repeatedly by supporters of the legislation, were the diversification of risk and the diffusion of losses. In this respect, a national plan would differ from the state plans, which had "violated the primary insurance tenet that risks must be decentralized and sufficiently spread so as to avoid concentrated losses."[33]

For others, the distinction between government and private backing defined the difference between insurance and guaranty. Both Sen. Glass and Rep. Steagall were adamant that coverage be provided privately, not by the government:

> This is not a Government guaranty of deposits. ... The Government is only involved in an initial subscription to the capital of a corporation that we think will pay a dividend to the Government on its investment. It is not a Government guaranty.[34]

> I do not mean to be understood as favoring Government guaranty of bank deposits. I do not. I have never favored such a plan. ... Bankers should insure their own deposits.[35]

The argument against government backing was outlined by Sen. Bulkley.[36]

An insurance feature included in both the Steagall and Glass bills and in Sen. Vandenberg's temporary insurance amendment to the Glass bill was a provision for depositor co-insurance.[37] The Glass and Steagall bills called for a progressive depositor copayment schedule: the first $10,000 would be covered in full, the next $40,000 would be covered at 75 percent, and only 50 percent of amounts over $50,000 would be covered; the Vandenberg amendment set a single coverage ceiling at $2,500. Some propo-

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[29]The FDIC (1951), p. 69, provides a clear distinction between insurance and guaranty. By their definition, a guaranty is a promise from the U. S. government to pay off depositors in a failed bank; insurance is paid from an independent private fund. There was no agreed definition for insurance or guaranty in 1933, however, although the explicit acknowledgement that "no clear distinction [between the terms 'guaranty' and 'insurance'] has been made," was rare; see Rep. Bacon (R-NY), *Congressional Record* (1933), p. 3959. W. B. Hughes also attempted to extricate the "inexcusable mixture of the two terms ... Guarantee is where you make the good bank pay for the poor one. Insurance is where you make those who get the benefit pay for it." See ABA (1933b) p. 59. I use the two terms interchangeably in this article.

[30]In fact there were numerous conflicting legislative proposals afoot. That of Henry Steagall, who chaired the House Banking Committee, was taken most seriously; it eventually became law. See FDIC (1951) and Paton (1932).

[31]*Congressional Record* (1933), p. 3836.

[32]ABA (1933a), p. 7.

[33]Sen. Vandenberg, *Congressional Record* (1933), p. 4239.

[34]Sen. Glass, *Congressional Record* (1933), p. 3729. See also footnote 28.

[35]Rep. Steagall, *Congressional Record* (1933), p. 3838.

[36]See the quote referenced by footnote 1. Similar concerns were voiced by Jamison (1933), p. 451: "The great urgency for balancing the national budget precludes even the thought of piling another subsidy on the shoulders of the already overburdened taxpayers."

These sentiments are especially noteworthy in light of recent attempts to paint the insurance schemes as having taxpayer backing from the start. For example, Title IX of the Competitive Equality Banking Act of 1987 states that Congress "should *reaffirm* that deposits up to the statutorily prescribed amount in federally insured depository institutions are backed by the full faith and credit of the United States;" (emphasis added).

[37]Co-insurance is the insurance practice of involving the insured party in some portion of the risk. Common techniques of co-insurance are coverage ceilings, deductibles and copayment percentages. The aim of such provisions is to mitigate the problem of moral hazard or the tendency of people to behave more riskily when insured.

nents saw no need for such mitigating features. Rep. Dingell (D-MI), for example, offered bankers no quarter; his idea was "to guarantee every dollar put in by the depositor from now on and to make the banker and the borrower pay the cost."[38] For Sen. Vandenberg, on the other hand, co-insurance was crucial; he complained angrily when Treasury Secretary Woodin proposed "not a limited insurance such as is included in the amendment which the Senate adopted, but a complete 100% guarantee."[39]

Opponents in the banking industry were unimpressed by such arguments. Although all of the proposals achieved a spreading of losses and many had other familiar features of insurance, such as co-insurance or provision for a large reserve fund, they still were not "insurance."[40] Francis Sisson was obstinate: "Detailed and technical differences in this bill as compared with former guaranty schemes do not differentiate it in essential principle from them."[41] For all their trouble, crafters of the legislation had failed to meet the bankers' standard for insurance, the principle of selected risks:

> Insurance involves an old and tried principle. The essence of insurance is the payment *by the insured* of premiums in *actuarial relation to the risk involved*. Under the terms of the permanent plan, however, the costs or premiums are not charged according to the risk.[42]

Roosevelt made a similar connection. In his first presidential press conference, he asserted:

> I can tell you as to guaranteeing bank deposits my own views, and I think those of the old Administration. The general underlying thought behind the use of the word 'guarantee' with respect to bank deposits is that you guarantee bad banks as well as good banks. The minute the Government starts to do that the Government runs into a probable loss.[43]

Although he associates the "guaranty" terminology with government backing, its defining characteristic is clearly the absence of selected risks.

Despite the attention given to selected risks in the debate, no significant attempt appears to have been made to include a risk-based premium in legislation. Emerson, for one, thought such an arrangement could work.[44] The ABA, on the other hand, thought it impossible:

> The apparently unsurmountable actuarial difficulty in the guaranty plan appears to be the impossibility of placing it on the basis of selected risks;

the risks involved were "wholly unpredictable," and banks were subject to "internal deterioration" when their deposits were guaranteed.[45]

History and Geography

As to the history of the guaranty plan, a wave of guaranty of state bank deposits laws swept over the seven contiguous western states of Oklahoma, Kansas, Texas, Nebraska, Mississippi, South Dakota and North Dakota and the Pacific Coast state of Washington in the period 1908-17. ... The laws establishing it were repealed or allowed

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[38] *Congressional Record* (1933), p. 489. More thoughtful commentators realized that the incidence of the cost could not be contained. Rep. Kloeb (D-OH), ibid., p. 489, challenged Rep. Dingell immediately: "Assuming that an assessment is made upon the bankers, how are we going to prevent that from sifting down to the depositors?" Similarly, Jamison (1933), p. 454, explained that, "while the banks would remit the premiums," they would also adjust their interest rates, so that, "in the end the banks' customers would pay the premiums."

[39] Quoted in "Congress Passes and President Roosevelt Signs Glass-Steagall Bank Bill as Agreed on in Conference" (1933), p. 4193. The proposal itself is surprising, given Woodin's strong objections to deposit insurance. Many others shared Vandenberg's view; see, for example, Sen. Glass, *Congressional Record* (1933), p. 3728; Sen. Bulkley (quoted by Sen. Murphy), ibid., p. 3007.

[40] There was disagreement about the reserve fund even after the legislation had been signed. The Association of Reserve City Bankers (1933), p. 28, asserted baldly that "no provision is made for building up a reserve fund as would be the case under a true insurance plan," while Sen. Vandenberg (1933), p. 39, contended that the plan was "capitalized with truly prodigal reserves" (any irony in his use of the adjective "prodigal" is doubtless unintended). The discrepancy lies in the fact that, unlike Vandenberg, the Association of Reserve City Bankers did not treat the FDIC's capital as an insurance reserve fund.

[41] Sisson (1933b), p. 31.

[42] Association of Reserve City Bankers (1933), p. 27, (emphasis in the original). "Selecting risks" refers to the practice of differentiating insured parties according to risk and charging insurance premia according to those risk classes. For example, 17-year-old men on average pose a greater risk to auto insurers than do 30-year-old men; therefore, 17-year-olds usually pay higher auto insurance premia.

[43] Roosevelt (1938), p. 37.

[44] Emerson (1934), p. 244, states, "To put such a provision [assessments levied according to risk] into effect would require the classification of the banks of the country according to various standards: geographical location, size, type, and character of banking policy. The last would present administrative difficulties, but these would not be insuperable." *Bankers Magazine* had also thought it feasible: "Presumably, an insurance company could be formed ..., which by carefully selecting its risks, might operate successfully." See "Protecting Bank Depositors" (1931), p. 435.

[45] ABA (1933a), pp. 42-43. Similarly, Jamison (1933), p. 454, argued that selection of risks in this context would present "complications that can not be easily overcome."

to become inoperative as one after another of the plans became financially insolvent and was recognized as serving to make banking matters worse.[46]

As in the case of branch banking, Nation-wide diversification of insurance risks would secure banking against any eventuality except such a national calamity as would destroy the Government itself.[47]

The "guaranty" terminology connoted the defunct state deposit guaranty plans, a specter that terrorized the bankers. The mere mention of deposit guaranties could induce a banker to show "every sign of incipient apoplexy."[48] At the same time, the unvarying failure of the state plans provided a trove of evidence for foes of the federal scheme.[49] Release of the ABA report coincided with the introduction of the Glass and Steagall bills in Congress. It found perverse delight in the failure of all eight of the state plans:

> Eight large scale tests, by practical working experience, of the guaranty of bank deposits plan as a means for strengthening banking conditions and safeguarding the public interest are a matter of record. Each one of these attempts failed of its purpose.
>
> Taken separately, special circumstances such as technical defects in the plan or faulty administration might be held accountable for the breakdown in any given instance, leaving it an open question as to whether the idea might not be successful under different circumstances. Taken as a composite whole, however, the failures of the various plans not only confirm one another in their defects, but each one also supplies added special features that were tested and found wanting.[50]

This unbroken string of failures demanded an explanation from supporters of federal legislation. Proponents chose to distinguish clearly the new plan from the state schemes: "there is no logical relationship between these old *State* Guarantees and this new *Federal* Insurance; no analogy; no parallel; and no reason to confuse the mortality of the former with the vitality of the latter."[51]

To make this case, supporters emphasized foremost the much broader geographic—and therefore industrial—diversification of a federal insurance fund. "The fact that bank-deposit-guaranty projects have failed in local, restricted areas only proves one of the fundamental principles of insurance, that is, that there must exist wide and general distribution and diversification."[52] In particular, the old plans were said to have suffered from a "one-crop" problem, that is, their application in states overwhelmingly dependent upon agriculture:

> There is a vast difference between what can be accomplished by a small number of banks in one State dependent upon a single crop and what can be successfully accomplished by the banking system of this great Nation that holds the financial leadership of the world in its hands.[53]

On this point, at least, the bankers were forced to concede.[54]

The bankers revealed the geographic breadth of the federal plan to be a two-edged sword,

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[46]ABA (1933a), p. 7. The seven states listed are not, in fact, contiguous.

[47]Rep. Bacon, *Congressional Record* (1933), p. 3959.

[48]Stephenson (1934), p. 35. There is a hint of truth in Stephenson's hyperbole. Francis Sisson died of heart failure within a fortnight of the ABA convention of September 1933 — which had included excoriating harangues [see Bell (1934)] delivered by Jesse Jones of the Reconstruction Finance Corporation and soon-to-be FDIC board member J. F. T. O'Connor; see "Death of Francis H. Sisson, Vice-President Guaranty Trust Co. of New York and Former President American Bankers Association" (1933), and O'Connor (1933). In a tribute at the next convention, Sisson's ABA colleagues offered that his death was "a tragic demonstration of devotion to duty even to the extent of exceeding the physical power of endurance ... He was a martyr to his work in your behalf." Nahm (1934), p. 30.

[49]Several groups dissected the state plans in the course of the debate; see American Savings, Building and Loan Institute (1933), ABA (1933a), Blocker (1929), Boeckel (1932), and the Association of Reserve City Bankers (1933). Reference was also made to an earlier essay by Robb (1921). There are also numerous retrospective accounts of the state guaranty plans, including Calomiris (1989 and 1990), Wheelock (1992b and 1992c), and Wheelock and Kumbhaker (1991); the most comprehensive, however, is Warburton (1959), parts of which appear in FDIC (1953 and 1957). The original legislation is collected in Federal Reserve Board (1925a and 1925b).

[50]ABA (1933a), p. 7.

[51]Vandenberg (1933), p. 39, (emphasis in the original).

[52]Donald Despain, quoted by Sen. Schall, *Congressional Record* (1933), pp. 4631-32. Virtually identical arguments are offered by Vandenberg (1933), p. 39, and Rep. Bacon, *Congressional Record* (1933), p. 3959.

[53]Rep. Steagall, *Congressional Record* (1933), p. 3838.

[54]For example, the Association of Reserve City Bankers (1933), pp. 31-32, acknowledged that, "It is suggested ... that a single crop failure could shake the stability of all the banks in a State. On a national scale the plan would operate upon a broader base. This is true."

Table 1

Estimated Assessments and Losses by Geographic Division

Geographic division	Percent of assessments in each division to total assessment	Percent of losses in each division during 1921-1931 to total losses
New England	7.6%	3.7%
Middle Atlantic	44.0	20.0
North Central	18.6	21.9
Southern Mountain	3.5	5.8
Southeastern	2.8	13.7
Southwestern	4.3	7.0
Western Grain	8.0	20.7
Rocky Mountain	1.8	4.5
Pacific Coast	9.4	2.7
United States	100.0%	100.0%

however, and used it to fight back. They exploited the well-known fact that bank failures throughout the 1920s had occurred disproportionately among small, rural banks (see table 1).[55] This information was used to argue that, with insurance premia assessed against deposits, the burden of funding federal deposit insurance—had it existed during the 1920s—would have been borne in large measure by the money center banks of the Northeast, where much of the industry's deposit base lay. The benefits of insurance, however—the payments to cover losses in failed banks—would have gone south and west.

Subsidy and Discipline

> *For it is to be remembered that the weak banks get the same insurance as the strong ones, and, unlike the situation in other kinds of insurance, the bad risk pays no more for its insurance than the good one. This means competition among banks in slackness in the granting of loans. The bank with the loose credit policy gets the business and the bank with the careful, cautious credit policy loses it. The slack banker dances and the conservative banker pays the fiddler. If the conservative banker protests, the slack one invites him to go to a warmer climate. Soon all are dancing and the fiddler, if paid at all, must collect from the depositors or from the taxpayers.*[56]

For those who opposed deposit insurance on actuarial grounds, such technicalities were merely manifestations of a more fundamental issue. As a matter of principle, deposit insurance was held to be unjust. It involved the forced subsidization of poorly managed banks by well managed institutions; it subsidized the "bad" banker at the expense of the "good." This moral point provided substantial emotional force. Opponents concluded that only good bank management could ultimately assure safe and sound banking.

Their argument, founded in actuarial theory and the experience of the state plans, proceeded in two steps. First, by protecting depositors against loss, a deposit guaranty would destroy discipline; insured depositors would take no interest in the quality of their bank's management. Recalling the state plans, the guaranty had created "a sense of false security and lack of discrimination as between good and bad

[55]The table is reproduced from Association of Reserve City Bankers (1933), p. 26. See Bremer (1935) and Upham and Lamke (1934) for analyses of failures in the 1920s.

[56]E. W. Kemmerer of Princeton University, speaking to the Savings Bank Association of Massachusetts on September 14, 1933, and quoted in Association of Reserve City Bankers (1933), pp. 40-41. Kemmerer was the economic advisor to the comission that produced the latter. Similar thoughts were offered by Jamison (1933), p. 451: "Government guaranty of bank deposits can be but one of two things — an outright subsidy ... or a plan of insurance." Bradford (1933), p. 538, added: "Such subsidization of weak banks by the Government, however, carried out on the basis of taxpayers' money, is so monstrous as to be almost unthinkable."

banking."[57] In many minds, this dichotomy between good and bad bankers was the central issue.[58] *Bankers Magazine* editorialized that "the surest reliance of good banking is to be found in the men who manage the banks rather than in the laws governing their operations."[59] In 1931, ABA President Rome Stephenson contended

> that, a large element in the internal conditions of the banks that failed was bad management and that a predominant element in the internal conditions of the bank that remained sound in the face of the same external conditions was good management.[60]

What was needed was to teach "the conception of scientific banking."[61]

The second step in the logic of opposition was an objection to the subsidy implicit in a guaranty. In the tones of a prudish parent, the ABA complained that the beneficiaries of state systems had been the "bankers with easier standards," who gained competitive advantages over those with "sounder but less attractive methods."[62] The subsidy was especially problematic among those banks "which have little chance of ultimate success."[63]

> A bank which does not earn a fair average rate of return over a period of years not only is unable to build up reserves against bad times, but, in order to improve profits, is under constant temptation to take risks which in the end are likely to lead to failure.
>
> The tendency of a guaranty plan will be to nurture these unprofitable units and keep them going temporarily in the knowledge that upon failure the losses can be shifted to other banks.[64]

Thus, the subsidy was seen to extend beyond the simple protection of unsound institutions from the competitive pressures of vigilant depositors. Given their contention that, "no provision is made for building up a reserve fund," losses charged to the insurer by failing banks would have to be recouped after the fact from the survivors.[65] Such a system would necessarily entail transfers of wealth from surviving to failed banks.

There was no consensus in Congress on the importance of discipline; some members pointed out that life insurance was no incentive for suicide.[66] The framers of the Glass and Steagall bills, however, recognized the validity of the bankers' objections and addressed the issue directly. Both bills, as well as the temporary in-

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[57]ABA (1933a), p. 13.

[58]The advertisement above depicts an insurer's characterization of the bad banker. Coincidentally, President Roosevelt had been a vice-president for the Fidelity and Deposit Co. of Maryland after his unsuccessful Vice-Presidential bid in the 1920 election.

[59]"Federal Guaranty of Bank Deposits" (1932), p. 381.

[60]Stephenson (1931), p. 592.

[61]Ibid., p. 592.

[62]ABA (1933a), p. 25. More specifically, "greater numbers than ever of undercapitalized, ill-situated banks, as well as of persons wholly unfitted as to training, character or methods to be allowed to conduct banks, were able to command public trust and patronage and to attract large deposits to their institutions through high interest rates and trading on faith in the guaranty plan." ABA (1933a), p. 17.

[63]Association of Reserve City Bankers (1933), p. 29.

[64]Ibid., pp. 19-20.

[65]Ibid., p. 28.

[66]See, for example, Rep. Luce (R-MA), *Congressional Record* (1933), p. 3918. Sens. King (D-UT) and Glass briefly debated the role of immortality in the context of this analogy; *Congressional Record* (1933), p. 3728.

surance amendment in the Senate, were careful to limit coverage. Sen. Vandenberg stated explicitly the rationale for coverage ceilings:

> the *State* Guarantees involved complete protection for *all* banking resources. ... *Federal* Insurance, on the other hand, leaves the individual bank and banker so seriously responsible for such a preponderance of their resources that there is no appreciable immunity at all.[67]

Sen. Glass noted a second source of discipline inherent in the plan. Because the banks insured each other, deposit insurance would "lead to the severest espionage upon the rotten banks of this country that we have ever had."[68]

Under both the temporary and permanent plans, the small depositor was to be covered in full, in recognition of his inability to monitor bank management adequately:

> At present the depositor is at the mercy of his fellow depositors, over whom he has no control, and of the management of the bank, about which he is not usually in a position to be well informed. The depositor takes the risks, and the banks take the profits.[69]

A survey conducted by the Comptroller of the Currency and the Federal Reserve in May 1933 revealed that the ceiling of $2,500 under the temporary plan would fully cover 96.5 percent of depositors and 23.7 percent of total deposits in member banks.[70]

PROTECTING DEPOSITS

While most industry opponents fought the deposit insurance plan on actuarial grounds, supporters argued that deposits *per se* required protection, to stabilize the medium of exchange and promote a renewed expansion of bank credit. More significantly, proponents responded with an argument of powerful simplicity: the losses to innocent depositors in a bank failure were a plain injustice. Given the status of banks in the political climate of 1933, this was a charge that the bankers ultimately could not counter.

The Agglomeration of Deposits for Speculation

> *The use of banking funds for speculation became a stench in the nostrils of the people.*[71]

There was a strong sense that the banking industry in the 1920s had functioned as an elaborate network to collect savings at the local level and funnel them into lending on securities speculation:

> Another cause for many banking collapses was the domination of smaller banks by their large metropolitan correspondents, which drained funds from the country districts for speculative purposes and loaded up the small bank with worthless securities.[72]

Indeed, this was a primary motivation for those sections of the Banking Act requiring a separation of commercial and investment banking. Similar arguments were brought against proposals for nationwide branch, chain and group banking.[73]

A sensitivity to such a possibility was doubtless nurtured by the popularity of Ponzi schemes in the 1920s, including the infamous Florida land swindles.[74] With such analogies in mind, banks came to be seen as

> merely fueling departments in enterprises run not by bankers concerned with operating banks but by promoters whose object was to exploit the credit resources of the bank. ...

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[67]Vandenberg (1933), p. 39, (emphasis in the original).

[68]Sen. Glass, *Congressional Record* (1933), p. 3728.

[69]Rep. Bacon, *Congressional Record* (1933), p. 3959.

[70]See Federal Reserve Board (1933c), p. 414. The point to be made was that even the temporary plan succeeded in fully covering the vast majority of depositors. The survey, of course, took place before depositors had an incentive to split larger deposits into multiple accounts to achieve full deposit insurance coverage.

[71]Rep. Luce, *Congressional Record* (1933), p. 3914.

[72]Rep. Bacon, *Congressional Record* (1933), p. 3952. Comptroller Pole was instrumental in dichotomizing the industry into "two definite types of banking, namely, that carried on by the small country bank and that of the large city bank." See "Comptroller Pole's Views on Rural Unit Banking," (1930), p. 468.

[73]Group banking and chain banking are essentially variants of the modern bank holding company form of organization. Group banking presumed some degree of standardization among the subsidiary banks in the holding company, while chain banks were operated as largely independent franchises within the holding company.

[74]A Ponzi scheme is a fraudulent investment plan, such as a chain letter, in which returns to existing investors are paid directly from the deposits of new investors, with the director of the scheme skimming the difference. Some of the Ponzi schemes had been run by Charles Ponzi himself. After several jail terms and a stint on the lam, Ponzi was finally deported to his native Italy in 1934. This was not his first one-way ticket. In 1903, his family had bought him a one-way ticket to Boston on the *S. S. Vancouver* in a successful bid to get rid of him. See Grodsky (1990).

> The primary evil in our banks for many years has been the incessant efforts of promoters to get control of the funds which flow into the banks. The bank is the depository of the community's funds and as such is the basis of the available credit of the community. The promoter-banker needs nothing so much as access to these credit pools.[75]

Such accusations were inevitably tinged with at least a hint of the conspiratorial.[76]

In keeping with this theme, the issues were framed for popular consumption as a morality play in which the naive depositor is pitted against the sophisticated banker. The depositor tucks away the hard-earned wages of his honest labor, only to be systematically duped by the cunning intrigues of the banker. At the extreme, some politicians played the religious card face up: "We discovered that what we believed to be a bank system was in fact a respectable racket and so many connected with it only cheap, petty loan sharks and Shylocks."[77] In the end, a providential government was seen to intercede on behalf of the depositor, and deposit insurance was trumpeted as "the shadow of a great rock in a weary land."[78]

The notion of the small depositor as an innocent victim had immense popular appeal. McCutcheon's 1931 political cartoon celebrating the blamelessness of the depositor in a failed bank won the Pulitzer Prize (above right). Such popularity, of course, was plainly evident to politicians, who responded by introducing deposit insurance legislation in Congress. Rep. Steagall is reported to have told House Speaker Garner in April 1932, "You know, this fellow Hoover is going to wake up one day soon and come in here with a message recommending guarantee of bank deposits, and as sure as he does, he'll be re-elected."[79]

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For obvious reasons, bank failures concentrated the attention of large numbers of voters, and Congressmen were anxious to associate themselves with the legislation. Sen. Vandenberg, up for re-election in 1934, was always careful to call his temporary insurance amendment to the Banking Act of 1933 "The Vandenberg Amendment." Rep. Dingell announced: "guaranty of bank deposits is my baby in Michigan."[80] A petition circulated in the House in June 1933 to postpone adjournment indefinitely until a deposit insurance bill was made law.[81] Figure 1

[75]Flynn (1934), pp. 394-96.

[76]Rep. Steagall, for example, avowed that a "campaign was turned on urging bankers everywhere to ... employ their facilities in investment banking, in speculation, in stock gambling, and in aid of wild and reckless international high finance." *Congressional Record* (1933), p. 3835. The Seventy-first Congress had formed a Senate Banking and Currency Subcommittee to investigate the extent to which the Federal Reserve and National Banking systems had been co-opted to "finance the carrying of speculative securities." Sen. Bulkley, quoted by Sen. Murphy, *Congressional Record* (1933), p. 3006. See also footnotes 15 and 16 an the related text.

[77]Rep. Dingell, *Congressional Record* (1933), p. 3906.

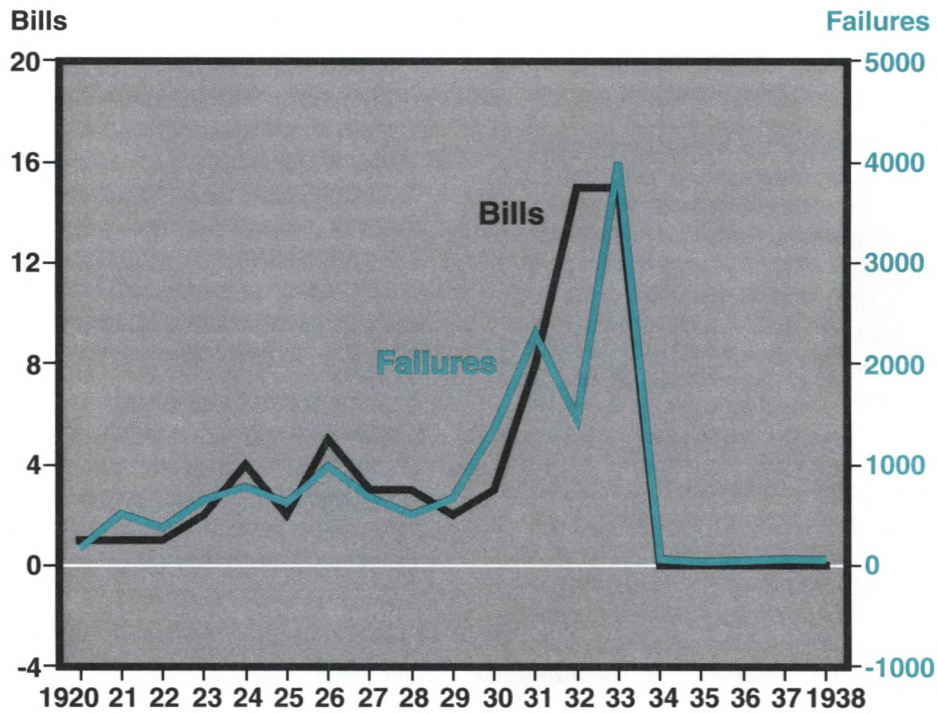
[78]Rep. Hill (D-AL), *Congressional Record* (1933), p. 5899. Hill's pronouncement was met with a round of applause in the House.

[79]Timmons (1948), p. 179. Garner responded, "You're right as rain, Henry, so get to work in a hurry. Report out a deposit insurance bill and we'll shove it through." The result was H. R. 11362, which passed the House on May 27, 1932.

[80]Rep. Dingell, *Congressional Record* (1933), p. 3906. It is noteworthy that both Sen. Vandenberg and Rep. Dingell were from Michigan, where, on February 14, 1933, William A. Comstock had become the first governor to declare a state banking holiday during the crisis; see Colt and Keith (1933), pp. 6-8. In light of the temporary insurance amendment, any dispassionate observer would have to regard deposit insurance as Vandenberg's baby in Michigan.

[81]See H. Preston (1933), p. 589, and Rep. McLeod (R-MI), *Congressional Record* (1933), p. 5825.

Figure 1
The Cause of Deposit Insurance



reveals that the number of guaranty bills introduced in Congress correlated neatly with the number of bank failures.

Theatrics aside, the central point for proponents of the legislation remained, and it was difficult to refute: "The main point is always this—*the depositor owns the money*. If he puts it in for safe-keeping it should be safely kept."[82]

Indeed, opponents conceded directly that depositor losses in bank failure were unjust.[83] Instead, they tried to redirect the debate to the question of "whether the guaranty plan will in fact cure the defects in our banking system and give depositors the safety which they seek and to which they are entitled."[84] On this latter question, the bankers remained obstinately negative; they favored "reform methods for banking that really strengthen banking," and therefore opposed deposit guaranties.[85]

The Stabilization of the Medium of Exchange

> *We think of the busy bee and the ant as tireless, but they are loafers compared with the activity of a busy dollar.*[86]
>
> *We got the guarantee of bank notes after having had wildcat banking in connection with State bank notes and after having had people injured who held notes of the State banks. ...*

[82]Ford (1933), p. 9, (emphasis in the original). Similarly, Sen. Vandenberg stated: "The savings of America must be made safe." *Congressional Record* (1933), p. 4428. The question of legal title to deposited funds was somewhat more subtle than Ford's quote suggests; see, for example, Amberg (1935), pp. 49-51.

[83]Amberg (1935), p. 51, felt that the struggle and fear of a bank run *per se* were bad, and that "a great social purpose would be served if the occasion of such fear could be removed."

[84]Association of Reserve City Bankers (1933), p. 2.

[85]Sisson (1933a), p. 563. He added: "There can be no question that the people of the United States should have a banking structure based on conditions rendering the banks immune from failure."

[86]Donald Despain, quoted by Rep. Schall, *Congressional Record* (1933), p. 4631.

It is much more important in principle to guarantee bank deposits, because the real circulating medium of the country is bank deposits.[87]

Although, as a strictly political matter, depositor protection was the central motivation responsible for the progress of deposit insurance in Congress, other forces were at issue. Chief among these was the role of banking in the real economy. Regarding bank failures, it was recognized that causality ran two ways: just as the general drop in real incomes had caused loan defaults and thus widespread bank failures, bank failures and the concomitant restriction of bank services had caused real incomes to fall. The latter effect was seen to operate both directly and indirectly.

Bank suspensions and failures could trap depositors' wealth for a period of months or even years until the bank either reopened or its bankruptcy was resolved. The direct result was reduced consumption and investment spending by the affected depositors. In the extreme case, when a town's lone bank failed, even the simplest forms of exchange could be hopelessly encumbered:

> [The unacceptability of failure] would perhaps not be so if they were grocery stores or butcher shops, where failure would be disastrous to only a few people at most; but bank failures paralyze the economic life of whole communities, not only through the loss of money accumulations but by the destruction of the deposit currency which is the principal medium of exchange in all business activity.[88]

Under such circumstances, some affected regions instituted scrip currencies, wooden coinage or systematic barter arrangements, the most elaborate of which was the Emergency Exchange Association in New York, headed by Leland Olds.[89]

A depositor's natural response to these possibilities was to withdraw his funds before failure occurred. Both bank runs and the hoarding of currency received considerable attention.[90] Withdrawals for the purpose of safeguarding one's wealth were deemed unpatriotic; legislation was even proposed to outlaw the practice. Banks had a natural response to the threat of runs: "Credit was tightened in the desire to remain as liquid as possible to meet the emergencies of runs."[91] Bankers maintained large cash reserves rather than lend:

> It is estimated that banks now have available billions of dollars of collateral for use in extending loans, but the plain fact is that for more than 3 years bankers have given little thought to anything except to keep their banks in liquid condition. ... The fear that grips the minds and hearts of bankers, keeping ever before them the nightmare of bank runs, makes it impossible for them to extend the credits that are indispensable to trade and commerce.[92]

This analysis is confirmed by the facts. The aggregate excess reserves of Federal Reserve member banks, for example, had ballooned from $42 million in October 1929 to a peak of $584 million in January 1933, even though the number of member banks had fallen from 8,616 to 6,816 over roughly the same period.[93] Thus, bank failures were seen to have an indirect effect on output, as both depositors and bankers in solvent institutions prepared for the possibility of runs and failures.

In the final analysis, depositor protection and stabilization of the medium of exchange were recognized as opposite sides of the same coin:

> We may talk about percentage of gold back of our currency, we may discuss technical provisions of legislation ... The public does not understand these technical discussions, but from one end of this land to the other the people understand what we mean by guaranty of bank deposits; and they demand of you and me that we provide a banking system worthy of this great Nation and banks in which citizens may place the fruits of their toil and know that a

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[87]Fisher (1932), p. 143.

[88]Greer (1933b), p. 538.

[89]See "What'll We Use for Money?" (1933).

[90]See Ives (1931) for colorful accounts of depositor runs and the various responses of bankers. Rep. Bacon, *Congressional Record* (1933), p. 3959, estimated hoarding at $1.5 billion in January 1933. The extent of hoarding was also roughly gauged by tracking deposits in the U. S. Postal Savings system. Such deposits roughly quadrupled in the two years ending June 30, 1933 [see O'Connor (1933), p. 23]. Friedman and Schwartz (1963), p. 173, state that such deposits remained a "minor factor" in spite of their growth. The system was established by the Postal Savings Bill of 1910 and was intended primarily for the savings of new immigrants. Deposits were guarantied in full. Vice-President-elect Garner reportedly told Roosevelt, "You'll have to have it [deposit insurance], Cap'n, or get more clerks in the Postal Savings banks." See Timmons (1948), p. 179.

[91]Rep. Bacon, *Congressional Record* (1933), p. 3959.

[92]Rep. Steagall, *Congressional Record* (1933), p. 3840.

[93]Federal Reserve Board (1943), pp. 72-74, 371.

> deposit slip in return for their hard earnings will be as safe as a Government bond. [Applause.]
>
> They know that banks cannot serve the public until confidence is restored, until the public is willing to take money now in hiding and return it to the banks as a basis for the expansion of bank credit. This is indispensable to the support of business and the successful financing of the Treasury. It will bring increased earnings, higher incomes, and make it possible to balance the Government's Budget without resort to vicious and vexatious methods of taxation.[94]

As such, they should be considered inseparable; it is clear that supporters of the legislation intended it to achieve both ends. Attempts to rank the two issues according to their relative importance are likely to be inconclusive.[95]

The Chastening of Wall Street

> *One banker in my state attempted to marry a white woman and they lynched him.*[96]

The opposition to federal deposit guaranties emanated largely from the nation's bankers. This fact was a crushing liability to their cause in the political climate of 1933. The introduction of the Glass and Steagall bills came on the heels of the banking panic and, not entirely coincidentally, amid the daily revelations of self-dealing and other cupidities from the Pecora hearings.[97] The banker had become a pariah.

Roosevelt fired the opening volley for his administration in his inaugural address:

> Plenty is at our doorstep, but a generous use of it languishes in the very sight of the supply. Primarily this is because the rulers of the exchange of mankind's goods have failed, through their own stubbornness and their own incompetence, have admitted their failure, and abdicated. Practices of the unscrupulous money changers stand indicted in the court of public opinion, rejected by the hearts and minds of men.[98]

He went on to demand safeguards against the "evils of the old order": strict supervision of banking, an end to speculation with "other people's money," and provision for an adequate but sound currency.[99]

Others were happy to follow this lead. It was commonplace to hold the bankers, and particularly their "speculative orgy" of 1929, responsible for the nation's woes:

> You brought this country to the greatest panic in human history! ... There never was such an economic failure in the history of mankind as your outfit has brought upon us at this time, and it is due to this same speculation that you are defending here more than any other one thing.[100]
>
> But these affiliates, I repeat, were the most unscrupulous contributors, next to the debauch of the New York Stock Exchange, to the financial catastrophe which visited this country and was

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[94]Rep. Steagall, *Congressional Record* (1933), p. 3840.

[95]Golembe (1960) has argued that, among the motives for deposit insurance, depositor protection was secondary to protection of the circulating medium. Others have gone further, arguing that protection of depositors was a rationalization created after the fact. The issue raised by Golembe is certainly plausible; Rep. Bacon, for example, appears to have ranked them this way [*Congressional Record* (1933), p. 3959]. On the other hand, it is noteworthy that Sen. Glass in 1933 abandoned his earlier plan for a liquidation fund, which would have prevented the freezing of funds in suspended banks while still not protecting depositors from loss. The latter notion of depositor protection as an ex-post or revisionist justification is clearly false, however.

[96]This was a popular quip that made the rounds in 1933. In this instance, it is attributed to Carter Glass; see Kennedy (1973), p. 133; Bell (1934), pp. 262-63, also cites it. The joke is startling in its insensitivity. Examples of bankers of the day indulging in overtly racist humor are also available; see, for example, Dyer (1933), pp. 91 and 94, and Amberg (1935), p. 49.

[97]The hearings were organized in January 1933 by the Senate Committee on Banking and Currency, and were run by the Committee's counsel, Ferdinand Pecora; see Pecora (1939). The dust jacket relates that, in one instance, a journalist "begged Mr. Pecora not to break so many front-page stories daily because it was physically impossible to cover them all." See Benston (1990) for a thorough, revisionist view of the hearings.

[98]Roosevelt (1938), pp. 11-12.

[99]Roosevelt (1938), p. 13. His reference to "other people's money" was a nod to Justice Brandeis's book of the same title, a reprint of his articles on the money trust that appeared in *Harper's Weekly* in 1913-14. Those who hold that all the great thoughts have long since been had will be pleased to learn that Kane's (1991) reference to the "Sorcerer's Apprentice" segment of Walt Disney's *Fantasia* as a metaphor for bank regulation was anticipated by Brandeis. Lacking Mickey Mouse's rendition, however, Brandeis was forced to use the German original, Goethe's *Der Zauberlehrling;* see Brandeis (1933), p. vii.

[100]Sen. Brookhart (R-IA) speaking to a New York Stock Exchange official at a Senate committee hearing in 1932; quoted by Danielian (1933), p. 496.

> mainly responsible for the depression under which we have been suffering since.[101]

In the previous year, Huey Long had announced his intent to campaign for Roosevelt under the slogan: "Rid the country of the millionaires."[102] A popular ditty mocked:

> Mellon pulled the whistle,
> Hoover rang the bell,
> Wall Street gave the signal,
> And the country went to hell.[103]

In short, the bankers were vilified.

Although some felt such indiscriminate abuse was slanderous, they fought against the tide.[104] One of the casualties of the anti-banker sentiment was the bankers' battle against deposit insurance. Some in Congress announced that the bankers' opinions should be openly ignored:

> I believe that the myopic banker as an adviser should receive about as much consideration at the hands of the House as a braying jackass on the prairies of Missouri. They proved by their inability to maintain their own business that they have absolutely no right to advise the House as to what course we should follow.[105]

The bankers, while they acknowledged the merit of individual aspects of the deposit insurance proposals, obstinately refused to countenance any of the schemes as a realistic reform. Even as the legislation was signed into law, Francis Sisson called a crusade, rallying ABA members to fight "to the last ditch against the guaranty provisions" of the bill.[106] That the bankers' concerns were not ignored entirely resulted largely from the presence in government of opponents of deposit guaranties who were more politically astute than the bankers themselves. Sen. Glass, for example, compromised his principles in a bid for some control over the legislation, explaining that it was "better to deal with the problem in a cautious and a conservative way than to have ourselves run over in a stampede."[107] Roosevelt held out until the very end, thus forcing Congress to concede in delaying implementation of the temporary plan until January 1934.

BANK MARKET STRUCTURE

The ramifications of deposit insurance were recognized as far-reaching. In many ways, the central and most contentious battle concerned neither actuarial feasibility nor the desirability of protecting deposits, but the regulatory issues of bank chartering and supervision. Because of the fundamental legal issues involved, it was here that the economic and political aspects of the debate became most fully intertwined. This was a fight with the weight of a long tradition behind it, and arguments were often self-consciously historical.

Regulatory Competition and Lax Supervision

> *Bank examinations to be effective must be made by experienced men, free from political influence. ... We will never have proper banking supervision, national or state, until it is taken entirely away from political influence.*[108]

Much of the blame for high rates of bank failure throughout the 1920s was placed upon competition between state and federal authorities. Because banks could choose the less costly of federal and state charters—and the associated regulations—state and federal regulators were forced into a "competition in laxity" if they were to sustain the realm of their bureaucratic influence.[109] For example, as a prelude to recommending broader powers for national banks, Comptroller Pole emphasized that:

> If Congress therefore would protect itself from the loss of its present banking instrumentality, it must make it to the advantage of capital to seek the national rather than a [state] trust company charter. ...

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[101]Sen. Glass, *Congressional Record* (1933), p. 3726. Glass is referring to the proposed separation of investment affiliates from Federal Reserve member banks.

[102]Kent (1932), p. 260.

[103]Kennedy (1973), p. 26.

[104]See, for example, Bell (1934). Sisson (1933b), p. 30, offered that the treatment of bankers as "demons of darkness" and as an "unseen mythical power for evil which spreads its baneful influence over [human beings]" merely satisfied an emotional need for a scapegoat.

[105]Rep. Dingell, *Congressional Record* (1933), p. 3906.

[106]Sisson's telegram is quoted in Pecora (1939), pp. 294-95.

[107]Sen. Glass, *Congressional Record* (1933), p. 5862.

[108]Andrew (1934b), p. 93.

[109]Daiger (1933), p. 563, attributes coinage of the phrase "competition in laxity" to Eugene Meyer in 1923 testimony to the House Banking and Currency Committee. The phrase attained some popularity; it was also used, for example, by Wyatt (1933), p. 186, and Awalt (1933), p. 4.

> It is within the power of Congress to turn the advantage in favor of the national banks and thereby make it to the interest of all banks to operate under the national charter[110]

In the eyes of opponents of deposit insurance, an especially important manifestation of the competition in laxity was the "promiscuous granting of bank charters."[111] The immediate result of loose chartering was a condition called "over-banking," or

> a host of weak, unreliable banks that crowd one another out of existence by being too numerously organized in places where there is no support for the multifarious institutions that have been established there.[112]

This "indiscreet indulgence of charter applicants" was held responsible for the vast numbers of bank failures throughout the previous decade:[113]

> There are too many banks in the United States. The areas of greatest density of banks per capita coincide with the areas where failures are proportionately highest.[114]

The function of a deposit guaranty under such circumstances would be to exacerbate the problem by mitigating one source of public scrutiny: inspection by depositors. Opponents confirmed their contention by reference to the ill-fated state guaranty schemes:

> In practice the guaranty of deposits plan generally tended to induce an unsound expansion in the number of banks ... This was clearly connected with the indiscriminate popular confidence created toward the banks under the guaranty.[115]
>
> It is to be feared that the adoption of deposit guaranty laws may have somewhat retarded the inevitably slow and unsensational process of strengthening the banking system by strict regulation, vigilant public opinion and strict requirements.[116]

The Association of Reserve City Bankers went further, predicting that managers of the insurance fund would be slow to close troubled institutions.[117] In addition to regulatory competition, some saw political influence as a secondary force debilitating the supervisory process:

> We never will have such supervision under political regulation and examination; we will never have any supervision worthy of the name that does not have real authority and heavy responsibility tied to it.[118]

Only a few supporters of insurance addressed directly the plan's implications for the regulatory process, which they presented as a counterweight to incentives for bad banking under a guaranty. Rome Stephenson felt that the additional regulatory powers in the Banking Act differentiated the FDIC markedly from the state plans:

> Right there is the crux of the debate: Will banks under the federal plan be permitted the abuses which were tolerated in every one of the states where guaranty was tried? If so, then failure is inevitable. If not, success is practically certain. ... Let me assert unequivocally that the men who drew up the federal plan profited by the mistakes of the state guaranty failures and avoided them. ... None of the state laws had teeth in them. The federal law has teeth like a man-eating shark, and already has done some highly effective biting.[119]

Carter Glass, railing that "the Comptroller's office has not done its duty—its sworn duty—

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[110]Pole (1929), p. 23.

[111]Association of Reserve City Bankers (1933), p. 30.

[112]H. Parker Willis, quoted in Lawrence (1930), p. 105.

[113]Lawrence (1930), p. 104. Lawrence took this priggish tone one step further, admonishing that "A little birth control of banks on the part of the states which now suffer most from bank failures might have had a wholesome effect on the rate of mortality;" ibid., p. 84.

[114]Westerfield (1931), p. 17; the "multiplicity of banks" was first on his list of the six causes of bank failures since 1920. Andrew (1934b), p. 93, concurred that "Everyone agrees that one of the main causes of our banking trouble was too many banks." See also Bremer (1935). Awalt (1933), p. 4, attributes the boom in charters to "lax State laws" and the 1900 reduction in the minimum capitalization for national banks from $50,000 to $25,000.

[115]ABA (1933a), p. 42. Mississippi was held up as the exception that proved the rule: "The banking authorities in Mississippi had full discretion in the matter of granting new charters and used it liberally in refusing permission for unneeded banks or to unqualified promoters to open new institutions;" ibid., p. 22. The result was seen to be less over-banking and fewer failures relative to Oklahoma and Nebraska.

[116]A *Saturday Evening Post* editorial of August 9, 1924, quoted in Association of Reserve City Bankers (1933), p. 42.

[117]See the quote referenced by footnote 64.

[118]Donald Despain, quoted by Sen. Schall, *Congressional Record* (1933), p. 4632.

[119]Stephenson (1934), p. 46. In addition to authorizing the supervisory power of the FDIC, the Banking Act of 1933: increased the punitive authority of the Federal Reserve for member banks financing securities "speculation," prohibited insider lending for member banks, authorized federal regulators to remove the officers and directors of member banks for illegality or unsound banking practice, and required deposit-taking private banks to submit to supervision by the Comptroller's office.

and has permitted this great number of banks to engage in irregular and illicit practices," argued that mutual responsibility inherent in the insurance plan implied mutual supervision: if the strong banker "knows that he has got to bear a part of the burden of my irregular banking, he is going to report me to the Comptroller of the Currency and is going to insist that his examiners come there and do their duty."[120]

The Dual Banking Question

> *The fact is, of course, that the deposit insurance scheme would not have been permitted by the conservative leaders in Congress if its organization could not have been so shaped as to further their idea of a unified system of banking in the country under the Reserve System. On the other hand, the more radical elements, in response to popular demand for some sort of protection for bank depositors, could not have built a nationwide guaranty system upon any other foundation than the Reserve organization.*[121]

Questions about the effect of insurance on the quality of chartering and supervision were sideshows to the main event, however. At the heart of the debate lay a decades-old controversy over the dual banking system. Given its far-reaching nature, the proposed legislation was universally regarded as a prime opportunity for fundamental changes in banking policy.

Comptroller Pole had campaigned vigorously throughout his four-year tenure for some form of interstate branching for national banks. He drew a strong distinction between the small, state-chartered, rural unit bank—the "country" bank—and the large, nationally chartered institution. While he pretended to maintain great respect for the small unit bank as the "single type of institution which has contributed the most to ... the foundation of our national development," he was fighting to have them replaced by branch networks of national banks.[122] He justified this split sentiment by arguing that irreversible social changes—telephone, radio, and especially the automobile—had forever obviated the rural isolation that had made the unit bank competitively viable. Accompanied by a long parade of statistics, he emphasized the high failure rate of small, state-chartered banks during the 1920s.[123] The country bank, he said, could not survive in competition with large metropolitan institutions, which had more professional management and were inevitably better diversified.

Comptroller Pole was not alone in this crusade. The McFadden Act had already broadened the branching powers of national banks; in 1930, the House Banking Committee arranged new hearings into the possibility of national or regional branch banking.[124] The unsuccessful Glass bill of 1932 included limited provisions for statewide branching by national banks. *Business Week* staked out the extreme position, announcing that "what we really need is just one big bank with 20,000 branches."[125] Supporters of branch banking took heart in the Canadian experience:

> Canada has branch banking, and Canada has not had any bank failures during the depression. Is this a matter of cause and effect?
> 'It is,' declare the advocates of branch banking in the United States.[126]

Such highly concentrated branch networks were offered as an alternative to deposit insurance as a means of geographic diffusion of loan losses and the diversification of credit risks.[127]

Comptroller Pole, of course, felt branching to be the better option:

> Any attempt to maintain the present country bank system by force of legislation in the nature of guaranty of deposits or the like, would be economically unsound and would not accomplish the purpose intended.[128]

Deposit guaranties had long been advocated as a way of diversifying risk for the unit bank without a fundamental change in the ownership

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[120]Sen. Glass, *Congressional Record* (1933), p. 3728.

[121]Anderson (1933c), p. 17.

[122]Pole (1929), p. 24.

[123]See Pole (1930a, 1931, 1932a and 1932b), "The Need of a New Banking Policy" (1929) and "Comptroller Pole's Views on Rural Unit Banking" (1930).

[124]U. S. Congress, House of Representatives, Committee on Banking and Currency (1930).

[125]"The Ideal Bank" (1933), p. 16.

[126]Greer (1933a), p. 722. See also Lawrence (1930), and Rep. Bacon, *Congressional Record* (1933), pp. 3949-50.

[127]For example, Rep. Bacon, *Congressional Record* (1933), p. 3961, noted that "deposit guaranty is undoubtedly a guaranty of reckless banking. ... Safety for the depositor can best be achieved by a unified branch banking system."

[128]Pole (1930b), p. 5. This same sentence appears in Pole (1930a), p. 4.

structure of the banking industry.[129] The various histories of Populism, "Bryanism," the Panic of 1907 and the Pujo hearings all contained elements of a deep popular mistrust of money center banks. The publicity of the Pecora hearings in 1933 clearly did not assuage this mistrust. It was not pure coincidence that the western agricultural states—the heart of the Grange and Populist movements—had been the ones to enact state deposit guaranties. In this context, then, it is ironic that, in 1933, federal deposit insurance should most often have been viewed as a lethal threat to the country bank. That it was such a threat testifies to the influence and legislative skill of Carter Glass.

Sen. Glass, who had shepherded the Federal Reserve Act through the House in 1913, was protective of his handiwork:

> I took occasion to tell the Secretary of the Treasury the other day that if they pursue present policies much longer they will literally wreck the Federal Reserve System; that Woodrow Wilson in history will enjoy the distinction of having set up a banking system that fought the war for us and saved the Nation in the post-war period, and if they keep on making a doormat of it this Congress will enjoy the distinction of having wrecked it.[130]

His primary concern in the banking legislation of 1933 was to buttress that system. Thus, the Glass bill required all FDIC member banks to join the Federal Reserve System, ostensibly to give the Fed the legal right to examine FDIC members (the Fed was to be a prominent shareholder in the FDIC).[131] Because an uninsured country bank facing insured competitors was not considered viable, and because Fed membership would require at least $25,000 minimum capital, deposit insurance represented the end for the small, state non-member banks.[132] Deposit insurance would force a consolidation of banking within the Federal Reserve System.

It is instructive to note that Glass had abandoned an earlier scheme that would have forced the same consolidation within the Fed: unification of banking in the National Banking System. Comptroller Pole had sought to accomplish the same thing indirectly, by providing national banks with an undeniable competitive advantage in the form of interstate branching privileges. In 1932, Glass had requested of Gov. Meyer of the Federal Reserve a constitutional method of unifying banking:

> Meyer: "Do you want to bring about unified banking?"
> Glass: "Why, undoubtedly, yes."
> Meyer: "I shall be glad to help you."
> Glass: "I think the curse of the banking business in this country is the dual system."
> Meyer: "Then the Board is entirely in sympathy with the Committee on the subject."[133]

The result was a legal opinion prepared by the General Counsel of the Federal Reserve Board on the constitutionality of such unification in the absence of a constitutional amendment.[134] While Board Counsel confirmed that such a constitutional means existed, Sen. Gore introduced a constitutional amendment.[135] Constitutionality was crucial, because champions of the rural unit bank were certain to raise the powerful specter of states' rights in opposition:

> The fight regarding the American Dual System of Banking is a clear-cut issue between those who believe in the sovereignty of our states and home rule, and those who are in favor of a 'unification of our banking system' into one Washington bureau.[136]

Indeed, the political sensitivity of the states' rights issue was sufficient to force Sen. Glass to abandon such a direct assault on the state banks before it could earnestly begin.[137]

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[129]White (1982, 1983, 1984) reviews the historical connections between deposit insurance and bank chartering.

[130]Sen. Glass, *Congressional Record* (1933), p. 3728.

[131]See the interchange between Sens. Glass and Couzens (R-MI), *Congressional Record* (1933), p. 3727.

[132]Section 17 of the Glass bill "provides for the amount of capital of national banks depending upon the population of the places where they are to be located and also *prohibits the admission of a bank into the Federal Reserve System unless it possesses a paid-up unimpaired capital sufficient to entitle it to become a national bank.*" See Glass (1933b), p. 16, (emphasis added). The population schedule for minimum capital was: $25,000 for areas under 3000 persons; $50,000 for 3000 to 6000 persons; $100,000 for 6000 to 50,000 persons; $200,000 for areas over 50,000 persons; see Steagall (1933a), pp. 18-19.

[133]Quoted by Anderson (1932b), p. 678.

[134]The opinion was published as Wyatt (1933). The Attorney General had felt it was not possible, and had told Glass that; see Anderson (1932b), p. 678.

[135]Joint resolution S. J. Res. 18 was introduced by Sen. Gore (D-OK), *Congressional Record* (1933), p. 249.

[136]Andrew (1934b), p. 95.

[137]See Burns (1974), pp. 11-12.

Arrayed against Sen. Glass in the battle for unification within the Fed was a coalition led by Henry Steagall in the House and Huey Long in the Senate.[138] Sen. Long had crippled Glass's banking bill in the previous Congress with a ten-day filibuster; as champion of the common man, he had objected to an envisioned concentration of power implicit in the bill's branching provisions.[139] This coalition indeed viewed deposit insurance as a means of survival for the small bank:

> If there is one purpose more than another which is inherent in the amendment which is now at stake in this conference, it is the purpose to protect the smaller banking institutions, and to make the reopening of closed banks possible as speedily and as safely as it can be done.[140]

The final legislation was a two-stage compromise between Sen. Glass's push for unification and the Steagall-Long coalition's desire to preserve the dual banking system. In the first stage, Glass agreed to support a deposit guaranty in exchange for provisions for significantly expanded Federal Reserve authority:

> With these provisions, dependent upon them in fact, the Senate bill drafters were willing to accept the new Steagall bill for the insurance or guaranty of bank deposits in Federal Reserve member banks—but in member banks only.[141]

In the second stage, the dual banking supporters obtained several concessions, most notably: immediate insurance coverage for non-member banks under the temporary plan, and grandfathering of small state banks under the new minimum capital standards for Fed membership. Non-member banks would still have to apply for Federal Reserve membership by July 1, 1936, at the latest. With these changes, Sen. Long supported the bill, which then passed the Senate without objection.[142]

CONCLUSIONS

> *Prophesying the future of Federal Deposit Insurance is at the same time both difficult and simple. It is difficult because the subject cannot be treated independently, that is, without relation to banking structure, banking practice, political and economic trends and human emotions. It is easy, on the other hand, because ... any man's guess is as good as that of another.*[143]

It is obvious from an examination of the record that the debate surrounding the adoption of federal deposit insurance was both wide-ranging and well informed. The banking crisis in March 1933, coming at the depths of the Great Depression and breaking on inauguration day, had focused attention with unique intensity on all aspects of public policy toward banks. While some contended that the urgency accompanying the crisis injected haste into the proceedings, it also ensured that all major interests were roused to offer their views and argue their cases.

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[138]See Anderson (1933a), p. 17. They were joined by Sen. Vandenberg, whose temporary plan extended insurance to state non-member banks upon certification of soundness by the relevant state banking authority.

[139]There was little fondness connecting the two Southern Democrats. Smith and Beasley (1939), pp. 346-47, relate that, in the heat of the banking debate and in response to a series of Long's *ad hominems*, Glass unleashed a string of invective that literally chased the Kingfish — his hands clamped over his ears — off the Senate floor. This version of events is apocryphal, however.

[140]Sen. Vandenberg, referring to the temporary insurance amendment, *Congressional Record* (1933), p. 5256. See also Vandenberg (1933), p. 43.

[141]Anderson (1933a), p. 63.

[142]Rep. Luce reported that bank structure issues predominated in the conference committee reconciling the Glass and Steagall bills: "There were but two points of serious controversy in the discussions of the conferees — those to which I have just referred, branch banking, the membership requirement together with other details of insurance of bank deposits," *Congressional Record* (1933), p. 5896. Much of the force of Glass's requirements for Fed membership was lost when deposit insurance was revamped by the Banking Act of 1935; see, for example, Woosley (1936), pp. 24-26. See also the shaded insert on the following page. The membership requirement was dropped entirely in 1939; see Golembe (1967), pp. 1098-1100.

Opinions varied on the significance of the consolidation of bank regulation implicit in the final act. *Bankers Magazine* editorialized that, "while this development will bring the state banks under a considerable degree of Federal control, it will not — for a time at least — result in that unification of banking regarded by many as desirable. The state banks, by coming into the deposit-guaranty scheme have escaped with their lives." "State Banks Qualifying for Insurance of Deposits" (1933), p. 490. Anderson (1933c), p. 17, warned that, "with all this variation, this glorification of the unit bank principle, however, comes the hard fact that these institutions, for the first time in their history, will be under one direct control whose authority is such as practically to set aside all the principle privileges for which state banks have fought so long."

[143]Amberg (1935), p. 49.

The Four That Passed

Law	Banking Act of 1933 (temporary plan)	Banking Act of 1933 (permanent plan) — Never operational —	Act of 1934 Extending Temporary Deposit Insurance	Banking Act of 1935
Period of operation	From Jan. 1, 1934, to July 1, 1934, or earlier if the President so proclaims.	From July 1, 1934 (or earlier if the President so proclaims).	From July 1, 1934, to July 1, 1935 (extended to Aug. 31, 1935, in June of 1935).	From August 23, 1935, onward.
Coverage	All deposits covered in full up to $2,500	100% coverage up to $10,000, 75% on the next $40,000, 50% of all over $50,000	All deposits covered in full up to $5,000.	All deposits covered in full up to $5,000.
Membership	All Fed member banks required to join. Nonmembers allowed in with state certification and approval of the corporation.	All Fed member banks required to join. Nonmembers allowed in from 7/1/34 to 7/1/36 (with state and FDIC approval); Fed membership required by 7/1/36.	All Fed member banks required to join. Nonmembers allowed in until 7/1/37 (with state and FDIC approval); Fed membership required by 7/1/37.	All Fed member banks required to join. Nonmembers allowed in with FDIC approval. Nonmembers with 1941 average deposits over $1 million must join by 7/1/42.
Assessments on insured banks	0.5% of insured deposits, one half paid in cash, the other half subject to call. One more such assessment as needed. Surplus as of 7/1/34 to be refunded.	0.5% of total deposits, half in cash, half subject to call. Extra assessments of 0.25% of total deposits, as needed and without upper limit.	Same as under the temporary plan of the Banking Act of 1933, except the surplus is to be measured and refunded as of 7/1/35.	Annual assessment of 1/12 of 1% of average total deposits, payable in two installments.
FDIC's capital	Provided according to the assessment schedule.	$150 million on call from Treasury (to pay 6% div.) *plus* one-half the surplus of Federal Reserve banks (ca. $139 million) for $100-par, no-div., nonvoting stock *plus* 0.5% of deposits of FDIC banks ($150-200 million) for $100-par, 6% div., nonvoting stock.	Provided according to the assessment schedule.	Same as under the permanent plan of 1933, except: all stock is no-par, no-div., non-voting; insured banks do not buy FDIC stock; and Federal Reserve bank surpluses are measured as of 1/1/35, rather than 1/1/33.
Control	Board of three: the Comptroller and two Presidential appointees.	Same.	Same.	Same.

It has been suggested that the framers of the Banking Act of 1933 failed to consider the warnings about the potential dangers of government-sponsored deposit insurance.[144] It is significant, then, that an examination of the historical record clearly shows that bill's chief patrons were aware of the failure of the state schemes, the actuarial arguments against deposit guaranties, and the various chartering issues involved. Moreover, they took these issues into account when crafting the bill. In the end, even the Association of Reserve City Bankers was able to recommend the temporary insurance plan:

> It appears to this Commission that if guaranty is retained after July 1, 1934 [the date for implementation of the permanent plan], this temporary plan, in some modified form, would meet every emergency need, and eliminate many of the dangers in the permanent plan.[145]

Under the temporary plan, coverage ceilings were conservative, the insurance corporation was emphatically segregated from the federal taxpayer, chartering standards for national banks were raised, and supervisory authority was broadly increased. These characteristics were retained under the permanent plan of the Banking Act of 1935. As such, deposit insurance, as construed in the Banking Acts of 1933 and 1935, succeeded in simultaneously protecting the small depositor and leaving the banker answerable to both supervisors and large depositors for the quality of his management.

At the same time, the deposit insurance provisions of the Banking Act of 1933 were used as leverage to consolidate the industry within the Federal Reserve, although the Banking Act of 1935 significantly weakened the requirements for Fed membership of insured banks. A piecemeal dismantling of other provisions of the original legislation has also occurred in the intervening decades: coverage ceilings have risen steadily, even after accounting for inflation and before considering brokered deposits or too-big-to-fail policies; the full taxing authority of the U. S. Treasury has, *de facto*, been inserted behind the deposit insurance corporations; and deregulation has subjected both banks and thrifts to increasingly harsher competition—and, in some cases, relaxed regulatory scrutiny—without simultaneously making bankers responsible to depositors for the riskiness of bank assets.[146] It is perhaps with this more recent negation of individual elements of a complex and interdependent package of bank reforms that we should seek the proximate cause of our recent deposit insurance troubles, rather than with policy flaws in the Banking Act of 1933 itself.

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[144]Kaufman, for example, claims that the opinions of Emerson (1934) — and, by association, those of the banking community as a whole — regarding flaws in the actuarial basis for the plan were unheeded at the time.

In particular, Kaufman (1990) states, pp. 1-2: "Some of the problems are new, however many have been around for many years and were even clearly foreseen at the time they were forming or, worse yet, even earlier, at the time their underlying causes were put in place in the form of legislation or regulation. This is the case with the extant structure of federal deposit insurance. Among those forecasting the problems that this innovation would come to cause was Guy Emerson, a long-time economist for the Bankers Trust Company (New York). His warnings are evident in his article "Guaranty of Deposits Under the Banking Act of 1933" published in the February 1934 *Quarterly Journal of Economics* and reprinted in this volume. Much of this book is necessitated because policy makers did not listen to Emerson and others more than half a century ago." Related remarks appear on pp. xi-xii of the preface to the same volume.

[145]Association of Reserve City Bankers (1933), p. 7. They were, however, at pains not to appear eager in their praise: "*What we are recommending, therefore, is cooperation in an emergency measure of the sort that has been deemed necessary in almost all branches of our economic life, but we are not, directly or indirectly, endorsing the principle of deposit guaranty,*" ibid., p. 7, (emphasis in the original). The permanent plan was never operational; it was in fact ultimately superseded by a modified form of the temporary plan.

[146]The technical legal question of the *de jure* liability of the United States government for deposit insurance is surprisingly complex, and the answer is not entirely clear. As a practical matter, however, the question is neither complex nor unclear. See FDIC (1990), pp. 4438-39.

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The Response of Market Interest Rates to Discount Rate Changes

IT IS WELL-ESTABLISHED that discount rate changes of the same size can have markedly different effects on market interest rates. Studies of such effects, starting with Thornton (1982), have generally divided discount rate changes into two groups: "technical" changes, those made solely to keep the discount rate in line with market rates, and other "non-technical" changes.[1] The former generally do not have a significant impact on market rates, while the latter generally do. The use of this technical/non-technical dichotomy is predicated on the assumption that the market responds to a discount rate change based on the reasons for the change. Hakkio and Pearce (1992) find that the reasons generally fall into three categories: "(1) conditions in the market for bank reserves ...; (2) movements in intermediate targets such as the money supply and the foreign exchange value of the dollar; and (3) movements in ultimate targets such as inflation and economic growth." They observe that "changes in the rate because of type (1) factors are likely to be used to complement open market operations, while changes because of type (2) or (3) factors are more likely to be used as signals of future Fed policy."[2] Thus, technical changes result when the opportunity cost to banks of borrowing reserves—the federal funds rate less the discount rate—is too high or low to be consistent with attaining the Fed's operating target. Since October 1982 that target has been the level of borrowed reserves.[3] Non-technical changes, on the other hand, encompass all of the other reasons the Fed might change the discount rate. Clearly a combination of the factors identified by Hakkio and Pearce can be behind a given discount rate change, so the reaction of market interest rates to discount rate changes might be more heterogeneous than the technical/non-technical dichotomy would suggest. Moreover, as the efficient markets hypothesis implies, the response of market interest rates to a discount rate change should vary with the amount of new information the discount change imparts regarding the Fed's policy intentions or the state of the economy in general.[4]

This article presents results on the differential response of market interest rates to discount

[1]The technical/non-technical dichotomy has subsequently appeared in analyses of the effects of discount rate changes on interest rates [Roley and Troll (1984), Smirlock and Yawitz (1985), Thornton (1986, 1991), Cook and Hahn (1988)] and exchange rates [Batten and Thornton (1984)].

[2]Hakkio and Pearce (1992), pp. 56-57.

[3]Thornton (1988) discusses under what conditions targeting borrowed reserves is equivalent to targeting the federal funds rate. The Fed's operating target was the federal funds rate throughout the 1970s until October 1979 when the Fed began to target non-borrowed reserves.

[4]It is not surprising that the theoretical links between the discount rate and market interest rates have found empirical support in previous studies, given that from 1973 to 1989, for example, 6.2% of the variation in the T-bill rate took place on only 1.3% of the days, the 56 days when the discount rate changed.

rate changes using an econometric framework that explains more heterogeneous responses in market interest rates than the technical/non-technical dichotomy allows. The mixture model employed here assumes that the market response is determined by either a "high-response" or "low-response" data-generating process. Inferences about which process governs a given period's interest rate depend on the information policymakers cite when they change the discount rate. Thus, we can consider hypotheses like "the higher the unemployment rate, the larger the response of market interest rates to a discount rate change of a given size." With the technical/non-technical dichotomy, in contrast, a discount rate change is described as non-technical if the Fed mentions any number of things in its announcement, such as the inflation rate, unemployment rate, industrial production, money growth rate, etc. The technical/non-technical dichotomy tells us little about the relative importance of these individual factors. A principal aim of the mixture model employed here is to study the influence these individual factors have on the market response.

This paper also includes some conjectural interpretations of the empirical results. For example, if the market rates respond strongly to discount rate changes when the unemployment rate is high, one might conclude that the market believes that the Fed will consistently change monetary policy in reaction to shifts in the unemployment rate. Objectively, however, the mixture model's fit and forecasts of the interest rate response serve as measures of its performance relative to the standard technical/non-technical dichotomy. The second half of the paper addresses the implication of the efficient markets hypothesis that a discount rate change must be "news" for market rates to respond by testing whether the timing of discount rate changes is sufficiently predictable to require that models of the market's response to discount rate changes distinguish explicitly between anticipated and unanticipated changes.

A MIXTURE MODEL OF T-BILL RESPONSES

Given the limited number of discount rate changes (only 56 from 1973 to 1989), the model estimates two levels of response of 90-day Treasury bills to discount rate changes. The yield on T-bills is chosen because of the important role it plays in calculating present values for stock dividends, bond coupons, annuities, housing rents, etc.[5] While the statistical model assumes that one of two mutually exclusive processes generates the change in the T-bill rate from any given discount rate change, the two response levels, "high" and "low," should be understood as upper and lower bounds where all fitted responses are a probability-weighted combination of the two boundary values.[6] For example, if ΔTB is the change in the T-bill rate, ΔDR is the change in the discount rate and ε is a mean-zero stochastic disturbance, then the mixture model estimates two data-generating processes,

$$\text{Process 1: } \Delta TB_t = \beta_0 + \beta_1 \Delta DR_t + \varepsilon_t$$

$$\text{Process 2: } \Delta TB_t = \beta_0 + \beta_2 \Delta DR_t + \varepsilon_t$$

where β_2 is greater than β_1, so that Process 2 governs the highest responses. A single equation can describe the mixture model if we define a dummy variable, S_t, which equals one if Process 1 holds and zero if Process 2 holds.

$$(1)\ \Delta TB_t = \beta_0 + \beta_1 S_t \Delta DR_t + \beta_2 (1 - S_t) \Delta DR_t + \varepsilon_t$$

Equation 1 is a mixture model because the dependent variable is assumed to be drawn from a mixture of data-generating processes, in this case two.[7] Because we do not observe S_t, only probabilistic inferences about its value are forthcoming. Hence, the inferred value of S_t can lie anywhere between zero and one, making the mixture model more general than the technical/non-technical dichotomy, which restricts S_t to equal either zero or one.

[5] This is because the T-bill rate serves as, or at least proxies, the "risk-free" rate of return. Applications of the term structure theory of interest rates also treat the T-bill rate as an anchor, whose current and expected future values largely determine longer-term interest rates, which are relevant for investment decisions and the level of economic activity. Portfolio insurance, through the writing and buying of options, is another activity that must constantly refer to the T-bill rate; options must be priced such that riskless hedges, which create synthetic riskless assets, do not violate arbitrage bounds relative to T-bill yields.

[6] The assumption that there are only two response levels is not to be taken literally. It is a convenient way to estimate upper and lower bounds for the T-bill response and thus generate, through mixtures of the two levels, a continuum of response levels the model can explain, while estimating only a few parameters. Of course, some responses will lie outside these bounds: the difference is simply part of the residual and not explained by the econometric model.

[7] See Quandt and Ramsey (1978).

Table 1

Mixture Model Coefficients

Parameter	Description	Value	t-statistic
β_0	Intercept	.0018	1.12
β_1	Process 1 Response	.1449	4.57
β_2	Process 2 Response	.7743	10.40
θ_0	Constant	7.141	3.11
θ_1	Magnitude and Sign of ΔDR	−4.374	2.77
θ_2	Unemployment Rate	−.4633	1.99
σ_0	St. Dev. Outside 1979-82	.096	
σ_1	St. Dev. During 1979-82	.280	
R^2	When ΔDR ≠ 0	.726	

Furthermore, since a primary objective is to use the mixture model to create one-step-ahead forecasts of the T-bill response to discount rate changes, we pay special attention to the prior probabilities of Process 1 relative to Process 2. In particular we examine whether the prior probabilities are constant or whether they vary according to the magnitude of the discount change, previous discount rate changes, or various indicators of economic activity like inflation, output, unemployment, etc. Such variables (denoted Z_t) might indicate whether financial markets believe that the Fed is actively changing policy in response to economic conditions. Because drawing inferences about the likelihood of Process 1 vs. Process 2 is analogous to drawing inferences from a logit model, the logistic function provides a useful parameterization of the prior probability of Process 1:[8]

$$(2)\quad \text{Prob.}(S_t = 1 | Z_t) = \frac{\exp(Z_t'\theta)}{1+\exp(Z_t'\theta)}$$

where all elements of Z_t are known at time $t-1$, except the change in the discount rate. For policymakers, then, all of Z_t is known before the Fed actually changes the discount rate, while for market watchers, the Prob.$(S_t = 1 | Z_t)$ is useful for making inferences conditional on the occurrence of a given-sized discount rate change.[9]

Table 1 gives results from estimating the parameters in equations 1 and 2, β and θ. Further details on the mixture model and its estimation are in the Appendix.

Estimation Results for Mixture Model

The prior probabilities for Process 1 and Process 2 are conditioned on the following variables in the results in table 1: a constant; the change in the discount rate multiplied by the sign of the previous change; and the unemployment rate. As an explanatory variable, the change in the discount rate multiplied by the sign of the previous change responds to the following observation: Generally, large absolute changes in the discount rate lead to relatively large responses in the T-bill rate; exceptions occur, however, when the discount rate change represents a change in the direction of the discount rate (increases to decreases and vice versa). For this explanatory variable, the relationship between the absolute magnitude of the discount rate change and the T-bill response will reverse itself when the direction changes. An alternative approach would be to estimate a separate coefficient on a change-in-direction dummy variable, but, given that only eight changes in direction occur in the sample, the additional coefficient cannot be

[8] The parameters θ represent the derivative of the log of the odds of Process 1 versus Process 2 with respect to Z.

[9] Many professional forecasters will present different forecasts for different "scenarios," where one scenario might include an easing in monetary policy accompanied by a discount rate change of 25 basis points.

estimated precisely.[10] The unemployment rate is included because it might summarize the effects of real shocks on the economy.[11]

The hypothesis that $\beta_1 = \beta_2$ is easily rejected, so that qualitative differences among discount rate changes of the same size do indeed cause them to differ in their effects on the T-bill rate. It is also useful to interpret the signs of the θ parameters, all three of which are significantly different from zero. The positive constant implies that, other things equal, the low-response process is more likely to hold. The negative coefficient on the magnitude variable implies that increasing the size of the discount rate change leads to more than a proportionate increase in the T-bill response, provided that the change is in the same direction as the previous one. Thus, perhaps markets interpret 100 basis-point changes in the discount rate as especially convincing signals of a changing environment. The negative coefficient on the unemployment rate indicates that relatively large responses in the T-bill rate are more likely when the unemployment rate is high. One interpretation is that the market believes that the Fed reacts to high unemployment with active policy steps to stimulate the economy, so the market tends to key off discount rate changes and Process 2 is likely to hold.

In fitting the change in the T-bill rate on the days the discount rate changes, the mixture model attains an R^2 of .726 (on days when the discount rate does not change, the R^2 is zero by construction).[12] Estimation of the T-bill response, using the technical/non-technical classifications from Federal Reserve announcements, results in a lower R^2 of .459.[13] Furthermore, as table 2 shows, the mixture model provides a superior fit across both the October 1979-October 1982 period, when the Fed targeted non-borrowed reserves, and the rest of the sample.

Table 2

Sum of Squared Residuals when $\Delta DR \neq 0$

Sample period	Mixture model	Technical/ Non-technical
Full sample	1.837	3.076
1979-1982	1.448	1.936
Outside 1979-1982	.390	1.141

The generality of the mixture model, relative to the technical/non-technical dichotomy, is that the probability of Process 1 vs. Process 2 can lie anywhere between zero and one; table 3 shows that the probabilities of the high-response process lie between 10 and 90 percent for five responses. Table 3 also indicates that the differences between the mixture model and the technical/non-technical regression derive mainly from the fact that 33 of the 56 discount changes are non-technical, yet the estimated probabilities of Process 2 determining the T-bill responses in the mixture model sum only to 12.2, which indicates that non-technical discount rate changes are considerably heterogeneous with respect to the market response. This concurs with Thornton (1991) who notes that the T-bill rate does not change significantly following some non-technical changes. Nevertheless, almost all high-response cases are non-technical, and on only three occasions did the probability of Process 2, the high-response case, exceed 0.9 outside of October 1979-October 1982, the period of non-borrowed reserves targeting. It is not yet clear, then, whether the large T-bill responses between 1979 and 1982 were due to the operating procedure or the abnormally high unemployment rates. The next section shows that *both* the

[10]Such a version of the model was estimated with separate coefficients for the magnitude and the sign change. Not surprisingly, the coefficient on the sign-change variable suggests that changes in direction lead to small responses in the T-bill rate; with only eight occurrences, however, the standard error is large, making the point estimate unreliable. The coefficient on the magnitude of the discount rate change, which can use all 56 observations, is statistically significant. Overall, both the version reported in the paper and the one described here give nearly identical estimates of the response levels and the number of high-response cases.

[11]Other variables tried but found not to be significant were the most recent change in the inflation rate and the growth rate of industrial production.

[12]Note that a mixture model with constant prior probabilities fits almost as well as the one with time-varying prior probabilities. Nevertheless, the prior probabilities do exhibit statistically significant variation, and by estimating their co-movements with other variables, we gain some insight as to what lies behind the T-bill responses.

[13]This regression follows Thornton (1982) who first documented that dividing discount rate changes into "technical" and "non-technical" changes leads to a regression of interest rate changes on discount rate changes where non-technical changes are significant and technical changes are insignificant: $\Delta TB_t = \delta_0 + A(L)\Delta TB_{t-1} + \delta_1 D_t \Delta DR_t + \delta_2 (1 - D_t) \Delta DR_t + \varepsilon_t$, where D_t is a dummy variable that equals one when the discount change is technical. The estimates of δ_1 and δ_2 are .036 and .540, respectively, for this data set.

Table 3

Specific Discount Rate Changes

Date	Change in discount rate	Change in T-bill rate	Probability of high-response process	Non-technical = 1
1-15-73	0.50	0.030	1.5028E-06	0
2-26-73	0.50	0.210	0.043218	1
4-23-73	0.25	0.060	0.0099814	0
5-11-73	0.25	0.230	0.13455	0
6-11-73	0.50	0.080	0.00061177	1
7-02-73	0.50	0.380	0.91483	1
8-14-73	0.50	0.230	0.073415	0
4-25-74	0.50	0.190	0.023996	1
12-09-74	−0.25	−0.180	0.023127	1
1-06-75	−0.50	−0.060	0.0015696	1
2-05-75	−0.50	−0.150	0.029039	0
3-10-75	−0.50	0.060	3.9024E-05	1
5-16-75	−0.25	0.010	0.021211	0
1-19-76	−0.50	−0.080	0.0027500	0
11-22-76	−0.25	−0.060	0.037609	0
8-30-77	0.50	0.020	2.8641E-06	0
10-26-77	0.25	−0.050	0.0038216	0
1-09-78	0.50	0.390	0.96901	1
5-11-78	0.50	−0.070	7.5165E-06	0
7-03-78	0.25	−0.060	0.0024606	0
8-21-78	0.50	−0.040	1.9156E-05	1
9-22-78	0.25	0.110	0.035044	1
10-16-78	0.50	0.060	0.00048244	1
11-01-78	1.00	0.100	1.3174E-10	1
7-20-79	0.50	0.160	0.012015	1
8-17-79	0.50	0.060	0.00052925	1
9-19-79	0.50	−0.200	1.0186E-07	0
10-09-79	1.00	1.120	0.99437	1
2-15-80	1.00	0.570	0.75012	1
5-29-80	−1.00	0.220	2.0124E-06	0
6-13-80	−1.00	−0.020	0.076875	0
7-28-80	−1.00	0.160	0.022486	0
9-26-80	1.00	0.460	0.00035858	1
11-17-80	1.00	0.800	0.96824	1
12-05-80	1.00	0.980	0.99060	1
5-05-81	1.00	0.600	0.86819	1
11-02-81	−1.00	−0.060	2.4887E-05	0
12-04-81	−1.00	−0.580	0.90221	0
7-20-82	−0.50	−0.400	0.56798	1
8-02-82	−0.50	−0.810	0.86346	1
8-16-82	−0.50	−0.580	0.72376	1
8-27-82	−0.50	0.700	0.019068	0
10-12-82	−0.50	−0.370	0.99147	0
11-22-82	−0.50	−0.140	0.070041	1
12-14-82	−0.50	−0.320	0.96461	1
4-09-84	0.50	−0.090	1.0819E-07	0
11-23-84	−0.50	−0.100	4.8352E-05	1
12-24-84	−0.50	−0.130	0.010614	1
5-20-85	−0.50	−0.140	0.014009	1
3-07-86	−0.50	−0.080	0.0019898	1
4-21-86	−0.50	0.000	0.00013878	0
7-11-86	−0.50	−0.100	0.0034851	0
8-21-86	−0.50	−0.130	0.0088348	1
9-04-87	0.50	0.190	0.00044880	1
8-09-88	0.50	0.220	0.076418	1
2-24-89	0.50	0.040	0.00018991	1

Table 4
Sum of Squared Forecast Errors

Sample period	Forecast 1	Technical/ Non-technical	Forecast 2
Full sample	3.552	3.076	2.404
1979-1982	2.721	1.936	1.711
Outside 1979-1982	.831	1.141	.694

operating procedure and the unemployment rate matter for forecasting.

How Good Are The One-Step-Ahead Forecasts?

Substitution of the prior probabilities, Prob.$(S_t = 1|Z_t)$, into equation 1 for S_t gives one-step-ahead forecasts for this model. Comparing the mixture model's sum of squared forecasts errors, found in table 4 under forecast 1, with the sum of squared residuals from the technical/non-technical regression provides a relative measure of forecast performance.

The mixture model's forecast 1 does not fare well from October 1979-October 1982, although it performs better than the technical/non-technical regression outside this period. One interpretation is that Federal Reserve announcements of discount rate changes, on which the technical/non-technical classifications are based, take on special importance during periods when the Fed is targeting non-borrowed reserves. To learn about this, we add a dummy variable, which equals one when there is a non-technical change during the 1979-82 period, into Z_t in the prior probabilities of equation 2 of the mixture model.[14] The sum of squared forecast errors is reported in table 4 under forecast 2. Knowing whether the discount change is technical greatly improves the forecasts between 1979-82. One possible explanation is that market watchers can directly observe discrete shifts in Fed policy by watching the federal funds rate when it is the operating target. Under non-borrowed reserves targeting, however, the funds rate is market-determined, so discrete shifts in Fed policy are more likely to be revealed through the discount rate, thereby enhancing the informational value of discount rate changes, as it takes time for shifts in policy to translate into sustained changes in the rate of reserves growth.

Out-of-Sample Forecasts from 1990-92

Compared with in-sample forecasting, out-of-sample forecasting offers a stiffer and more economically meaningful test of an empirical model. Thus, it is useful to compare forecasts from the mixture model and the technical/non-technical regression for the seven discount rate changes beginning in December 1990, using the coefficients estimated over the 1972-89 period.[15] Table 5 summarizes the results.

The time-varying prior probabilities of Process 1 vs. Process 2 are clearly illustrated in table 5. As the unemployment rate increases, the prior probability of Process 2 increases, perhaps as markets expect active policy steps from the Fed to combat recession. Also, the change in December 1991 leads to a much higher prior probability of the high-response process, because it was a change of 100 basis points and the sign of the discount rate change did not change from the previous one. The technical/non-technical regression, in contrast, consistently overpredicts the T-bill responses with its characterization that all non-technical discount rate changes of the same size should have the same effect on the T-bill rate.

[14]Adding a second dummy variable for non-technical changes outside 1979-82 does not improve the estimates significantly.

[15]It is easy to formulate in-sample forecasts that suggest, for example, that people in 1932 should have known that it was a great time to buy stocks. When making real-world decisions, however, people have to forecast into the very uncertain future, a fact captured in out-of-sample forecasting.

Table 5
Out-of-Sample Forecasting

Date	12-19-90	2-04-91	4-30-91	9-13-91	11-6-91	12-20-91	7-02-92
Unemployment rate	6.1	6.5	6.6	6.8	6.9	7.1	7.8
Technical change	0	0	0	0	0	0	0
Prior Probability Process 1	.999	.875	.869	.859	.853	.372	.205
Change in Discount Rate	−.50	−.50	−.50	−.50	−.50	−1.0	−.50
Change in T-bill Rate	−.11	−.02	−.08	−.06	−.13	−.30	−.31
Technical forecasted ΔTB	−.273	−.273	−.273	−.273	−.273	−.546	−.273
Mixture forecasted ΔTB	−.027	−.064	−.066	−.069	−.070	−.475	−.274

Overall, the mixture model with time-varying prior probabilities fits the changes in the T-bill rate better than the technical/non-technical regression; it also provides better one-step-ahead forecasts, given that the prior probabilities use information about whether the change is technical or non-technical during periods when the operating target is non-borrowed reserves. Furthermore, the variables determining the prior probabilities of the two response levels may reveal something about the market's beliefs about discount rate policy.

ARE DISCOUNT RATE CHANGES ANTICIPATED?

Previous research has considered that whether a discount rate change is anticipated or not is a potentially important factor in determining how strongly the T-bill rate responds.[16] In other words, when market rates do not respond to a non-technical change in the discount rate, it might be due to the fact that the market anticipated the change and market rates had already moved before the discount change. The relevance of this scenario hinges on whether market participants can predict with reasonable accuracy both the timing and magnitude of discount rate changes. The analysis here will follow the work of Hakkio and Pearce (1992) by lumping together different-sized changes in the discount rate and concentrating on whether the direction and timing of changes are predictable.[17] The distinction will be that Hakkio and Pearce either estimate sub-samples of discount rate increases and decreases separately, or estimate a multinomial logit model, neither of which recognizes the ordering inherent in discount rate changes (decrease, no change, increase). The ordered probit model employed here takes into account that the probability of a decrease in the discount rate, relative to the probability of no change, does not remain constant as the probability of an increase changes; the multinomial logit requires this assumption.[18]

Maddala (1983) presents the basic ordered probit model, written here in terms of discount rate changes:

$$(3)\quad \text{Prob.}(\textit{decrease}\,|\,X_{t-1}) = F(X'_{t-1}\beta)$$

$$\text{Prob.}(\textit{no change}\,|\,X_{t-1}) = F(X'_{t-1}\beta + c) - F(X'_{t-1}\beta)$$

$$\text{Prob.}(\textit{increase}\,|\,X_{t-1}) = 1 - F(X'_{t-1}\beta + c)$$

where X_{t-1} is a vector of information available at time $t-1$, $F(\cdot)$ is the cumulative normal density function and c is a positive constant.

Furthermore, rather than view the anticipated/unanticipated dichotomy as an alternative to

[16]Examples are Thornton (1986, 1991), Roley and Troll (1984), Smirlock and Yawitz (1985), and Hakkio and Pearce (1992).

[17]This restriction is simply due to a lack of a sufficient number of 25, 50, and 100 basis-point increases and decreases to allow for full separation of discount changes based on their sizes. Smirlock and Yawitz (1985), on the other hand, obtain an estimate of the expected change in the discount rate, not only the prior probability of a change. This comes at a cost, however, because their model does not consider the discrete nature of discount rate changes, i.e., their model ignores the fact that the Fed always changes the discount rate by a minimum of 25 basis points, which effectively makes the likelihood of a discount rate change trivially small in many time periods.

[18]Applications of the multinomial logit model are often criticized for assuming an "independence of irrelevant alternatives" when this property fails to hold for the choices being modeled. See Maddala (1983) for some examples.

Table 6
Response Coefficients for T-Bill

	Technical Increase	Technical Decrease	Non-technical Increase	Non-technical Decrease
Anticipated	α_1	α_2	α_3	α_4
Unanticipated	α_5	$-\alpha_5$	α_6	$-\alpha_6$

technical/non-technical as Smirlock and Yawitz (1985) do, we can estimate the market's responses to polychotomous discount rate changes: anticipated technical increases in the discount rate; anticipated non-technical decreases; unanticipated technical changes; etc. In all there are eight different responses, as outlined in table 6.

Hence, the hypothesis that anticipations of discount rate changes do not significantly move the T-Bill rate cannot be rejected if $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ cannot be rejected. The model imposes symmetrical responses for unanticipated increases and decreases in the discount rate simply due to sample-size constraints. With only 23 and 33 technical and non-technical changes, respectively, it is not possible to obtain good estimates of separate coefficients for either unanticipated technical increases and decreases or unanticipated non-technical increases and decreases.

The sequential nature of the model means that we first use time $t-1$ information to estimate the respective probabilities of a decrease, no change or an increase in the discount rate at time t. Then, given the direction of the discount rate change, we use time $t-1$ information to estimate the probabilities of technical and non-technical changes in the discount rate. Together these prior probabilities give the prior probability of a technical discount rate increase:

$$(4)\ \text{Probability}\ (\textit{tech.increase}|X_{t-1})$$
$$= \text{Prob.}(\textit{increase}|X_{t-1})$$
$$\times\ \text{Prob.}(\textit{tech.change}|\textit{increase},\ X_{t-1})$$

The objective here is to regress changes in the T-bill rate on the prior probabilities of discount rate changes, such as the one in equation 4, to see whether market interest rates react to changing anticipations of discount rate changes.[19]

Results from the Ordered Probit Model

Estimates from this model help determine which explanatory variables are useful in predicting discount rate changes and to what extent discount rate changes are predictable.[20] The results from estimating equation 3 with weekly data (Friday-to-Friday) are in table 7 and indicate that discount rate changes are somewhat predictable in a qualitative sense; figures 1 and 2 show that the prior probability of a discount rate decrease or increase often peaks near the actual changes, but it never reaches one-half. Significant explanatory variables for the discount rate changes are the spread between the repurchase rate and the discount rate,

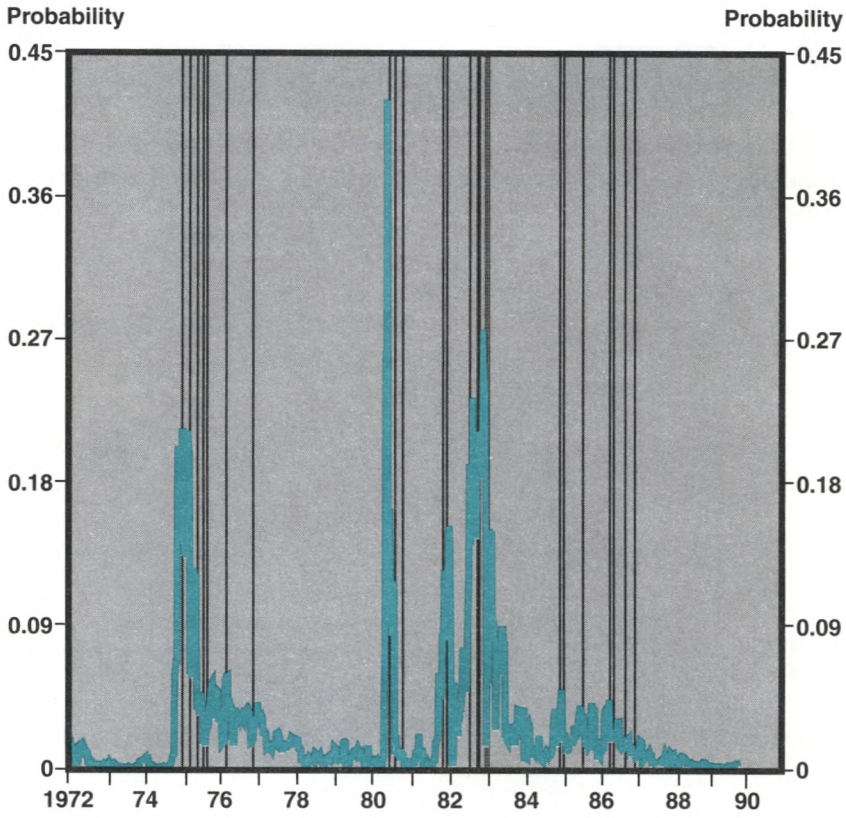
Table 7
Ordered Probit Coefficients

Variable	Coefficient	t-statistic
Intercept	3.88	8.94
Spread	−.217	4.09
Industrial Production	−27.94	3.88
Unemployment Rate	.265	5.00
Constant (c)	4.34	24.11

[19]We say "anticipations of discount rate changes" and not "anticipated discount rate changes," because the model should include the effect on the T-bill rate of cases in which a discount change seemed likely, but none occurred. The estimates of Smirlock and Yawitz (1985) and Thornton (1991) do not fully account for unfulfilled anticipations of discount rate changes.

[20]The variables tried had been suggested in Hakkio and Pearce (1992).

Figure 1
Prior Probability of a Discount Rate Decrease



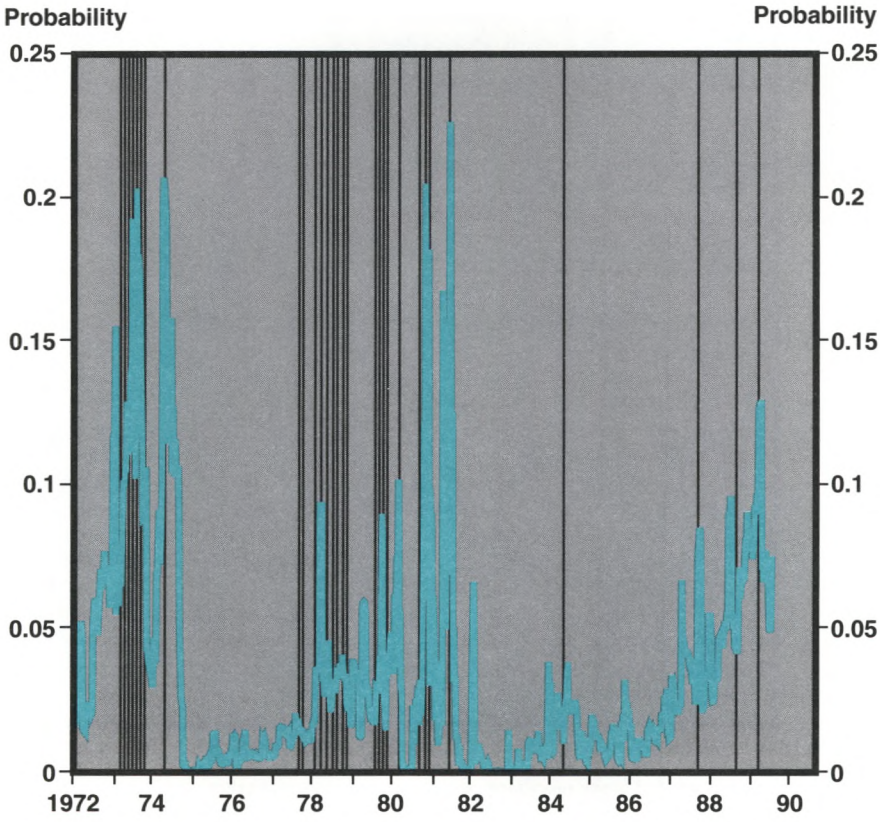
NOTE: Vertical lines represent dates of discount rate cuts.

industrial production and the unemployment rate; money growth is not significant.

The signs of the ordered probit coefficients imply that, as the repurchase rate rises above the discount rate, the probability of a discount rate hike increases; low industrial production and high unemployment raise the probability of discount rate cuts, so all coefficients have the expected signs. The growth rate of industrial production is not significant in determining the prior probabilities in the mixture model, but is significant in predicting discount rate changes, which means that industrial production helps indicate when discount rate changes will take place, but not how market rates will respond. The unemployment rate, on the other hand, is significant in both contexts. Figure 3 provides some interpretation by showing that early in recessions sometimes monetary policy easings bring discount rate decreases, yet other times the discount rate simply follows the cyclical path of market rates. Late in recessions, however, when the unemployment rate reaches its cyclical peak, monetary policy easings usually take the discount rate substantially below its pre-recession level.

Correlations between the probabilities of the high-response process and the unemployment rate and the growth rate of industrial production also support the idea that the market believes that the Fed shifts monetary policy more often in response to unemployment than output. The correlation coefficient between the probability of the high-response process and the unemployment rate is .31; it is only .09 between the high-

Figure 2
Prior Probability of a Discount Rate Increase



NOTE: Vertical lines represent dates of discount rate increases.

response probability and the growth rate of industrial production.

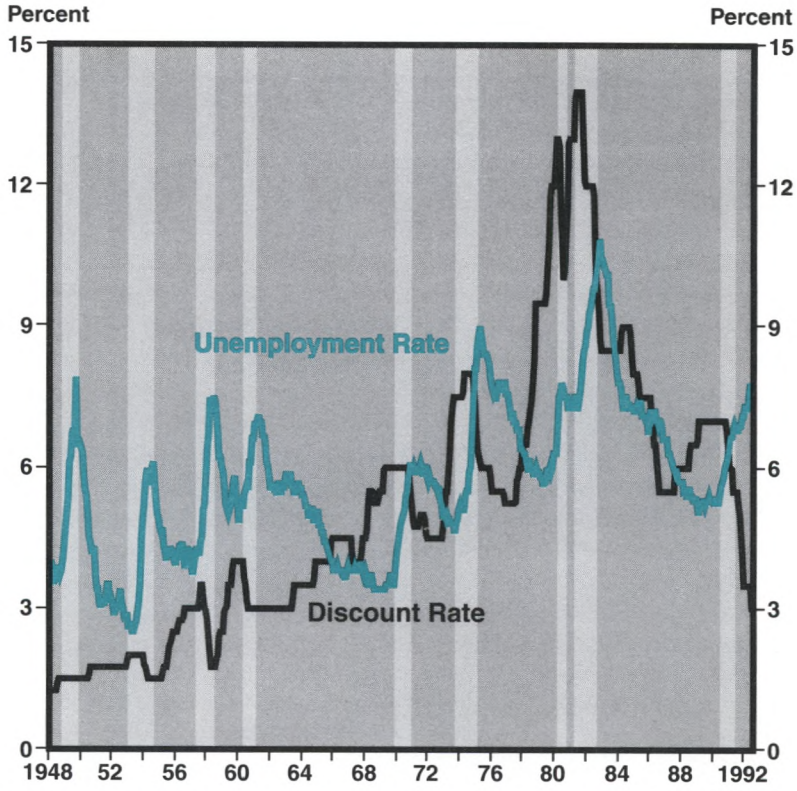
Probability That a Discount Rate Change Will Be Technical

The ordered probit gives the first probability on the right-hand side of equation 4. The second, the Prob.*(technical change|increase,* X_{t-1}), comes from modeling the technical/non-technical binary variable with an ordinary probit, using all the discount rate increases in the sample.[21] The estimated probit coefficients and X_{t-1} can then be used to calculate Prob.*(technical change|increase,* X_{t-1}) for each observation. When using the Federal Reserve announcements to form the binary dependent variable (technical/non-technical), however, none of the explanatory variables is a statistically significant predictor of whether discount rate increases are likely to be technical or non-technical. Results for both probit models, one each for increases and decreases, appear in table 8.

The probability of the discount change being technical is $F(X'_{t-1}\beta)$, where $F(\cdot)$ is the cumulative

[21]The ordinary probit model is similar to the ordered probit of equation 3, except that the dependent variable is binomial, rather than trinomial.

Figure 3
The Discount Rate and the Unemployment Rate



NOTE: Light shaded areas represent periods of business recession.

density function for the normal distribution, so that a positive coefficient on a variable means that the probability that a change is technical increases with that variable. Despite the lack of statistical significance for all coefficients except that on the spread between the federal funds rate and the discount rate for the decreases, we nevertheless use fitted values generated with these coefficients in testing whether anticipations of discount rate changes affect T-bill rates. This is because the limiting factor with respect to anticipating the timing and nature of discount rate changes is most likely an inability to predict the timing, given that in the ordered probit the prior probabilities of discount rate decreases and increases never reach 50 percent and 25 percent, respectively, as shown in figures 1 and 2.

T-Bill Responses to Anticipated Discount Rate Changes

The results of estimating table 6's response coefficients appear in table 9. None of the four anticipated variables has a significant coefficient, although the F-test of joint significance gives an $F_{4,905}$ statistic of 3.115, which lies between the critical value $F_{4,\infty} = 3.32$ at the 99 percent confidence level and the 95 percent critical value of 2.37.[22] Thus when using the

[22]Because the anticipated discount rate change variables are generated regressors (they come from the sequential ordered probit model), the reported standard errors, as Pagan (1984) demonstrates, are valid for hypothesis testing only under the null hypothesis that their coefficients are zero.

Table 8
Probability of Technical vs. Non-technical

	Discount Rate Increases		Discount Rate Decreases	
Variable (X_{t-1})	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	−.626	.323	1.71	.794
Spread	.119	.412	−1.29	2.273
M1 Growth Rate	8.48	1.32	2.61	.494
Industrial Production Growth	−38.24	.654	30.73	.823
Unemployment Rate	−.079	.251	−.272	1.01

technical/non-technical classifications, it might appear that anticipations of discount rate changes have an effect on the T-bill rate. It is unclear, however, whether this result holds when we use the mixture model's classifications. Consequently, we repeat the exercise using a binary variable generated from the posterior probabilities from the mixture model, whereby a discount rate change is classified as coming from Process 2 if the Prob.(Process $2|\Delta TB) \geq 0.5$. Only the dependent binary variable (Process 1/Process 2) changes from the previous analysis; the probabilities of discount rate changes from the ordered probit still apply. Table 10 contains new estimates of the T-bill response coefficients.

With the mixture model classifications, the timing of discount rate changes does not appear to be sufficiently predictable to uncover evidence that anticipations of discount changes lead to movements in the T-bill rate. In table 10, no coefficient on an anticipated variable is significant, and the $F_{4,905}$ statistic for joint significance is only 1.77, which is less than the 95 percent critical value of 2.37. We conclude that the timing of a discount rate change is difficult to predict, even at the weekly horizon, and anticipations of discount rate changes do not appear to be major determinants of movements in the T-bill rate, especially when classifying the discount rate changes as high- or low-response changes.

CONCLUSIONS

This paper presents a mixture model of two levels of T-bill responses to discount rate changes. All of the model's results are compared with results obtained from classifying discount rate changes as technical or non-technical, which is the standard approach in the literature. The mixture model yields superior results with the single exception of forecasting T-bill responses during the 1979-82 period of non-borrowed reserves targeting. Conditioning the mixture model's forecasts on whether the discount change is technical or non-technical from 1979-82 remedies this shortcoming. Moreover the mixture model is well-suited to forecasting because it derives prior probabilities for each response level, which policymakers and market participants can use to analyze the likely impact of a discount rate change on market interest rates.

Table 9
T-Bill Response Coefficients

Variable	Coefficient	t-statistic
Intercept	.030	1.50
Spread	−.049	2.45
Unanticipated Non-technical	.827	5.95
Unanticipated Technical	.230	1.10
Anticipated Non-technical Decrease	−.201	.234
Anticipated Technical Decrease	−.692	1.624
Anticipated Non-technical Increase	3.123	1.639
Anticipated Technical Increase	−.616	.834

Estimates of the market's responses to discount rate changes are consistent with the idea that the market believes in several stylized facts. First, discount rate changes of larger absolute magnitudes appear to generate proportionately larger responses in the T-bill rate. Second, markets look for the Fed to respond actively when the

Table 10

Alternative T-Bill Response Coefficients

Variable	Coefficient	t-statistic
Intercept	−.037	1.85
Spread	−.047	2.47
Unanticipated Process 2	.826	6.03
Unanticipated Process 1	.174	.833
Anticipated Process 2 Decrease	−.785	1.230
Anticipated Process 1 Decrease	−.217	.547
Anticipated Process 2 Increase	.516	.831
Anticipated Process 1 Increase	−.273	.168

unemployment rate is high. Third, discount rate policy apparently becomes an important source of information transmission during periods of non-borrowed reserves targeting. This is probably because discrete shifts in Fed policy are not revealed through the federal funds rate under non-borrowed reserves targeting, thereby boosting the status of Federal Reserve announcements of discount rate changes as indicators of shifts in monetary policy. The technical/non-technical dichotomy is much less able to separate these individual influences behind the market response to discount rate changes. Furthermore, the mixture model provides an econometric framework within which such stylized facts can be quantified to further our understanding of when and why some discount rate changes will have a significant impact on market interest rates.

The second half of the paper uses a sequential ordered probit model, an econometric model that is arguably more suited to estimating the extent to which discount rate changes can be anticipated than ones used previously in the literature. The estimates are consistent with Smirlock and Yawitz (1985) in that anticipations of discount rate changes might appear to affect the T-bill rate when the changes are classified as technical or non-technical. The evidence, however, does not support such a role for anticipations of discount rate changes when we use the mixture model to classify the discount rate changes.

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Appendix
Estimating the Mixture Model

An intuitive method of estimating mixture models with unknown sample separation across the different processes is the Expectation-Maximization (EM) algorithm of Dempster, Laird and Rubin (1977). Following the EM algorithm, we write the joint density of the change in the T-bill rate and the unobserved state, S_t, conditional on Z_t as

$$(A1)\quad f(\Delta TB_t, S_t = j | Z_t) = \phi(\Delta TB_t | S_t = j)\ \text{Prob.}\ (S_t = j | Z_t), \quad j = 0,1.$$

Taking logs and differentiating with respect to $\gamma = (\beta, \theta, \sigma)$ in A1, we obtain scores of the log-likelihood under the assumption that the changes in the T-bill rate are normally distributed, so that when ϕ denotes the normal density function, the probability-weighted scores to be set to zero are

$$(A2)\quad \sum_{t=1}^{T} \left[\text{Prob.}\ (S_t = 0 | \Delta TB_t) \frac{\partial \ln f(\Delta TB_t, S_t = 0 | Z_t)}{\partial \gamma} + \text{Prob.}\ (S_t = 1 | \Delta TB_t) \frac{\partial \ln f(\Delta TB_t, S_t = 1 | Z_t)}{\partial \gamma} \right]$$

The variance σ_t is assumed to take on either of two values:

$\sigma_t = \sigma_1$ if $t \in$ (Oct. 1979-Oct. 1982)

$= \sigma_0$ otherwise.

Hence, the model allows for $\sigma_1 \geq \sigma_0$, reflecting the greater volatility of interest rates experienced under the Fed's non-borrowed reserves operating procedure from October 1979 until October 1982. In the case where changes in the T-bill rate are not normally distributed, the estimates are still consistent, but not as efficient as they would be if the true density were known and maximized. Furthermore, Hamilton (1990) has shown that disturbances to real GNP growth appear more homoscedastic and normal when modelled with a non-linear, state-switching model than with a linear model.

Finally, Bayes' Law allows for calculation of Prob. $(S_t = 0 | \Delta TB_t)$:

$$(A3)\quad \text{Prob.}\ (S_t = 0 | \Delta TB_t) = \text{Prob.}\ (S_t = 0 | Z_t)\phi(\Delta TB_t | S_t = 0) \Big/ \left[\text{Prob.}\ (S_t = 0 | Z)_t \phi(\Delta TB_t | S_t = 0) + \text{Prob.}\ (S_t = 1 | Z_t)\phi(\Delta TB_t | S_t = 1) \right]$$

The EM algorithm calls for the following steps to be taken in the estimation of (β, θ, σ):

Step 1

Given starting values of the parameters, calculate Prob.$(S_t = 0 | \Delta TB_t)$ using Bayes' Law.

Step 2

Find (β, θ, σ) which sets the probability-weighted scores equal to zero.

Step 3

With new estimates of (β, θ, σ), update the estimates of Prob.$(S_t = 0 | \Delta TB_t)$.

Step 4

Iterate over 2 and 3 until convergence.

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