Monetary policy and credit conditions: new evidence

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Abstract

A number of recent papers seek to distinguish between "money" and "credit" theories of the transmission of monetary disturbances using asymmetric information arguments. In credit models money causes output not only through the real interest rate but also through the availability of bank credit. The research described in this paper extends the work of Kashyap, Stein and Wilcox (1993), who construct a model that incorporates a relationship benefit to bank borrowing and then test the implications of the model. In this paper I extend their work by taking into account the households' demand for commercial paper, the T-bill market and the default risk of the banking sector as a determinant of the relationship benefit.

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I. INTRODUCTION

The objective of this paper is to contribute to the "money versus credit" debate by providing both theoretical and empirical support for the idea that the health of the banking sector influences real activity.

I begin with a brief review of the relevant literature. I do not attempt to improve or extend the slate of recent reviews by Bernanke (1993), Gertler (1988), Scholtens (1993), among others. Rather I focus on the specialness of banks and the relationship benefit. The relationship benefit is an intriguing concept recently introduced into the macroeconomics literature by Kashyap, Stein and Wilcox (1993). A number of papers in the finance literature lend theoretical and empirical credibility to the idea that from the firm's perspective a banking relationship is a valuable option. Bank default disrupts the relationship. Hence risk in the banking sector influences the value of the relationship benefit, the cost of corporate finance, and the level and growth of real activity. Since the effect of bank default on the relationship benefit and, ultimately, real activity is the focus of the paper, I also review some of the current literature on causes and consequences of bank defaults.

This paper extends the Kashyap et al. model by taking into account the households' demand for commercial paper, the T-bill market and the default risk of the banking sector as a determinant of the relationship benefit. In the extended model an increase in default risk decreases investment and output, and increases the paper-bill spread.

This paper will provide empirical evidence on the ability of a measure of risk in the banking sector to predict output. My admittedly crude measure of bank default, the ratio of the total assets of closing banks requiring disbursements by the FDIC to the total assets of commercial banks, outperforms the federal funds rate and nearly outperforms the paper-bill spread in Granger causality, variance decomposition and out-of-sample forecasting tests in a model similar to that of Friedman and Kuttner (1993a). Preliminary evidence also supports the view that the condition of the banking sector at least partly explains the predictive power of the paper-bill spread. Further research seems warranted.

II. LITERATURE REVIEW

A. THE MONEY VERSUS CREDIT DEBATE

In a standard "money" model monetary policy operates through the liability side of banks' balance sheets. If the Fed withdraws reserves from the banking sector, transaction balances fall, interest rates increase, and real activity slows due to declining investment.

In a "credit" model, on the other hand, a tighter monetary policy decreases the size of the banking system and, through an increase in the cost of credit or through credit rationing, reduces the supply of credit to those borrowers for whom non-bank sources of credit are not a perfect substitute. Investment and aggregate demand will decrease more than can be accounted for by the money channel.

Several elements in the credit view stand out.[1] First, bank credit (on the asset side of bank balance sheets) is special and no perfect substitutes (commercial paper, trade credit, etc.) for bank lending are available to the firm. I will discuss this "specialness" and its root cause, the pervasive imperfect information problem in the credit market, in somewhat greater detail below.

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[1] This discussion is partly based on Gertler and Gilchrist (1993).

Second, in credit models monetary policy provides a binding constraint on bank lending. There are no perfect substitutes available on the asset side of banks' balance sheets (commercial paper, government securities, etc.) and no other liabilities (time liabilities) are available to cushion the impact of the monetary policy on the demand deposits.

Third, dynamic credit models often contain the excess sensitivity, or balance sheet, hypothesis as a propagation mechanism.

A fourth element of the credit view is that credit rationing in credit markets, while not a necessary condition for the existence of a credit channel, becomes possible as an equilibrium solution.

Fifth, a relationship exists between the level of development of lending arrangements in the financial sector and the level of real activity.

Modern intermediation theory rests on the idea of imperfect information in credit markets. Lenders are uncertain about the characteristics of borrowers (leading to adverse selection problems), and about borrowers' actions during and at the end of the period of the credit contract (leading to moral hazard and enforcement problems). However, the "informational canyon" separating lenders and borrowers is not everywhere equally wide. Some borrowers, like large firms, are close by and easily observed. Lenders will provide credit without too much screening and monitoring. Other borrowers, like small firms, are hardly visible. The lender will try to bridge the information gap before providing or extending credit. Banks are especially proficient in dealing with the latter situation. Banks are "special". They are the main providers of screening and monitoring and social accounting services for the allocation of credit. Other lenders, like some alternative types of financial institutions and individual savers, focus on providing credit directly or through marketable credit instruments to easily observable borrowers. A large number of both domestic[2] and international[3] empirical studies provides support for the idea that banks are special. In the next section I discuss in more detail why firms are prepared to pay a higher interest rate on a bank loan than on commercial paper.

[2] Mikkelson and Partch (1986), James (1987), among many others.
[3] Hoshi, Kashyap and Scharfstein (1990a, 1990b, 1991) among others.

B. THE RELATIONSHIP BENEFIT

In his "Pecking Order Theory" of corporate finance Meyers (1984) argues that, because of imperfect information problems, firms prefer internal finance (retained earnings) over debt finance and firms prefer debt finance over equity finance. If a firm has exhausted its internal funds, it will issue commercial paper (or bonds) on the capital market or apply for a loan in the banking sector. The cost of loan finance, the loan rate, has typically been higher than the cost of paper finance, the paper rate. Therefore Kashyap, Stein and Wilcox (1993) argue that loan finance has an offsetting benefit for the firm, a relationship benefit.

This benefit may consist of better non-interest terms, such as lower collateral requirements, better repayment programs, less restrictive covenants, lower compensating balances (Simonson, 1992), and lower issuing costs (Blackwell and Kidwell, 1988). The benefit may also include risk sharing between risk averse clients and less risk averse banks (Baltensperger, 1978). Examples of risk-sharing mechanisms include overdraft facilities and the possibility of rescheduling and renegotiating loans. Risk sharing will reduce the costs of financial distress and "the likelihood of myopic firm behavior, caused by the fear of withdrawal of outside finance in case of failure in an early stage of a project" (von Thadden, 1991).

In some cases firms cannot raise funds from public markets due to adverse selection problems, which are solved by the enhanced monitoring and enforcement mechanisms available to banks. More generally a credit relationship makes a firm less dependent on its own internal funds.[4] A credit relationship also allows a firm to fulfill its more complex and non-standard credit needs (Bernanke and Gertler, 1985).

Once a credit relationship is established with a particular bank, it can prove costly and very difficult for a firm to switch to another bank (Kaufman, 1991). Banks also become somewhat complacent and do not monitor credit risk as closely as for new loans (Arshadi and Lawrence, 1991). And the "used intertemporal borrower market" may be thin or nonexistent (Stiglitz and Weiss, 1983).[5] Further game-theoretic arguments focus on the multi-period character of a banking relationship. The 'time inconsistency' problem between shareholders, the firm, and the bank, and the 'strategic uncertainty' faced by a firm in its choice of outside finance, can be partially solved by the commitment of both parties in a long term credit relationship (Mayer, 1988 and Hellwig, 1989). And in a recession firms will prefer to solve their expected financial problems privately

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[4] Petersen and Rajan (1994).

[5] Hence the current lender might be able to extract rents from the locked-in firm (Sharpe, 1990; Rajan, 1992).

in a credit relationship, rather than damaging their reputation on the market (Diamond, 1991).

Other explanations for the willingness of the firm to pay for a long term credit relationship with a bank come out of the agency and signaling literature (O'Brien and Brown, 1992). Shareholders see a credit relationship with an intermediary as an extra control mechanism that deters excess risk-taking by managers. For managers, establishing a long term credit relationship provides a credible, favorable signal to the market about the creditworthiness of the firm (Leland and Pyle, 1977; Ross, 1977; Campbell and Kracaw, 1980 and Fama, 1985). The signal increases the capitalized market value of the firm, and may also alleviate information asymmetries between managers and outside investors that prevent managers from issuing new equity and cause them to forego positive net-present value investments (Meyers and Majluf, 1984). And if markets do not always price stocks efficiently (Shiller, 1992 and Lowenstein, 1991), then managers should look for 'relational investors' who focus on the company's real value over the long term (Nichols, 1993).

All these advantages arise from a lesser degree of informational asymmetry due to continuous monitoring by the banks, or due to lower "objective" search costs for banks involved in long term relationships (Milde, 1974). Moreover the confidentiality of the bank-firm relationship encourages the flow of information, reducing information asymmetry (Campbell, 1979; Christensen, 1992).

C. CAUSES, CONSEQUENCES, AND PREDICTION OF BANK DEFAULT

If the banking relationship is important for the firm,[6] bank default and disruption of the relationship will affect the firm negatively. Hence it is important to look at the causes of bank defaults.

Numerous studies point to factors internal to the financial institutions, i.e. fraud and internal irregularities, poorly managed rapid growth generating losses due to risky loans and investments, or sustained low performance and management quality as important causes of bank failures.[7] While banks obviously do not operate in a vacuum, an important number of bank failures are mainly the result of internal processes.

Bank default may affect output negatively through a number of different channels (uninsured deposit holders, employees, other banks, shareholders, borrowers), among which I argue the loss of the relationship benefit for the borrowers is the most important. Banks are "at the nexus of the solution of the asymmetric information problem". They invest in information, which is like a "sunk-cost", and

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[6] Elliehausen and Wolken (1990) and Holland (1994), among others.

[7] See Peterson and Scott (1985), Pantalone and Platt (1987, p.48), the report by the Comptroller of the Currency (1988), Seballos and Thomson (1990), Siems (1992), Barker and Holdsworth (1993), and Randall (1993, p.32). Risky strategies and poor management were also the cause of recent Canadian bank failures (Dowd, 1989, p.119). Akerlof and Romer (1993) claim that "looting", i.e. bankruptcy for profit, was the main cause of the S&L crisis.

"their death will destroy localized knowledge about borrowers" (Stiglitz, 1992, op.cit., p.291).

Borrowers are unable to avoid losses. The difficulty of outsiders in ascertaining the value of bank assets at any given moment is a distinguishing characteristic of the bank sector.[8] Three factors cause the inaccuracy of formal, prediction (early-warning) models in the bank sector: the inability of bank accounting data to reflect market values; the presence of criminal misconduct, which is a frequent cause of bank default; and, the regulatory process by which a bank is declared insolvent.[9] There are information problems in assessing the loan portfolio and general performance of the bank, and administrative and staff constraints in executing the closure of the bank (Kane, 1989). There are important legal and political constraints as the process itself and the outcome are influenced by principal-agents conflicts that exist between regulators, politicians and taxpayers (Havrilesky, 1989). Regulators will try to avoid visible large-bank failures (Kane, 1989), because they fear public perceptions about their own quality (Boot and Thakor, 1993). Moreover there are implicit and explicit funding constraints (Barth, Brumbaugh and Litan, 1992).

Empirical studies in which bank default is hypothesized as causing aggregate output are numbered. The key issue is

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[8] Bernanke and Gertler (1985), and Park (1991).
[9] Kane (1986) and Thomson (1989 and 1991).

the determination of the direction of the causality in the default-output relationship. Recent empirical studies use different approaches in dealing with this issue.[10]

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[10] Bernanke (1983), Cromwell (1990), Bernanke and James (1991), Grossman (1993).

III. THEORETICAL MODEL

A. MODEL SPECIFICATION

In this section I extend the theoretical model employed by Kashyap, Stein and Wilcox in their 1993 American Economic Review paper. I incorporate the households' demand for commercial paper, the T-bill market, and a measure of the default risk of the banking sector. I show that in this extended model default risk and output are negatively related.

In Kashyap et al. a representative firm invests an amount, I, and can choose between two sources of finance in raising the funds for the investment. A fraction α comes from bank loans at an interest rate r_l, the remaining ($1-\alpha$) comes from commercial paper at rate r_p, with $r_l > r_p$. Bank loans and commercial paper are imperfect substitutes and bank loans are more expensive than paper. Loans have a countervailing relationship benefit that depends on the total amount borrowed from the bank.

I assume that the relationship benefit also depends negatively on the default risk of the banking sector, measured by the variable, θ. A high default risk in the banking sector decreases the value of the credit relationship to the firm, as the relationship has a high probability of being discontinued in the near future.

I also assume that the firm lacks bank-specific information, hence the firm can only rely on its overall assessment of the health of the financial sector. I assume $0 \leq \theta \leq 1$, with $\theta=0$ indicating complete absence of any bank default risk, and $\theta=1$ indicating certain default by banks. Hence the total relationship benefit, Π, at time t, depends positively on the level of the capital stock, K, the fraction of lending coming from bank loans, α, and the overall financial health of the banking sector, θ.

(1) $$\Pi_t = K_t f(\alpha_t) g(\theta_t),$$

with $\alpha_t, \theta_t \in]0,1[$. Notice that $f, f_1 > 0$ and $f_{11} < 0$, as assumed by Kashyap, Stein and Wilcox. In addition, I assume that $g > 0$, $g_1, g_{11} < 0$, $f(0) = 0$, $f_1(0) = +\infty$, $f_1(1) = 0$, and $g(1) = 0$.

Assuming zero depreciation and no adjustment costs, the capital stock, K, at time t, depends on the firm's net cost of capital, k:

(2) $$K_t = K(k_t),$$

with $K > 0$ and $K_1 < 0$. The firm's net cost of capital, k, is:

(3) $$k_t = \alpha_t r_{lt} + [1-\alpha_t] r_{pt} - f(\alpha_t) g(\theta_t).$$

Given these assumptions, the firm's cost minimization problem yields the optimal financing mix, $\alpha^* = F(s_{lpt}, \theta)$. The mix is decreasing in the loan-paper spread, $s_{lpt} = r_{lt} - r_{pt}$, and in bank default risk, θ. Hence the firms' demand for bank loans and commercial paper is:

(4) $$BL_t^D = \alpha(s_{lpt}, \theta_t)[K(k_t)],$$

(5) $$CP_t^S = [1 - \alpha(s_{lpt}, \theta_t)][K(k_t)],$$

with $\alpha_1, \alpha_2 < 0$.

Extending the Kashyap et al. model, I assume the households' demand for commercial paper and money depends on the paper rate and their end-of-period assets, A_t. Households save part of the temporary deviations of output, Y, around the long-run steady state level of output, $\overline{Y}$, to smooth consumption.

(6) $$CP_t^D = \beta(r_{pt}) A_t,$$

(7) $$M_t^D = [1 - \beta(r_{pt})] A_t,$$

(8) $$A_t = \overline{A} + A(Y_t - \overline{Y}),$$

with $\beta_t \in]0,1[$, $\beta_1 > 0$, $A_1 > 0$, $\overline{A} > 0$, and $A(0) = 0$.

Kashyap et al. assume that banks are fully financed through demand deposits, hold cash only to satisfy reserve requirements, z, and hold no excess reserves. Thus the quantity of reserves, R, is a sufficient statistic for the stance of monetary policy. In this model, banks hold loans and T-bills as assets. The ratio of assets invested in loans or T-bills, is determined by the spread between the loan rate and the T-bill rate:

(9) $$M_t^S = \frac{R_t}{z},$$

(10) $$BL_t^S = \gamma_t(s_{lbt})[1-z]M_t^S,$$

(11) $$TB_t^D = [1-\gamma_t(s_{lbt})][1-z]M_t^S,$$

with $z, \gamma_t \in]0,1[$ and $\gamma_1 > 0$.

All financial markets clear, with the supply of T-bills by the government assumed to be exogeneously determined:

(12) $$M_t^S = M_t^D,$$

(13) $$CP_t^S = CP_t^D,$$

(14) $$\overline{TB}_t = TB_t^D,$$

(15) $$BL_t^S = BL_t^D.$$

The goods market also clears; private investment demand is assumed to be equal to the change in outstanding capital stock, and government deficit is assumed to be zero. Private savings is assumed to be equal to the change in assets.

Assuming the economy starts at $Y_{t-1} = \overline{Y}$, comparative statics can be derived (see the next section). It is shown that $(dY/d\theta) < 0$. An increase in the bank default risk decreases the relationship benefit, reflecting the potentially disruptive effect of a bank closing on the credit relationship, and decreases output.

B. PREDICTIONS OF THE MODEL

The comparative statics sign most responses; this in contrast to the Kashyap et al. model in which there are a number of necessary conditions.[11] While the model is static in nature, I assume that the financial adjustments, i.e. adjustments in the financial markets, require a smaller amount of time than the real adjustments, i.e. in the investment and real output variables. This simple dynamic assumption makes the financial variables leading indicators for changes in investment and real activity. This assumption is also sufficient to guarantee local stability (Appendix A). A summary of the responses to an open market operation (or a change in the reserve requirements) and to a change in risk in the banking sector is provided in table 1. The calculations are provided in Appendix B.

An increase in bank default risk decreases investment and output, decreases the loan-paper spread, the loan and the bill rate, and increases the paper-bill spread. A monetary expansion increases investment and output, decreases the loan-paper spread, the loan and the bill rate, and increases the paper-bill spread. Notice that both the loan-paper spread and the paper-bill spread are linked differently to output in the two cases. The negative effect of a monetary contraction on output is preceded by a smaller

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[11] This is pointed out in my earlier work, as well as in Hall and Thomson (1993a, 1993b).

paper-bill spread (larger loan-paper spread), while the negative effect of an increase in bank default risk is preceded by a larger paper-bill spread (smaller loan-paper spread). Empirical work, indicating the power of the paper-bill spread as a leading indicator[12] which increases before a decrease in output, seems to be at odds with a model incorporating standard portfolio choice theory, unless the paper-bill spread derives most of its predictive power from changes in bank default risk.[13] I will provide some preliminary evidence that this might indeed be the case. However, the main objective of this paper is to provide empirical evidence of a negative effect of an increase in bank default on real activity.

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[12] See Stock and Watson (1989), Bernanke (1990), Friedman and Kuttner (1992, 1993b, 1993c), and Kashyap, Stein and Wilcox (1993).
[13] "Any story of the [paper-bill] spread ought to feature the behavior (and the condition) of commercial banks" (Gertler, 1993, p.275). See also Morgan (1992).

IV. EMPIRICAL EVIDENCE

A. METHODOLOGY

In investigating the usefulness of my measure of default risk in the banking sector as leading indicators, I use the federal funds rate (FUNDS) and the spread between the commercial paper rate and the T-bill rate (SPB) as benchmarks. The predictive power of the funds rate (Bernanke and Blinder, 1992) and the predictive power of the paper-bill spread are well documented in the literature.[14] These three financial variables (a measure of bank default, the federal funds rate, and the paper-bill spread) compete in Granger causality tests. I use a model employed by Friedman and Kuttner in their 1993 Journal of Econometrics paper in which they argue for the inclusion of a time trend in money-income causality tests.

The vector auto regression (VAR) methodology underlying the Granger causality tests has been criticized on a number of grounds (Friedman and Kuttner, 1993a). Hence I have included a number of other tests to address some of these problems. First, "Zellner (1988) has argued that the Granger approach deviates from standard definitions of 'logical' causality, and that it is divorced from

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[14] An alternative is the use of a discounted spread, as in Baer and McElravey (1993, p.19, endnote 9).

conventional 'laws' of economic behavior" (Friedman and Kuttner, 1993a, p.201). This is an issue far beyond the scope of this paper. However, I do present a theoretical framework in which bank default and output are negatively related because bank default "causes" output. I also conduct reverse Granger causality tests to indicate possible feedback effects. A second shortcoming of VAR methodology is that it is linear and hence restrictive. I do not address this problem, but I also use a different linear specification, i.e. a Bernanke and Blinder (1992) model, to provide some indication of the robustness of my results.

A third consideration is that exclusion tests are sensitive to lag length. I use lag lengths for the funds rate and the paper-bill spread that are common in the literature and confirm my choices by a procedure of successive elimination.[15] For the bank default variable I use the same procedure to determine the appropriate lag length.

Fourth, Granger causality tests are unable to distinguish between economic and statistical significance in the presence of indirect causality. Hence I also perform

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[15] Start with some maximum value for k, say k_{max}, chosen a priori. I use k_{max}=24. Estimate the equation. If the last included lag is significant, select k=k_{max}. If not reduce the number of lags by one until the coefficient on the last included lag is significant. If none is significant, select k=0. Campbell and Perron (1991, p.155) advocate this procedure to determine the optimal lag length for an augmented Dickey-Fuller test. Akaike and Schwarz procedures favor somewhat longer optimal lag lengths. However, Godfrey-Breusch or Ljung-Box tests do not indicate serial correlation in the more parsimoneous model.

variance decomposition exercises to get an idea of the economic relevance of the financial variables. Fifth, the out-of-sample forecast performance of standard VARs is poor (Litterman, 1986). Hence I perform some out-of-sample forecasting exercises. And finally, a difficulty not mentioned in Friedman and Kuttner (1993a) is that Granger causality tests are sensitive to influential observations. Hence I use a rolling regression technique, as suggested by Thoma and Gray (1994).

B. DATA

All series, except those needed to create my bank default measures, are standard and obtained from the CITIBASE database made available by Citicorp Database Service. The data are monthly and run from 1959:01 to 1992:12.

The risk in the bank sector (DEADBANK) is defined as the ratio of the total assets of closing banks requiring disbursements by the FDIC (CLOSING) to total assets of commercial banks (ASSETS). The CLOSING series is obtained from the Annual Report of the Federal Deposit Insurance Corporation (FDIC). The Report provides data on insured banks requiring disbursements by the FDIC. The month in which the bank actually requires disbursements is used. The CLOSING series measures the total assets of insured banks requiring disbursements by the FDIC. However the series does not include **1)** assets of banks requiring disbursements under the Voluntary Assisted Merger Program, which permits troubled banks to merge into operating banks with the financial assistance of the FDIC to prevent failure, **2)** assets of banks obtaining financial assistance as an Open Bank, under section 13(c)(1) of the FDI Act to prevent failure, **3)** assets of Bridge Banks, introduced in 1988, which are "full service national banks established on an interim basis to assume the deposits, certain liabilities and substantially all the assets of the failed banks"

(Annual report, 1991, p.131, footnote), nor assets of banks absorbed by Bridge Banks, **4)** assets of banks involved in a Loss-sharing Arrangement, which provides adequate protection to the acquirer by minimizing disruption to loan customers (Annual Report, 1991, p.20).

The banks in these four categories not included in CLOSING stay open for all practical purposes. Their relationships with borrowers are probably affected, but to a lesser degree than the closing (deposit payoff, deposit transfer) and assumed defaulted banks.

The ASSETS series is obtained from the Federal Reserve Bulletin of the Board of Governors of the Federal Reserve System. It contains the total assets of all commercial banks. More details are provided in Appendix: Data.

The DEADBANK measure is presented along with industrial production (INDPRODU) in figure 1. For the DEADBANK measure, the default of Franklin National in October of 1974 stands out. It is the largest bank default to date in which a bank was actually closed and the depositors paid off. The default of United States National Bank in San Diego in October 1973 is also notable. Large failures in 1991 include the assumption of Goldome by Key Bank of Western New York in May and the assumption of Southeast Bank by First Union Bank of Florida in September.

C. FRIEDMAN AND KUTTNER (1993A)

The empirical model employed in this study is adopted from Friedman and Kuttner (1993a). They use a trend variable and first-difference the T-bill rate, since "univariate root tests typically indicate that the levels of most interest rates, including the paper and the bill rate, are difference stationary, as are, for that matter, income, money and prices" (op.cit., p.196).[16] I confirm this result using an augmented Dickey-Fuller test, for a 1% cut-off, with the lag length chosen by the successive elimination procedure, advocated by Campbell and Perron, with a maximum lag length of 24.

On the left-hand-side of the Friedman and Kuttner model is the log of industrial production (INDPRODU), henceforth output growth. The independent variables are a constant and a time trend, and lagged values of output growth, the log of the producer price index (PPI), the log of M1, the secondary market 3-month U.S. T-bill rate (BILL3M), and one of three financial variables (FINANCE). All variables are seasonally adjusted except for PPI, the interest rates and DEADBANK. All variables except the paper-bill spread (SPB) and DEADBANK are first-differenced. The latter are in level form, since they exhibit no unit-roots. Indeed Friedman and Kuttner find SPB to be stationary without differencing.

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[16] Bernanke and Blinder (1992) "do not view [differencing interest rates] as a very sensible procedure" (op.cit., p.906, footnote 12).

Again I confirm these results and I find that the marginal significance levels for the augmented Dickey-Fuller test of DEADBANK are even lower than the significance levels for SPB. Hence DEADBANK exhibits no unit root and first-differencing is not necessary. I also first-difference the federal funds rate, since it is integrated of order 1, or I(1).

To adjust for cointegration, I include error-correction terms. These terms were not included in the Friedman and Kuttner model. To determine the number of cointegrating vectors, r, I use a Johansen (1988) trace test, with 5% cut-off.

The lag length on the three financial variables are determined by the successive elimination procedure, with a maximum lag length of 24. The lag lengths on the other variables are chosen to be the same as in the Friedman and Kuttner model. Notice that M1 gets only 6 lags. The complete model is:

$$\Delta INDPRODU_t = \beta_0 + \beta_1 trend + \sum_{i=1}^{12} \beta_{2i} \Delta INDPRODU_{t-i} + \sum_{i=1}^{12} \beta_{3i} \Delta PPI_{t-i} + \sum_{i=1}^{6} \beta_{4i} \Delta M1_{t-i}$$
$$+ \sum_{i=1}^{12} \beta_{5i} \Delta BILL3M_{t-i} + \sum_{i=1}^{n} \beta_{fi} FINANCE_{t-i} + \sum_{i=1}^{r} \beta_{zi} Z_{it-1} + \varepsilon$$

$FINANCE \in \{\Delta FUNDS, SPB, DEADBANK\}$

and if

$FINANCE = \Delta FUNDS \Leftrightarrow f = 6, n = 12$

$FINANCE = SPB \Leftrightarrow f = 7, n = 12$

$FINANCE = DEADBANK \Leftrightarrow f = 8, n = 3$

D. RESULTS

1. GRANGER CAUSALITY TESTS

Figure 2 displays the results of (forward) rolling Granger causality tests.[17] The vertical axis indicates the marginal significance level of an F-test on the lagged coefficients of the financial variable for a joint null hypothesis specified as: $H_0: \beta_{f1} = \beta_{f2} = \ldots = \beta_{fn} = 0$, with n indicating the appropriate lags of the financial variable (i.e. twelve lags of dFUNDS and SPB and three lags of DEADBANK). The horizontal axis indicates the end-date of sample period over which the model is estimated. Thus I begin by estimating the model over the period 1960:02 (notice 12 lags + first-differencing) through 1966:01 and conducting an F-test of the null hypothesis just described. The F-statistic is then compared to the appropriate (depending on the degrees of freedom) tabulated F-distribution to yield the marginal significance level. It is this marginal significance level that is plotted in figure 2 above the date 1966:01. One month is then added to the data set so that it covers 1960:02 through 1966:02 and the estimation, the test and the calculation of the marginal

[17] All the results are obtained using RATS 4.02 on a UNIX-based mainframe as the statistical package.

significance level are repeated.[18] Subsequent months are added to the data set until it covers the full sample, 1960:02 through 1992:12. Notice that a marginal significance level below 5% indicates that the null hypothesis can be rejected with a statistical certainty of 95% or more. Hence a marginal significance level below 5%, or 1%, indicates that the coefficients on the financial variable are likely to differ from zero, and are likely to contribute to explaining output growth. Given the model specification, the financial variable is also said to "Granger cause" output growth.

Unreported results of various experiments showed that the number of common stochastic trends, the cointegrating vectors and hence the error corrections change considerably over time. These experiments raise important issues about the long term nature of cointegrating relationships, but this problem is beyond the scope of this paper. However, to allow for these changes over time the rolling procedure has to contain <u>two</u> steps. For every added month in the rolling procedures a first step determines the number of stochastic trends and cointegrating vectors using a Johansen Trace test with 5% cut-off level. The cointegrating vectors are determined using Johansen, Juselius and Hansen (1990). In a second step the causality test is undertaken, incorporating the appropriate number and "size" of error corrections.

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[18] Notice that there is one more degree of freedom.

It is clear from the figure that the marginal significance levels of all three financial variables are volatile before 1975. The importance of December of 1974 for both dFUNDS and DEADBANK, and to a lesser extent for SPB, stands out. After this date the marginal significance levels of all three financial variables drops below the 10% level, except for the sample periods ending between 1980 and 1986, where the marginal significance level of dFUNDS is higher than 10%. Also notice that the marginal significance levels of all three financial variables are lower than 1% for the full sample in both models, which illustrates the usefulness of the rolling regression technique in spotting influential data points.

In figure 3 all financial variables are included at once. After 1975 DEADBANK increases the marginal significance levels for SPB over 10% until 1980, and makes SPB in general less significant for the samples ending after 1980 (see blow-up included with figure 3). This provides preliminary evidence that risk in the banking sector explains part of the paper-bill spread.

2. REVERSE GRANGER CAUSALITY TESTS

To check for feedback effects a (forward) rolling reverse Granger causality test is performed. A reverse Granger causality test replaces output growth (dINDPRODU) on the left-hand-side with one of the financial variables (dFUNDS, SPB, or DEADBANK). The joint null hypothesis now focuses on the coefficients of output growth on the right-hand-side of the equation: $H_0\colon \beta_{p1} = \beta_{p2} = \ldots = \beta_{pm} = 0$, with m indicating the appropriate number of lag of output growth (i.e. twelve lags in a Friedman and Kuttner model). The point of this test is to determine if output growth causes any or all of the financial variables under consideration.

The rolling regression procedure is similar to the procedure used to perform the Granger causality tests of the preceding sub-section. Figure 4 indicates the marginal significance levels of the F-statistics on the appropriate number of lags of output growth for the indicated time periods. A marginal significance level below 5% would indicate that the coefficients on the output growth are statistically significant, with a certainty of at least 95%, and jointly different from zero. In these cases output growth explains the financial variable, and, given the model specification, is said to "Granger cause" the financial variable.

If the financial variable and output growth "Granger cause" each other simultaneously, the regression result is possibly due to a third variable not included in the model, that strongly influences both variables. There is some indication that this could be the case for dFUNDS extending beyond 1982. This finding warrants further investigation of the results reported in Bernanke and Blinder (1992), which support the view that the federal funds rate is exogenous.

3. VARIANCE DECOMPOSITIONS AND IMPULSE RESPONSES

Variance decompositions, in contrast to Granger causality tests, account for indirect effects of the right-hand-side variables on the left-hand-side variable. All variables used in the Friedman and Kuttner model, except the trend, are included in a VAR, with the lag length set at twelve months. A Choleski decomposition is employed to obtain VAR identification. Figures 5 and 6 indicates the decomposition of the variance of output growth for the indicated time period (again, a forward rolling technique is used), at a 24-month horizon, and employing the indicated ordering (from low to high position in the figure). Notice that the financial variable is last in the ordering. This is the most disadvantageous position in terms of contributing to the explanation of the variance of output growth.

All variables, except the two financial variables (SPB and DEADBANK), are estimated in differences. Special care is needed to link the levels of the I(1) variables, present in the error correction terms, to the differences. The 5% confidence band for the financial variable is indicated in dark gray, while the remaining light gray area plus the dark gray area represents the average contribution of the financial variable to the variance of output growth. Confidence intervals were determined by bootstrapping, using

100 draws, following a technique used by Christiano and Ljungqvist (1988).

The percentage of the variance of output growth explained by DEADBANK is not negligible, given its position, compared to SPB and dFUNDS (not reported).

Figure 7 reports the impulse responses (with 5% and 95% confidence intervals) for dINDPRODU, following a shock in SPB and DEADBANK, and for DEADBANK following a shock in dINDPRODU. The responses are derived for the full sample, but otherwise the set-up is identical to the variance decomposition exercise. A positive shock to SPB and DEADBANK has a significant negative effect on output growth, while there is no effect of a shock to output growth on DEADBANK.

4. OUT-OF-SAMPLE FORECASTS

"The ultimate test of an equation is the ability to forecast out of sample" (Bernanke, 1990, p.59). Hence a forecasting exercise, at a 6-month horizon, is executed using the Friedman and Kuttner equation. Again, a forward rolling regression technique is employed to check the robustness of the results over time. A 36-month moving average is constructed to smooth the results. Hence, figure 8 indicates the mean square errors of 36 consecutive 6-month-ahead forecasts of output growth generated from equations that include one of the three financial variables (dFUNDS, SPB and DEADBANK) or none of the three variables (NO).

The forecast error of dFUNDS is at best equal to the forecast error of NO and the forecast error of SPB is larger than the forecast error of NO before 1973 and in the period 1974-1978. The forecast error of DEADBANK is larger than the forecast error of NO only around 1978 and 1991. Otherwise the forecast error of DEADBANK is equal to or smaller than the forecast error of NO. It is also important to note that influential observations at the end of 1974 increase the forecasting power of DEADBANK.

As indicated in table 2 the mean value and the standard deviation of this forecast error, for samples ending in 1966:01 until 1992:06, of an equation including DEADBANK is smaller than the mean values and the standard deviations of equations including dFUNDS, SPB, or none of the three variables (NO).

E. ALTERNATIVE SPECIFICATIONS

The order of integration of the producer price index, PPI, determined by augmented Dickey-Fuller tests, is potentially influenced by the choice of the criterion to determine lag lengths and by the choice of the maximum lag length. It is possible to find PPI to be I(2). However, Granger causality tests are virtually unaffected if ddPPi (PPI differenced twice) is used instead of dPPI.

Given the importance of the 1974-1975 period, and the Franklin National case (October 1974) in particular, it is useful to control for supply shocks and for foreign exchange shocks. Granger causality tests, which include the growth rate of the refined petroleum price,[19] and of the Canadian Dollar and Deutsch Mark exchange rates,[20] show that the marginal significance level of dFUNDS is larger than 1% for all but the full sample, and the significance level of SPB is larger than 1% for samples ending before 1983. After 1974, DEADBANK has a marginal significance level lower than 1% for all years, except 1978-1979, for which the significance level is still smaller than 10%.

To check for robustness across specifications, I use an empirical model, which follows Bernanke and Blinder (1992).

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[19] McMillin (1993) uses the difference between the rate of change of the consumer price index and crude oil prices in variance decompositions which measure the impact of bank portfolio composition on macroeconomic activity.

[20] All three variables were found to be I(1), hence were first-differenced, and error correction terms were included, if necessary.

They keep interest rates in levels, include M2 and the 10-year bond rate as explanatory variables, use 6 lags, and employ the consumer price index.

Their paper tests the funds rate as a leading indicator, using a battery of Granger causality tests and a variety of real activity variables. Their results are reported for empirical models specified in log-level form. However they also discuss specifications in which the data are both lagged and first-differenced, except for interest rates. It is this first-differenced specification I use, with output growth as my measure of real activity. On the right-hand-side the independent variables are 6 lags of the log of output, the log of the consumer price index (CPI), the logs of M1 and M2, the secondary market 3-month U.S. T-bill rate (BILL3M), the 10-year constant maturity U.S. Treasury bond rate (BOND10Y), and one of three financial variables (FINANCE), the federal funds rate (FUNDS), the paper-bill spread (SPB), and the risk in the bank sector (DEADBANK). All variables are seasonally adjusted and first-differenced, except for the interest rates and DEADBANK. A number of error correction terms are also included.

The lag length on DEADBANK, i.e. 3 lags, is determined by the successive elimination procedure, outlined before. Bernanke and Blinder use 6 lags on FUNDS, but the test indicates a longer lag length as optimal. Using 6 lags for FUNDS in Granger causality tests does not change the results significantly, hence I decided to stick with 12 lags. The successive elimination procedure also favors using 12 lags on SPB.

Figure 9 shows the results of Granger causality test for this alternative specification. The results are very similar to the results obtained with the Friedman and Kuttner specification for both SPB and DEADBANK. For sample periods ending between 1982 and 1986 the marginal significance levels for FUNDS are below 1% in this specification, while the significance levels for dFUNDS are above 10% in the Friedman and Kuttner model. I suspect that the level versus first-differenced form of FUNDS is the main cause of this different result.

Not reported results for a reverse Granger causality test indicate marginal significance levels well above 10% for SPB and DEADBANK. The significance levels for FUNDS are around 10% for samples ending in the 1982-1991 period, a slightly better result than in the Friedman and Kuttner model, in which the significance levels were solidly below 5% for sample periods ending in the 1983-1992 period. Again, I think the level form of FUNDS in the Bernanke and Blinder specification is responsible for the different result.

F. SUMMARY OF EMPIRICAL RESULTS

The results indicate that the federal funds rate has potential problems as a leading indicator. Reverse Granger causality tests indicate a possible lack of exogeneity. Moreover this financial variable is not significant in Granger causality tests and has weak out-of-sample forecasting power in differenced form, a finding also reported in Thoma and Gray (1994).

The results for the paper-bill spread are compatible with the results reported in the literature. However, its in-sample explanatory power is not matched by out-of-sample forecasting power, especially in late 1974 when it's forecasting ability deteriorates dramatically.

The results for bank default are encouraging. It performs as well as the paper-bill spread in Granger causality tests and variance decompositions and is slightly better in out-of-sample forecasting. My future research will focus on its weak forecasting power at the end of 1991 and the impact of influential observations.

These results confirm the insights provided by the extended Kashyap et al. model developed in this paper. An increase in risk in the banking sector, captured by my measure of bank default, will decrease the relationship benefit that firms derive from bank lending. This decrease in relationship benefit increases the net cost of capital and results in lower investment and output.

V. FUTURE RESEARCH

Both the theoretical model and some preliminary evidence suggest that an explanation of the predictive power of the paper-bill spread should be based on the condition of the banking sector.

It is obvious that by construction the series on bank default is a crude measure. Alternative and possibly better measures of default risk in the banking sector do exist. The FDIC has a confidential monthly series on net charge-offs on loans, non performing assets to total assets, and number and assets of "problem banks". The latter series is derived using various accounting measures (capturing Capital, Assets, Earnings, and Liquidity). Since 1986 the series are available on a quarterly basis. At this stage, access to the confidential, monthly series seems impossible.

Another approach could consist in the exploitation of information in stock prices of banks. A possible drawback is that most smaller banks are not (directly) publicly owned. And it is argued that it is especially these smaller banks, which service the smaller firms, for which credit relationships are crucial.

On both theoretical and empirical grounds, further research into the impact of the condition of the banking sector on real and financial variables seems warranted.

APPENDIX A: STABILITY CONDITIONS

Excess demand in the goods market (EDG) is assumed to determine the adjustment of output, Y. The rate of adjustment, q_1, is positive. Similarly, the excess demands in the money (EDM), the loan (EDL) and the T-bill (EDB) markets determine the adjustment of the paper, loan and bill rate. All rates of adjustments, q, are assumed positive:

(A.1) $$\frac{dY}{dt} = q_1 EDG(Y, r_p, r_l, r_b),$$

(A.2) $$\frac{dr_p}{dt} = q_2 EDM(Y, r_p, r_l, r_b),$$

(A.3) $$\frac{dr_l}{dt} = q_3 EDL(Y, r_p, r_l, r_b),$$

(A.4) $$\frac{dr_b}{dt} = -q_4 EDB(Y, r_p, r_l, r_b).$$

The signed order traces, $(-1)^i B_i$, of the matrix of this system are positive; i indicates the order and goes from 1 to 4. The Routh-Hurvitz conditions for local stability for a fourth-order system are:

(A.5) $$-B_1 > 0,$$

(A.6) $$-B_1 B_2 + B_3 > 0,$$

(A.7) $$B_3(B_1 B_2 - B_3) - B_1^2 B_4 > 0.$$

The first and second condition are always satisfied. A sufficient condition to sign the third condition is the speed of adjustment in the goods market, q_1, to be small relative to the speeds of adjustments in the financial markets, q_i, i=1,2,3. The tedious calculations, performed using MAPLE V, are available upon request.

APPENDIX B: COMPARATIVE STATICS

The comparative statics are derived for a change in the riskiness of the banking sector and for an open-market operation. A program in MAPLE V provided the results.

a. The effects of a change in the riskiness of the banking sector.

A decline in the default risk of the banking sector (a drop in θ) increases investment and therefore output. The derivative of K with respect to θ is:

(B.1) $$\frac{dK}{d\theta} = \frac{-AKK_1\beta_1[\alpha\alpha_2 + fg_1\alpha_1]}{AK_1\alpha^2\beta_1 + \alpha_1[AK\beta_1 - KK_1[1-\beta]]}.$$

The denominator, henceforth denoted $\det X$, is the determinant of the full matrix of the system. Notice that K_1 and α_1 are negative, and A, K, β, and β_1 are positive, with $0 \le \beta \le 1$, hence $\det X < 0$. Also notice that g_1 and α_2 are negative and f and α are positive. To show that $\alpha\alpha_2 + fg_1\alpha_1 > 0$, use the first order condition of the firm's minimization problem, to derive $f > \alpha f_1$, as an equivalent condition. The latter condition is satisfied given the concavity of f with respect to α. The total effect on investment of an increase in the riskiness of the banking sector, $(dK/d\theta)$, is negative. Also notice that the risk in the bank sector only enters the model through the relationship benefit equation, hence all derivatives with respect to θ are equal to zero when $g = \alpha_2 = 0$. The derivatives of Y and s_{lb} with respect to θ are:

(B.2) $$\frac{dY}{d\theta} = \frac{1}{A_1}\frac{dK}{d\theta},$$

(B.3) $$\frac{ds_{lb}}{d\theta} = 0.$$

The signs of the other derivatives with respect to θ are:

(B.4) $$\frac{ds_{lp}}{d\theta} = \frac{KK_1\alpha_2[1-\beta] - A\beta_1[K\alpha_2 - fg_1K_1\alpha]}{\det X} < 0,$$

(B.5) $$\frac{ds_{pb}}{d\theta} = -\frac{ds_{lp}}{d\theta} > 0,$$

(B.6) $$\frac{dr_p}{d\theta} = \frac{-KK_1[1-\beta][\alpha\alpha_2 + fg_1\alpha_1]}{\det X} < 0,$$

(B.7) $$\frac{dr_l}{d\theta} = \frac{KK_1[1-\beta]\{\alpha_2[1-\alpha] - fg_1\alpha_1\} + A\beta_1[-K\alpha_2 + fg_1K_1\alpha]}{\det X} < 0,$$

(B.8) $$\frac{dr_b}{d\theta} = \frac{dr_l}{d\theta} < 0.$$

b. The effects of a change in money ($dR = -d\overline{TB}$).

It can be shown that the cost of capital, k, is decreasing in R, hence investment and output are increasing in R.

(B.9) $$\frac{dk}{dR} = \frac{A\alpha\beta_1 - K\alpha_1}{z\det X} < 0,$$

(B.10) $$\frac{dK}{dR} = K_1\frac{dk}{dR} > 0,$$

(B.11) $$\frac{dY}{dR} = \frac{K_1}{A_1}\frac{dk}{dR} > 0.$$

The derivatives of the loan-bill and loan-paper spread with respect to R are:

(B.12) $$\frac{ds_{lb}}{dR} = \frac{1-\gamma[1-z]}{\gamma_1 R[1-z]} > 0,$$

(B.13) $$\frac{ds_{lp}}{dR} = \frac{A\beta_1 - K_1[1-\alpha-\beta]}{z\det X} < 0,$$

To show that $1-\alpha-\beta > 0$, notice that the total demand for capital by the firms (the summation of bank loan demand and commercial paper supply) equals the bank loan supply and commercial paper demand. Using the money market equilibrium condition, this equality yields $K = \{\beta + \gamma[1-z][1-\beta]\}A < A$.
Using this inequality in the equilibrium condition of the commercial paper market completes the proof.
The derivatives of the other financial variables with respect to R are:

(B.14) $$\frac{ds_{pb}}{dR} = \frac{1}{R\gamma_1[1-z]\det X}\{R\gamma_1[1-z]\{K_1[1-\alpha-\beta]-A\beta_1\} + \{1-\gamma[1-z]\}\{K\alpha_1[A\beta_1-K_1]+AK_1\alpha^2\beta_1\}\} > 0$$

(B.15) $$\frac{dr_p}{dR} = \frac{K\alpha_1 - K_1\alpha[1-\alpha-\beta]}{z\det X},$$

(B.16) $$\frac{dr_l}{dR} = \frac{-K\alpha_1 + A\beta_1 - K_1[1-\alpha][1-\alpha-\beta]}{z\det X} < 0,$$

(B.17) $$\frac{dr_b}{dR} = \frac{1}{R\gamma_1[1-z]\det X}\{R\gamma_1[1-z]\{-K\alpha_1 - K_1[1-\alpha][1-\alpha-\beta]+A\beta_1\} + \{1-\gamma[1-z]\}\{K\alpha_1[-A\beta_1+K_1[1-\beta]]-AK_1\alpha^2\beta_1\}\} < 0$$

APPENDIX C: DATA

All series, except the CLOSING and ASSETS series, are standard and obtained from the CITIBASE database, made available by Citicorp Database Service. The variable name used in CITIBASE is maintained throughout the paper, unless indicated otherwise in the Appendix: Variable Definitions. A more precise definition of each variable can be found in the CITIBASE Manual (Updated MAR '92) and in the Manual referenced source.
The CLOSING series is obtained from Table B (formerly 123) in the Annual Report of the Federal Deposit Insurance Corporation (FDIC). This table provides data on insured banks requiring disbursements by the FDIC. The month, in which the bank actually requires disbursements, is used. The series does <u>not</u> include **1)** Assets of banks requiring disbursements in a Wholesale Purchase and Assumption, introduced in 1987, which "softens the impact on the local community because the failing bank's loan customers continue to be serviced locally by an ongoing financial institution instead of FDIC liquidators" (Annual Report, 1987, p.5). The FDIC reports Wholesale Purchase and Assumptions in Appendix A of "Failed bank cost analysis: 1986-1992", a publication by the Financial Reporting Branch of the Division of Finance. The Wholesale P&As are indicated with "TA" (Total Assumptions). **2)** Assets of Bridge Banks, introduced in 1988, which are "full service national banks established on an interim basis to assume the deposits, certain liabilities and substantially all the assets of the failed banks" (Annual Report, 1991, p.131, footnote), nor Assets of banks absorbed by Bridge Banks, nor Assets of Banks placed in Conservatorship, introduced in 1992 (Annual Report, 1992, p.35). Bridge Banks are established "if the continued operation of the failed bank is essential to provide adequate banking services in the bank's community or the continued operation of the failed bank is in the best interest of the depositors and the public" and "the cost of establishing a bridge bank does not exceed the cost of a liquidation" (Annual report, 1987, p.28). The FDIC reports Bridge Banks in the Bridge Bank section of Table 123 in the Annual Report. **3)** Assets of banks requiring disbursements under the Voluntary Assisted Merger Program, under which banks merge into operating banks with financial assistance of the FDIC to prevent failure and to insure that the resulting financial institution "would continue to serve the credit needs of its community" (Annual Report, 1982, p.4). The FDIC reports Voluntary Assisted Mergers in the Annual Report (Banks indicated with a star in Table B in the Annual Reports of 1981 and 1982, and listed on p.12 for 1983 and on p.15 for 1984; since 1985 the mergers are indicated in the

Assistance Transactions section of the Table). **4)** Assets of Banks involved in a Loss-sharing Arrangement, which "provides adequate protection to the acquirer by minimizing disruption to loan customers" (Annual Report, 1991, p.20). The FDIC reports Loss-sharing Arrangements in the Annual Report (1991, p.20; 1992, p.35). **5)** Assets of banks obtaining financial assistance as an Open Bank, under section 13(c)(1) of the FDI Act to prevent failure. The FDIC reports Open Bank transactions in the Annual Report (Annual Report 1971, pp. 5-6; 1972, pp.5-6; 1980, p.17; 1984, pp. 3-6; since 1985 listed in the Assistance Transactions section).

The Annual Report of 1969 does not mention the banks requiring disbursements by the FDIC. I used as an alternative source the FDIC "Changes among operating banks and branches" annual. To approximate the Total Assets of the banks listed as ceasing operations with financial aid of the FDIC (p.6-14), I used data on Total Assets from the Rand McNally International Bankers Directory (Rand McNally and Company), final 1967 edition.

The Annual Report of 1976 does not mention the Total Assets of the banks requiring disbursements by the FDIC. To approximate the 8 missing observations, I used data on Total Assets from the Rand McNally International Bankers Directory (Rand McNally and Company), first 1973 edition. The Total Assets of three banks not listed in the directory were approximated, based on the average, for the 1976 data points, ratio of amount of Deposits in 1976 (for which data were available in 1976), divided by the Total Assets in 1973.

The ASSETS series is obtained from the Federal Reserve Bulletin of the Board of Governors of the Federal Reserve System. Before 1977 the series was listed in Table "Principal assets and Liabilities and number, by class of bank", Heading "All commercial Banks", Series "Total Assets/Total Liabilities and Capital Account". In January 1977 the series became number 10 in Table T 1.24, in January 1981 number 13 in T 1.25, in march 1985 number 20 in T 1.25, in January 1992 number 1 in T 1.25 and in December 1992 number 1 in T 1.23. In case of multiple entries for a month, only the latest entry is retained. Data for 58:07, 58:08, 78:01, 78:02, 78:07, 78:08, 78:09, 79:01 were preliminary, but never revised or confirmed. Data for 84:01 and 84:02 were never published, hence were estimated by linear interpolation, using 83:12 and 84:03.

APPENDIX D: VARIABLE DEFINITIONS[1]

ASSETS	TOT ASSETS OF COMMERCIAL BANKS (00MIL$,NSA)
BILL3M	= FYGM3
BOND10Y	= FYGT10
CLOSING	TOT ASSETS OF CLOSING BANKS ($,NSA)
CPI	= LOG(PUNEW) : Consumer Price Index
d	first-difference of indicated variable
DEADBANK	= (CLOSING/ASSETS)
EXRCAN	CANADIAN $ PER U.S.$, MONTHLY AVG OF DAILY RATES (NSA)
EXRGER	DEUTSCHE M PER U.S.$, MONTHLY AVG OF DAILY RATES (NSA)
FM1	MONEY STOCK: M1 (BIL$,SA)
FM2	MONEY STOCK: M2 (BIL$,SA)
FUNDS	= FYFF : federal FUNDS rate
FYCP	INT RATE: COMMERCIAL PAPER, 6-MONTH (% PER ANN,NSA)
FYFF	INT RATE: FEDERAL FUNDS (EFFECTIVE) (% PER ANN,NSA)
FYGM3	INT RATE: U.S.T-BILLS,SEC. MARKET AVG,3-MO.(% PER ANN,NSA)
FYGM6	INT RATE: U.S.T-BILLS,SEC. MARKET AVG,6-MO.(% PER ANN,NSA)
FYGT10	INT RATE: U.S.T-BILLS, CONST MAT,10-YR.(%PER ANN,NSA)
INDPRODU	= LOG(IP) : INDPRODUction
IP	INDUSTRIAL PRODUCTION: TOTAL INDEX (1987=100,SA)
M1	= LOG(FM1)
M2	= LOG(FM2)
OILPRICE	= LOG(PW57)
PPI	= LOG(PW) : Producer Price Index
PUNEW	CONSUMER PRICE INDEX, ALL ITEMS (1982-84=100,SA)
PW	PRODUCER PRICE INDEX, ALL COMMODITIES (1982=100,NSA)
PW57	REFINED PETROLEUM PRICE INDEX (1982=100,NSA)
SPB	= FYCP - FYGM6 : Spread Paper Bill

[1] All variables, except CLOSING and ASSETS, are copied from CITIBASE, Macro Economic Database, Citicorp Database Services, updated version of MAR 1992 (See Appendix: Data for details). The original abbreviation and explanation of each variable, as provided by CITIBASE, is used. The variables in bold, are the ones used in the tables. The following abreviations are used: AVG= average, BIL= billion, CONST= constant, INT= interest, MIL= million, (N)SA= (Not) Seasonally Adjusted, PER ANN= per annum, SEC.=secondary, TOT=total.

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TABLE 1. COMPARATIVE STATICS

	open market operation $d\overline{TB} = -dR$	change in bank default risk
\	dR	$d\theta$
dY	+	-
dK	+	-
ds_{lb}	+	0
ds_{lp}	-	-
ds_{pb}	+	+
dr_p	unsigned	-
dr_l	-	-
dr_b	-	-

TABLE 2. SUMMARY STATISTICS

Mean and standard deviation of 36 consecutive 6 month-ahead forecasts (samples ending in 1966:01 until 1992:06).

Friedman and Kuttner (1993a)	dFUNDS	SPB	DEADBANK	NO
mean	2.09-04	1.84-04	1.46-04	1.47-04
st. deviation	1.80-04	1.60-04	0.93-04	1.00-04