NORTH-HOLLAND

Monetary Policy and Bank Portfolios

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This paper examines the existence of the bank lending channel for monetary policy over the period 1973:1–1994:11. The results are consistent with a bank lending channel when the Bernanke-Blinder model is extended to include commercial paper and the spread between the loan and commercial paper rates. The results are robust to alternative monetary policy measures. However, stability tests indicate instability over the nonborrowed reserves operating regime. When the estimates excluded data for this period, there was little evidence of systematic movement in bank loans in the direction predicted by the bank lending channel.

Keywords: Monetary policy; Bank portfolios; Bank credit channel; VAR models

JEL classification: E44

I. Introduction

Recent years have seen a revival of the debate on whether monetary policy operates through a bank lending channel as well as through a traditional interest rate channel. Bernanke (1993), Kashyap and Stein (1994a), Hubbard (1995), and Cecchetti (1995) provide thorough discussions of the theoretical and empirical studies of the lending view.[1] Basic to this view is the idea that because of asymmetric information and moral hazard considerations, banks play a special role in the intermediation process. Bank loans are viewed as imperfect substitutes for bonds both on the asset side of bank balance sheets and among borrowers. Monetary policy actions are thought to systematically alter the mix of loans and securities held by banks, and changes in the supply of bank loans are considered to have effects on aggregate demand independent of the effects of monetary policy on the money supply and, hence, interest rates. In this view, a contractionary monetary policy reduces the supply of loans; as a consequence, firms which have limited

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[1] These studies also discuss a broader credit channel which can be operative even if the bank lending channel does not exist. As Hubbard (1995) pointed out, this broader channel depends upon the presence of financial constraints on borrowing. The notion of a financial accelerator in which financial market conditions amplify relatively small shocks is developed in Bernanke et al. (1994).

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or no access to the bond market and hence rely upon bank loans for financing expenditures, curtail spending.

Bernanke and Blinder (1992) recently examined the effect of monetary policy actions, as proxied by movements in the federal funds rate, on bank deposits, security holdings, and loans within the context of a small vector autoregressive (VAR) model. They interpreted their results as indicating systematic movements in the elements of bank portfolios following a shock to monetary policy. Specifically, they found that bank deposits fall immediately following a positive shock to the federal funds rate as do security holdings by banks. Loans are initially unchanged. Deposits continue to fall and remain at a lower level than initially even after twenty-four months. Banks begin to rebuild security holdings after nine months and security holdings rebound to approximately their initial level after twenty-four months. Loans begin to decline after about six months and continue declining for the horizon reported. The decline in loans is essentially coincident with a rise in the unemployment rate. The differential response of security holdings and loans is interpreted to stem from the fact that loans are difficult to change quickly because of their quasi-contractual nature. Consequently, banks initially response to the contraction in deposits by selling securities, and only later begin to adjust their loan holdings.

The conclusions of Bernanke and Blinder (1992) are not uncontroversial, however. One criticism is that the roughly coincident movements in the unemployment rate and loans stems not from the operation of the lending channel but rather from feedback from the macroeconomy to loan demand. In this alternative view, contractionary monetary policy operates in the traditional manner, raising interest rates and slowing the pace of economic activity. The slowdown in economic activity leads to a reduction in credit demand, one manifestation of which is a smaller volume of loans by banks.[2] A second point is that there is not unanimous agreement that the federal funds rate is the most appropriate monetary policy variable. For example, Eichenbaum (1992) argues that nonborrowed reserves are preferred to the federal funds rate as a monetary policy variable.

The primary focus of this paper is twofold: 1) to extend the analysis of the effects of monetary policy on bank portfolio composition by introducing both commercial paper and the spread between the prime rate on bank loans and the commercial paper rate as additional variables in the Bernanke-Blinder model in order to provide evidence on whether the changes in bank portfolios reflect the operation of the credit channel or feedback from the macroeconomy; and 2) to examine the stability of the results over the sample. Additionally, the effects of alternative monetary policy measures (the federal funds rate and nonborrowed reserves) in VAR models similar to the one used by Bernanke and Blinder are considered.[3] Separate VAR models have been estimated for each monetary policy measure. Impulse response functions were calculated to determine the timing and magnitude of monetary policy shocks on the model's variables.

[2] However, Bernanke and Blinder (1992) argued against this interpretation, citing the results of a 1991 version of Kashyap et al. (1993). The Kashyap et al. argument is discussed in the text.

[3] In an earlier version of this paper, the sensitivity of the results to consideration of credit actions of the type described by Romer and Romer (1993) and Owens and Schreft (1993) was examined by including credit action dummies in the models, but the inclusion of these dummies had no effect on the results. The results were also not sensitive to the incorporation of dummy variables for the imposition of risk-based bank capital requirements in the model. Details are available on request.

Section II describes the model estimated and the sample period, and discusses the alternative monetary policy measures. Estimates of monetary policy effects are discussed in Section III. The stability of the models is examined in Section IV, and Section V provides a summary and conclusion.

II. Model Specification and Data Description

The effects of monetary policy on bank portfolios were estimated within the context of a VAR model similar to that of Bernanke and Blinder (1992). The model includes the six variables used by Bernanke and Blinder—a monetary policy variable, the unemployment rate, the log of the CPI, and the log levels of real bank deposits, real bank security holdings, and real bank loans—plus the log level of real commercial paper issued by nonfinancial corporations and the spread between the prime rate on bank loans and the commercial paper rate.[4] The model was also estimated with the log of industrial production replacing the unemployment rate as a proxy for aggregate real activity.

A critical element in estimating the effect of monetary policy actions on bank portfolio composition is the choice of a measure of monetary policy. Bernanke and Blinder (1992) contended that the federal funds rate is a good monetary policy measure.[5] Although Bernanke and Blinder make a strong case for the federal funds rate as a measure of monetary policy, there is still disagreement as to the proper measure of monetary policy. Eichenbaum (1992) argued that nonborrowed reserves are the preferred measure because they are the monetary aggregate most closely controlled by the Federal Reserve. In light of this disagreement on the appropriate measure of monetary policy, the response of bank portfolio composition to monetary policy has been examined for both monetary policy measures.

The volume of commercial paper and the spread between the bank loan rate and the commercial paper rate were included as additional variables in the system based upon the model developed by Kashyap et al. (1993).[6] In this model, monetary policy actions alter the spread between loan and commercial paper rates,

[4] The variables used in this study, their Citibase name, and a brief description are: federal funds rate (*fyff*); unemployment rate (*lhmu*25)—the unemployment rate for males aged 25–64; industrial production (*ip*)—total index; consumer price index (*punew*)-consumer price index, urban, all items; deposits (*fmsd* + *fmcdc*)—demand deposits plus other checkable deposits; securities (*fcsgv* + *fcsngv*)—U.S. government securities at commercial banks plus other securities at commercial banks; loans (*fcll*)—total loans and leases at commercial banks; commercial paper (*fcpnf*)—commercial paper outstanding, nonfinancial corporations; commercial paper rate (*fycp*)—interest rate on six-month commercial paper; prime rate on short-term business loans (*fypr*); and nonborrowed reserves (*fmrnbc*)—nonborrowed reserves plus extended credit, adjusted for reserve requirement changes. The real values of bank deposits, bank securities, bank loans, and commercial paper were constructed by deflating the nominal values by the consumer price index.

[5] They argued that this rate is a better forecaster of macroeconomic activity than monetary aggregates and other interest rates, and that movements in the federal funds rate can be explained as monetary policy reaction to the state of the economy rather than as simply endogenous movements in response to prior changes in economic activity. Their first argument is based on a forecasting derby among alternative monetary policy measures. Their second argument is based on estimation of Federal Reserve reaction functions which indicate systematic movements of the federal funds rate in response to shocks to inflation and unemployment, and upon statistical evidence that reserve demand shocks have little effect on movements in the federal funds rate. Bernanke and Blinder thus concluded that movements in the federal funds rate primarily reflect policy actions.

[6] The spread measure is crude because, as Kashyap et al. (1993) and Bernanke (1993) pointed out, the true cost of bank borrowing reflects covenants, collateral requirements, and other aspects of bank loans as well as the explicit interest rate on the loan.

and lead to a change in the composition of firm finance between bank loans and commercial paper only if loans and commercial paper are imperfect substitutes as bank assets. Although the link between monetary policy and the composition of firm finance is through the effect of monetary policy on the spread, Kashyap et al. argued against focusing solely on the spread in assessing the existence of a lending channel. They noted that the spread can be affected by other factors such as changes in default probabilities which accompany cyclical swings in economic activity. They pointed out that if, in downturns, the probability of default rises more for firms which borrow primarily from banks (typically small firms) than for firms which borrow primarily in the commercial paper market (large firms), then a contractionary monetary policy might be associated with an increase in the observed spread between the loan and commercial paper rates even if there is no bank lending channel for monetary policy.

Consequently, Kashyap et al. argued that it is important to examine the volume of commercial paper as well. They noted that if the behavior of loans merely reflects a decline in credit demand which occurs when economic activity turns down, then borrowing in the commercial paper market should also drop. However, if the behavior of loans reflects a channel of transmission of the effects of monetary policy, it is expected that commercial paper issued will rise as firms which are able substitute commercial paper for bank loans. Thus, inclusion of the commercial paper variable helps in the interpretation of the behavior of loans following a shock to monetary policy. Friedman and Kuttner (1993) and Thornton (1994) also argued that both price and quantity variables need to be considered in analysis of credit markets.

The model thus extends the Bernanke and Blinder (1992) model in a way which may be useful in assessing whether the bank lending channel for monetary policy exists. It should be noted that Kashyap et al. (1993) examined empirically the effects of monetary policy measures on commercial paper volume and the spread, as did Romer and Romer (1993) and Friedman and Kuttner (1993). Kashyap et al. and Romer and Romer used single-equation methods. Friedman and Kuttner examined the effects within small VAR models which comprised real GDP, the GDP deflator, the federal funds rate, and either commercial paper or the spread as a fourth variable.[7] However, it seems more appropriate to examine the effects of monetary policy shocks on bank portfolios, commercial paper and the spread, within the context of the same macro model. The single-equation studies have assumed all movements in the monetary policy proxies represent policy actions, a questionable assumption. The VAR approach focuses upon shocks to the monetary policy proxy as a measure of policy actions in the context of a system which models the monetary policy measure as a function of lagged values of model variables. A potential problem with an approach which uses separate VARs to examine the effects of monetary policy actions on commercial paper and the spread is that the monetary policy shocks differ from system to system as the explanatory variables in the VARs differ. These particular problems are reduced by examining the effects of monetary actions on the variables of interest within the same model. The identification of monetary policy shocks is further discussed below.

[7]They also estimated systems in which bank loan volume, bank security holdings, the volume of large certificates of deposits, and the spread between the commercial paper rate and the treasury bill rate were used in turn as the fourth variable.

The model was estimated using monthly data for the period 1973:1–1994:11. This study followed Bernanke and Blinder (1992) in using monthly data, although their primary sample period was 1959:1–1978:12. The use of monthly data reduces problems which might be associated with temporal aggregation of data [see, for example, Christiano and Eichenbaum (1987)]. Bernanke and Blinder's sample was not used in this study because monthly data for commercial paper of nonfinancial firms are available only from 1969. The sample begins in 1973:1 in order to obtain consistent series for the portfolio variables. In December 1972, the loan series was substantially revised by the Federal Reserve to include data from a broader range of financial institutions. The period 1973:1–1974:1 was used as presample data, and the model was estimated over 1974:2–1994:11. Estimation began in 1974:2 in order to allow several months transition from the definitional change to insure a consistent series.[8] With the exception of the addition of the commercial paper and spread variables, the same specification of the VAR which Bernanke and Blinder employ has been used here. That is, a lag of 6 months was used, and the data were in levels (or, as appropriate, log levels). This was done in order to facilitate comparison to Bernanke and Blinder (1992).

III. Empirical Results

The effects of monetary policy on bank portfolio composition were estimated by computing impulse response functions (IRFs) derived from the moving average representation of the VAR models estimated. A separate VAR model was estimated for each monetary policy measure.[9] The IRFs presented in Figures 1 and 2 indicate the effect of a one-standard deviation shock to the monetary policy

[8] McMillin (1993) pointed out that the definitional change in the loan series is not merely cosmetic. He found that the optimal lag for an autoregression of the loan series was different for the periods before and after the definitional change.

[9] Granger-causality tests were also computed. Given the focus of the paper, likelihood ratio tests of whether the coefficients on the lagged values of the monetary policy variables in the real bank deposits, real bank security holdings, real bank loans, spread, and real commercial paper issued equations were jointly equal to zero, were computed for both measures of monetary policy. The basic systems were first estimated, and then systems were estimated in which the coefficients on the lagged values of the monetary policy variables were simultaneously set to zero in the equations just listed. Likelihood ratio tests indicated that the hypothesis that the coefficients on the monetary policy variables were jointly equal to zero in these equations could be rejected for both the federal funds rate and nonborrowed reserves systems. It thus appears that the monetary policy variables have some predictive content for the bank portfolio variables, the spread, and real commercial paper issued considered jointly. The effect of the monetary policy variables on each of these variables was considered separately as well. For example, the basic system was estimated, and then a system was estimated in which the coefficients on the lagged values of the monetary policy variable were set to zero for the real bank deposits equation. A likelihood ratio test of the hypothesis that the coefficients on the monetary policy variable in this equation jointly equalled zero was computed. Similar tests were computed for the other four variables listed above. The federal funds rate was found to Granger-cause these variables in all cases. Nonborrowed reserves were found to Granger-cause real loans, real deposits, and the spread, but no direct Granger-causality was found from nonborrowed reserves to real security holdings or real commercial paper issued. Details are available on request.

It should be kept in mind that these Granger-causality tests provide evidence only upon the incremental predictive content of lagged values of the monetary policy variables, and provide no evidence on the effects of structural shocks to monetary policy on these variables. To draw any inference about the effects of monetary policy from the Granger-causality tests requires the assumption that all movements in these variables represent policy actions. This assumption is at odds with the identification of monetary policy shocks from the residuals of the VAR described in the text.

measures on the unemployment rate, bank loans, bank deposits, bank security holdings, commercial paper of nonfinancial corporations, and the spread. With the exception of the commercial paper and spread variables, these are the same variables for which Bernanke and Blinder (1992) presented IRFs. In computing the IRFs, Bernanke and Blinder's (1992) assumption that innovations in the monetary policy measure can be interpreted as policy shocks was followed. Thus a Choleski decomposition with the monetary policy variable placed first in the order was employed.[10] This method of identifying shocks to monetary policy assumes that policymakers respond only with a lag to movements in the other variables. An alternative identification scheme suggested in Christiano et al. (1994a; 1994b) was also employed to check the robustness of the results. This alternative scheme assumes that shocks to monetary policy affect aggregate activity and the price level only with a lag. This identification scheme can be implemented using a Choleski decomposition with the monetary policy variable ordered third after unemployment (industrial production) and the price level. The point estimates of the effects of monetary policy (for both measures) generated using this identification scheme were all within one standard deviation of those in Figures 1 and 2 and are not reported in order to save space.[11]

As noted earlier, the IRFs indicate the effect of a one-standard deviation shock to a monetary policy variable on the unemployment rate, the bank portfolio variables, commercial paper, and the spread. Each plot includes the point estimate of the IRF represented by the solid line and a one-standard deviation band around this point estimate. This band is represented by the dotted lines, and is generated from a Monte Carlo simulation like that described in Doan (1992) which employs 1000 draws.

Figure 1 presents the results for the model with the federal funds rate as the monetary variable. A horizon of thirty-six months is presented. Note the pattern of movement in the unemployment rate, loans, deposits, and securities is similar to that in Bernanke and Blinder's (1992) Figure 4, p. 918. The effects of the unemployment rate seem to be quite persistent, with the interval heading back toward zero at the longer horizons. The interval estimate for the effect on loans becomes negative after about four months and begins to turn back toward zero by the end of the horizon reported. Loans begin to turn down faster than in Bernanke

[10]The ordering of the variables is: monetary policy variable, unemployment rate, consumer price index, deposits, security holdings, loans, commercial paper, and spread. Because the monetary policy variable is placed first, the effects of monetary policy shocks on the variables ordered after it are the same regardless of the ordering of these variables with respect to one another. That is, with the monetary policy variable ordered first, the effect of monetary policy shocks on commercial paper is the same when commercial paper is last in the ordering as when commercial paper appears immediately after the monetary policy variable.

[11]As Bernanke and Blinder (192) noted, there are alternative means of identifying policy shocks. One is the structural VAR approach suggested by Bernanke (1986) which requires commitment to a specific structural model. This approach was not employed for two reasons. One is due to the fact that there is no consensus on the appropriate specification of a macro model. The second stems from the desire to examine the sensitivity of the Bernanke and Blinder results to various modifications of the model, given their method of identifying policy shocks. Another alternative is the use of long-run restrictions in the manner of Blanchard and Quah (1989). The second reason given for not using the Bernanke approach argues against the use of this method as well. Furthermore, it is not clear exactly what sort of long-run restrictions one would impose in a model of this size, although this is an interesting topic for future research.

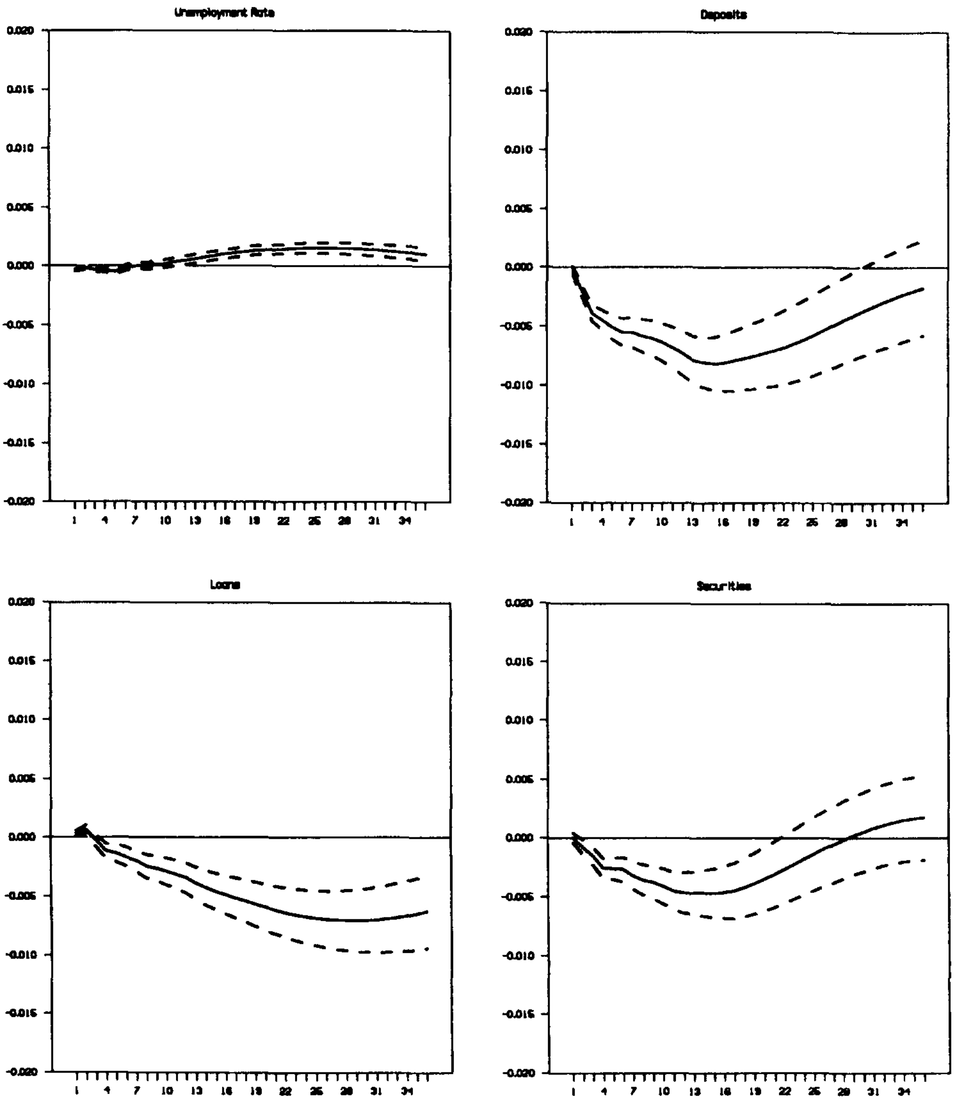

Figure 1. Shock to federal funds rate.

and Blinder, and this downturn is not exactly coincident with the upturn in the unemployment rate. Recall that Bernanke and Blinder found essentially coincident movements in loans and the unemployment rate.

Deposits fall sharply, and it takes a substantial period of time for deposits to return to the initial level following a shock to monetary policy. Securities fall quickly following the shock to monetary policy; this decline is somewhat more rapid than for loans, but the contrast in the timing of the movement in these two variables is not as great as in Bernanke and Blinder. The interval estimate for the effect on commercial paper becomes positive after about four months, the approximate time it takes for loans to fall. The interval estimate returns to zero after

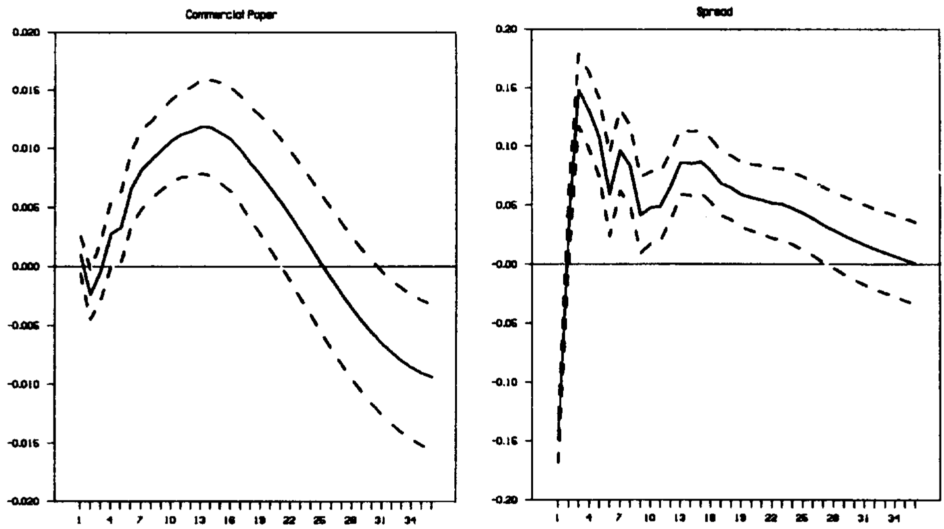

Figure 1. (*Continued*).

about 20 months. Note further that the spread rises quickly following a contractionary monetary policy shock and the interval estimate remains above zero for an extended period of time. There is a sharp plunge in the spread in period 1, but the effect becomes positive in the next period. Kashyap et al. (1993) found a positive effect of contractionary monetary policy on the spread. Friedman and Kuttner (1993) found a similar pattern of effects in their four-variable VAR model and attributed the initial plunge to inertia in the adjustment of bank loan rates. Considered jointly, the behavior of loans, commercial paper, and the spread is consistent with the operation of the bank lending channel. The rise in commercial paper outstanding at the time loans were initially falling does not seem consistent with the story that loan behavior primarily reflects feedback from the economy.[12] This interpretation is consistent with the conclusion of Kashyap and Stein (1994b) who employed a different methodology which involves examination of the differ-

[12] Note that the point estimate of the increase in commercial paper issued is somewhat larger in magnitude than the point estimate of the decline in bank loans. Part of the rise in commercial paper may reflect a substitution of commercial paper for loans by firms which can borrow in the commercial paper market and whose banks curtail their loans. However, part of the rise in commercial paper issued may reflect borrowing to offset the effects of a decrease in sales generated by the contractionary monetary policy action on cash flow by firms with bank credit which is not curtailed. Thus, total commercial paper issued may exceed the decline in bank loans following the contractionary monetary policy action. This explanation is consistent with the results in Gertler and Gilchrist (1993).

Ideally, trade credit would also be added to the system, but reliable monthly data do not appear to be available. Calomiris et al. (1994) noted that one explanation for the increase in commercial paper following a contractionary monetary policy shock is that large firms issue commercial paper in order to extend trade credit to smaller firms which are cut off from bank loans.

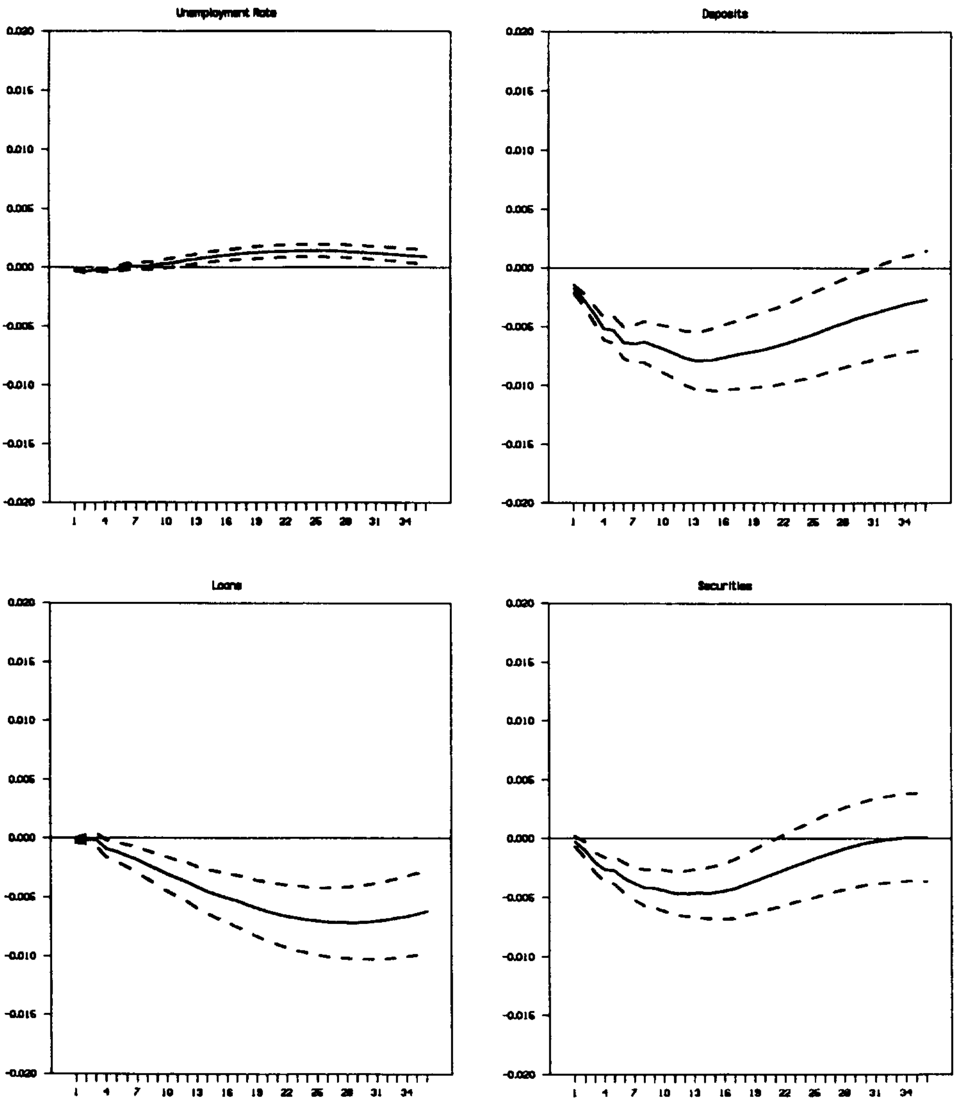

Figure 2. Shock to nonborrowed reserves.

ential response of the portfolios of large and small banks to monetary policy shocks.

Figure 2 presents results for the system with nonborrowed reserves as the monetary variable. The general pattern of results is similar to that in Figure 1, with only very slight differences in timing and magnitude of effects. The same is true for the systems with industrial production replacing the unemployment rate. The interval estimate for industrial production becomes negative with approximately the same lag as for the unemployment rate, and the interval estimate returns to

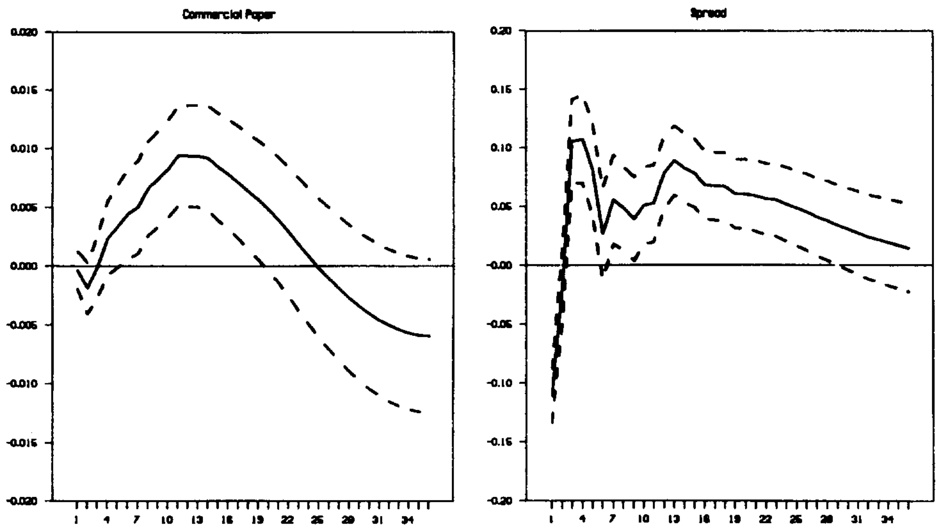

Figure 2. (*Continued*).

zero only at the longer horizons. Figures for systems with industrial production are available upon request.

IRFs were also computed for VAR models in which the coefficients on the macro variables–the lagged unemployment rate and the consumer price index—were set to zero in the equations for the bank portfolio composition variables, commercial paper, and the spread. All other coefficients were the same as before.[13] The macro variables could thus affect the portfolio variables, commercial paper, and the spread only through their lagged effects on the monetary policy variables. To the extent that feedback from the economy to the bank portfolio variables is captured by the lagged values of the unemployment rate and the price level, when this feedback is eliminated, the IRFs with this feedback eliminated should differ substantially from the regular IRF if the behavior of the bank portfolio variables and commercial paper primarily reflects this type of feedback from the economy. The plots were examined to see if the IRFs with the feedback eliminated lie within the confidence intervals for the regular IRFs. Figures 3 and 4 reproduce the point estimates (solid line) and bounds (small dashed lines) from Figures 1 and 2, and present the IRFs with feedback removed (two large dashes followed by one small dash).

[13]This procedure is similar in spirit to that of Ramey (1993). In an exercise aimed at determining the relative strengths of the money and credit channels on industrial production, Ramey zeroed out, in separate exercises, the lagged coefficients on the monetary policy variable on M2 velocity and bank loan velocity in a vector error correction model. She computed the IRF for these alternative systems and compared the results to the IRF computed from the model in which the lagged coefficients on the monetary policy variable in the velocity equations take on their estimated values. Her model is quite different from that of Bernanke and Blinder and the model estimated here, however.

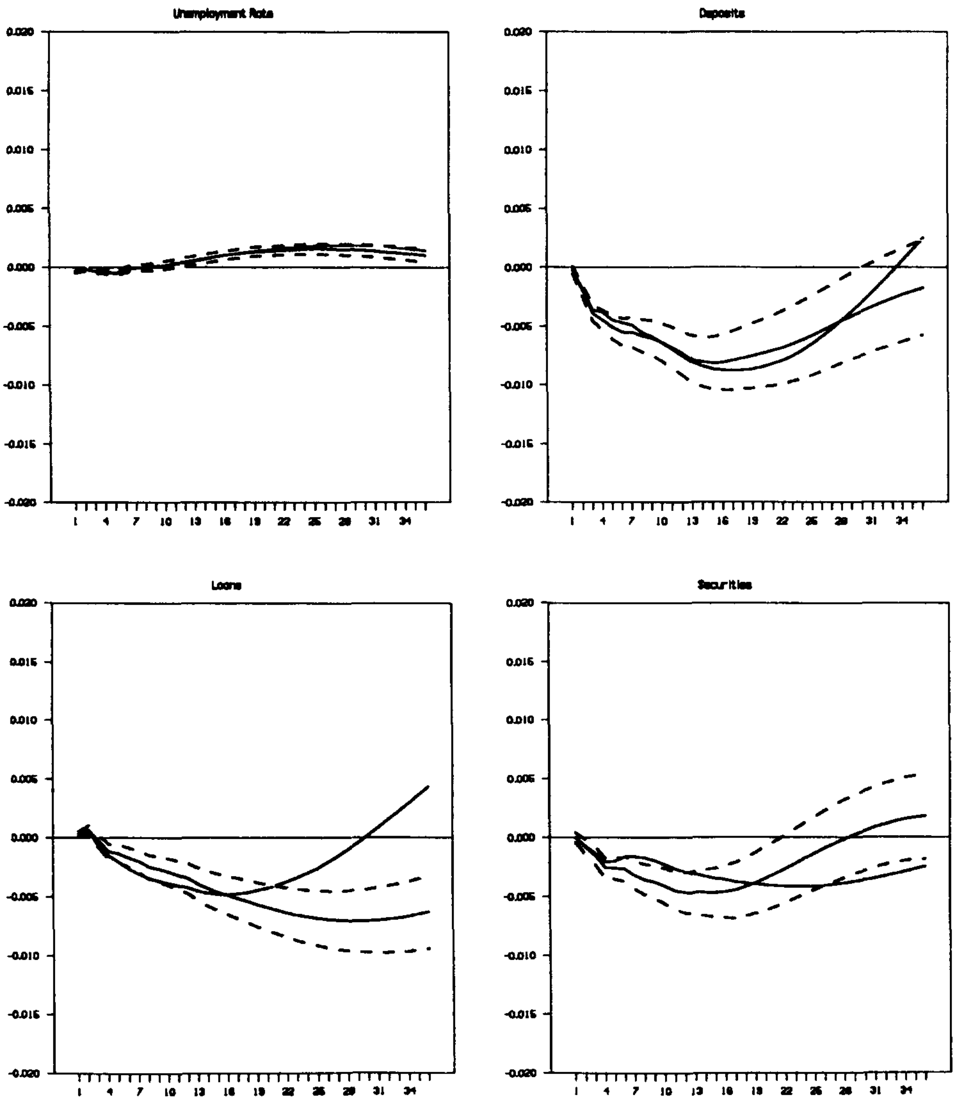

Figure 3. Shock to federal funds rate.

For the model with the federal funds rate, for the first 20 months the IRF for loans with feedback removed lies within the interval estimate for the regular IRF, but thereafter returns quickly toward zero. It appears that feedback to loans helps explain the sustained decrease in loans observed, but the initial fall in loans is similar in both systems. For most of the horizon reported, the IRF with feedback removed lies within the interval estimate for deposits, securities, and the unemployment rate. The effects on commercial paper lie within the interval estimate for the first 17 months, but fall slightly outside the upper bound until the end of the

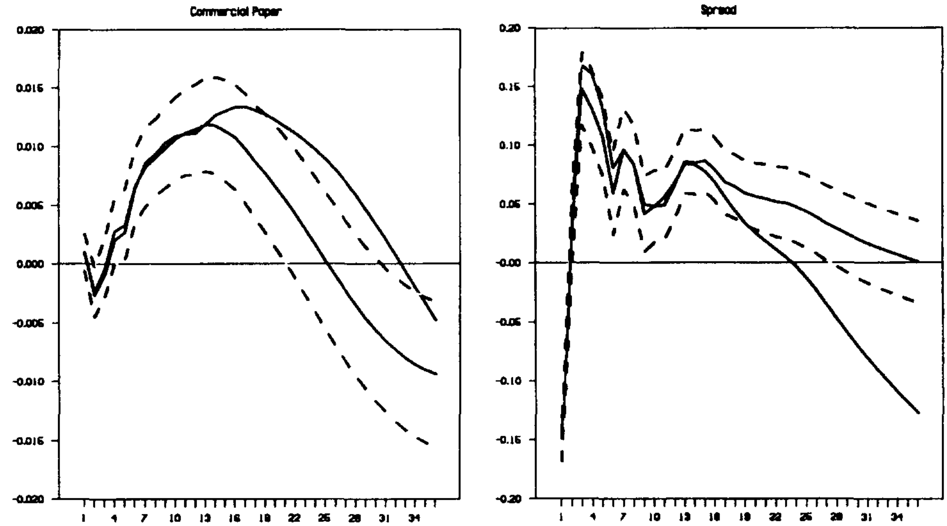

Figure 3. (*Continued*).

horizon and, hence, take longer to return to zero than in the unrestricted model. The effects on the spread lie within the interval estimate for about 17 months, but fall below the lower bound after this. The effect on the spread dies out somewhat faster than in the initial model.

For the nonborrowed reserves model, the IRF for loans with feedback eliminated (Figure 4) does not rebound to zero as sharply as in the federal funds rate

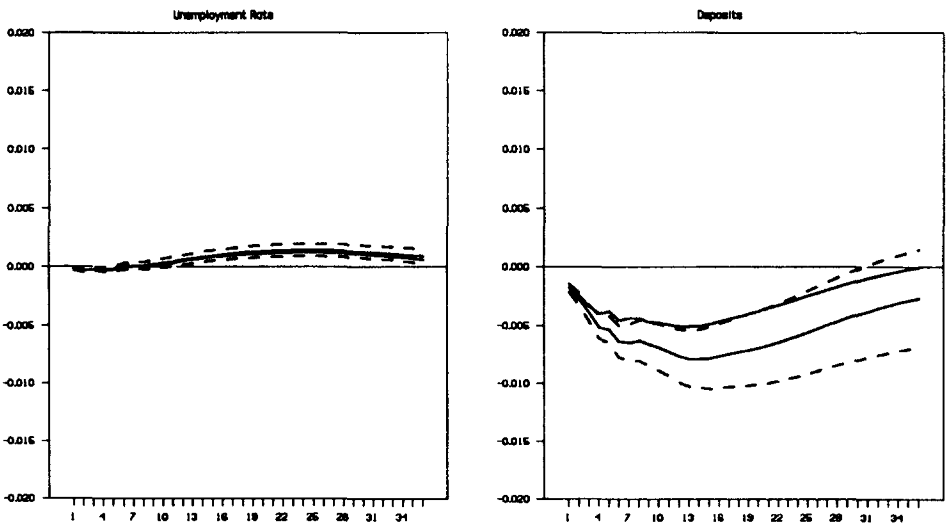

Figure 4. Shock to nonborrowed reserves.

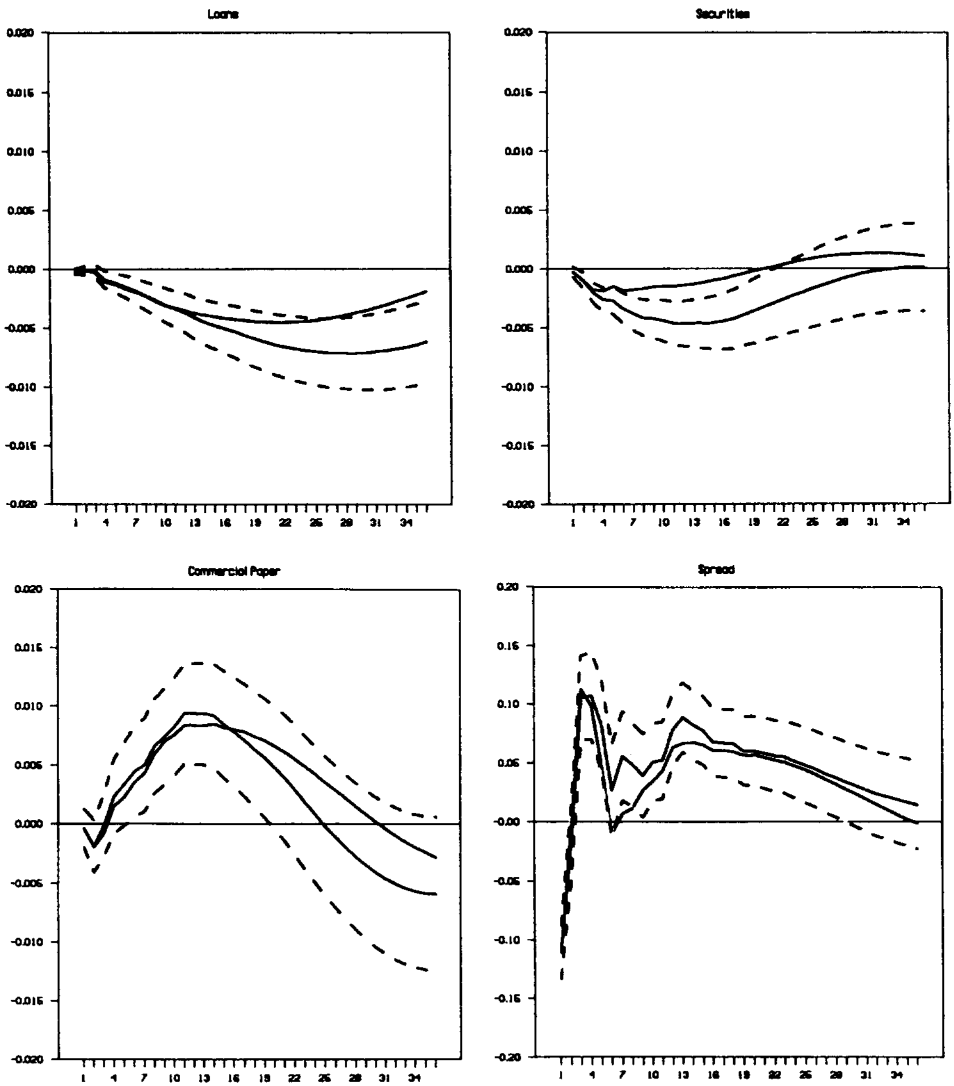

Figure 4. (*Continued*).

model with feedback removed, and the IRF for securities lies below the lower bound for the horizon from approximately 8 months to 21 months. The IRFs with feedback removed for the other variables lie within the interval estimates at virtually all horizons.

Eliminating the lagged values of the unemployment rate and the price level from the equations for the bank portfolio variables, commercial paper, and the spread didn't alter the fundamental patterns of movement in these variables, reinforcing the previous argument that this pattern of movement doesn't primarily reflect feedback from the economy.

IV. Stability of Results

The sample period employed here (1974:2–1994:11) spans several different monetary policy operating regimes. In the periods prior to October 1979, and after October 1982, targeting the federal funds rate was a primary focus in the short-run implementation of monetary policy, while the focus shifted to targeting nonborrowed reserves in the period from October 1979 to October 1982. A question naturally arises as to whether the results change when the focus of the Federal Reserve shifted from operating procedures with a short-run focus on the federal funds rate to a procedure which focused on nonborrowed reserves. The stability of the results over these regimes was tested using a multivariate extension of the procedure suggested by Dufour (1980; 1982).[14] These tests indicated instability over the period 1979–982.

This instability suggests it is important to determine whether the results presented thus far are in artifact of the inclusion of data from the nonborrowed reserves operating regime. Ideally, one would estimate the systems over each of the three periods and compute the IRFs. However, the small size of the 1974:2–1979:9 and 1979:10–1982:10 samples precludes this. Because the periods before and after the nonborrowed reserves operating regime were characterized by a short-run focus on the federal funds rate, data from these periods were used to estimate the systems. That is, models were estimated over the 1974:2–1994:11 period excluding data from 1979:10–1982:10. This is similar to the procedure used in Becketti and Morris (1992).[15]

IRFs for the model estimated for the sample which omits 1979:10–1982:10 were computed and are presented in Figures 5 (federal funds rate system) and 6 (nonborrowed reserves system). In comparing Figures 1 and 5, we see that, except

[14] In this procedure a 0–1 dummy variable is added to each equation in the VAR for each observation in the period in which instability is suspected. For this study, the period of suspected instability is October 1979–October 1982, so 37 of these 0–1 dummies were added to each equation in the VAR. As Dufour noted, the coefficients on a particular dummy variable measure the prediction error for that observation. The model was estimated over the full sample and the joint significance of the coefficients on the dummies was tested. Instability is indicated if the null hypothesis that the coefficients on the dummies are jointly equal to zero is rejected.

The joint significance of the dummy variables was tested by a likelihood ratio test. The test statistic

$$T \cdot (\log|DR| - \log|DUR|)$$

was computed where $|DR|$ = determinant of the variance-covariance matrix of the restricted system, $|DUR|$ = determinant of the variance-covariance matrix of the unrestricted system (system with dummies), and T = number of observations in the sample period. This statistic is distributed as χ^2 with degrees of freedom equal to the number of restrictions (i.e., the number of coefficients on the dummy variables in the system).

Stability tests were performed and, in all cases, the marginal significance level of the test statistic was essentially zero, indicating that the null hypothesis that the coefficients on the dummy variables are jointly equal to zero can easily be rejected. (The calculated values of the test statistics are available on request). It appears that a shift in the time series process occurred during the nonborrowed reserves operating regime.

[15] This is implemented in RATS using the SMPL option in the estimation of the system. It should be noted that as the equations of the VAR contain six lagged values of each variable on the right-hand side of each equation, 1982:11 is treated as the sixth lag, 1982:12 as the fifth lag, and so on. Thus no observations from the period excluded appear as lags in the estimation.

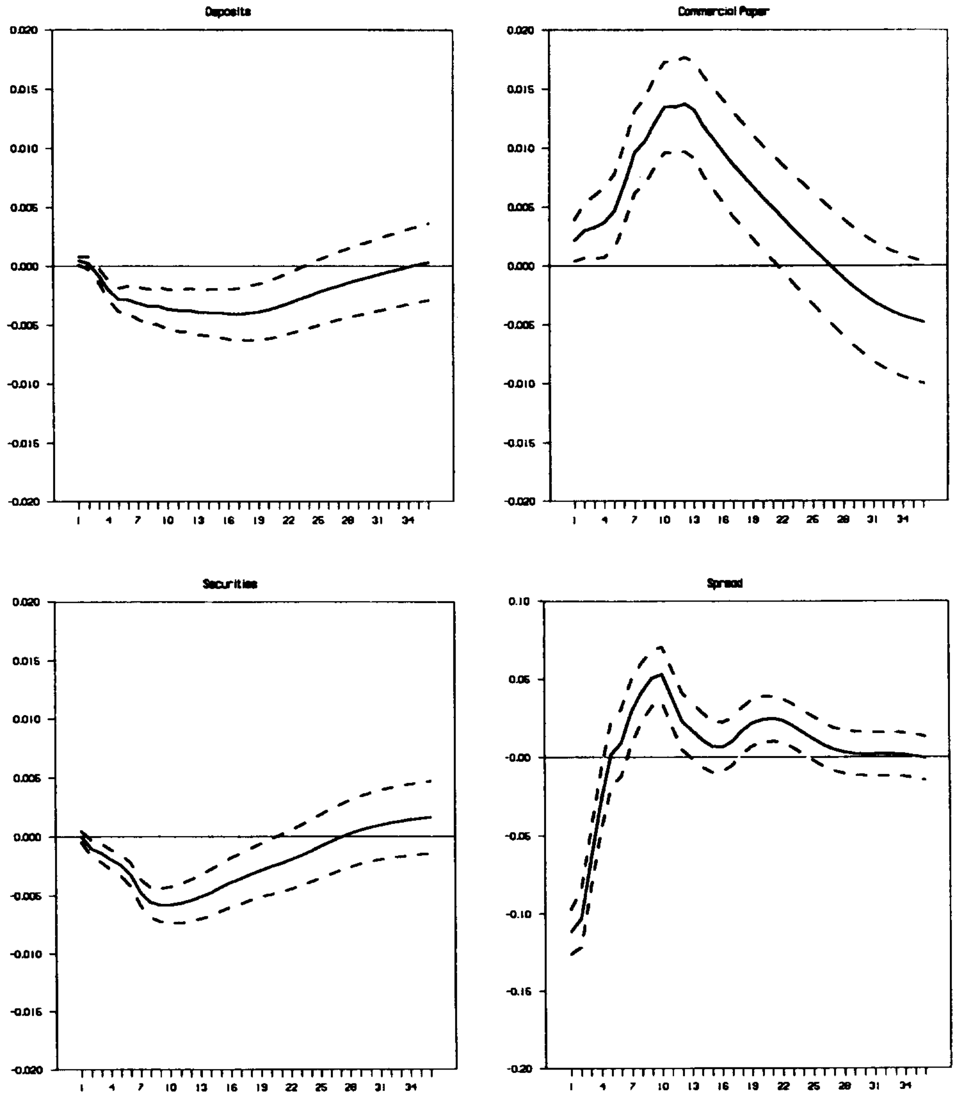

Figure 5. Shock to federal funds rate.

for loans, the basic pattern of movement in the variables is similar. However, the magnitude of effect on deposits, the unemployment rate, and the spread is less for the sample which excludes the nonborrowed reserve period. The most striking difference is the behavior of loans. For the sample which excludes the nonborrowed reserves period, the interval estimate for loans is actually slightly above zero for approximately twelve months after a contractionary monetary shock. The point estimate falls below zero after 19 months, but the interval estimate estimate thereafter includes zero. With the exception of loans and the first period effect for the spread, the pattern of effects is similar in Figures 2 and 6. The magnitude of effects for deposits, securities, the unemployment rate, and the spread is attenu-

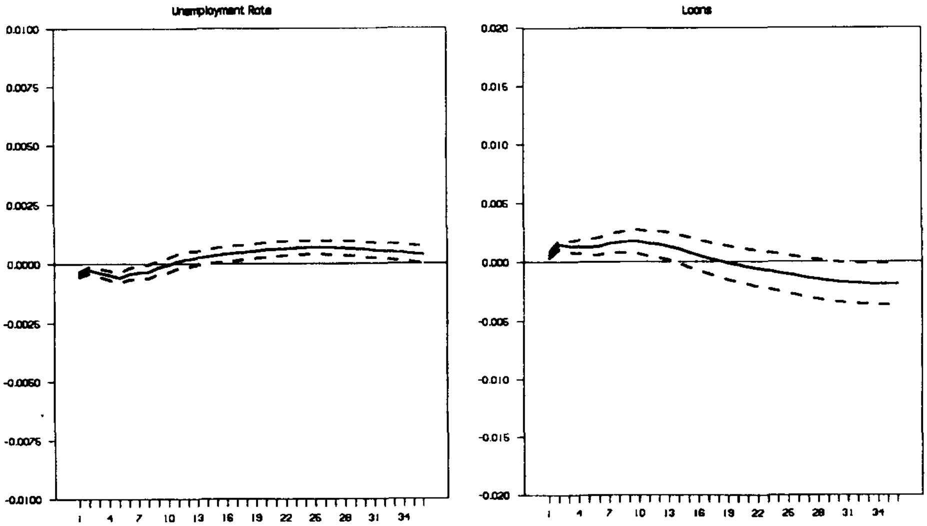

Figure 5. (*Continued*).

ated for the sample which excludes the nonborrowed reserves period. The point estimate for loans is negative, but the interval estimate spans zero at all horizons.

Substitution of industrial production for the unemployment rate yielded generally similar results for the system with the federal funds rate as the monetary policy variable (figures are available on request). For the sample which excludes the nonborrowed reserves period, the interval estimate for loans was slightly positive and after approximately two years, dipped somewhat below zero. For the system with industrial production and nonborrowed reserves, the results for both samples for loans were similar; the interval estimate for loans fell below zero, although the magnitude of effects for the sample which excludes the nonborrowed reserves period was smaller than for the more inclusive sample. The magnitude of effects for most of the other variables was also less for the sample which excludes the nonborrowed reserves period.

When data for the nonborrowed reserves operating regime were excluded from the sample, the behavior of loans was not favorable to the lending view, with the sole exception of the model with industrial production and nonborrowed reserves. There appears to be essentially no systematic movement in loans, contrary to the prediction of the lending view. As the pattern of movement (but not necessarily the magnitude) of most of the other variables is similar for the samples with and without data from the nonborrowed reserves regime, the question arises as to why the response of loans to monetary policy shocks differs so much for the two samples. Examination of the loans series indicates that the real value of loans fell sharply beginning in late 1979 and continuing through late 1980 and fluctuated slightly around this lower level from late 1980 to late 1982. Based upon Romer and Romer (1989) dating of contractionary monetary policy actions, we note that omitting the nonborrowed reserves period excludes data for a contractionary monetary policy shock (October 1979) which is followed by a sharp and protracted decline in the real value of loans. However, Romer and Romer (1993) also

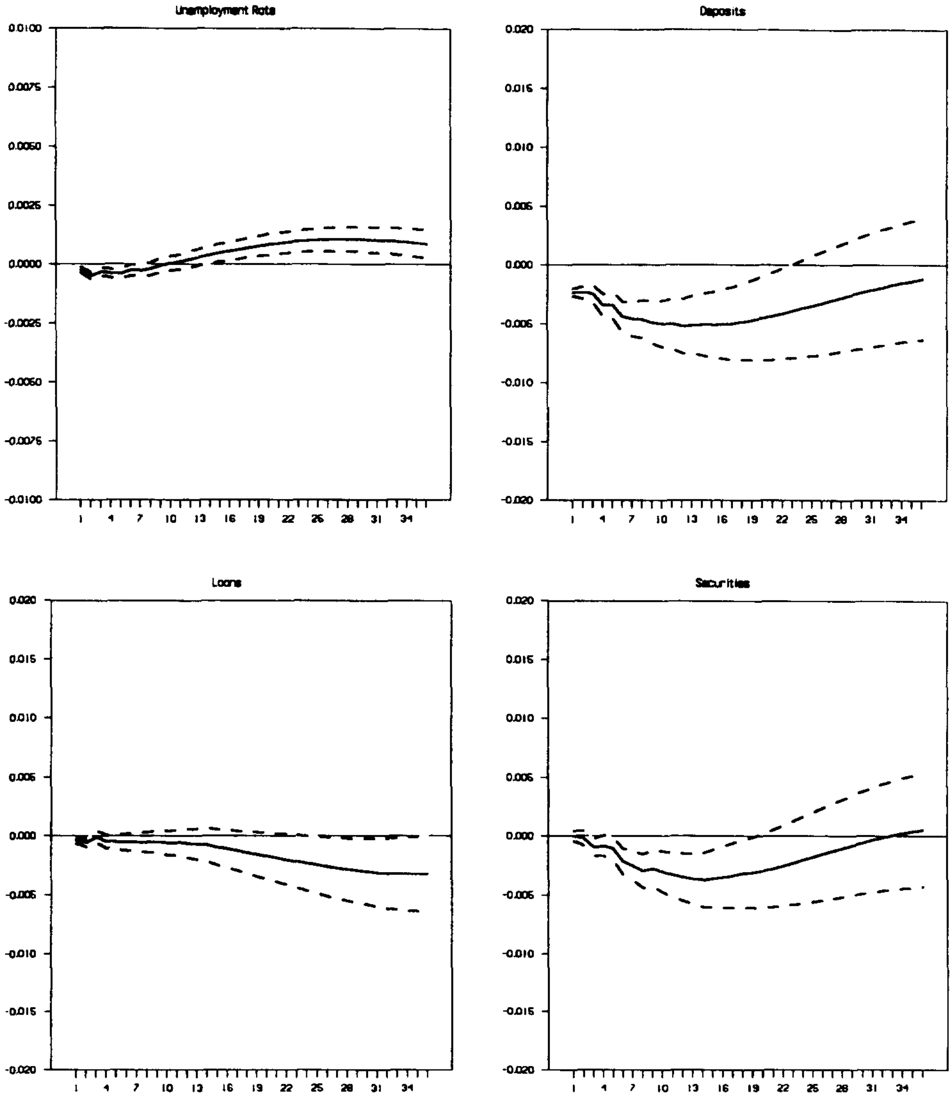

Figure 6. Shock to nonborrowed reserves.

identified October 1979 as the beginning of a credit shock (defined by them as explicit Federal Reserve actions undertaken to directly curtail bank loans), and the period 1979–1982 contain data from the period of credit controls imposed by the Federal Reserve (March 1980–June 1980).

Suppose we assume that the behavior of the real value of loans in the period 1979–1982 was driven by a contractionary monetary action in October 1979. Exclusion of data from the period 1979–1982 indicates that contractionary monetary policy actions had no systematic effect on loans. It thus appears that the full period results which indicate a systematic effect are the result of a single contractionary shock. This single episode is rather unique in that it also reflects a change

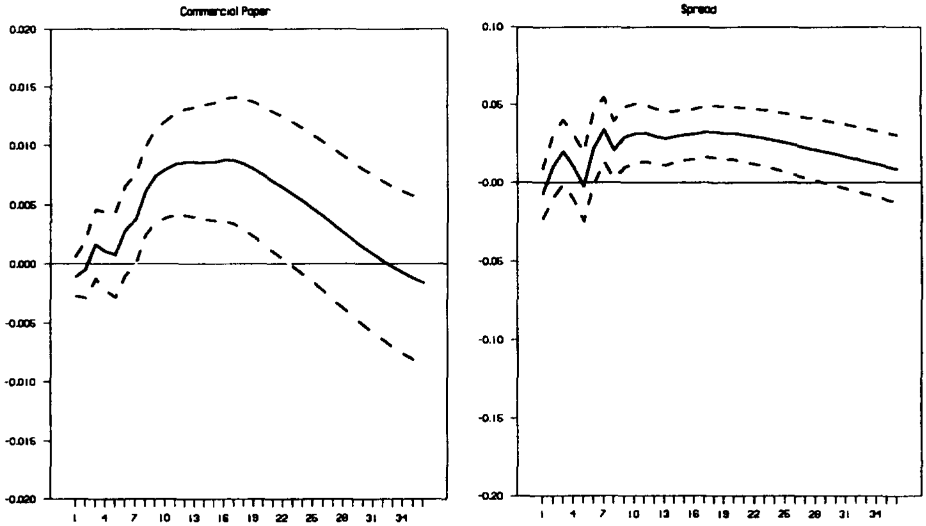

Figure 6. (*Continued*).

in operating regime. Consequently, it is thus difficult to argue that monetary policy *generally* operates, at least in part, through a bank lending channel.

Suppose, however, we assume that the behavior of loans in the period 1979–1982 reflects a credit shock as defined by Romer and Romer. Romer and Romer (1993) argued that, in the absence of specific actions to curtail lending, banks are able to offset the effects of contractionary monetary policy actions on loans by selling off securities or extending managed liabilities. In this view, the systematic effects of monetary policy actions on bank loans, found in the full sample, reflects the operation of the sole credit action undertaken in the full sample. When data spanning this action are omitted, no systematic effect on bank loans is found.[16]

Regardless of whether the behavior of loans in 1979–1982 reflects a monetary policy action or a credit action, the difference in the results for the full sample and for the sample excluding 1979–1982 weighs against the idea that monetary policy *generally* operates through a bank lending channel. The full period results appear to be driven solely by one episode.

However, as noted by a referee, exclusion of the period 1979–1982 leaves only two downturns in the sample: (most of) the 1974 downturn and the relatively mild 1991 downturn. This referee suggested it may be difficult to identify a lending channel in such a sample. Ideally, one would estimate the full model over a longer

[16]At this point, it is appropriate to elaborate briefly on some of the results cited in footnote 3. When a dummy variable which takes on the value of 1 in October 1979 and 0 elsewhere is added to the system and the system is estimated over the full period, a likelihood ratio test of the joint significance of the dummy variable in all equations of the system indicates the dummy variable is significantly different from zero. However, IRFs for the system with this dummy variable are well within the confidence bounds in Figures 1 and 2. Furthermore, Romer and Romer (1993) found that when their credit action dummy was added to equations for Kashyap-Stein-Wilcox's mix variable and the spread which contained a monetary policy measure, the magnitude of the effects of the monetary policy measures fell but remained statistically significant.

sample, say from the 1950s to 1994, which contains more cyclical fluctuations. Recall that the 1974:2–1994:11 sample was selected because monthly data on commercial paper began only in 1969 and because the Federal Reserve revised the loan series beginning in December 1972. In order to provide a rough check on whether the results reported above stem from using a sample with only two downturns, one of which was relatively mild, the old and revised loan series were spliced together and the federal funds rate system was estimated over two alternative samples: 1969:7–1994:11 and 1959:7–1994:11. The splicing was done by taking the ratio of the old and revised loan series in December 1972 (the only period in which there is overlap) and multiplying the old loan series by this ratio over the period 1959:1–1972:12. The full model could then be estimated over the period 1969:7–1994:11. However, for the period 1959:7–1994:11, commercial paper had to be dropped from the model.

For both samples, the model was estimated with and without data for the period 1979:10–1982:10, and IRFs were computed as before. The pattern of results, not presented here but available on request, for the samples including the 1979–1982 data is similar to the results in Figure 1 for both samples. The major differences are a longer lag in the effect of the monetary policy shock on loans and a more persistent effect on deposits and securities. When data for 1979–1982 were excluded from both samples, the pattern of results was similar to those in Figure 5. Again, the interval estimate for loans is slightly positive initially, and then spans zero for the rest of the horizon. Even in the longer samples, omitting the period 1979–1982 indicated that policy actions apparently have no systematic effect on loans.

VI. Conclusion

This paper has examined the existence of the bank lending channel for monetary policy over the period 1973:1–1994:11, employing a variant of the Bernanke and Blinder (1992) model. Based upon Kashyap et al. (1993), the Bernanke and Blinder model was extended to include commercial paper issued by nonfinancial firms and the spread between the loan rate and the commercial paper rate. The sensitivity of the results to alternative monetary policy measures–the federal funds rate and nonborrowed reserves—has been examined, and the stability of the results over the sample tested. The question of stability proves to be critical to the assessment of whether a bank lending channel for monetary policy is generally operative.

When commercial paper and the spread were added to the basic Bernanke-Blinder model, the results for the unemployment rate, loans, deposits, and securities following a contractionary monetary policy shock were very similar in pattern to those of Bernanke and Blinder for both monetary policy measures. The movement in commercial paper and the spread were consistent with the operation of a bank lending channel for monetary policy and suggest that the behavior of loans does not stem from feedback from economic activity.

Because the sample spans several different monetary policy regimes, the stability of the models was tested. These tests indicate instability over the period of the nonborrowed reserves operating regime (1979:10–1982:10). When the models were estimated excluding the data for this period, the results were not supportive of the bank lending view. There was little evidence of systematic movement in bank loans in the direction predicted by the bank lending channel, although the basic pattern of movement in the other variables was very similar to the full sample. These results indicate the importance of accounting for changes in the behavior of the monetary authority when examining issues related to the transmission of monetary policy effects in general, and to the operation of the bank lending channel in particular.

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