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Is Financial Stability Central to Central Banking?

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Abstract

The appropriate responsibilities of the central bank are being reexamined in light of the recent financial crisis. This study shows that significant synergies exist among monetary policy and bank supervision when attempting to attain both economic and financial stability. We show that bank supervisory information about the risk of contagious failures of banks can improve macroeconomic forecasts and are an independent determinant of monetary policy decisions. Similarly, macroeconomic forecasts by the central bank can improve forecasts of the risk of contagious bank failures. Exploiting the symbiosis among monetary policy, the supervision of financial intermediaries, and financial stability should play a central role in discussions about regulatory reform.

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Introduction

The recent financial crisis has highlighted the nexus between banking, financial markets, and the real economy. The complex interactions between the financial system and the real economy raise important questions about the role central banks should play in responding to episodes of financial instability. While many central banks have a mandate to focus on inflation, and the Federal Reserve has a dual mandate to focus on inflation while maintaining full employment, financial stability is not currently included directly in the mandate of major central banks, although it was the impetus for creating the Federal Reserve. This study examines the role financial stabilization should play in the actions and responsibilities of central banks by investigating the symbiosis between the prevention, or mitigation, of financial instability and achieving the explicit goals of many central banks: price stability and full employment.

We first examine how U. S. monetary policy reacts to periods of financial instability, particularly instability in highly levered institutions. Several papers have examined the importance financial markets in general should play in influencing Fed behavior (such as Bernanke and Gertler, 1999 and 2001; Rigobon and Sack, 2003), emphasizing the role bubbles might play in policy. However, this paper is concerned about markets disappearing, not price variability, in the spirit of Borio and White (2003) and Adrian and Shin (2008).

It has become common to examine Federal Reserve policy actions in terms of moving the target federal funds interest rate in response to deviations of the expected future inflation and unemployment rates from their targets. These simple rules assume that periods of financial instability, or at least a change in the risk of financial instability, do not *independently*

influence Federal Reserve actions; rather, episodes of financial instability affect the path of the federal funds rate only insofar as that financial instability changes the expected deviation of inflation from its target and/or the expected deviation of the real economy from full employment. To test this hypothesis, we examine periods when bank supervisors observe that a large percentage of bank assets are in banks with a higher probability of failure. We find that Federal Open Market Committee (FOMC) policy actions are affected by such information, above and beyond its effect on the expected path of inflation and real output; for example, given the outlook for inflation and output, the FOMC reacts to a deterioration in the overall health of banks by lowering the federal funds rate.

There are a variety of reasons why the central bank might respond in this way. First, traditional model-driven forecasts of inflation and real output growth may underestimate the impact of episodes of financial instability. However, even if the macroeconomic models used by the central bank and by private forecasters do not fully capture the effects of financial market frictions, FOMC reactions to changes in the risk of financial instability still might incorporate such effects. In fact, we do find that macro models do not fully capture the effects of financial instability, and that their forecasts of real output growth can be improved by incorporating the information contained in bank supervisory data.

Forecast inefficiencies are not the only possible explanation for the apparent independent role of financial variables. Episodes of increased risk of financial instability might also increase the probability of extreme adverse economic outcomes (i.e., producing an asymmetrically thicker tail to the distribution), even if the expected paths of inflation and real

output are little changed. That is, the FOMC might respond to changes in the distribution of possible outcomes, as well as to changes in the central tendency of the distribution (i.e., the forecast value). These concerns are visible in the FOMC discussions of taking out "insurance" against downside or upside risks. This possibility is being explored further in ongoing work by the authors.

But the benefit of the interaction between supervision and monetary policy is not a one-way street. Not only is incorporating supervisory information into the production of the macroeconomic forecasts relevant for guiding monetary policy, but macroeconomic data are shown to be useful in forecasting problems in the banking sector. In particular, bank supervisory models based on banking data alone can be improved by incorporating macroeconomic data in the form of the macroeconomic forecasts used to guide the FOMC in their monetary policy deliberations. Thus, supervisory policy may be improved by utilizing the forecasts of the central bank. That is, the transfer of information between bank supervisors and monetary policy makers should be more than just a monologue.

An example of how this symbiotic relationship between monetary policy and supervisory policy might be made operational would be through the use of scenario analysis, such as was incorporated into the recent bank stress tests. Tools routinely used to reach the monetary policy goals of the Federal Reserve would certainly help determine how "stressful" a stress test should be. Moreover, adequately incorporating the interactions between the financial and real sectors of the economy may require a more complete understanding of macroeconomic modeling than is typically required for a bank examination. In fact, we find

that close interactions between a central bank's bank supervisory division and its monetary policy makers is required to fully exploit the two critical sources of information that can improve the performance of both the supervisory policy and monetary policy functions. This symbiosis highlights the nexus between supervisory policy, monetary policy, and financial stability policy.

In addition, better integrating monetary policy, supervisory policy, and financial stability policy may provide a useful instrument for monetary policy makers when addressing asset bubbles. For example, if the central bank observed a rapid increase in asset prices in combination with increased leverage by lenders and increased borrowing by purchasers of the assets in a particular sector of the economy, focusing on underwriting standards and the degree of leverage of lenders may be more effective than altering the cost of financing to all sectors of the economy. Emerging bubbles may be better addressed by targeted changes in supervisory policy rather than the more blunt instrument of monetary policy, although such a decision will be better informed if it is made by a regulator that also is familiar with how macroeconomic activity is evolving. While monetary policy generally influences the cost of credit, the role of a macroprudential supervisor will be more focused on the availability of credit, especially insofar as that availability is affected by the health of the banking system and the stability of financial markets. In particular, a macroprudential supervisor should be interested in whether current underwriting standards and capital standards are consistent with a growth rate in asset prices that is sustainable.

Because financial intermediaries provide critical financing that enables the economy to grow, monetary policy makers need to understand emerging financial trends and how regulation and supervision are affecting those trends. The next section begins by showing that the health of the banking system provides useful information about the course of monetary policy above and beyond the information contained in the macroeconomic forecasts produced by the staff of the Board of Governors of the Federal Reserve System (Board). Evidence is then provided that supervisory policy also would benefit from incorporating the information contained in the Board staff's macroeconomic forecasts when assessing the risks to the banking system as a whole; this would help supervisory policy makers understand how macroeconomic developments could result in the contagious failure of financial institutions. To effectively mitigate episodes of financial instability, greater integration of these important policy functions would be beneficial. The study ends by showing that even after incorporating the contribution of measures of bank health into the macroeconomic forecasts and the macroeconomic forecasts into future measures of bank health, the FOMC still appears to react independently to the information contained in an aggregate measure of bank health. Possible reasons are articulated in the conclusion.

I. The Nexus between monetary policy, supervisory policy, and financial stability policy

The recent experience provides a clear example of the importance of financial stability in monetary policy making. The FOMC began to ease policy in August 2007 after the onset of the financial crisis, even though the current recession had not yet begun and macroeconomic

forecasts still remained relatively benign. By December of 2007, the FOMC began an aggressive easing of policy (see Figure 1). After a 25 basis point reduction of the federal funds rate in December of 2007, the FOMC followed with 225 basis points of further monetary policy easing over the following three months as the financial sector continued to deteriorate and Bear Stearns collapsed. After stabilizing at 2 percent, the federal funds rate resumed its sharp decline following the Lehman failure.

The initial easing occurred despite many private forecasters seeing little evidence that the economy was faltering. Estimates of even a forward-looking Taylor rule setting the current funds rate as a function of the outlook for real economic activity and inflation significantly over predicted the federal funds rate over this period.[1] Forecasts as of January 2008 indicated little reason for aggressive action. At that point, forecasters expected that the unemployment rate would rise only to a little above 5 percent by the end of 2008 (see Figure 2). While it is not unusual for econometric models to miss turning points in economic activity, the onset of the recession was not apparent to forecasters even by May 2008. Four months into the recession, forecasters still failed to see evidence of serious problems with unemployment (Figure 3). In fact, even as late as the end of 2008, forecasts of the 2009:Q3 unemployment rate still remained well below its eventual actual value (see Figure 4), although forecasters had begun to adjust their forecasts faster by late 2008. So what caused the Federal Reserve to act so aggressively?

In general, the simple rules used to characterize FOMC policy decisions originate with the simplicity of the assumed Fed objectives. Taylor (1993), McNees (1986), Luckett and Potts (1978), and a host of others popularized simple FOMC reaction functions that assumed that the

[1] Estimated Taylor rules traditionally include the lagged federal funds rate. Including the lagged rate makes it difficult for the predicted funds rate to deviate too much from its actual value. However, with or without including the lagged federal funds rate, the funds rate moved much lower than predicted over this period.

Federal Reserve would adjust the federal funds rate to hit its targets for the unemployment rate (or real output) and the inflation rate. Such rules quantify the Federal Reserve's mandate set by Congress to maintain the lowest unemployment rate consistent with stable prices. While the rule is simple, achieving those targets is a bit more complicated. For example, given that the forecasts of inflation and unemployment were not significantly different from their long-run targets at the onset of this recession, these simple rules failed to capture FOMC behavior at that time. Because forecasting is so inexact, the FOMC often supplements those forecasts with other information; in this instance, explaining, at least in part, the significant reduction of the target federal funds rate over a very short time span.

This study argues that these simple rules miss an important element of FOMC policy setting: the usefulness of the nexus between monetary policy, supervisory policy, and financial stability. This nexus allows monetary policy to be influenced by information the Federal Reserve has about the condition of banks, and financial markets more generally, and, at the same time, provides bank supervision with the opportunity to benefit from Federal Reserve information about the likely path of the macroeconomy.

A. The possible role of supervisory policy on monetary policy

It is worth first highlighting whether the FOMC can, and does, utilize its information on bank supervision to improve its conduct of monetary policy. While recent experience does highlight that monetary policy makers did react aggressively at a time when many forecasters saw little need for additional ease, it is useful to determine whether this represented an isolated case or reflected a more general approach to the conduct of monetary policy that better characterizes FOMC actions.

To do so requires an examination of how the FOMC actually behaves, rather than providing an outline for how it should behave; thus, the Taylor Rule is confronted with the data. It is assumed that the FOMC adjusts the target federal funds rate in response to its outlook for the real economy and inflation. Given the lags in the effect of monetary policy, the FOMC must react to the expected future path of inflation and real economic activity. As a result, we use the Greenbook forecasts produced by the Board staff for these variables over the next several quarters. Specifically, we estimate:

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 E_t \pi_{t+i} + \alpha_3 E_t \dot{Q}_{t+i} + \alpha_4 UR_t + \varepsilon_t , \quad (1)$$

where the current federal funds rate depends on the rate last period, the most recently available unemployment rate, and expectations of inflation and real GDP growth over the next i periods. Without the work of the Board staff, determining what to use for these expectations would be problematic. However, by producing an extremely detailed set of forecasts for the economy over the next four or more quarters, the Board staff makes this decision relatively clear. Note that the current unemployment rate plus the forecast of the real GDP growth rate captures estimates of the gap between full employment and current employment through Okun's law. Given the limitations due to the available frequency of some of the other variables used in our analysis, the estimation is performed at a quarterly frequency.[2]

Table 1 provides the results from the estimation of the above reaction function. As can be seen in the first column of Table 1, estimating equation (1) over the 1985:Q1 through 2009:Q1 sample period produces estimated coefficients that are of the predicted sign and are

[2] Because the FOMC meets eight times a year, the Greenbook forecasts are available at that frequency. However, the bank call report data used later in this study are available only at a quarterly frequency. Consequently, the last forecast in the quarter is used. Furthermore, the inflation rate of the core CPI is used. Finally, the estimation begins in 1985 because the CAMELS data were incomplete before that point.

each highly statistically significant. However, this simple specification assumes that the expected path of inflation and the output gap are sufficient to capture the information to which the FOMC responds in conducting monetary policy. Thus, problems in the banking sector or financial markets would impact the course of monetary policy only to the extent that they impact the forecasts of inflation and the output gap over the next year. Most models of central bank behavior, starting with the theoretical work of, for example, Kydland and Prescott (1979) and Barro and Gordon (1982), and ending with the recent empirical literature of, for example, Clarida, Gali, and Gertler (1998), do, in fact, assume that the Fed cares only about deviations from its target inflation rate and full employment.

However, the FOMC may appear to react independently to variables other than the forecasts of inflation and real output gaps for several reasons.[3] First, the Greenbook outlook, like all forecasts, is imperfect. Peek, Rosengren and Tootell (1999) highlighted that using confidential bank supervisory information can improve forecasts of inflation and real economic activity. If standard macroeconomic models, and their forecasts, do not fully incorporate how banking problems or financial instability affect the outlook for the relevant variables, then the FOMC may respond by qualitatively adjusting the forecasts generated by these models for the consequences of financial frictions and episodes of significant financial stress to improve the conduct of monetary policy. In that case, the risks of financial stress are not independently affecting FOMC policy; rather, this information is being used to improve the macroeconomic forecasts of the traditional variables used to guide the conduct of monetary policy. Second, these simple reaction functions are specified to rely on the expected path for future macroeconomic activity, usually taken to be the mode of the forecast distribution, with no consideration of the

[3] Recent examples include Fuhrer and Tootell (2005), Rigobon and Sack (2005), and Adrian and Shin (2008).

shape of the distribution itself. If periods of financial stress greatly increase the uncertainty or tail risk in the forecasts, the FOMC may react to this financial instability because it also seeks to avoid severe adverse outcomes.[4] Thus, it is important to understand whether the FOMC does respond differently during periods of financial instability, or even during periods of heightened risk of financial instability.

One way to determine whether, and if so, to what extent, the FOMC does respond to financial stress is to estimate a reaction function that includes measures of financial stress. An obvious current candidate for the designation as a period of financial stress would be episodes of increased risk of contagious failures of financial institutions. Because financial institutions are highly leveraged, adverse shocks to their capital can have a broader impact on the economy as a whole.

Bank supervisory information can be used to construct a measure of the likelihood of experiencing an episode of contagious bank failures. Bank supervision generally focuses on assessing the health of individual institutions. The bank examination process evaluates the Capital, Asset quality, Management, Earnings, Liquidity, and Sensitivity to market risk to produce individual C, A, M, E, L, and S ratings for each bank, as well as combining these assessments into a composite CAMELS rating for the bank. These ratings are then used by bank examiners to discuss with a bank's management and board of directors any deficiencies they have found, as well as the actions needed to be taken by management to rectify any deficiencies.

The CAMELS ratings are on a scale of one to five, with one indicating a very low probability of failure for an individual institution, and five indicating a very high probability of

[4] While a thorough exploration of this issue is beyond the scope of the current study, it will be more fully addressed in a forthcoming working paper.

failure for an individual institution. To capture the likelihood of a contagious failure of banks, we construct an aggregate measure of bank health (SH345) as the ratio of the assets of banks with a rating of 3 or worse to the total of all bank assets. As the share of bank assets held by banks rated three or worse rises, the risk to the banking system of contagious failures increases.

Column 2 of Table 1 contains the results obtained when the SH345 variable is added to the basic specification shown in column 1. The estimated coefficient on SH345 is negative (-0.020) and statistically significant at the 1 percent confidence level, indicating that as the share of bank assets in institutions with a CAMELS rating of 3 or worse increases, the FOMC is more likely to reduce the federal funds rate. Thus, as bank health deteriorates, the FOMC responds by reducing the federal funds rate by more than would be expected, even allowing for any effect of that deterioration that might be incorporated in the Greenbook forecasts of inflation and real output growth.

The next two columns provide the same information, but with the sample truncated at the end of the second quarter of 2008. The sample should be truncated then because at the end of 2008 the federal funds rate ran up against its lower bound of zero, forcing the Federal Reserve to turn to nontraditional methods to stimulate economic activity and mitigate financial instability. Columns 3 and 4 show that when the sample is confined to the period prior to reaching the zero lower bound for the federal funds rate, the results are essentially unchanged, although the magnitude and statistical significance of SH345 increases. This is not surprising, since once the federal funds rate hit the zero lower bound, the share of assets in banks with a CAMELS rating of 3 or worse was quite elevated and the real economy was deteriorating, indicating that the FOMC would probably have chosen to reduce the federal funds rate further had that option still been available. However, because the federal funds rate was already at the zero lower bound, the

FOMC had to turn to nontraditional policies that are not captured by the typical reaction function.

Other specification tests also were conducted. Interestingly, the tests (not shown) indicate that the significant negative effect of SH345 does not emanate solely from those periods when SH345 reaches its highest values. Much the same results are obtained when the sample excludes the periods of very high values for SH345, such as the early 1990s and the most recent episode. In summary, the reaction function estimates shown in Table 1 indicate that the FOMC does react to changes in the risk of contagious bank failures. Thus, not only is bank supervisory information useful for the conduct of monetary policy, the FOMC explicitly incorporates such information into its monetary policy actions. The next section examines some of the alternative explanations for why this might occur.

Why does bank health seem to have an independent effect on monetary Policy?

Bank health appears to have an independent effect on the conduct of monetary policy by the FOMC, even after controlling for the Greenbook inflation and real output growth forecasts. As noted above, however, there are alternative explanations for this effect. Most obviously, the Greenbook forecasts may not fully incorporate the useful bank health information. In that case, the statistically significant effect of SH345 in the reaction function might derive from the FOMC members qualitatively adjusting the Greenbook forecasts to account for the missing contribution of bank health on the macroeconomic outlook. If so, the evidence in Table 1 is not indicating that bank health has an independent effect on FOMC policy decisions. Rather, the significance of SH345 in Table 1 is a direct consequence of inefficient Greenbook forecasts. This section examines this possibility.

The traditional test for forecast efficiency entails regressing the actual future value of an economic variable on its forecasted value. If the forecast is efficient, no other variable known at the time the forecast was made should be able to improve the predictability of the actual variable. Specifically, for a forecast made at time t for real output growth i periods ahead (i.e., at time t+i), the following equation is estimated:

$$\dot{Q}_{t+i} = \beta_0 + \beta_1 E_t \dot{Q}_{t+i} + \beta_2 X_t + \eta_t \qquad (2)$$

If β_0 or β_2 is significantly different from zero, then the forecast could be improved by incorporating either a change to the mean of the forecast or the information contained in the variable X.

We test for the efficiency of the Greenbook forecasts for real output growth and the unemployment rate by including the bank health variable, SH345, as the X variable in equation 2. We focus on measures of the real economy because problems in the financial sector are likely to directly and immediately impact the paths of real output and unemployment. The results for three alternative forecast horizons, the first quarter ahead, the second quarter ahead, and the fourth quarter ahead, are contained in Table 2.[5] With a slight complication, including the bank health measure does improve the Greenbook forecasts. The complication concerns the stability of the estimated β_2 coefficient. It appears that the magnitude of the effect of SH345 shifts around 2000. Thus, we have included a (0,1) dummy variable (D00) that has a value of one for

[5] The third quarter ahead is omitted for concision; the results for that quarter are similar.

observations after 1999, as well as being interacted with SH345 to allow a shift in the estimated bank health effect.[6]

For real GDP growth, SH345 has a statistically significant negative effect at all horizons, indicating that the higher the value of SH345, the more the Greenbook tends to overestimate real GDP growth. For the period beginning in 2000, the total effect of SH345 is obtained by summing the estimated coefficients on SH345 and D00*SH345. For the one-quarter and the four quarter horizons, the additional post-1999 effect is statistically significant. At the more policy relevant long-term horizon, the additional effect for the post-1999 period suggests that the overly optimistic predictions of real GDP growth are even more substantial after 1999. Thus, the effect is amplified during the latter part of the sample. The efficiency tests for the unemployment rate provide consistent evidence that the Greenbook forecasts underestimate the unemployment rate at each of the three horizons, with each of the estimated coefficients on SH345 being statistically significant. Moreover, during the post-1999 period, the degree of underestimation becomes magnified, with two of the three estimated post-1999 differential effects being statistically significant.[7]

To summarize, model-driven forecasts seem to have difficulty efficiently incorporating information about duress in financial markets, particularly banking markets. Using SH345 as a proxy for bank health, the forecast errors due to the omission of this variable are in the predicted direction, showing increasing over-prediction of real economic activity as bank health

[6] The shift in the constant term picked up by D00 captures that, in general, the forecast was too optimistic – the "job-less" recovery was not expected, and it went on for a relatively long time. One possible explanation for the shift in the SH345 coefficient is the difference in the nature of the two largest banking crises. The pre-2000 banking crisis was dominated by problems at smaller banks, while the post-2000 crisis was dominated by difficulties at the larger banks.

[7] The significance of the estimated coefficient on bank health in the longer horizon specification for GDP is sensitive to the constraint on having constant coefficients over the entire sample period. That is not the case for its effect on the unemployment rate.

deteriorates. Still, one must wonder why the model -driven forecasts have such difficulty fully incorporating information about bank health? Free-flowing information across division boundries is important, so better integration of the monetary policy function with the bank supervisory function might help, but it is also important to know how and when to utilize that bank information. Hence, the mere transfer of bank supervisory information may not be enough; rather, a greater sense of the nuances of bank supervision also must be communicated, suggesting the need for a more sophisticated degree of integration of these two central bank functions.

B. Synergies between monetary policy and bank supervision

The previous section focuses on how bank supervisory information might help in the conduct of monetary policy by improving the Greenbook forecasts. This section examines the possible symbiosis between monetary policy and bank supervision policy from the other direction: Can having access to the Greenbook macroeconomic forecasts improve forecasts of bank health? While bank supervision generally focuses on assessing the current health of individual institutions, reliable forecasts of future bank health could help guide supervisory policy, perhaps enabling bank supervisors to mitigate episodes of financial stress, or at least the effects of such episodes on the banking system. In fact, off-site monitoring of banks is a step in this direction because such monitoring is used by bank supervisors to determine whether examiners should focus their attention sooner on an individual bank, or in a particular area of the bank's operations. For example, if a bank's nonperforming loans begin to accelerate, examiners may choose to focus on the credit quality of that bank. Still, off-site monitoring focuses on current balance sheet and income statement data of the individual banks, rather than either being forward looking or taking a more macroeconomic view of developments in the banking sector.

Forward-looking assessments of bank health are particularly valuable if macroeconomic conditions, or even local economic conditions in the case of smaller banks, are likely to change, making current bank health assessments a misleading guide to the risks faced by both individual banks and the banking system as a whole. For example, during a run up in commercial real estate prices, nonperforming commercial real estate loans are likely to be quite low. However, if the run up in prices is accompanied by weaker underwriting standards, a bank's commercial real estate loan portfolio may be particularly susceptible to an economic downturn. Thus, while bank examiners generally focus on the current conditions of the bank, the informational content of bank ratings could be improved if they incorporated the likely future path of the economy when evaluating bank health, serving as an improved early warning system to both bank supervisors and macroeconomic forecasters, especially given the value of current bank health to macroeconomic forecasts shown earlier.

To test whether forecasts of macroeconomic variables improve estimates of the future path of bank health, as measured by the share of assets in banks with a CAMELS rating of 3 or worse, we estimate the following equation:

$$Sh345_{t+i} = \alpha + \beta X_t + \lambda E_t Q_{t+i} + \xi_t. \qquad (3)$$

Future values of SH345 are assumed to depend on standard bank balance sheet and income measures, contained in X. These variables include the capital-to-assets ratio; asset quality, as measured by loan charge-offs and loan delinquencies, each measured as a share of assets; earnings, scaled by assets; liquidity, measured as the bank's holdings of securities, predominantly government and U.S. government agency securities, scaled by assets. In addition, we include the Greenbook forecast for real GDP growth over the next year.

Table 3 provides the analogue of Table 2, but for forecasts of the bank health measure. Forecasting the aggregate SH345 variables four-quarters in the future is clearly a messy business. Because the currently known SH345 measure is included in the equation, the other current bank balance sheet and income measures will have estimated coefficients that are statistically significant only to the extent that they contain information not already incorporated in the current SH345 measure. For the most part, the signs of the estimated coefficients make sense; higher loan delinquencies and charge-offs bode ill for future bank health, while higher net income and liquidity bode well. The current capital-to-assets ratio provides no additional information beyond its contribution to the current CAMELS ratings information embedded in SH345. Moreover, the current SH345, as expected, becomes less informative about future values of SH345 the longer the horizon. The most interesting result, however, is the sign and significance of the estimated coefficients on the Greenbook forecast of real GDP growth over the next four-quarters. At each horizon, the estimated effect is negative and either statistically significant or at the margin. The stronger the economy is expected to be over the next year, the better will be bank health four-quarters down the road. This result is robust to different specifications of the exact form of the function. [8]

The results in Table 3 show that estimates of the potential contagious failure of banks one-quarter, two-quarters, and four-quarters ahead, as measured by SH345, are significantly improved by using the Federal Reserve's internal forecast of GDP growth. In fact, the success of the stress tests on banks in the Spring of 2008 was the first time that a comprehensive forward-looking exercise was done that integrated macroeconomic forecasts with an assessment of the

[8] Again, the third quarter horizon is omitted for brevity; the output forecast coefficient at that horizon is also correctly signed and statistically significant. Also, the errors are corrected for possible serial correlation and heteroscedasticity. Finally, preliminary work using different components of the forecast produce stronger results.

need for additional capital. This exercise, along with the results in Table 2, indicates that significant potential synergies arise from using macroeconomic data to improve bank supervisory policy.

Using internal forecasts of macroeconomic variables will be particularly advantageous if the Greenbook forecasts of macroeconomic variables produced by the Board staff, incorporating confidential supervisory data, are significant improvements over those of private forecasters. Peek, Rosengren, and Tootell (1999) did find that macroeconomic forecasts are improved by using supervisory data. Updating those results, it remains the case that forecasts of macroeconomic variables produced by private forecasters or by the Board staff can be improved when the information set upon which they are based is augmented by bank supervisory information. If macroeconomic forecasts can be improved using supervisory data, the central bank will have an advantage in estimating the future path of the economy. This is at least one potential reason that the estimated Taylor rule in Table 1 shows that monetary policy reacts to the potential contagious failure of banks. Furthermore, having a detailed idea of where the economy is headed helps forecast the future health of the banking system as a whole; again, that knowledge helps provide a better forecast for the economy. The question, however, remains, does a better forecast of the health of the banking system affect current monetary policy independently of its effect on the forecasts of the real economy?

II. Is there an independent effect of bank health on FOMC decisions?

To account for the apparent symbiosis between the supervisory data and the macroeconomic forecast data, the equations in Table 1 must be re-estimated. Only after this

symbiosis is accounted for can one really discern whether bank health has an independent effect on the conduct of monetary policy. Because bank supervision information can improve macroeconomic forecasts, and macroeconomic forecasts can improve estimates of contagious failures, we reestimate equation 1 using two-stage least squares estimation techniques. Specifically, it is assumed that the FOMC wants to adjust monetary policy to affect the future course of the economy,

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 Q_{t+i} + \alpha_3 \pi_{t+i} + \alpha_4 UR_t + \alpha_5 Sh345_{t+i}. \quad (4)$$

Thus, the federal funds rate today depends on the actual course of the economy. The FOMC does not know that course with certainty and must forecast it. Obvious instruments for the above actual values of these variables are the Greenbook forecasts of these variables. However, the previous sections reveal that forecasting the health of banks also should improve the forecast of these variables. Because the issue remains as to whether the FOMC cares independently about the health of banks beyond its effect on the forecasts, a measure of future bank health also is included in the regression. Future rather than current bank health is included, since, like the economy as a whole, the FOMC can do little about bank health today. Thus, we utilize two-stage-least-squares methods to estimate the coefficients in equation (4). As instruments, we use the current unemployment rate, the Greenbook forecasts for inflation and real GDP growth,

SH345 at the time of the FOMC meeting, and the most recently available bank call report data – specifically, the variables used in Table 3.[9]

The results are broadly similar to the results reported in Table 1. Several different reaction functions are estimated, varying how forward-looking the FOMC is. At each forecast horizon, the estimated coefficient on the inflation rate is correctly signed and statistically significant, just as in Table 1. The real GDP growth rate has the expected positive estimated coefficient and is significant at the one-quarter and half-year horizons. More interesting, the estimated coefficient on SH345 measuring the independent effect of bank health on monetary policy remains negative and statistically significant at both the half-year and full year horizons. Thus, even after accounting for the synergies between the information flows from monetary policy to bank supervision, and from bank supervision to monetary policy, the "independent" effect of bank health on monetary policy seems robust. In the next section, possible reasons for this independent effect are discussed.

III. Conclusion

In the wake of the very severe financial crisis and recession experienced over the past two years, Congress is examining proposals for regulatory changes that would ensure that we do not experience a reoccurrence of the recent financial turmoil. While a variety of proposals are currently under consideration, this study highlights several issues that should play a central role in the discussions.

[9] The proper instrument set is crucial to the paper. The use of the Greenbook forecast avoids most problems of which instruments or models to use, as in most of the work in this area, but it is not enough. It does allow a cleaner interpretation of any other variable included in the set. The results also appear to be robust to which of these call report variables we include.

First, an important nexus exists among monetary policy responsibilities, bank supervision responsibilities, and concerns about financial instability. The FOMC does ease monetary policy more during a financial crisis, controlling for the expected trajectories for inflation and real GDP growth. In part, this may reflect that many macroeconomic models do not have a fully developed financial sector. Thus, even if the Federal Reserve cared only about the expected path of inflation and the achievement of full employment, the FOMC still may need to make qualitative adjustments to the Greenbook forecasts that are based on quantitative models using historical data, especially given our current circumstances that have little historical precedent.

In addition, financial crises are likely to increase the risk of more severe adverse outcomes, given the evidence that countries experiencing banking problems in combination with a recession tend to experience longer and more severe economic downturns. Thus, it is important for the Federal Reserve to understand both the problems being experienced by financial intermediaries and the associated risk that banking problems could result in contagious failures that might lead to significantly more severe outcomes than are generated in most macroeconomic models.

Second, supervisory policy and programs to promote financial stability are likely to be improved when integrated with monetary policy. The stress tests conducted on banks earlier this year show the advantage of using scenario analysis and macroeconomic assumptions to better understand the risk exposures of individual financial institutions and of groups of financial institutions.

Whatever regulatory reform is adopted, it should exploit the synergies between monetary policy, supervisory policy, and policies to promote financial stability. While policy makers are

still collecting "lessons learned" from the recent crisis, it is clear that the economic outcome would have been much worse had the central bank not had the access to the knowledge about, and the hands-on experience with, financial institutions and financial markets required to take immediate actions to stabilize financial markets and the real economy.

Future research should focus on obtaining a better understanding about how financial market problems can spill over to the real economy. Many macroeconomic models do not allow a sufficient interaction of the real economy with financial institutions and financial markets, an omission that made them less useful during this crisis. Furthermore, much more research needs to be focused on achieving an improved understanding of how future crises can be avoided, and if they do occur, how their impacts can be mitigated through the exploitation of the symbiosis shown to be present among monetary policy, bank supervisory policy, and concerns about financial instability.

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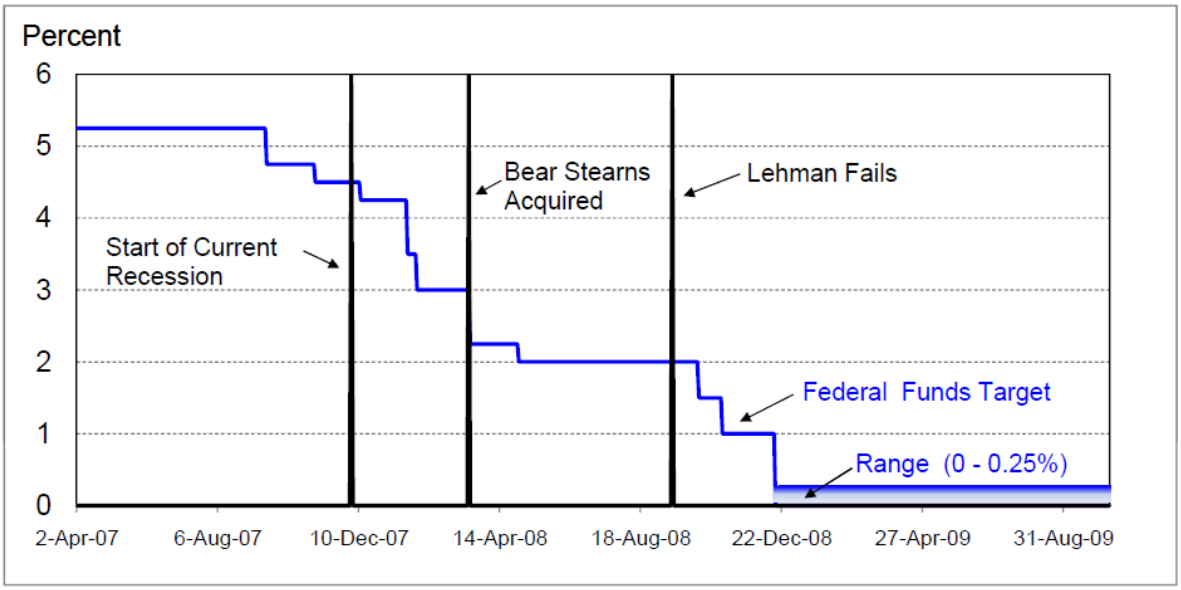
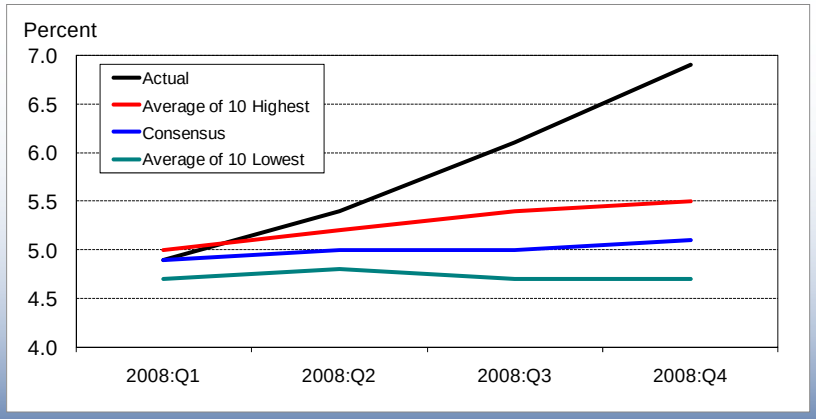
Figure 1
Federal Funds Target Rate
April 2, 2007 - October 9, 2009



Source: Federal Reserve Board / Haver Analytics

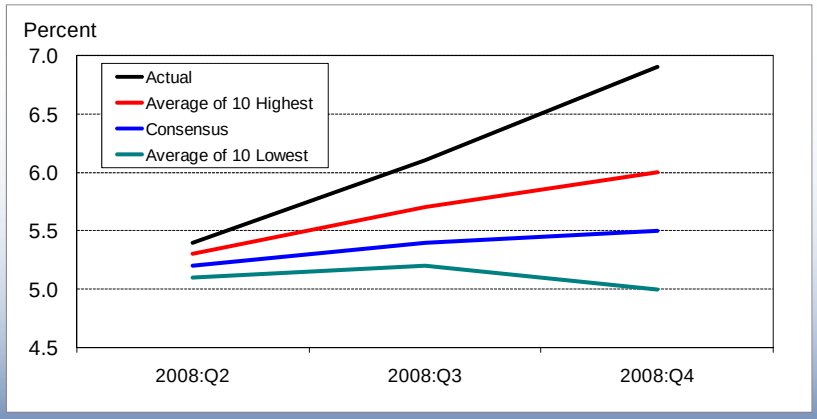
Figure 2
Blue Chip Forecast for Unemployment Rate
Forecast as of January 10, 2008



Source: Blue Chip Economic Indicators / Haver Analytics

3

Figure 3
Blue Chip Forecast for Unemployment Rate
Forecast as of May 10, 2008



Source: Blue Chip Economic Indicators / Haver Analytics

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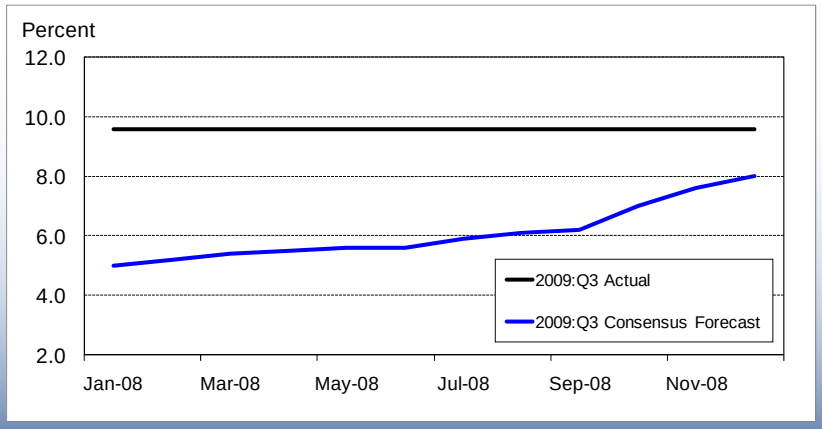
Figure 4
Blue Chip Forecast for 2009:Q3 Unemployment Rate
Forecast as of the Tenth of Each Month



Source: Blue Chip Economic Indicators / Haver Analytics

2

Table 1

Reaction Function : $r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 E_t \pi_{t+i} + \alpha_3 E_t \dot{Q}_{t+i} + \alpha_4 UR_t + \varepsilon_t$

	1985:Q1-09:Q1		1985:Q1-08:Q2	
Variables	without SH345	with SH345	without SH345	with SH345
constant	0.046	-0.734	-0.067	-1.098
	(.880)	(.057)	(.831)	(.007)
lagged federal funds rate	0.917	0.922	0.927	0.940
	(.000)	(.000)	(.000)	(.000)
inflation expectation	0.228	0.328	0.250	0.380
	(.002)	(.000)	(.001)	(.000)
real GDP growth expectation	0.183	0.126	0.236	0.196
	(.000)	(.002)	(.000)	(.000)
lagged unemployment rate	-0.156	-0.008	-0.183	-0.013
	(.004)	(.908)	(.001)	(.851)
SH345		-0.020		-0.024
		(.002)		(.000)

Note: p-values are in parenthesis. r_t: Current federal funds rate. r_{t-1}: Last period's federal funds rate. $E_t \pi_{t+i}$: Inflation expectation over *i* periods. $E_t \dot{Q}_{t+i}$: Real GDP growth expectation over *i* periods. UR_t: Unemployment rate

Table 2

Efficiency Equations, Quarterly Frequency, 1985Q1-2008Q2 :

$$X_{t+i} = \beta_0 + \beta_1 E_t X_{t+i} + \beta_2 SH345_t + \beta_3 D00 + \beta_3 (D00 * SH345_t) + \eta_t$$

	Real GDP Growth, Q			Unemployment Rate, UR		
Variables	1Q ahead	2nd Q ahead	4th Q ahead	1Q ahead	2nd Q ahead	4th Q ahead
constant	1.650	3.089	1.718	0.035	0.338	1.164
	(.000)	(.000)	(.004)	(.637)	(.011)	(.001)
Q^E or UR^E	0.808	0.384	1.001	0.987	0.906	0.684
	(.000)	(.029)	(.001)	(.000)	(.000)	(.000)
SH345	-0.035	-0.057	-0.063	0.003	0.009	0.031
	(.004)	(.003)	(.004)	(.006)	(.000)	(.000)
D00	-1.514	-1.618	-2.257	-0.001	-0.040	0.106
	(.000)	(.001)	(.001)	(.980)	(.420)	(.464)
D00*SH345	0.155	-0.029	-0.363	0.005	0.043	0.164
	(.002)	(.698)	(.000)	(.085)	(.000)	(.000)

Note: p-values are in parenthesis. Errors are corrected for any heteroscedasticity or auto correlation using Newey-West. $E_t X_{t+i}$: Greenbook forecasts of real GDP growth, inflation, or unemployment rate. Q^E, P^E, or UR^E: forecasts of real GDP growth, inflation, or unemployment rate. $SH345_t$: Bank health variable, CAMELS share 345. $D00$: (0,1) dummy variable that has a value of one for observations after 1999. $D00 * SH345_t$: Dummy variable interacted with SH345 to allow a shift in the estimated bank health effect

Table 3

Forecasts of Bank Health, 1985Q1-2008Q2: $SH345_{t+i} = \alpha + \beta X_t + \lambda E_t \dot{Q}_{t+i} + \xi_2$

	SH345		
Variables	1Q ahead	2Q ahead	4Q ahead
constant	20.625	35.895	59.590
	(.046)	(.031)	(.019)
equity capital to assets	0.028	0.600	1.128
	(.959)	(.554)	(.544)
net charge-offs to assets	5.203	5.865	4.007
	(.032)	(.127)	(.599)
nonperforming loans to assets	-0.371	1.747	8.220
	(.789)	(.298)	(.022)
net income to assets	-1.721	-2.901	-5.271
	(.175)	(.225)	(.242)
liquidity to assets	-0.502	-1.101	-1.981
	(.003)	(.000)	(.000)
SH345	0.903	0.749	0.230
	(.000)	(.000)	(.276)
annual real GDP growth expectation	-1.033	-1.389	-1.917
	(.005)	(.025)	(.066)

Note: p-values are in parenthesis. Errors are corrected for any heteroscedasticity or auto correlation using Newey-West. $SH345_{t+i}$: Future values of CAMELS share 345. X_t: Bank balance sheet and income measures. $E_t \dot{Q}_{t+i}$: Greenbook forecasts of real GDP growth.

Table 4

2-Stage-Least-Squares Reaction Function [a] : $r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 \dot{Q}_{t+i} + \alpha_3 \pi_{t+i} + \alpha_4 UR_t + \alpha_5 SH345_{t+i}$

	1985:Q1-2008:Q2		
Variables	One Quarter	First Half	Annual
constant	-0.803	-1.168	-0.979
	(.092)	(.001)	(.019)
lagged federal funds rate	0.973	0.950	0.927
	(.000)	(.000)	(.000)
inflation	0.229	0.439	0.650
	(.012)	(.000)	(.000)
real GDP growth	0.175	0.130	-0.038
	(.001)	(.022)	(.435)
unemployment rate	-0.023	0.008	0.011
	(.763)	(.899)	(.873)
SH345	-0.015	-0.031	-0.050
	(.098)	(.000)	(.000)

Note: p-values are in parenthesis. r_t: Current federal funds rate. r_{t-1}: Last period's federal funds rate. $\dot{Q}_{t+i}$: Real GDP growth expectation over *i* periods. π_{t+i}: Inflation expectation over *i* periods. UR_{t-1}: Unemployment rate. $SH345_{t+i}$: Bank health variable, CAMELS share 345.

[a] : the instruments used are the current unemployment rate, Greenbook forecasts for inflation and real GDP growth, SH345 at the time of the FOMC meeting, and the most recently available bank call report data (variables used in Table 3)