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Does Fed Policy Reveal a Ternary Mandate?

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Abstract

This paper examines the role of financial instability in setting monetary policy. The paper begins with a model that examines the interaction of monetary and regulatory policy. It then empirically tests whether financial instability has affected monetary policy. One important innovation is to construct a measure of financial instability directly related to the FOMC financial instability concerns expressed in FOMC meeting transcripts. We find that, even after controlling for forecasts of inflation and unemployment, the word counts of terms related to financial instability do correlate with monetary policy decisions. Thus, the FOMC not only "talks the talk" about financial stability, but it "walks the walk."

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I. Introduction

Although the creation of the Federal Reserve in 1913 was, in part, a response to repeated episodes of financial instability, the Fed is usually described as having a dual mandate, targeting low inflation and full employment. Even so, many would argue that during the recent financial crisis, and perhaps at other times in the more distant past, monetary policy may have reacted to concerns about financial instability. Thus, an important question is whether the Fed should pursue, or in fact is implicitly pursuing, a third mandate related to financial stability. The issue of what the Fed should, and does, target takes on added importance given the current discussions about imposing limits on how monetary policy is implemented. Using a new, direct measure of FOMC financial instability concerns constructed from FOMC meeting transcripts, we find evidence that monetary policy has reacted in a manner consistent with having financial stability as a third mandate.

The 2008 financial crisis renewed interest in how financial stability risks should be addressed by policy makers. In the United States, the Dodd-Frank Act established a new Financial Stability Oversight Council both to monitor financial stability trends and to designate systemically important financial institutions. The provisions of Dodd-Frank highlighted the fact that an important goal of the regulatory changes is to reduce the probability that systemically important institutions will fail. Other countries increased their focus on financial stability as well. For example, in the United Kingdom a new Financial Policy Committee was created as part of the central bank to focus on financial stability issues. Unlike the situation in the United States, the committee was given explicit powers to enhance the achievement of financial stability goals using tools such as limits on the loan-to-value and debt-to-income ratios for mortgages.

This paper empirically examines the interplay between financial stability and monetary policy in the United States. While a great deal of evidence supports the common belief that the Federal Open Market Committee (FOMC) reacts to deviations from full employment and the inflation target, it is less well understood how the Fed should, and does, react to potential or actual episodes of financial instability. Does the Fed have the tools it needs to attain financial stability as well as its dual mandate? If not, has it used its primary monetary policy tool, the federal funds rate, to try to minimize financial instability? Complicating the matter, Fed responses to potential or actual episodes of financial instability may arise directly from concerns that financial instability might impact the outcomes of its mandated policy goals for inflation and/or employment in the future; hence, should financial instability be thought of only as something that impedes the attainment of the inflation and employment goals over time, or do society and the Fed care intrinsically about financial stability for other reasons as well?

We examine adding a third mandate to the Federal Reserve goals to explicitly consider financial instability concerns that are independent of inflation and output. After providing some background in Section II on the role of financial instability considerations relevant for guiding monetary policy, Section III provides the theoretical implications of explicitly including a role for financial stability in the Fed's objectives. The model produces "Taylor rule" type reaction functions that include financial stability as a variable that might contribute to the setting of the federal funds rate. Sections II and III highlight that the setting of macroprudential regulatory policies should also be consistent with monetary policy reactions to financial instability concerns. With these additions, a traditional dual mandate reaction function may not be sufficient to model FOMC behavior, since monetary policy authorities must consider financial stability when considering the appropriate setting of multiple monetary policy instruments. And similarly, regulatory policy should not be considered as being independent of the goals of monetary policy.

In Section IV, we describe the construction of our measure of FOMC financial instability concerns based on word counts from the FOMC meeting transcripts. Section V examines whether a simple dual mandate reaction function implying little role for financial instability is consistent with conversations the FOMC members had when setting interest rates in the past. Specifically, the measure of financial instability word counts from the FOMC transcripts of monetary policy meetings are included as arguments in simple reaction functions to ascertain whether financial stability concerns significantly enter monetary policy deliberations. We find that financial instability concerns do appear to influence the setting of the federal funds rate beyond any effects incorporated in the forecasts of the dual mandate variables. Importantly, we show in Section VI that this result is not due to the forecasts inefficiently incorporating financial instability concerns.

Thus, the results are consistent with the FOMC behaving as if financial stability were a third mandate. Future work will need to distinguish whether this result reflects other factors, such as concerns with tail events that might impact risks around the Fed's expectations of the traditional dual mandate variables. But the results certainly imply that a simple reaction function meant to explain, or set, monetary policy is flawed if it ignores how concerns about financial instability affect the setting of the federal funds rate. The final section provides some conclusions.

II. The Origins of a Financial Stability Objective

While there has been renewed interest in the role of financial stability in achieving the goals of central banks, this is not a new concern. In fact, the desire to ensure financial stability was a significant factor in the creation of the Federal Reserve in 1913. The need for a central bank in the United States had its impetus in the financial panics that were endemic during the 19th century and culminated in the financial panic in 1907. The Federal Reserve was given the power to "furnish an elastic currency," which, among other things, gave the Federal Reserve the power to offset seasonal or macroeconomic shocks to the economy that could disrupt credit availability. The Federal Reserve was also given powers for "more effective supervision of banking," reflecting the important role that bank failures had played during earlier financial panics. Notably, no explicit macroeconomic goals were set, except some responsibility for the conversion of dollars for gold. The early mandate partly reflected the focus on financial stability, but it also revealed only a nascent understanding of how monetary policy tools influence the economy.

By the 1930s, as the effects of monetary policy on the economy became clearer, Congress reorganized the structure of the FOMC. The increased focus on macroeconomic goals culminated in the Full Employment and Balanced Growth Act of 1978 (commonly referred to as the Humphrey-Hawkins Act), which amended the Fed's mandate to now "promote effectively the goals of maximum employment, stable prices, and moderate long-term rates." This was the genesis of the dual mandate, whereby the Federal Reserve focused on achieving macroeconomic outcomes regarding stable prices (more recently interpreted as an explicit 2 percent inflation target) and maximum employment (typically interpreted as ensuring that the unemployment rate not exceed the natural rate of unemployment).

Despite the general shift in focus toward macroeconomic goals, the degree of attention directed toward financial stability fluctuated, tending to rise during periodic episodes of financial turmoil, such as occurred on October 19, 1987, when the Dow Jones average declined by 22.6 percent. The Federal Reserve reacted to "Black Monday" by affirming "its readiness to serve as a source of liquidity to support the economic and financial system." In addition, Bernanke (1990) notes that the Fed provided substantial encouragement to banks to lend on customary terms, including to broker-dealers, in an effort to stabilize the payments system and financial markets by preventing financial gridlock. After Black Monday, the FOMC conducted conference calls each remaining day in October, presumably reflecting concerns about the risks to financial stability. In addition, the stock market crash was actively discussed at the November 3, 1987, FOMC meeting, with a particular focus on financial stability. For example, Chairman Greenspan stated, "Financial markets have been so inherently unstable, just looking at the variations in volume and prices." A reading of that FOMC transcript makes it clear that concerns with financial instability were particularly important for the monetary policy deliberations at that time.

While financial instability concerns appear in the FOMC transcripts during periods of financial turbulence, the prevailing view during the period of the now forgotten "Great Moderation" was that monetary policy should not react to financial pressures but should respond only if financial market movements affected variables relevant for the dual mandate. This view is reflected by Bernanke and Gertler (2001), who argue: "Asset prices become relevant only to the extent they may signal potential inflationary or deflationary forces."

Moreover, as a result of the recent financial crisis, there has been significant recognition that the ability of the Fed to react to adverse shocks post-crisis may be further constrained. Of course no central bank can completely offset all shocks, whether they are real, nominal, or financial, but with low inflation targets and low equilibrium real rates, the higher probability of hitting the zero lower bound makes it even more difficult to eliminate the effects of such shocks. As a result, a central bank might need other potential tools in its arsenal, including regulatory instruments, to keep its economy close to its inflation and output targets. In fact, given the social costs of bank failures—the large fiscal costs associated with trying to offset the shocks, and the potential income transfers generated by a large financial shock and the subsequent policy response—one could argue that central banks should consider maintaining financial stability as an additional central bank mandate, a position consistent with the concerns about financial instability that were a key consideration underlying the founding of the Federal Reserve.

Hence, the recent financial crisis raises the question of whether financial stability should be an independent third mandate of monetary policy. In what sense should monetary policy makers care *independently* about financial stability, and how does that affect the conduct of monetary policy? Is there any evidence that the Fed has included financial instability concerns in its reaction function? And if so, can we distinguish between financial stability being a third, independent mandate rather than simply an additional indicator of future inflation and employment outcomes?

Given the possible costs associated with adding a third goal to the Fed's mandate, specifically, as Swenson (2015) has emphasized, in terms of sacrificing the attainment of the other two goals, any argument for including financial stability as an independent element in the Fed's objective function needs to clearly articulate a rationale. The significant costs that can arise from the political uncertainty and the fiscal expenditures that can result from a financial crisis, along with the widespread public outcry concerning the assistance given to large financial firms as part of the central bank's exercise of the lender-of-last-resort function, highlight why the Fed might place independent weight on avoiding episodes of financial instability. Even the Congressional reaction embedded in the Dodd-Frank Act, which limits the Fed's ability to offset financial shocks to markets and financial intermediaries once they occur, represents the public's view of the severity of the costs from financial crises. Thus, the Dodd-Frank Act only raises the Fed's desire to head off any incipient financial instability before it becomes a reality, especially insofar as the public and Congress likely place the primary responsibility for avoiding financial crises on the Fed.

Before the crisis, the Fed's apparent sensitivity to financial instability may have reflected concerns not fully incorporated into forecasts of inflation and unemployment. Furthermore, financial instability might directly affect unemployment and inflation, although this impact is not well captured by simple monetary policy reaction functions, for example due to nonlinearities in the relationships or asymmetric effects of monetary policy. Some of these issues will be explored in later sections of the paper.

III. What If the Fed Cared about Financial Instability?

In the simple monetary policy reaction function based on the dual mandate, financial stability has no independent role. Changes to interest rates are determined by deviations of output and inflation from their targets due to shocks to aggregate demand and inflation. The central bank attempts to minimize the losses caused by these shocks in a manner consistent with a Taylor-rule-type reaction function. While this is an extreme simplification of monetary policy decision making, this type of formulation is quite prevalent when modeling Federal Reserve behavior in the literature.

A relatively simple version of the Fed's reaction function can easily be derived from minimizing its assumed loss function:

1) $$\underset{r}{Min}\ \Gamma\left(Y_t - Y^*\right)^2 + \Phi\left(\pi_t - \pi^*\right)^2 \qquad \Gamma, \Phi > 0$$

2) $$s.t.\quad Y_t = \alpha_0 + \alpha_1 r_t + \eta_t \qquad \alpha_1 < 0$$
$$where\ Y_t = Y_t^*\ when\ r_t = r_t^*\ and\ \eta_t = 0$$

3) $$s.t.\quad \pi_t = \beta_0 + \beta_1 (Y_t - Y^*) + \varepsilon_t, \qquad \beta_1 > 0$$
$$where\ anchored\ expectations \Rightarrow \beta_0 = \pi^*.$$

The two constraints sketch out a simplified model of the economy. Aggregate demand depends on the interest rate and a shock, η—an IS curve. Inflation, when inflation expectations are well anchored at the target, depends on the deviations of output from its long-run equilibrium level—the Phillips curve. Minimizing the loss function in equation 1, subject to the two given constraints, produces an equation describing central bank monetary policy behavior that reacts to the demand and price shocks that push the economy away from full employment at the inflation target:

$$4) \qquad r_t = \mathrm{A} - \left(\frac{\Gamma\alpha_1 + \Phi\alpha_1\beta_1}{\Gamma\alpha_1^2 + \Phi\alpha_1^2\beta_1^2}\right)\eta_t - \left(\frac{\Phi\alpha_1\beta_1}{\Gamma\alpha_1^2 + \Phi\alpha_1^2\beta_1^2}\right)\varepsilon_t\,.$$

The interest rate depends on both real and nominal shocks. Note that if the central bank cares only about inflation, Γ = 0 from equation 1, the reaction function depends on both real and nominal shocks, as they both affect inflation. On the other hand, if the Fed cares only about real output, Φ=0, nominal shocks will have no effect.[1]

Given that α_1 is negative, and β_1, Γ, and Φ are each positive, equation 4 indicates that the Fed would raise rates if a positive shock to either output or inflation occurred. The positive effects of η_t and ε_t are of the expected sign and consistent with previous empirical findings. It should also be noted that both the equilibrium real interest rate and the inflation target are contained in A. Hence, when both shocks equal zero, the real funds rate is set equal to its equilibrium rate. While many bells and whistles have been added to this simple structure in the literature, the basic conclusion remains the same: monetary policy reacts to the shocks that cause deviations of the economy from the desired values of the two goal variables in the dual mandate.

Given the recent crisis, many now wonder about the simplicity of models like the one above. Consequently, this paper examines how the model of central bank behavior may differ from the simple specification outlined above. Specifically, this paper considers the possibility that the objective function in equation 1 is incomplete because it ignores concerns about financial stability. Thus, the remainder of the paper investigates the implications for Fed

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[1] This asymmetry is a consequence of the real rate reaction function. It would be symmetric if, instead, the nominal rate were used.

behavior, and the interest rate reaction function, of an expanded objective function. In particular, we derive an alternative expression for interest rate determination with financial stability included as a third mandate, highlighting that financial stability could play a role in setting interest rates and that regulation could play a role in economic stabilization. A very simple model of the economy is used in order to clarify the role financial stability might play. With this addition, shocks to financial stability and changes in bank regulations can impact the interest rate being set by the monetary authority, as real and nominal shocks to the economy could affect regulatory policy. Further, the addition of a ternary mandate for the Fed has important implications not just for the proper setting of monetary policy, but also for the tools that are available and appropriate for monetary policy.

To begin, the objective function is expanded to include deviations of financial instability from its optimal level:

$$5) \quad \underset{r,\mathrm{R^C}}{Min} \quad \Gamma\left(Y_t - Y^*\right)^2 + \Phi\left(\pi_t - \pi^*\right)^2 + \mathrm{K}(FI_t - FI^*)^2 .$$

The addition of this third term in the loss function could, and has, led to much debate in the profession.

As mentioned earlier, the public in many countries, including in the United States, have made it quite clear that the actions needed to clean up after a financial upheaval to ensure macroprudential and economic stability are not palatable. Taxpayers have revealed a strong preference against bearing the costs of "bailing out" systemically important institutions after a crisis: these are income transfers the public clearly would like to avoid in the future. Yet unless all risk is wrung out of the system, FI*=0, taxpayers will always face the possibility of being on the hook when a systemically important event occurs. And, in fact, it is not optimal to wring all of the risk out of the system. For example, extremely high required capital ratios for banks may remove most of the risk of bailouts, but such elevated capital ratio requirements make it very difficult to obtain a loan. Because it may be costly to have too much as well as too little financial stability, it makes sense to use a quadratic term for FI.

The amended objective function now acknowledges the central bank's role as the lender of last resort and, hence, as an important regulator of the financial system.[2] As a regulator, the central bank has an added instrument, R^C, in its arsenal of weapons. Note that the way regulation interacts with the financial system and the way the financial system might affect the macroeconomy further complicate our understanding of a more complete policy reaction function. The possible tradeoffs between R^C and the funds rate depend on how the FI variable affects the economy.

Acknowledging the existence of these complexities, the model in this paper remains as simple as possible in order to maintain clarity. The equations describing the model need to incorporate the possible role of financial instability in the economy. The new IS curve in equation 6 below includes an effect of financial instability on aggregate demand,

$$6) \qquad Y_t = \alpha_0 + \alpha_1 r_t + \alpha_2 (FI_t - FI^*) + \alpha_3 R_t + \eta_t.$$

FI represents the risks from potential financial instability. Here, increased risk of financial instability, caused, for example, by asset prices rising above fundamental values, may have a positive effect on demand, $\alpha_2 > 0$, emanating from a wealth effect on consumers or by stimulating investment. The variable R represents regulation used by the government and the central bank to help control these risks to financial instability. The higher the regulation, the tighter are credit conditions, $\alpha_3<0$. These regulations could include stricter capital standards, more extreme stress test scenarios, or various other macroprudential policies; hence, they would have a direct effect on financial stability, but could also have an effect via their effect on aggregate demand.

The inflation equation is unchanged:

$$7) \qquad \pi_t = \beta_0 + \beta_1 (Y_t - Y^*) + \varepsilon_t \quad \textit{where } \beta_0 = \pi^* \textit{ when expectations are well anchored at } \pi^*.$$

However, because several new variables are being added to the model, we need additional equations defining their determinants:

$$8) \qquad FI_t = \delta_0 + \delta_1 R_t + \delta_2 (P_t^A - P_F^A) + \lambda_t \quad \textit{where } P_F^A \equiv \textit{fundamental value} \quad \delta_1 < 0, \ \delta_2 > 0$$

[2] Note that some countries, such as Australia, have a separate bank regulator rather than embedding regulation responsibilities in the central bank.

9) $R_t = \overline{R} + R^C + \xi_t$

10) $P_t^A = P_F^A + \rho_1(r_t - r^*) + \mu_t \quad where \ \rho_1 < 0$.

Equation 8 states that the risk of financial instability depends, in part, on the degree of regulation: the more highly regulated are financial intermediaries, the lower the risk of financial instability, $\delta_1 < 0$. In addition, due to the risk of financial instability that can be caused by the popping of asset bubbles as asset prices rise beyond their fundamental values, the risk of instability increases, $\delta_2 > 0$. The central bank has some control over that risk, however. Equation 9 highlights the notion that the degree of regulation depends on the exogenous regulations set by the government authorities responsible for regulating financial institutions, $\overline{R}$, and on the financial regulations that the central bank can control, R^C , representing countercyclical macroprudential regulation. Finally, equation 10 attempts to capture potential financial instability from "reaching for yield," which has been widely discussed in the context of concerns about excessively easy monetary policy.

Reaching for yield represents a monetary policy risk that does not work through inflation and output directly, but works indirectly through increasing the risk of financial instability. One might expect factors such as reaching for yield to be most relevant during boom periods or when the economy is stuck at the zero lower bound. Of course, asset bubbles can occur due to nonmonetary factors, which would be reflected in ρ_1 or μ_t. Positive values would reflect asset bubbles, while negative values may reflect depressed values that occur in the middle of a severe recession or financial crisis. One could also expand the P^A equation to include a role for regulation, in particular macroprudential regulation, in leaning against the buildup of asset price bubbles. However, to keep the model simple, that extension is omitted here.

Solving the maximization of policy subject to these constraints produces more complicated solutions for the policy interest rate and the degree of regulation by the central bank. Generally, the solutions take the form:

11) $r_t = A + B\,R^C{}_t + C\,\eta_t + D\,\varepsilon_t + F\,\lambda_t + G\,\xi_t + H\,\mu_t$

12) $R^{C}{}_{t} = K + L\,r_t + M\,\eta_t + N\,\varepsilon_t + P\,\lambda_t + S\,\xi_t + T\,\mu_t.$

Here, the funds rate still depends on the traditional shocks that affect deviations from the FOMC's targets of output, η_t, and inflation, ε_t. However, now the central bank attempts to accomplish its goals by jointly using its two instruments (r and R^C). Two key results are:

13) $$\frac{\delta r_t}{\delta R^{C}{}_{t}} < 0 \text{ and } \frac{\delta R^{C}{}_{t}}{\delta r_t} < 0 .$$

Hence, in order to achieve an optimal policy setting for the macroeconomy, a shock that causes regulatory policy makers to raise R^C could cause the monetary policy authorities to reduce the policy interest rate below what it otherwise would be, and a shock that causes policy makers to raise the policy interest rate could cause the central bank policy makers in their role as regulators to react by decreasing R^C below what it would otherwise be. Hence, a fiscal shock could cause both regulatory and interest rate instruments to respond. That is, the optimal policy mix incorporates a tradeoff between conventional monetary policy and macroprudential regulatory policy. The two might not be set independently. Essentially, when the goals conflict, say when a shock to stock prices causes an increase in asset prices beyond fundamental values, the model indicates that the central bank will tend to tighten regulations and lower the policy interest rate; as a result, we get a better answer to the old question of whether policy should tighten or loosen when we know there is a bubble: the answer is both. Solving the two equations simultaneously provides much more complicated expressions for r_t and $R^C{}_t$ as determined by the macroeconomic shocks, including potentially regulatory shocks:

14) $r_t = \Gamma + \mathrm{X}\eta_t + \Delta\varepsilon_t + \mathrm{E}\lambda_t + \Lambda\xi_t + \mathrm{O}\mu_t$

15) $R_t^C = \mathrm{I} + \Theta\eta_t + \Sigma\varepsilon_t + \Upsilon\lambda_t + \Omega\xi_t + \Psi\mu_t ,$

where the coefficients of the policy rules in these two equations are complicated functions of the coefficients from equations 5–10.

The purpose of this section is to outline the effects a ternary mandate might have on monetary policy. Acknowledging the assumed, admittedly ad hoc, structure of the model, the section also produces a definition of macroprudential policy: it is a supervisory and regulatory policy with macroeconomic implications that is driven, at least at the central bank, by the same objectives that drive monetary policy. Certainly, recognizing the nature of the tradeoffs faced by a central bank with responsibilities for both monetary policy and regulatory policy, such as the Fed, or even a central bank that does not set regulatory policy but can only react to changes imposed by a separate regulatory authority, raises a host of questions. Ultimately, it would be worthwhile to examine the interaction between regulatory and monetary policy at the central bank. However, that is beyond the scope of this paper. The focus of the remainder of this paper is to test whether the Fed has behaved as if it has had a ternary mandate.

IV. An Empirical Measure of Concerns about Financial Instability

Attempting to measure financial instability has been a goal in financial economics for some time. Such measures tend to be constructed as weighted averages of observable financial statistics, such as those related to interest rates, interest spreads, leverage, volatility, credit volumes, etc.[3] For our particular purpose, two primary issues arise. First, to what extent are such measures reliable indicators of the fragility of the system? Second, are these measures on the radar of monetary policy makers so that they could potentially influence the stance of monetary policy? Given these issues, we propose a measure of financial instability that sidesteps the problems associated with identifying a good indicator of actual or potential risks of financial instability and with determining whether or how that information is taken into consideration by policy makers. We accomplish this by examining financial stability concerns raised directly by participants in the FOMC monetary policy meetings. That is, rather than basing the measure on specific events or financial data and having to speculate whether the FOMC is sufficiently concerned about them, we develop a direct measure of mentions that actually appear in FOMC discussions.

Since these word counts are taken directly from FOMC meeting transcripts, they are particularly well suited for explaining the behavior of the FOMC. In general, examining such an indicator should highlight the degree of importance the FOMC accords to financial stability and

[3] Examples include financial stress indexes produced by the Office of Financial Research and the Federal Reserve Banks of Chicago, Cleveland, Kansas City, and St. Louis, as well as the FDIC's problem bank series.

hence its importance to the implementation of monetary policy. If FOMC members never discuss financial stability at these meetings, it would be difficult to argue that the stance of monetary policy has been affected by financial stability concerns. If the committee does discuss financial instability concerns, then it either cares about financial instability separately or believes that the forecast has not incorporated these concerns fully or accurately. Such an examination might also produce a fairly accurate ex post indicator of financial distress.

The verbatim transcripts of FOMC meetings are available with a five-year lag. We examine all FOMC transcripts from 1982 through 2008. For the reaction function regression analysis examined in the next section, the sample begins in 1987, which is the first FOMC meeting in the calendar year in which Chairman Greenspan began his tenure, and ends with the last FOMC meeting in 2008, when the federal funds rate hit the zero lower bound.

Table 1 provides some key words that might be related to financial instability and provides the number of times these words are mentioned in the FOMC meeting transcripts during our 1987–2008 regression sample period. Subjectivity inevitably plays a role in the selection of which words to examine. The purpose of the selection is to identify terms that are likely to be used during times of rising concern about the financial markets. The selection is not meant to be complete, only representative. The results of the word search indicate that words associated with financial instability concerns are mentioned prominently at particular FOMC meetings. Words such as "bust," "crisis," and "volatility" appear quite frequently, with each of these words mentioned more than 500 times. A reading of the transcripts clearly indicates that financial instability concerns are discussed, with the mentions appearing most frequently during periods of financial turbulence.

One complication is that the expected sign of any FOMC policy response depends on how the key word mentions are measured. For example, if all we do is count mentions of bubbles, then the direction of the response of the federal funds rate to these mentions depends on whether the bubble is building up, producing a positive federal funds rate response as the FOMC preemptively leans against the bubble, or bursting, creating a negative response as the FOMC cleans up the associated mess. Furthermore, if the FOMC primarily responds to negative financial shocks, then the average response will be negative and may be larger in absolute value during periods when the economy is experiencing financial turmoil. In this case, the FOMC may respond more aggressively during periods of heightened financial instability. If the FOMC primarily responds preemptively to prevent, or at least mitigate, the buildup of bubbles, it may choose tighter policy when it suspects that asset prices are rising above their fundamental values, perhaps because investors are reaching for yield. In this case, a higher word count would be associated with a rise in the federal funds rate, and one might expect the largest impact to be during periods when the economy is, or at least some specific asset prices are, booming. Thus, the context in which a financial instability term is mentioned is a key determinant of its expected effect on the federal funds rate.

Unfortunately, determining the context of the mention—whether a given mention represents concern about frothy markets or concern about a bursting bubble—can be a subjective judgment. Simple word counts cannot capture context, and simple programs capturing the words around the chosen financial stability word are not sophisticated enough to accurately capture context. Dealing with these problems requires a host of approaches to examining this issue.

This paper begins by separating the words into two groups, those associated with rising risks of instability, such as frothiness and bubble, and those associated with cleaning up after a financial disaster, such as liquidity issues and market freezes. Thus, Table 1 presents the selected words separated into negative words, those that signify concerns about a crash and suggest lower funds rates, and positive words, those that talk about frothy markets and could lead to a tightening of monetary policy. It also shows a short list of ambiguous terms that depend on the context. Because there was a special staff presentation on housing bubbles at the June 2005 FOMC meeting in which words related to financial instability were mentioned very frequently, we cap the word count for that meeting at the maximum that occurred in other FOMC transcripts.

The blue bars in Figure 1 show the time series of the total count of words related to financial instability at each FOMC meeting. The figure shows that, except for a few spikes, mentions of financial instability terms tended to occur less frequently at the beginning of the sample. The figure also includes vertical indicators of some instances of generally assumed financial distress, revealing that this measure of financial concerns is strongly correlated with these times of financial stress. That is, the time series seems to indicate heightened attention to financial instability concerns by the FOMC during times that ex post were periods of significant financial turbulence. For example, there was a blip up after the 1987 stock market crash (Black Monday). And starting in 1997 with the Asian crisis, the average number of mentions of financial instability terms also steps up before drifting down somewhat in the 2000s, and then stepping up again heading into the financial crisis.

The word count of financial instability terms strongly indicates that FOMC members occasionally spend a significant amount of time during monetary policy discussions raising financial instability concerns. This result suggests that a simple dual-mandate-style reaction function that does not consider financial instability concerns may not capture the actual behavior of monetary policy makers. This hypothesis is more formally tested in the next section.

V. Talking the Talk and Walking the Walk: Does the FOMC Respond to Concerns about Financial Instability?

The previous section documents the fact that the FOMC often discusses financial stability issues. The question remains whether interest rate policy is altered by that discussion. If so, can that response be explained by a third, financial stability mandate, or is the response simply incorporated in the responses to the forecasts of inflation and output that have themselves already assimilated the effects of potential financial instability on inflation and output?

In this section, we examine the Fed's past performance during episodes of potential or actual financial instability in the context of an estimated reaction function that is augmented with a measure of financial instability. Empirically, the first step is identifying periods when either an actual crisis is occurring or the risk of financial instability is high or growing, which is made particularly complicated when the instability episode is relatively mild or short-lived, possibly due to the monetary policy reaction itself.

The simple reaction function derived in Section III provides a natural starting point for the empirical work. Embedded in the solution for the funds rate in equation 4 is a simple reaction function that can be estimated. In the estimated reaction function, the funds rate depends on a constant term and the deviations of inflation and real output from their target values. Given the lags in monetary policy, the expectations of future output and inflation gaps are relevant. For the Fed, these expectations are contained in the staff forecast of the relevant variables, which are contained in the "Tealbook."[4] Because the Tealbook did not consistently provide forecasts for the GDP gap in the early years of our sample, we rely instead on forecasts of the unemployment rate, which can be related to the output gap through Okun's Law. Hence, we estimate a simple reaction function with the federal funds rate (FFR) determined by a constant term, the forecast of the inflation rate, the forecast of the unemployment rate, and a measure of FOMC concerns about financial instability (FI). Consistent with the literature, the specification also includes the lagged federal funds rate to allow for interest rate smoothing and to address the severe serial correlation commonly found in the empirical estimation of reaction functions.

16) $$FFR_t = r^* + \alpha_1 FFR_{t-1} + \alpha_2(\pi_t - \pi^*) + \alpha_3(UR_t - UR^*) + \alpha_4(FI_t - FI^*) + \varepsilon_t$$

17) $$FFR_t = (r^* - \alpha_2\pi^* - \alpha_3 UR^* - \alpha_4 FI^*) + \alpha_1 FFR_{t-1} + \alpha_2(\pi_t^E) + \alpha_3(UR_t^E) + \alpha_4 FI_t + \varepsilon_t .$$

The Fed reaction function in equation 16 is a close cousin to the one in equation 11. The funds rate depends on deviations from full employment and the inflation target. Equation 17 rearranges equation 16 into the equation that is estimated. The constant term captures the values of the equilibrium interest rate and the targets for inflation and unemployment rates and their coefficients.[5] It is expected to be positive, although a sufficiently low equilibrium real rate and inflation target could produce a negative constant. FFR is the average value of the federal

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[4] The Tealbook was formerly known as the Greenbook. Although most of our sample occurs during the Greenbook regime, we will refer to both by the current title for consistency.

[5] A simple formulation of the Taylor rule in its basic form is $FF_t = r^* + \pi_t + 0.5(\pi_t - 2) - (u_t - u^*)$, where *FF* is the federal funds rate, r^* is the estimated value of the equilibrium real rate, π is the inflation rate, u is the unemployment rate, and u* is the natural rate of unemployment. This example of a simple policy rule relates the federal funds rate to current inflation relative to a 2 percent target and the unemployment rate relative to the natural rate of unemployment. Such simple monetary policy rules rely on significant assumptions, including that r* and u* are fixed. Assuming interest rate smoothing and grouping terms assumed to be constant generates our empirical equation.

funds rate for the week following the FOMC meeting. FFR_{t-1} is the lagged federal funds rate (that is, the average for the week following the previous FOMC meeting), with its estimated coefficient expected to be positive but less than one.[6] As our proxy for inflation expectations (PFA), we use the Board staff inflation forecast over the next year. The forecast is taken from the Tealbook for each FOMC meeting. We use an inflation series that is spliced together in an attempt to capture the real-time inflation target of the FOMC. The core CPI is used until October 26, 2005. From December 7, 2005, we use the core PCE.[7] We use the core measure to limit the volatility embedded in the headline inflation rates emanating from temporary supply shocks. The coefficient is expected to be positive. For our expected unemployment rate proxy (URF4), we use the Board staff four-quarter-ahead forecast of the U3 unemployment rate collected from the Tealbook for each FOMC meeting. The estimated coefficient is expected to be negative. Note that if the staff outlook is efficient, all relevant information about the impact of actual or potential financial instability on the unemployment and inflation rates over the next year should be incorporated in these forecasts. Thus, if financial instability is not an independent third argument in the policy makers' objective function, instead entering only through its effects on inflation and economic activity, then the role of financial instability in the estimated equations should be captured by the inflation and unemployment rate forecasts.

The financial instability word count from the FOMC meeting transcripts, FIW, uses words such as "crisis," "instability," or "bubble," as described earlier. We also use the totals for positive word mentions, Positive, and negative word mentions, Negative, as described earlier. We enter these two word counts separately because their coefficients are expected to have opposite signs and asymmetric effects, given our priors that the FOMC will react more strongly to Negative (lowering the federal funds rate) than to Positive, because asset price bubbles build more slowly and are more difficult to discern than a financial crash that is both easily observable and requires an immediate policy response. The measures used in the regressions have been scaled by their standard deviations for ease of interpretation. If the FOMC behaved

[6] Note that this smoothing term may also incorporate a desire to maintain financial stability. Still, the reason for the significance of the lagged funds rate is debatable.

[7] The FOMC was transitioning its focus from the core CPI to the core PCE around this time. We chose this specific switch date because it allowed the switch to occur without introducing a discontinuity into our data series.

as described by Bernanke and Gertler (2000), with monetary policy responding to financial instability concerns only when bubbles, whether inflating or deflating, affect the forecasts of the unemployment and inflation rates, then the estimated coefficient on the financial instability word counts would be zero because the forecasts would already incorporate the relevant (to the FOMC) financial instability effects. An alternative hypothesis is that the FOMC will react strongly to financial instability concerns because financial instability will cause failures of financial institutions and the resulting potentially large fiscal costs. This alternative hypothesis would indicate that financial instability is in the Fed's utility function.

We first explore whether the estimated reaction function without including our measure of heightened financial instability concerns appears to miss the actual funds rate path during periods that might be associated with financial instability. For illustrative purposes, Figure 2 compares the residuals from estimating the simple reaction function without including FIW, measured as the actual federal funds rate minus the predicted rate from this estimated reaction function, to the difference between the total Positive and total Negative word counts; that is, the net Positive financial instability word count. A positive value of the residual indicates that the actual federal funds rate was above that predicted by the simple estimated reaction function, while a negative value indicates the opposite. The figure also includes recession shading and the indicators of specific events that one might associate with financial stability concerns shown in Figure 1.

Figure 2 shows that the net Positive word count tends to be negative around events that many would have construed as generating concerns about financial stability and are associated with large negative misses in the estimated FOMC reaction function. For example, the Black Monday event was associated with a high Negative word count and an over prediction of the funds rate. Events that show a similar pattern include the Russian crisis/Long Term Capital Management period and the period around the financial crisis. This indicates that at least during periods of adverse financial shocks, monetary policy appears to have been more accommodative than implied by a simple estimated reaction function based on Federal Reserve staff forecasts for inflation and unemployment. During the stock market run up before the Russian crisis and the housing price run up in mid-2000, there is some evidence of relatively more discussion of financial issues categorized as Positive being correlated with under predictions of the federal funds rate by the reaction function. However, as one might anticipate, the relationship of net Positive mentions with the reaction function errors is looser for episodes when bubbles might be building (that is, when Positive dominates Negative, suggesting a preemptive leaning against a building asset price bubble) than when a financial crisis occurs and an immediate monetary policy response is more likely (that is, when Negative dominates Positive).

The next step is to include our measures of financial instability concerns into an estimated reaction function. As noted earlier, we include Positive and Negative as separate regressors for at least two reasons. First, the signs of their estimated coefficients are expected to be opposite. The second reason is that both the likelihood and the strength of an FOMC response are likely to differ depending on whether the FOMC is leaning against a prospective bubble or reacting to an actual financial crisis. Table 2 provides the results from a regression that includes the two separate measures of financial instability concerns. In addition, the table includes the results from the reaction function omitting any measures of the word counts related to FOMC financial instability concerns used for the reaction function errors included in Figure 2, as well as the results from including the total financial instability word count, FIW.

The first column in Table 2 presents the results from a simple reaction function estimated using Tealbook forecasts of inflation and unemployment, along with the lagged dependent variable, as the determinants of the funds rate. All three coefficients are significant and correctly signed. Increases in the inflation rate forecast or decreases in the unemployment rate forecast imply an increase in the funds rate. The second column adds to the specification the total word count. FIW has an estimated coefficient that is negative and statistically significant, while the two forecast measures retain their signs and significance. The negative estimated effect of FIW is consistent with our prior that the FOMC is more likely to respond, and respond more strongly, to actual crises than to leaning against the buildup of financial imbalances (leaning against asset price bubbles).

Moreover, the estimated coefficient suggests a meaningful effect. If the word count in the FOMC transcripts that is related to financial instability concerns increased by one standard deviation, the federal funds rate would be 13 basis points lower than otherwise after controlling for the staff forecasts of inflation and unemployment. Alternatively, the most common 25 basis point change in the federal funds rate would be associated with a change of roughly two standard deviations in the word count.

Thus, it appears that the FOMC not only discusses financial instability concerns, but also acts on those concerns rather than confining its actions to the narrower concerns about its explicit dual mandate. Moreover, the negative sign on the estimated FIW coefficient for the full sample suggests that when the FOMC transcripts do mention financial instability terms, the mentions tend to be in the context of having an adverse effect on the economy. That is, the FOMC appears to be more likely to discuss and react to adverse shocks than to proactively raise the federal funds rate to mitigate the buildup of financial imbalances that could cause an asset price bubble, the subsequent bursting of which could have severe adverse effects on the economy.

The third column of Table 2 shows estimates of a specification that includes the two components of FIW, in order to separate financial instability concerns about frothiness from financial instability concerns about a crash. Note that the coefficients on the Tealbook forecasts of unemployment and inflation continue to have the expected signs and retain their statistical significance. The coefficient signs on the two separate measures of financial instability concerns are also as expected. Concerns about rising frothiness have a positive coefficient, while concerns about mopping up after a crash have a negative effect. That is, these concerns either increase, for rising frothiness, or decrease, for a financial crash, the funds rate beyond what the forecasts for the variables in the dual mandate dictate. Moreover, the estimated coefficient for Negative, a financial crash, is statistically significant at the 1 percent confidence level and of the same magnitude as the coefficient for FIW shown in column 2. While the estimated effect for Positive is not statistically significant, it is of the predicted positive sign. However, not surprisingly, the absolute value of the estimated effect and the significance level of this effect are weaker than those for Negative. First, relative to an actual crisis, identifying an emerging bubble is much more difficult, making the FOMC less likely to act, or at least likely to act more tentatively than to a crash that is easily observable and that presents an immediate impetus to act. Second, financial imbalances tend to build up slowly over time, while a crash tends to occur more rapidly and dramatically, as the words imply.

Robustness Checks

Determining whether a term is a "frothy" word or a "crashy" word is subjective and noisy. In an attempt to ensure that subjectivity is not the cause of the above results, several robustness checks are performed. The first such test uses the total word count associated with financial fragility (FIW), without any judgment about whether those words are positive or negative. The issue again has to do with the conflicting effects from booms and busts in financial markets. To examine these possibilities, we estimate an FOMC reaction function that includes FIW over perceived "bust" and "boom" subsamples, using several alternative indicators to select the bust and boom subsamples. We also explore separately counts for mentions of specific financial institutions. Because we find no statistically significant relationship for the specific-institution mention count, we do not report results using that measure, but focus instead only on the results for the FIW measures of financial instability concerns.

We use several alternative indicators to classify FOMC meetings into financial boom and financial bust subperiods to allow for differential FOMC responses that may vary depending on the degree and nature of the financial instability risks present in the economy. Since the choice of indicator to use is somewhat arbitrary, three alternative measures are shown in Table 3. Furthermore, even given the specific variable used to identify boom and bust subperiods, selecting a specific threshold is somewhat arbitrary. Of course, a symmetric treatment may not be appropriate, given that, much like recessions and recoveries, busts tend to be sharper and shorter, while an asset price bubble may build up slowly over an extended period of time. Still, by using a set of alternative indicators, we can obtain a sense of the robustness of the results from these imperfect measures. Also, note that the boom subsamples and the bust subsamples for the alternative indicator variables are not identical, since in each instance they are based on the values for one of the three different indicator variables over the 1987–2008 sample period.

The first measure is the average Baa–Aaa yield spread for the month prior to the FOMC meeting. When this interest rate spread is very large (the bust subsample), the perceived risk of corporate defaults is high. In such instances, the FOMC may be relatively more responsive to financial instability concerns. Alternatively, when the spread is very narrow, the perceived risk of corporate defaults is very low, and the FOMC may worry about investors reaching for yield, causing the financial instability word count to be positively rather than negatively related to the federal funds rate. The bust subsample is composed of the upper quintile of the Baa–Aaa interest rate spread observations, while the boom subsample is composed of the bottom quintile observations.

The second indicator (OPE) is based on whether the stock market price-to-operating-earnings ratio is inordinately high or low, or house prices are booming. The bust subsample is composed of the observations with values of OPE less than 16. The boom subsample is composed of the observations with values of OPE greater than 24 or house price growth greater than 12 percent. This allows the boom subsample to reflect potential bubbles for two alternative asset prices.

The third indicator is the percentage change in the S&P 500 index for the year ending in the month prior to the FOMC meeting. The bust subsample is composed of the observations in the bottom quintile of observations, while the boom subsample is composed of the observations in the top quintile.

Table 3 presents results from regressions that explore the extent to which the undifferentiated word count from the FOMC meeting transcripts provides an additional contribution to the explanation of the actual path of the federal funds rate beyond that provided by the contributions of the Board staff inflation and unemployment rate forecasts contained in the Tealbook. For comparison, the first column repeats the results from the second column of Table 2 that include the undifferentiated FIW measure estimated over the full sample period. The next three columns of Table 3 contain the results from estimating the reaction function over the bust subsamples for the three alternative indicators. The final three columns show the results for the boom subsamples.

For the bust subsamples, all three estimated effects are negative and statistically significant, with the estimated effects ranging from just above the full-sample effect to just over double the full-sample effect. The fact that the point estimates are larger (in absolute value) than those for the full sample is not surprising, given that the estimated effect in column 1 is an average effect across both boom and bust subsamples so that the positive effects of the boom subsample observations partially offset the negative effects of the bust subsample. These results suggest that when the risks of financial instability are elevated or a financial crisis occurs, the FOMC tends to ease policy more forcefully than when the situation is more benign to offset risks associated with actual or potential adverse outcomes for financial markets and the economy.

For the boom subsamples, the estimated FIW effect is positive for each of the three subsamples, with that for the Baa–Aaa yield spread significant at the 5 percent confidence level, and that for the percentage change in the S&P 500 index just missing significance at the 10 percent level. The positive effects are consistent with concerns about financial stability switching to leaning against potential emerging asset price bubbles in boom periods.

Table 3 corroborates the results in Table 2, while avoiding the arbitrary definition of what is a positive word and what is a negative word. The results still produce negative coefficients when expected, during financial busts, and positive coefficients when expected, during financial booms. Moreover, Table 3 shows estimated effects with a pattern similar to that in Table 2, with the point estimates of the Positive effects somewhat smaller than those of the Negative effects (in absolute value). Thus, simple reaction functions that ignore financial instability concerns appear to be missing the way the FOMC actually behaves during periods of potential or actual financial instability.

Interestingly, it is not only the financial instability word count that has an estimated coefficient that differs across subsamples. The estimated coefficients on both the unemployment forecasts and the inflation forecasts vary somewhat across the bust and boom subsamples. This suggests that a simple model of FOMC behavior that assumes that policy coefficients are constant over the business cycle may miss how the FOMC actually reacts. In particular, the estimated FOMC reaction to unemployment rate forecasts appears to be relatively larger (in absolute value) during the bust period than during the corresponding boom period for two of the three pairs of estimates, while the estimated FOMC reaction to the inflation forecast appears to be relatively larger in the boom periods for two of the three pairs of estimates. Such a pattern would be consistent with the FOMC shifting its relative concern toward its employment mandate and away from its price stability mandate during bust periods, and shifting the relative weights in the opposite direction during booms.

VI. Why Does the FOMC Care about Financial Stability?

The previous tables provide strong evidence that the FOMC cares about the current extent or potential risk of financial stability in the economy. However, the significance of the coefficients on the financial stability variables does not necessarily mean that financial stability is *independently* important to the FOMC members. It is possible that members use their concerns about actual or potential financial instability to improve the Tealbook forecasts of the unemployment rate and the inflation rate. If so, then the previous results would not necessarily indicate that the FOMC has behaved as if it had a ternary mandate. Instead, these results could indicate only that the FOMC members have used their concerns about financial instability to improve or augment the forecasts of the two variables it cares about, inflation and unemployment.

In an attempt to address this possibility, we adjust the inflation and unemployment rate forecasts to allow for the information from Positive and Negative to be incorporated into the Tealbook outlook. The estimated coefficients on Positive and Negative when using these adjusted forecasts should then capture their effects above and beyond any effect operating through the possible improvement in the (adjusted) forecasts. A finding that Positive and Negative maintain their effects, and the statistical significance of Negative, in the presence of these adjusted forecasts would provide strong evidence consistent with the hypothesis that financial stability has been treated by the FOMC as a third mandate.

The adjusted forecasts are constructed as the fitted value from regressions based on a moving window. The dependent variable (either the unemployment rate or the inflation rate) is regressed on a constant term, the corresponding Tealbook forecast, and the Positive and

Negative FIW measures as the explanatory variables. We use a set of moving-window regressions rather than a single regression based on the full sample period to avoid allowing information from Positive and Negative subsequent to an FOMC meeting to affect the estimated coefficients used to construct the adjusted forecast for that FOMC meeting. That is, we estimate the regression coefficients up to a given FOMC meeting and then use the fitted value for that meeting as the adjusted forecast. We then extend the sample to the next meeting and repeat the regression to obtain the adjusted forecast for that meeting.

To avoid losing the observations at the beginning of our sample, we use data for the five years prior to the beginning of our sample. Thus, for the first FOMC meeting in 1987, the regression estimates are based on only five years of data. We then extend the sample one meeting at a time until we have a full 10 years of data. At that point, we implement a moving window 10 years in length by deleting the oldest FOMC meeting from our sample as we add the new FOMC meeting.[8] We chose not to extend the initial window before 1982 to limit the extent to which our estimates would be affected by the turbulence of the oil shocks and monetary policy regime shifts during that period.

Table 4 presents the results using the adjusted forecasts for the unemployment and inflation rates for the full sample while including the positive mentions and negative mentions in the regression. Columns 1 and 2 of the table display the results using the Tealbook forecasts and the adjusted forecasts side-by-side. While the estimated coefficient for Negative is somewhat smaller (in absolute value) using the adjusted forecasts, it remains significant at the 1 percent confidence level. Thus, after incorporating Positive and Negative directly into the unemployment rate and inflation rate forecasts, Negative continues to have a statistically significant effect, consistent with the FOMC treating financial stability as a third mandate.[9] The point estimates and significance levels for Positive are quite similar for the two specifications, although neither is statistically significant. Thus, the overall results with the adjusted forecasts

[8] Alternatively, one could simply extend the sample period by one observation for each subsequent regression, keeping the beginning of the sample fixed at the beginning of 1982, so that the estimation sample period grows by one observation each time rather than having a fixed 10-year window. Such a specification produced qualitatively similar results in the adjusted reaction function regressions. We present the moving-window results to allow for changes in the relationship of the financial information with the forecast.

[9] Running the robustness regressions produces results similar to those in Table 3.

are qualitatively quite similar to those with the unadjusted Tealbook forecasts, suggesting that the original results are not due to the Tealbook forecasts failing to fully incorporate the information contained in the financial instability concerns raised at the FOMC meeting.

VII. Conclusion

While our results are strongly suggestive that the FOMC often behaves as if monetary policy has a third mandate, our evidence is not definitive. We have not yet cleanly ruled out a number of alternative explanations for why the FOMC is responding to financial instability concerns.

Other considerations concern reaction functions more generally. There might be more nuanced reasons why the FOMC cares about financial instability that overlap with the more traditional dual mandate explanations in the reaction function. Those reasons might have to do with risk aversion on the part of the Fed, with our financial instability measure capturing elements of the risk environment that an implicitly risk-neutral reaction function misses. It is possible that the failure of simple estimated reaction functions to account for nonlinearities in relationships or the higher moments of the forecasts of the dual mandate variables accounts for the significance of our financial instability measures. Yet the distinction between the risks to the dual mandate variables and financial stability as a ternary mandate starts to get muddied when we view financial stability as an indicator of the risks to achieving our dual mandate goals. It becomes very difficult to separate the direct effects of a financial crisis from its effects via all the variables of possible concern to the FOMC, and to the public. If the identification is impossible, perhaps the distinction is irrelevant.

Central banks are clearly increasing the attention they pay to financial stability issues in the wake of the most recent financial crisis. Many central banks include financial stability discussions in regular reports, and, in the United Kingdom, the Bank of England has an explicit structure and tools now in place to address financial stability issues. Yet in the United States, while financial stability issues were important at the time of the founding of the Federal Reserve, the connection between financial stability and monetary policy remains controversial.

We show that with a relatively simple adjustment to a common quadratic loss function for the central bank, concerns about financial instability might be considered independently in monetary policy decisions. In a simple model that allows the inclusion of financial instability in the utility function for monetary policy, financial instability concerns become relevant for the setting of monetary policy. Thus, there are reasons to believe that financial stability should be an explicit consideration of monetary policy makers. The model also suggests that regulatory/supervisory policy and monetary policy should be more integrated, a topic we intend to address in a future paper.

While the model provides an example in which financial stability concerns should be considered in setting monetary policy, is it? We document that terms related to financial instability are frequently mentioned in the transcripts of FOMC monetary policy meetings. These mentions tend to occur most frequently during periods of financial turbulence. If financial instability concerns are irrelevant to setting the funds rate, it seems odd that such topics receive such attention at FOMC meetings. Simple reaction functions that assume financial instability should not be in the loss function or in constraints seem at variance with these frequent mentions.

We find evidence that frequent mentions of financial instability terms at the FOMC, particularly during bust subperiods, result in a statistically significant reduction in the funds rate relative to that implied by a simple reaction function based on Federal Reserve staff forecasts of inflation and unemployment rates, indicating that simple reaction functions estimated during periods of financial instability may significantly miss actual FOMC behavior. Moreover, we obtain qualitatively similar results when we adjust the Tealbook forecasts to more fully incorporate our financial instability measure, consistent with the significant financial instability effect representing an independent effect on monetary policy.

In addition, this paper highlights why a simple policy rule is unlikely to capture actual FOMC behavior. Estimated coefficients on inflation and unemployment forecasts seem to change during periods of financial instability, in addition to the FOMC responding independently to the financial instability concerns. Following a simple policy rule that does not reflect this behavior would fail to capture the way the monetary policy loss function has been addressed by the FOMC.

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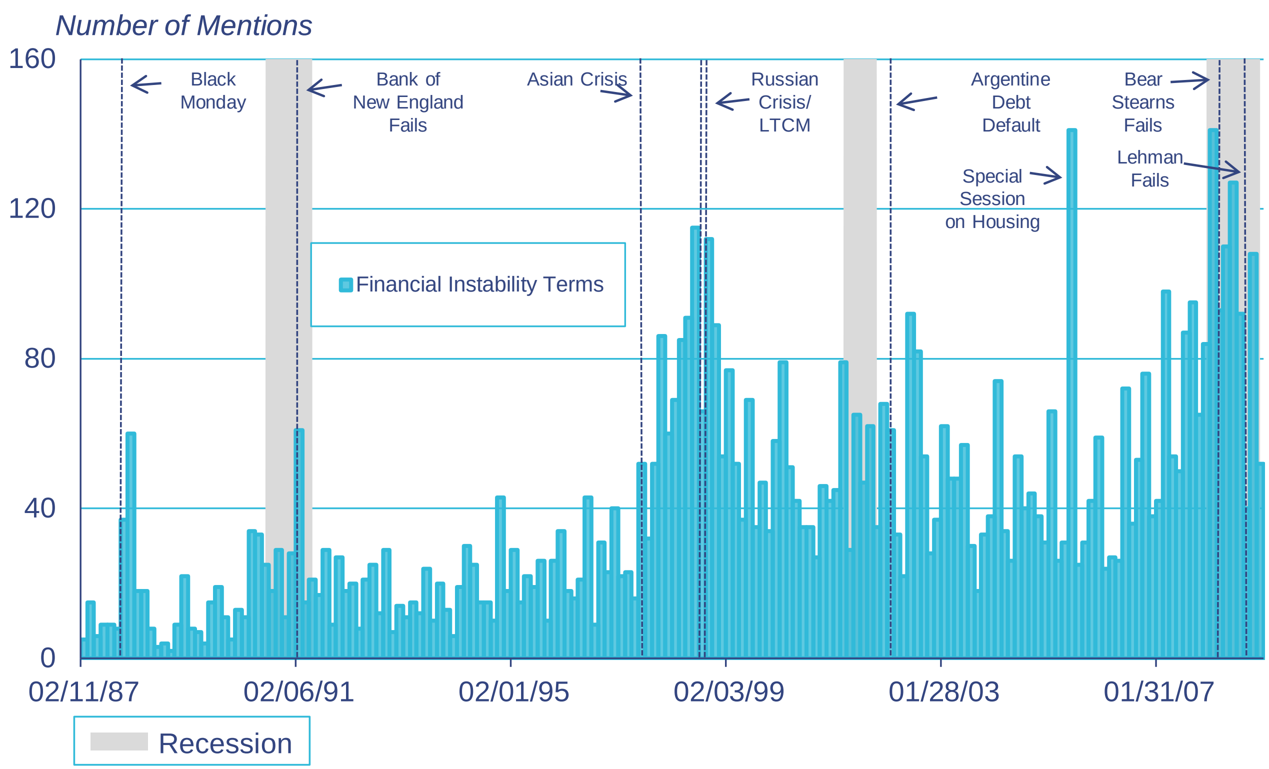
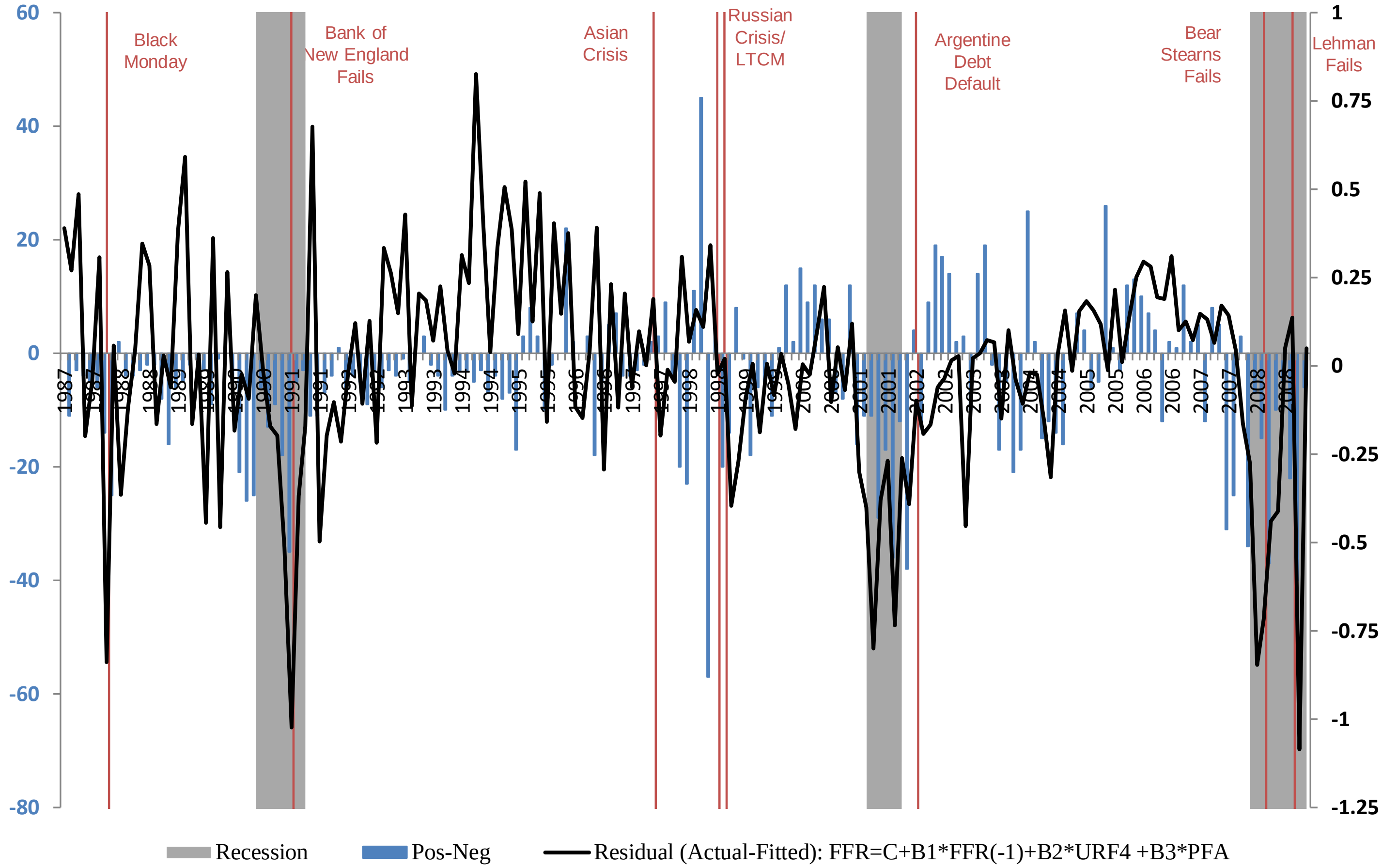
Figure 1: Mentions of Financial Instability in FOMC Meetings and Periods of Instability



Sources: The Federal Reserve Tealbooks, authors' calculations

Figure 2: Net Positive Financial Instability Mentions, Periods of Instability, and Errors in the Fed Reaction Function



Sources: The Federal Reserve Tealbooks, authors' calculations

Table 1: Financial Instability Term Word Counts

Sample: 1987-2008

Term	**# of Mentions**
Negative	*2775*
A/anxiety	96
B/burst	82
B/bust	916
CDS	55
C/collapse	181
C/crash	92
C/credit constrained	2
C/crises	74
C/crisis	532
C/crunch	285
I/illiquidity	34
I/instability	144
LDC	22
L/lending standards	61
L/liquidity issues	19
L/liquidity problems	16
Loan Officer	30
M/market correction	47
M/market distress	4
P/panic	83
Positive	*3278*
A/asset prices	234
B/bubble[a]	297
E/equities	160
E/equity prices	393
E/equity values	46
F/financial stability	71
F/froth	28
H/house prices[a]	367
H/housing prices[a]	187
I/irrational exuberance	8
S/stock market	1190
S/stock prices	297
Ambiguous	*1040*
PE / price to earnings/ price-to-earnings	10
R/regulation	132
S/supervision	86
V/volatility[b]	812

Sources: The Federal Reserve Tealbooks, authors' calculations

[a] This term spiked in June 2005 due to a special report on housing bubbles. The June 2005 datapoint is capped to the local max in the dataset used for analysis.

[b] Included in Negative or Ambiguous counts depending on regression.

Table 2: Reaction Function Estimates with Positive/Negative Financial Instability Mentions

	(1)	(2)	(3)
Sample:		Full Sample	
C	1.292 (.000)	1.807 (.000)	1.533 (.000)
FFR(-1)	0.861 (.000)	0.866 (.000)	0.868 (.000)
URF4	-0.288 (.000)	-0.316 (.000)	-0.291 (.000)
PFA	0.322 (.000)	0.255 (.000)	0.281 (.000)
FIW/SD		-0.131 (.000)	
Positive/SD			0.043 (.171)
Negative/SD			-.133 (.000)
Adjusted R^2	0.981	0.984	0.984
Log Likelihood	-35.080	-22.504	-22.827
Observations	176	176	176

Sources: Authors' calculations, Haver Analytics, The Federal Reserve Tealbooks
Notes: The sample dates are 1987 through 2008. The p-values are in the parentheses below the estimated coefficients.

Table 3: Reaction Functions During Bust and Boom Subsamples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Panel A: Bust			Panel B: Boom		
Sample:	Full Sample	Baa-Aaa Spread[a]	OPE Level[b]	Yearly Percent Change S&P500[c]	Baa-Aaa Spread[d]	OPE Level[e]	Yearly Percent Change S&P500[f]
C	1.807 (.000)	1.653 (.040)	3.86 (.001)	1.759 (.003)	0.174 (.724)	2.924 (.000)	0.876 (.051)
FFR(-1)	0.866 (.000)	0.752 (.000)	.748 (.000)	0.715 (.000)	0.812 (.000)	0.763 (.000)	0.837 (.000)
URF4	-0.316 (.000)	-0.313 (.006)	-.514 (.003)	-0.376 (.000)	-0.156 (.050)	-.606 (.000)	-0.240 (.004)
PFA	0.255 (.000)	0.447 (.022)	.280 (.004)	0.546 (.000)	0.574 (.000)	0.375 (.099)	0.399 (.001)
FIW/SD	-0.131 (.000)	-0.193 (.001)	-.303 (.011)	-0.137 (.010)	0.105 (.043)	0.050 (.217)	.098 (.104)
Adjusted R^2	0.984	0.987	0.962	0.990	0.968	0.984	0.982
Log Likelihood	-22.504	-6.039	-7.347	0.473	10.216	9.323	5.585
Observations	176	35	40	35	35	34	35

Sources: Authors' calculations, Haver Analytics, The Federal Reserve Tealbooks

Notes: The sample dates are 1987 through 2008. The p-values are in the parentheses below the estimated coefficients.

[a] Bust is defined as the top quintile of observations within the full sample of the Baa-Aaa spread.

[b] Bust is defined as OPE<16.

[c] Bust is defined as the bottom quintile of observations within the full sample of the yearly percent change for the S&P 500.

[d] Boom is defined as the bottom quintile of observations within the full sample of the Baa-Aaa spread.

[e] Boom is defined as OPE>24 or house price growth greater than 12 percent.

[f] Boom is defined as the top quintile of observations within the full sample of the yearly percent change for the S&P 500.

Table 4: FOMC Reaction Function with Adjusted Forecast

	(1)	(2)
Sample:	Full Sample	
C	1.533 (.000)	1.225 (.000)
FFR(-1)	0.868 (.000)	0.886 (.000)
URF4[a]	-0.291 (.000)	-.292 (.000)
PFA[a]	0.281 (.000)	0.338 (.000)
Positive/SD	0.043 (.171)	0.046 (.172)
Negative/SD	-.133 (.000)	-.085 (.004)
Adjusted R^2	0.984	0.983
Log Likelihood	-22.827	-26.285
Observations	176	176

Sources: Authors' calculations, Haver Analytics, The Federal Reserve Tealbooks

Notes: The sample dates are 1987 through 2008. The p-values are in the parentheses below the estimated coefficients.

[a] Column (1) results use Tealbook forecasts. Column (2) results use adjusted forecasts.