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A SURVEY OF THEORY AND EVIDENCE**

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Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence
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ABSTRACT

Over the last two decades, communication has become an increasingly important aspect of monetary policy. These real-world developments have spawned a huge new scholarly literature on central bank communication -- mostly empirical, and almost all of it written in this decade. We survey this ever-growing literature. The evidence suggests that communication can be an important and powerful part of the central bank's toolkit since it has the ability to move financial markets, to enhance the predictability of monetary policy decisions, and potentially to help achieve central banks' macroeconomic objectives. However, the large variation in communication strategies across central banks suggests that a consensus has yet to emerge on what constitutes an optimal communication strategy.

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1. A Revolution in Thinking and Practice

Prior to the 1990s, central banks were shrouded in mystery—and believed they should be. Conventional wisdom in central banking circles held that monetary policymakers should say as little as possible, and say it cryptically. In 1981, Karl Brunner (1981, p. 5) wrote, with evident sarcasm:

Central Banking... thrives on a pervasive impression that [it]... is an esoteric art. Access to this art and its proper execution is confined to the initiated elite. The esoteric nature of the art is moreover revealed by an inherent impossibility to articulate its insights in explicit and intelligible words and sentences.

Fifteen years later, in his 1996 Robbins lectures at the London School of Economics, one of the authors of this paper (Alan Blinder (1998), pp. 70-72) expressed a view of what central bank communications *should be*—one that had been lurking around in the underbrush but was far from mainstream at the time:¹

Greater openness might actually improve the efficiency of monetary policy... [because] expectations about future central bank behavior provide the essential link between short rates and long rates. A more open central bank... naturally conditions expectations by providing the markets with more information about its own view of the fundamental factors guiding monetary policy..., thereby creating a virtuous circle. By making itself more predictable to the markets, the central bank makes market reactions to monetary policy more predictable to itself. And that makes it possible to do a better job of managing the economy.

Five years later, Michael Woodford (2001, pp. 307 and 312) told an audience of central bankers assembled at the Federal Reserve's 2001 Jackson Hole conference that:

successful monetary policy is not so much a matter of effective control of overnight interest rates... as of affecting... the evolution of market *expectations*... [Therefore,] transparency is valuable for the effective conduct of monetary policy... this view has become increasingly widespread among central bankers over the past decade.

Notice the progression here: from Brunner's 1981 lament about central bankers' refusal to communicate, to Blinder's 1996 argument that more communication would

¹ For example, the basic idea was stated in Marvin Goodfriend (1991). We thank Michael Woodford for this reference.

enhance the effectiveness of monetary policy, to Woodford's 2001 claims that the essence of monetary policy is the art of managing expectations *and that this was already received wisdom*. Woodford probably exaggerated that last point. But the view that monetary policy is, at least in part, about managing expectations is by now standard fare both in academia and in central banking circles. It is no exaggeration to call this a revolution in thinking.

These new ideas have made a mark on central bank practice as well. At the Federal Reserve, for example, then-Chairman Alan Greenspan, who once prided himself on “mumbling with great incoherence,” was by 2003 explicitly managing expectations by telling everyone that the Fed would keep the federal funds rate low “for a considerable period.” This guidance was only the latest step in what was, by then, a long march toward greater transparency that began in February 1994 when the Federal Open Market Committee (FOMC) first started announcing its decisions on the federal funds rate target. In May 1999, the FOMC began publishing an assessment of its “bias” with respect to future changes in monetary policy in its statements. It also began issuing fuller statements, even when it was not changing rates. About three years later, it began announcing FOMC votes—with names attached—immediately after each meeting. Starting in February 2005, the FOMC expedited the release of its minutes to make them available before the subsequent FOMC meeting. And most recently, starting in November 2007, the Fed has increased the frequency and expanded the content and horizon of its publicly-released forecasts.

Other central banks have also become remarkably more transparent in the last 10-15 years and are placing much greater weight on their communications. In fact, the Fed is more of a laggard than a leader in this regard. The Reserve Bank of New Zealand and the Bank of

England were early and enthusiastic converts to greater transparency, and Norges Bank (the central bank of Norway) and Sveriges Riksbank (the central bank of Sweden) may now be in the vanguard. Arguably, the European Central Bank (ECB) has been more transparent than the Fed ever since it opened its doors in 1998. More extensive central bank communication is truly a worldwide phenomenon.

One important driver of increased transparency is the notion that more independent central banks should be more accountable—that they have a duty to explain both their actions and the thinking that underlies those actions. But the intellectual arguments just mentioned also played a role. As it became increasingly clear that managing expectations is a useful part of monetary policy, communication policy rose in stature from a nuisance to a key instrument in the central banker’s toolkit. In this survey, we concentrate on how central bank communication can be used to manage expectations both by what might be called “creating news” and “reducing noise.”

These real-world developments have spawned a huge new scholarly literature on central bank communication—almost all of it written in this decade. While this new literature includes some theoretical contributions, most of it is empirical; and this survey reflects that weighting. Studies of how central bank communications *create news* focus on how, e.g., the central bank’s pronouncements influence expectations and therefore move asset prices. In extreme circumstances, communication, used to anchor and guide market expectations, may even become the main tool of monetary policy. Studies of *reducing noise* focus, e.g., on how central bank talk increases the predictability of central bank actions, which should in turn reduce volatility in financial markets. As William Poole (2001, p. 9) put it: “The presumption must be that market participants make more efficient

decisions... when markets can correctly predict central bank actions.” In both cases, the central bank’s presumed objective is to raise the signal-to-noise ratio, and one major concern of this essay is how successful that effort has been.

That said, communication is no panacea. As with all human endeavors, there are pitfalls and occasional errors. One famous example came in October 2000 when then-ECB President Wim Duisenberg hinted to an interviewer that there would be no further central bank intervention to support the euro. Those words led to an immediate depreciation of the euro and to heavy criticism of Duisenberg. Similarly, when a supposedly off-the-record remark made in April 2006 by Fed Chairman Ben Bernanke, stating that his recent Congressional testimony had been misinterpreted, was reported, markets reacted strongly—as investors concluded that Bernanke was “reversing himself” and saying that interest rates could easily go up.

What constitutes “optimal” communication strategy is by no means clear. And these two examples illustrate that more talk is not always better.² The key empirical question is whether communication contributes to the effectiveness of monetary policy by creating genuine news (e.g., by moving short-term interest rates in a desired way) or by reducing noise (e.g., by lowering market uncertainty). There are two main strands in the literature. The first line of research focuses on the impacts of central bank communications on financial markets. The basic idea is that, if communications steer expectations successfully, asset prices should react and policy decisions should become more predictable. Both appear to have happened. The second line of research seeks to relate differences in communication strategies across central banks or across time to differences in economic performance. For

² However, in the Bernanke case, the Fed *was* going to raise rates further. So disabusing markets of the false notion that the tightening cycle was finished probably did manage expectations in a constructive way.

example, does announcing a numerical inflation target help anchor the public's long-run inflation expectations? The answer seems to be a qualified yes.

This article reviews the impressive number of mostly empirical studies of central bank communication that have been written in the last several years, mostly focusing on the experience of advanced economies. We take stock of what we now know about how central bank communication can contribute to the effectiveness of monetary policy, and we identify places where additional research is needed. Section 2 discusses in more detail why central bank communication matters. Section 3 examines the practices of three major central banks: the Federal Reserve, the ECB, and the Bank of England. Section 4 reviews the first strand of empirical research mentioned above, and Section 5 discusses the second. Finally, Section 6 provides our answers to the question of how central bank communication can contribute to the effectiveness of monetary policy and identifies avenues for future research.

2. Why does central bank communication matter? Theory

Central bank communication can be defined as the provision of information by the central bank to the public regarding such matters as the objectives of monetary policy, the monetary policy strategy, the economic outlook, and the outlook for future policy decisions.

Nowadays, it is widely accepted that the ability of a central bank to affect the economy depends critically on its ability to influence market expectations about the *future path* of overnight interest rates, and not merely on their current level. The reason is simple. Few, if any, economic decisions hinge on the *overnight* bank rate. According to standard theories of the term structure, interest rates on longer-term instruments should reflect the expected sequence of future overnight rates. So, for example, the n-day rate should be, approximately:

$$(1) R_t = \alpha_n + (1/n) (r_t + r^e_{t+1} + r^e_{t+2} + \dots + r^e_{t+n-1}) + \varepsilon_{1t},$$

where r_t is the current overnight rate, r^e_{t+1} is today's expectation of tomorrow's overnight rate (and so on for $t+2, t+3, \dots$), α_n is a term premium, and the error term indicates that the term premium might be stochastic.³ Equation (1) makes it clear that intermediate and long-term rates should depend mostly on the public's *expectations* of *future* central bank policy. Today's overnight interest rate barely matters. A particularly extreme case arises when interest rates get close to their zero lower bound. As long as the *current* overnight rate is stuck at or near zero, central bank communication about expected future rates becomes the essence of monetary policy (Ben S. Bernanke, Vincent Reinhart and Brian Sack 2004; Gauthier, Eggertsson and Woodford 2003).

Let us now embed this idea in a simple macroeconomic framework designed to illustrate the role of central bank communications, henceforth denoted by the vector s_t (for “signals”).⁴ Imagine that r in (1) is the short rate and R is the long rate. Then aggregate demand depends on r , R , expected inflation (π^e_t), and a host of other factors which need not be listed explicitly:

$$(2) y_t = D(r_t - \pi^e_t, R_t - \pi^e_t, \dots) + \varepsilon_{2t},$$

The aggregate supply relation could (but need not) be something like the New Keynesian Phillips curve:

$$(3) \pi_t = \beta E(\pi_{t+1}) + \gamma(y_t - y^*_t) + \varepsilon_{3t},$$

³ The time subscript can be thought of as indexing days, months, quarters, etc. The same interpretation holds. The weaknesses of the expectations theory of the term structure are well known. We use it here only for illustrative purposes.

⁴ We deliberately keep this model simple for expositional purposes. It could be expanded in several directions. For example, in a New Keynesian setting, expected output would appear on the right-hand side of equation (2)—which would open up another channel by which central bank communications could matter. One could also add a more complex financial sector and/or more complex interactions between the real and financial sectors. None of this is necessary for current purposes.

where π_t is inflation and y_t and y_t^* are, respectively, actual and potential real output. The model could be closed by appending a central bank reaction function (e.g., a “Taylor rule”):

$$(4) \quad r_t = G(y_t - y_t^*, \pi_t, \pi_t^*, \dots) + \varepsilon_{4t}.$$

where π^* denotes the central bank’s inflation target.

Now imagine that the economic environment is *stationary* (that is, equations (1)-(3) do not change over time), that the central bank is *credibly committed* to an unchanging policy rule (4), and that expectations are *rational*. In that unrealistic case, central bank communication has no independent role to play. Any systematic pattern in the way monetary policy is conducted would be correctly inferred from the central bank’s observed behavior (Woodford, 2005). In particular, when it comes to predicting future short-term rates, it would suffice to interpret incoming economic data in the light of the central bank’s (known) policy rule. Any explicit central bank communication would be redundant. Under Jon Faust and Lars Svensson’s (2001, p. 373) definition of central bank transparency—that is, how easily the public can deduce central-bank goals and intentions from observable data—the central bank would be fully transparent without uttering a word.

This extreme case points to four features that have the potential to make central bank communication matter: *nonstationarity* (whether of the economy or the policy rule), the *learning* that is a natural concomitant of such an environment, and either *non-rational expectations* or *asymmetric information* between the public and the central bank. If one or more of these conditions hold, central bank communication can matter.

Needless to say, these four conditions are the norm, not the exception. The real world is constantly changing, as Alan Greenspan never tired of emphasizing.⁵ So learning, including learning both by and about the central bank, never ends. Furthermore, it is

⁵ See Blinder and Ricardo Reis (2005), especially pages 15-24.

virtually inevitable that the central bank will know more about its own thinking than the public does. In addition, contrary to the impression given by simple Taylor rules, monetary policy decisions depend on much more than current inflation and output gaps (Svensson, 2003). It is also extremely unlikely that the central bank would stick to an unchanged policy rule for long. For example, Bernanke (2004) noted that “specifying a complete and explicit policy rule, from which the central bank would never deviate under any circumstances, is impractical. The problem is that the number of contingencies to which policy might respond is effectively infinite (and, indeed, many are unforeseeable).” Likewise, President Jean-Claude Trichet has repeatedly emphasized that the ECB takes its decisions one step at a time, rather than following a rule.

Under conditions like that, as Bank of England Governor Mervyn King (2005, p.13) has observed, “Rational optimising behaviour is ... too demanding, and actual decisions may reflect the use of heuristics.” Since central bank communication undoubtedly plays a role in shaping beliefs about those heuristics, it also plays a potentially important role in anchoring expectations.⁶ Similarly, Bernanke (2004) used the recent academic literature on adaptive learning to explain why communication affects monetary policy effectiveness. When the public does not know, but instead must estimate, the central bank’s reaction function, there is no guarantee that the economy will converge to the rational expectations equilibrium because the public’s learning process affects the economy’s behavior. The feedback effect of learning on the economy can lead to unstable or indeterminate outcomes—which effective communication by the central bank can help to avoid (see, for example, Stefano Eusepi and Bruce Preston 2007).

⁶ For example, King (2005, p. 12) suggests that, under inflation targeting, a good heuristic would be “expect inflation to be equal to target.”

In addition, the central bank may have, or may be believed to have, superior information on the economic outlook. Central banks usually devote many more resources than private sector forecasters to forecasting and even to estimating the underlying unobservable state of the economy. Various studies find that financial markets react to information on the outlook that central banks provide (e.g., Malin Andersson, Hans Dillén and Peter Sellin 2006). Apparently, investors update their own views in response to the information conveyed by the central bank. Donald L. Kohn and Sack (2004) argue that private agents may attach special credence to the economic pronouncements of their central bank, especially if the bank has established its *bona fides* as an effective forecaster. They point out that the Federal Reserve has been broadly correct on the direction of the economy and prices over the past two decades, on occasion spotting trends and developments before they were evident to market participants. In a well-known paper, Christina Romer and David Romer (2000) provide statistical evidence that Federal Reserve staff forecasts of inflation were far more accurate than private sector forecasts over a period of several decades.

Central bank communication and learning are inextricably tied, despite a dearth of scholarly attention to that obvious point. There are exceptions, however. In Athanasios Orphanides and John C. Williams (2004), the public is assumed to *know* the form of the equation describing inflation dynamics but to employ standard statistical methods to *learn about* its parameters—which depend on the unobserved objectives and preferences of the central bank. The learning process leads to different behavior than in the rational expectations equilibrium. For example, while people are learning, an increase in inflation may lead the public to revise its estimate of long-run average inflation upward, which, in

turn, raises actual inflation.⁷ As Bernanke (2004) pointed out, such a situation opens up a clear opportunity for the central bank to improve economic performance by providing information about its long-run inflation objective. As is true in many contexts, an information problem can be cured by providing more information.

We capture these ideas within our simple framework by replacing the assumption of rational (really, “model-consistent”) expectations by an explicit equation for interest rate expectations such as:⁸

$$(5) \quad r_{t+j}^e = H_j(y_t, R_t, r_t, \dots, s_t) + \varepsilon_{5t},$$

where s_t is a vector of central bank signals, which might range from crystal clear (e.g., announcing a numerical inflation target) to cryptic (e.g., some of the Fed’s words.) Some of these communications, such as the inflation target, might be long-term and durable while others, such as the daily reactions to data releases, might be high-frequency and fleeting—a distinction that will assume some importance in our review of the empirical evidence. There is no need to specify the details of equation (5), which can stand for a variety of possibilities for learning.

In this schema, the total effect of any central bank action operates through at least three distinct channels:

- the direct effect of the overnight rate on aggregate demand— D_r in equation (2)—which is probably quite small;
- the direct effects of central bank signals on expected future short rates: H_s in equation (5), including any learning that might take place;

⁷ Some other examples are Glenn Rudebusch and Williams (2008) and Michele Berardi and John Duffy (2007).

⁸ We focus on interest rate expectations for simplicity. Expectations of inflation or even of output may be equally important.

- the effect of changes in the short rate on expectations of the entire sequence of *future* short rates, via equations (1) and (5), and their consequent feedback onto long rates, R_t , and therefore onto demand (D_R). This channel will undoubtedly be influenced by the central bank's signals, s_t .

It should be clear from this trichotomy that any account of monetary policy that ignores central bank communication is seriously deficient. Indeed, if the first channel is as unimportant as we suggest, then the communication channels constitute most of the story—which is what Woodford meant and is why many economists these days characterize the job of monetary policy as one of *managing expectations*.

This modern view of monetary policy leads directly to several empirical questions that form the central concerns of this survey. First, what does the vector s_t look like in practice—and why might it vary across central banks? Second, what evidence is there that central bank communications influence expectations *directly*, as posited by equation (5)? Third, how do particular elements of the vector s_t affect measurable variables like interest rates, stock prices, and exchange rates? Fourth, the framework suggests that skillful communications can (a) raise the signal-to-noise ratio, (b) reduce financial market volatility, and (c) lead to better monetary policy outcomes (e.g., lower variances of inflation and output). Is there evidence that it does?

Is there a downside to communication?

All that said, poorly designed or poorly executed communications clearly can do more harm than good; and it is not obvious that a central bank is always better off by saying more. In practice, central banks do limit their communications. In most cases, internal deliberations are kept secret. Only a few central banks project the future path of their policy

rate. (More on this later). And most observe a blackout or “purdah” period before each policy meeting, and in some instances also before important testimonies or reports. The widespread existence of such practices illustrates the conviction of most central bankers that communication can, under certain circumstances, be undesirable and detrimental. In fact, communication during the purdah period has been shown to lead to excessive market volatility (Ehrmann and Fratzscher 2008).

The theoretical literature has not generated clear conclusions regarding the optimal level of transparency (Petra Geraats 2002, Carin van der Cruijsen and Sylvester Eijffinger 2007). The models differ with respect to both which aspects of central bank transparency they consider and their assumptions about how communications influence the monetary transmission mechanism. Looking at real-world central bank behavior, the range of views on what constitutes the “optimal” degree (and types) of communication has clearly evolved over time—mainly in the direction of greater openness. Are there valid—and *empirically relevant*—arguments for limiting communication on monetary policy?⁹

One possible argument dates back to the seminal paper by Alex Cukierman and Allan Meltzer (1986).¹⁰ Their case for obfuscation rested on two assumptions: that only unanticipated money matters, and that the central bank’s preferences are not precisely known by the public. Under these assumptions, some degree of opacity enhances the effectiveness of monetary policy because a fully-transparent central bank cannot create surprises. However, two decades later, Pierre Gosselin, Aileen Lotz, and Charles Wyplosz (2007) pointed out that both the view that only unanticipated money matters and the idea

⁹ We mention here, but do not discuss further, a few obvious ones: the need to preserve confidentiality, the fact that financial stability sometimes limits central bank talk, and the obvious point that no central bank can divulge what it does not know

¹⁰ For related work see Michelle Garfinkel and Seonghwan Oh (1995), Faust and Svensson (2001), and Henrik Jensen (2002).

that the central bank conceals its preferences in order to pursue its own agenda seem increasingly anachronistic.

Anne Sibert (2006) has recently raised doubts about the Cukierman and Meltzer argument. Her two-period model of a non-transparent central bank focuses on the role of private information. The central bank's welfare is increasing in unexpected inflation (because it increases output) and decreasing in actual inflation. As is typical in models with such objective functions, an unobserved shock that is realized after the public's expectations are formed but before monetary policy is made offers the central bank an opportunity to exploit a short-run Phillips curve tradeoff. Nonetheless, one of Sibert's main conclusions is that both the central bank and society are always better off with increased transparency – mainly because it reduces the inflation bias.

Surely there are limits to how much information can be digested effectively (Daniel Kahneman, 2003). So a central bank should perhaps be wary of communicating about issues on which it receives noisy signals itself—such as the evolution of the economy (as opposed to, say, its upcoming interest rate decisions). This point has been emphasized in the literature on coordination games initiated by Stephen Morris and Hyun Song Shin (2002). Jeffery D. Amato, Morris, and Shin (2002) argue that central bank communication has a dual function: On the one hand, it provides signals about the private information of central banks, and on the other hand, it serves as a coordination device for the beliefs of financial market agents. They argue that central bank communication might be welfare-reducing if agents give too much weight to central bank communication as a focal point, and too little to their own information. The central bank might even coordinate the actions of markets *away from* fundamentals.

But is this likely? Svensson (2006a) shows that the validity of the argument requires that central bank communication has a much lower signal-to-noise ratio than that of private information. He argues that this assumption hardly ever holds in reality. Moreover, Woodford (2005) notes that the Morris-Shin problem is even less likely to arise if the coordination of private agents' actions is a welfare objective *per se*. And Gosselin *et al.* (2006) point out that it is unrealistic to think that a central bank can withhold information as Amato *et al.* suggest. For example, policymakers tacitly reveal some of what they know merely by setting the interest rate. Furthermore, if we focus on providing information about future monetary policy—as opposed to, say, forecasting the stock market or the exchange rate—there is an even simpler and more compelling objection to the Morris-Shin reasoning. Who, after all, knows more about the central bank's intentions than the central bank itself? Thus *honest* central bank talk is almost certain to coordinate beliefs in the *right* direction.

Finally, we should mention the “cacophony problem,” pointed out by Blinder (2004, Chapter 2). When monetary policy decisions are taken *and subsequently explained* by a committee rather than by a single individual, there is a danger that too many disparate voices might confuse rather than enlighten the public—especially if the messages appear to conflict. If done poorly, uncoordinated group communication might actually lower, rather than raise, the signal-to-noise ratio. But the appropriate remedy for this problem, should it exist, is clarity, not silence.

Communication is not precommitment

Over the years, many central bankers and economists have at times confused *communication* with *commitment*—or worried out loud that the public might confuse the two. For example, it has been argued that words uttered today might restrict the freedom to

maneuver tomorrow. For example, then-Chairman Paul Volcker defended the Fed's refusal to announce its decisions immediately in 1984 as follows:

One danger in immediate release of the directive is that certain assumptions might be made that we are committed to certain operations that are, in fact, dependent on future events, and these interpretations and expectations would tend to diminish our needed operational flexibility.¹¹

In a similar vein, Alan Greenspan opposed immediate disclosure of the FOMC's decisions in 1989 because "a public announcement requirement also could impede timely and appropriate adjustments to policy."¹² (Yet less than five years later, he *voluntarily* did precisely that.)

From today's standpoint, the objections of Volcker and Greenspan to this minimalist disclosure proposal sound quaint—almost scholastic. While there are cases in which saying something *does* constrain future behavior—as in "giving a verbal commitment"—most central bank communication is not, or need not be, of this nature. In particular, the mere conveyance of information—such as about the policy decision, the inflation target, the forecast, etc.—does not commit the bank to any future action or inaction (although it might hint at such). Even the famous published "forward tracks" of the Reserve Bank of New Zealand (discussed later), which are *conditional forecasts* of its own future behavior, are conditioned on many future variables. That said, the conditional character of such forecasts may be difficult to convey (Otmar Issing 2005).

Of course, there may be cases in which a central bank *wants to* use words to commit itself in some way. For example, Bernanke, Thomas Laubach, Frederic Mishkin, and Adam Posen (1999) argued in favor of inflation targeting on precisely these grounds—as a way to

¹¹ Quoted in Goodfriend (1986), pp. 76-77. Goodfriend's paper was an early, and at the time highly controversial, critique of the Federal Reserve's secrecy—written by a Fed employee.

¹² Quoted in Blinder (1998), pp. 74-75.

constrain central bank discretion. But that is the exception, not the rule. For the most part, the sorts of communications that we deal with in this paper generally *do not* imply any form of commitment. Since there is already a huge and well-known theoretical literature on the role of commitment in monetary policy, we will not deal with that subject further.¹³

In sum, there are many theoretical reasons why central bank communication should be expected to matter, and many of them imply that skillful communication can improve macroeconomic outcomes. As against this, the arguments against greater transparency seem to be thin gruel: the profession no longer believes that only unanticipated money matters; the Morris-Shin coordination “problem” seems more likely to be an advantage of central bank communication than a disadvantage; and communication need not imply (unwanted) commitment. We turn now from theory to practice.

3. Central bank communication in practice

Many central banks with similar monetary policy objectives nonetheless follow fundamentally different communication policies; and these policies have evolved over time. In our framework, this means that the vector of communication signals, s_t , takes different forms in different times and places. In this section, we illustrate the diversity in current communication practices by examining the different types of signals that central banks send, concentrating mainly on three major central banks: the Federal Reserve System, the Bank of England, and the European Central Bank.¹⁴ We first split the vector of central bank signals, s_t , by *content* (Section 3.1), and then by *sender* (Section 3.2).

3.1 What to communicate

¹³ Among the many sources that could be cited, see Richard Clarida, Jordi Gali, and Mark Gertler (1999) or Woodford (2003).

¹⁴ The diversity in communication practices across central banks is also illustrated in Issing (2005), particularly Table A2.

Central banks communicate about at least four different aspects of monetary policy: their overall objectives and strategy, the motives behind a particular policy decision, the economic outlook, and future monetary policy decisions. Central banks' objectives and strategies tend to be more stable, so the corresponding signals show less variability over time than signals about the other three items.

Objectives and strategy

An independent central bank should be given a clearly-defined mandate by its government. Generally, this is done by enunciating central bank objectives, sometimes in quantitative terms. Some central banks that are not given quantitative objectives by their governments have nonetheless decided (or been directed) to provide their own quantification, for at least two reasons. First, numerical targets facilitate accountability, enabling the performance of the central bank to be assessed against its mandated yardstick (Jakob De Haan and Sylvester Eijffinger, 2000). Second, a quantitative objective (or objectives) helps to anchor the expectations of economic agents. In terms of our simple modeling framework, agents' expectation formation in (5) is facilitated by knowing the targets y_t^* and π_t^* that enter the policy rule (4). In turn, well-anchored inflation expectations help to stabilize actual inflation by removing an important source of shocks. However, few if any central banks actually communicate a precise policy rule.¹⁵ Instead, private agents learn about the "rule" both by watching what the central bank *does* and listening to what it *says*.

These accountability and anchoring arguments figure prominently in the debate over inflation targeting (IT) because better and more open communication is often taken to be a

¹⁵ Even formulating an objective function may be a daunting task for a central bank. Some of the difficulties in doing so are described by Mishkin (2004) and Cukierman (2008).

defining virtue of IT. While the Bank of England, for example, sets interest rates independently, its inflation target comes from the Chancellor. The ECB, in contrast, was not given a quantitative objective by the Maastricht Treaty, but provided one for itself as an important part of its monetary policy strategy. Yet a third approach is followed by the Federal Reserve, which has *two* legislated objectives, namely price stability and full employment, neither of which is quantitative as yet. This diversity of practices among otherwise similar central banks is striking, and we will later investigate the extent to which these differences bear on economic outcomes.

Policy decisions

Most central banks nowadays inform the public about their monetary policy decisions on the day they are taken. However, this was not always so. Prominently, the Federal Reserve only began announcing changes in its target federal funds rate on the day of FOMC meetings in February 1994. Before that, markets had to infer the intended funds rate from the type and size of open-market operations--until the decision was published after the subsequent FOMC meeting. Prompt and clear announcement of monetary policy decisions clearly creates news, but it also reduces noise by eliminating any guessing on the part of the public. So this type of central bank communication evidently raises the signal-to-noise ratio. As we will see in the next section, it also leads to improvements in the efficiency of monetary policy.

Practices differ enormously regarding what central banks should or should not say in the statement that accompanies the decision and, presumably, explains it. In particular, central banks apparently disagree over how much should be disclosed about the decision-making process itself, e.g., through the release of minutes and voting records. The ECB

does not publish minutes, and insists that it makes monetary policy decisions by unanimity. The Fed and the Bank of England (BoE) do release minutes (and both recently expedited the release), along with recorded votes. This information is particularly important for the BoE, whose Monetary Policy Committee (MPC) members are individually accountable, and therefore need to have their votes recorded and scrutinized. Interestingly, dissents on the British MPC are much more frequent than they are on the FOMC, where decisions are typically unanimous and dissent connotes fundamental disagreement.¹⁶ Instead of releasing minutes, some central banks (such as the ECB) hold press conferences immediately following their policy decisions. Press conferences may provide less detail than minutes, but they are more timely and more flexible, as they allow the media to ask questions. We will return to this issue later.

The economic outlook

Another important aspect of a central bank's communication strategy is the extent and content of any forward-looking information it provides. This information set includes the central bank's assessment (forecast) of future inflation and economic activity, and its own inclinations regarding future monetary policy decisions. Central banks differ sharply in whether and how they communicate such information.

Inflation-targeting central banks typically provide their assessment of expected future inflation in periodic reports. In that context, the Bank of England's display of probability distributions through "fan charts" has many imitators. However, central banks that are not inflation targeters also often release (some aspects of) their inflation forecasts. In the case of the ECB, this is done through the staff projections (now published four

¹⁶ On this point, see Blinder (2007), Henry Chappell, Rob Roy McGregor and Todd Vermilyea (2004), Ellen Meade and Nathan Sheets (2005), and Laurence H. Meyer (1998).

times a year), which serve as an input to the Governing Council's discussions, but need not be endorsed by it—a very different role from inflation forecasts in an IT strategy. The Federal Reserve keeps its staff projections secret; but it now publishes FOMC forecasts of inflation four times a year. The November 2007 changes in its communication practices increased both the frequency and length of its publicly-released forecasts (see Bernanke 2007). Although these changes did not include the adoption of an explicit inflation target, the new three-year-ahead forecast effectively reveals the inflation rate that policymakers believe is consistent with the Fed's mandate to achieve “stable prices.”

Until recently, the diversity across central banks was even wider when it came to the outlook for economic activity. However, the Federal Reserve has now joined the the Bank of England and the ECB in providing more frequent official forecasts of output measures. A number of central banks even publish estimates of the output *gap*. Given the difficulties in measuring and forecasting potential output,¹⁷ the latter option is practiced by only a few central banks (including those of New Zealand, Norway, the Czech Republic, Sweden, and Hungary).

The path of future policy rates

When it comes to likely future policy decisions, many central banks provide some sort of forward guidance, albeit in very different ways. Some, such as the ECB, use indirect signals, often in the form of code words like “vigilance” (David-Jan Jansen and De Haan, 2007). Other central banks are more explicit. The FOMC, for instance, sometimes (but not always) issues a statement with a forward-looking assessment of future monetary policy. These statements, which began in earnest in May 1999, have evolved over time. They were originally phrased in terms of the policy “bias,” then in terms of the “balance of risks” for

¹⁷ See, e.g., Orphanides (2001).

the “foreseeable future,” and so on. At times, especially during the 2003–2005 period, the FOMC has been quite direct about its expected future path of interest rates.¹⁸

A few central banks even provide *quantitative* guidance by publishing the numerical path of future policy rates that underlies their macroeconomic forecasts. Sweden and Iceland recently joined a small group that includes New Zealand and Norway in doing so. Some observers view the central bank’s forecasting its own future behavior as the last frontier of transparency, and none of the three major central banks on which we have focused have yet been willing to go there. The issue remains highly controversial.¹⁹

Both Mishkin (2004) and Charles Goodhart (2001) argue against announcing the path of the policy rate on the grounds that it may complicate the committee’s decision-making process. It may also complicate communication with the public, which may not understand the *conditional* nature of the projection. In practice, the main concern holding back many central bankers is that such communications might be mistaken for *commitments*. If the projected developments do not materialize, the discrepancy between actual and previously-projected policy might damage the central bank’s credibility (Issing 2005). In addition, while forward guidance by the central bank is intended to correct faulty expectations, and thereby reduce misallocations of resources, inaccurate forecasts might actually *induce* such misallocations, e.g., if agents make economic decisions (such as taking on a mortgage) based on the central bank’s communication.

To guard against these potential pitfalls, all central banks that provide forward guidance on interest rates emphasize that any forward-looking assessment is conditional on current information—and therefore subject to change. For example, the Riksbank regularly

¹⁸ For a detailed description of the evolution of the FOMC’s forward-looking language, see Rudebusch and Williams (2008).

¹⁹ The case in favor is made by Svensson (2006b) and Woodford (2005).

stresses the conditionality of its projected repo rate path by repeating the mantra: “It is a forecast, not a promise.”

3.2 How to communicate

Just as the content of signals differs markedly across central banks, so does the choice of communication tools. Central banks can choose from a large menu of communication instruments, and each central bank uses its own mixture.²⁰ This subsection provides a brief overview of one particularly important aspect of instrument selection, namely, the choice of sender (e.g., whether a signal is sent by the committee or by an individual committee member), which in turn may influence the precision of the signal. When signals are sent by or on behalf of the monetary policy committee, the appropriate content, timing, and channels must all be chosen. Communication by individuals raises further issues—such as whether one member (e.g., the chairman or governor) should serve as spokesperson for the committee, reflecting a more collegial approach to communication, or each member should present his or her own views, representing an individualistic communication strategy.

Communication by committees

The most natural occasion for communication by an MPC as a whole arises on meeting days, when decisions are announced. The timing of this communication and the amount of detail provided differ substantially across central banks. The Federal Reserve provides a short press release containing the decision, a concise (and typically stylized) explanation of its underlying reasoning, and (at times) some forward guidance. The Bank of England’s press statement announces the decision, but normally provides an explanation

²⁰ See Blinder *et al.* (2001) for a detailed, though by now somewhat dated, account and explanation of the various instruments used by central banks.

only when interest rates are changed or when its decision was largely unexpected.

Somewhat later, but prior to the subsequent meeting, both central banks provide detailed accounts and explanations of the decisions in the minutes.²¹

By contrast, the ECB not only releases a press statement with the policy decision, but also holds a press conference on the day of Governing Council meetings, including a question and answer session.²² Compared to the approach of the other two central banks, there are four main differences. First, while providing background information on the rationale for the decision, the ECB press conference is generally less detailed than the minutes of the Bank of England or the Federal Reserve. In particular, it does not provide any information on voting.²³ Second, however, the press conference avoids the substantial time delay of the minutes. Some observers have argued that there is a trade-off between the timeliness of this type of communication and its accuracy (Goodhart 2005), as minutes usually undergo a detailed sanitizing process to put the best possible face on the committee's views and intentions, which delays their release. Third, the Q&A session allows the press to ask follow-up questions and thus can help clarify ambiguities (Ehrmann and Fratzscher 2007a). Fourth, press conferences are typically televised live, which gives the central bank an opportunity to reach out to the broader public.

Another natural communication opportunity for a committee inheres in its legal reporting requirements. For example, each of the three central banks is obliged to provide an annual report and to testify before its legislature. For the ECB and the Federal Reserve,

²¹ In addition to the minutes, the Federal Reserve eventually also releases the transcripts of FOMC meetings, albeit only after a five-year lag.

²² The central banks of the Czech Republic, Japan, New Zealand, Norway, Poland, Sweden, and Switzerland also hold regular press conferences.

²³ For a stimulating debate on the ECB's decisions not to release either minutes or individual voting records, see Willem Buiter (1999) and Issing (1999). One important argument in favor of publishing minutes is that they provide some information about the internal deliberations.

these hearings provide the committee's views, whereas Bank of England testimonies relate more to members' personal views.

Among the most important reporting vehicles are regular publications such as the ECB's *Monthly Bulletin*, which is published one week after each monetary policy meeting and contains both the assessment of economic developments and information on the analytical framework—e.g., models, methods and indicators—used in its decision-making process. For the Bank of England, the most closely-watched reports are its quarterly *Inflation Report*, which sets out the detailed economic analysis that underlies the MPC's decisions and presents the Bank's assessment of the prospects for inflation over the following two years, and the *Quarterly Bulletin*, with its commentary on market developments and monetary policy operations. The publication of the *Inflation Report* is also accompanied by an hour-long press conference. The Federal Reserve's closest counterpart is its semiannual *Monetary Policy Report to the Congress*, presented with the chairman's testimony to Congress.

Communication by individual committee members

Most central banks these days make decisions by committee, reflecting an apparent consensus that doing so leads to superior policy (Blinder, 2004, Chapter 2). But committees come in a wide variety of shapes and sizes. Blinder (2004) distinguishes among three types of committees—individualistic, genuinely collegial, and autocratically collegial—and characterizes the Bank of England's MPC as individualistic, the ECB's Governing Council as genuinely collegial, and the Federal Reserve's FOMC under Alan Greenspan as autocratically collegial.²⁴ He emphasizes that these distinct types of committees need different communication strategies. In the individualistic case, the diversity of views on the

²⁴ The FOMC is clearly becoming more genuinely collegial under Ben Bernanke.

committee should be apparent, as a way to help markets understand the degree of uncertainty surrounding monetary policy making. But in the collegial case, a similar diversity of views, if made public, might undermine clarity and common understanding. Therefore, communication should mainly convey the committee's views.

Since the importance of individual views in the communication strategy of a particular MPC will reflect the structure and functioning of the committee, it will vary both across banks and across time. Despite its collegial structure, the Federal Reserve pursues a somewhat individualistic communication strategy, which at times reveals highly diverse opinions across FOMC members. This diversity stands in sharp contrast to the ECB, which has followed a far more collegial communication strategy, often displaying a much higher degree of consistency among the statements of individual committee members (Ehrmann and Fratzscher 2007b).

One difference between communications by individual members and by entire committees is the greater flexibility in timing of the former. Communications by committees are generally pre-scheduled, and thus somewhat inflexible in timing. But changes in the circumstances relevant to monetary policy do not always coincide with meeting dates or testimonies. Furthermore, the central bank might want to provide more guidance to financial markets and the public in times of great uncertainty (Jansen and De Haan 2005). Occasional speeches and interviews by individual committee members between meetings offer a way to communicate changes in views rapidly, if so desired. But the large variation across central banks in the intensity of inter-meeting communication suggests that they differ greatly in how much importance they attach to timeliness.

This section has shown that central bank practices differ enormously, both across central banks and across time. However, there are clear trends toward more timely and more open communication. We have also highlighted the huge variety of signals that are subsumed under the symbol s_t in our schema. This huge heterogeneity in central bank practices raises an obvious question: Are there better and worse ways of communicating? This is clearly an empirical question—and a large one. The rest of this survey will suggest partial answers based on recent empirical evidence.

4. The impact of central bank communication on financial markets

In Section 2, we noted that central bank communications (s_t) influence expectations of future short-term rates (r_{t+j}^e), which, in turn, influence long-term rates and other financial-market prices (R_t). These prices, in turn, influence such macro variables as inflation and output (y_t and π_t). But there are at least two crucial differences between the earlier and later links in this causal chain. Both relate to timing. First, while central bank communications, just like monetary policy, affect financial markets very quickly, interest rates and asset prices affect the economy only gradually—with the proverbial long and variable lags. Second, many factors other than monetary policy influence macro variables such as y_t and π_t . But, at least over the narrow time windows used in many empirical studies, it is arguable that financial market variables are reacting only, or at least mostly, to central bank signals. The upshot is that it is a much easier econometric task to estimate the effects of central bank signals using high-frequency data from financial markets (the subject of this section) than using low-frequency data on macroeconomic performance (the subject of the next section). So we begin with financial market reactions—where there is also, not by coincidence, much more literature to survey.

In Section 4.1, we explain some of the methodological approaches that have been used to identify and measure communication signals. Section 4.2 then moves on to what seems to be the logically first substantive question: Do central bank signals successfully steer market expectations about future monetary policy and therefore render policy more predictable? The evidence suggests that they do, though imperfectly. Section 4.3 takes the next step and inquires about the impact of central bank communications on interest rates and other asset prices—as well as on their volatility. Some of these impacts appear to be sizable, others less so. Finally, in Section 4.4, we turn to the possibility that some communications wind up being *miscommunications*, so that, e.g., relatively noisy central bank signals might actually increase, rather than decrease, uncertainty.

4.1 Identifying and measuring communication events

As we have noted, central bank communications differ in many ways and are sometimes difficult to measure. So we focus first on relatively well-defined, high-frequency signals, such as announcements and speeches. It has become standard practice to identify regular pre-scheduled communications (such as announcements of policy decisions) from central bank websites and irregular statements (such as speeches and interviews) through financial newswire reports. However, it is not always straightforward to determine exactly when a communication “event” took place. For example, when a late-Thursday media report on a Tuesday interview with a policymaker causes financial markets to react on Friday morning, was the communication event on Tuesday, Thursday, or Friday?

A second challenge is how to extract the intention or objective behind a policy statement—which is, after all, essential if we want to know whether central bank communications succeed. Different approaches to this issue have emerged. One line of

research does not even attempt to divine directional intent. Kohn and Sack (2004), Ellis Connolly and Marion Kohler (2004), and Rachel Reeves and Michael Sawicki (2007) study instead the effects of central bank communication events on the *volatility* of financial variables. The basic idea is that, if communications affect the returns on financial assets, the volatility of these returns should be higher on days of central bank communications, *ceteris paribus*, because the signals contain news.

Focusing on volatility makes it unnecessary to assign a direction to each statement, which is both a strength and a weakness. The researcher just studies whether central bank communications create news, not whether they move markets in the “right” direction. But there are other problems. One is that many factors, some of them unobservable, affect asset prices. So a rise in observed volatility may reflect the reaction of financial markets to shocks other than central bank communication. A second problem is that communication may be endogenous. A central bank may choose to communicate at a particular time because of a sudden change in the economic outlook or some other news. In this case, asset prices will probably be more volatile on communication days, but not necessarily because of the statement (Reeves and Sawicki 2007). Such endogeneity is less of a problem when the dates of major communications—such as policy decisions and testimonies—are known in advance. But it may be especially problematic for speeches or interviews of committee members, which are flexible in both timing and content (Ehrmann and Fratzscher 2007c).

Kohn and Sack (2004) show that the volatility of various asset prices reacts significantly to statements by the FOMC and its members. They argue that the increased volatility is evidence that central bank communication conveys relevant information to market participants. While this is an important first finding, it leaves several open questions.

Their approach says nothing about whether the policymaker *intended* to move asset prices in the way they did. It also does not tell us whether the rise in volatility reflects an *increase* in market uncertainty or a *decrease* in uncertainty that is outweighed by the immediate effect of the news. In other words, the Kohn and Sack approach establishes that central bank communication creates news, but it cannot determine whether it reduces noise.

Accordingly, a number of subsequent studies have attempted to *quantify* communication in order to assess both the direction and magnitude of its effects on asset prices—and thus to determine to what extent communication has its intended effects.²⁵ To do so, all statements must be classified according to their content and/or likely intention, and then coded on a numerical scale. Among the types of communications that have been studied in the literature are: statements on monetary policy and communication about the exchange rate (see Jansen and De Haan, 2005, for speeches and interviews by members of the ECB Governing Council), policy inclinations and the economic outlook (see Ehrmann and Fratzscher, 2007b, for communication by committee members at the Federal Reserve, the Bank of England, and the ECB), price stability, the real economy, and monetary indicators (see Helge Berger, Jan-Egbert Sturm and De Haan, 2006, for the introductory statement of the ECB’s press conference and Stefan Gerlach, 2007, for the editorial in the ECB’s Monthly Bulletin). All of these studies assign negative (positive) values to statements that are perceived as dovish (hawkish), and zero to those that appear to be neutral. Whereas some researchers restrict the coding to directional indications (e.g., Jansen

²⁵ This is similar to the so-called “narrative approach” to modeling monetary policymaking as, for instance, applied by Romer and Romer (1989) to identify times when the Fed tightened. Similarly, John Boschen and Leonard Mills (1995) generated a discrete measure of the Fed’s policy stance taking five different values $\{-2, -1, 0, 1, 2\}$, where -2 indicates a very tight policy stance, while 2 indicates a very loose policy stance. Like the Romer and Romer dates, their indicator is based on FOMC minutes. But it is a more informative measure of monetary policy, since it differentiates according to size as well as direction.

and De Haan 2005, Ehrmann and Fratzscher 2007b), others assign a finer grid that is at least suggestive of magnitude (Carlo Rosa and Giovanni Verga 2007, Marie Musard-Gies 2006), e.g. by coding statements on a scale from -2 to +2.

The strength of the coding approach is that it helps us understand whether communication succeeds or fails. But this comes at a price. First, the required classification is necessarily subjective, and there may be misclassifications. This risk can be reduced through content analysis (Ole Holsti 1969), such as when several researchers independently classify statements (as in Berger *et al.*, 2006); but it can never be eliminated.

Second, when statements are identified through newswire reports (as in Jansen and De Haan 2005, and Ehrmann and Fratzscher 2007b), communication is not measured at the source, but rather via the media intermediary. But these intermediaries could be selective or misleading in their reporting, or could release the story days after the interview. That said, if researchers are interested in testing market responses to communication, it may make sense to focus on statements that actually reach market participants, and on the content as conveyed by the media.

Third, subjective communication indicators are constructed *ex post* and may not accurately reflect how financial markets understood the signals at the time. The latter is likely to be affected by, e.g., expectations about monetary policy at the time of the statement. As we know, efficient financial markets should react only to the *unexpected* component of a statement.

One approach to these issues, first suggested by Refet Gürkaynak, Sack, and Eric Swanson (2005) and Gürkaynak (2005), and also implemented in Claus Brand, Daniel Buncic and Jarkko Turunen (2006), employs indirect measures derived from financial

market reactions. Gürkaynak *et al.* (2005) use a principal components method that identifies two common factors that describe asset price movements around FOMC announcements. The factor that is orthogonal to the surprise in the federal funds target rate is defined to be the communication effect of the FOMC statement. Brand *et al.* (2006) make use of the timing details of the ECB's meeting day communications. The ECB announces its decisions at 1:45 pm, without any explanatory statements, and then explains the decisions in detail in the press conference 45 minutes later. Because of that delay, the market reaction to the release of the decision can be distinguished from the market reaction to the forward-looking communication by using very high-frequency data. Doing so leads to results that are similar to those obtained with the principal components approach of Gürkaynak *et al.* (2005). Rosa (2008) approximates the unexpected components of both FOMC and ECB statements by estimating forecasting regressions that explain the content of each statement by the preceding statement and the slope of the yield curve just prior to the release of the statement. Interestingly, he finds stronger market reactions to unexpected Fed talk than to unexpected ECB talk.

4.2 Does central bank communication enhance the predictability of monetary policy?

Equation (5) in our conceptual schema posited effects of central bank signals on *expectations* of future monetary policy decisions. It seems that successful central bank communication efforts should make policy more predictable and market expectations of future short rates more accurate. Is it true?

Presumably, central banks are most concerned with *long-term* predictability, which comes when the public develops a genuine understanding of the way the central bank thinks and operates. This is what King (2000) meant by saying provocatively that a central bank

should be “boring.” The idea is that the monetary policy reaction function should be so well understood that all the relevant news for financial markets would stem from developments in the economy, not from the actions or words of the central bank. In a similar vein, Blinder (2004, p. 25) suggested that “perhaps the best a central bank can do is to ‘teach’ the markets its way of thinking.”

Unfortunately, long-term predictability is inherently difficult to gauge, so empirical studies typically resort to predictability at short horizons, which is more measurable.²⁶ Often, financial market prices are used for this purpose. And indeed, research has shown convincingly that the predictability of the interest rate decisions of the major central banks has improved remarkably in recent years—so much so that financial markets’ expectations nowadays are generally well aligned with actual decisions (Kerstin Bernoth and Jürgen von Hagen, 2004).

The case of the Federal Reserve, with its continuously increasing level of transparency since the 1980s, has been studied most extensively. Poole and Robert Rasche (2003) provide evidence that the surprise component of policy decisions decreased considerably after February 1994. Joe Lange, Sack, and William Whitesell (2003) show that the ability of Treasury bill yields to predict changes in the federal funds rate some months in advance has increased since the late 1980s. Similarly, Swanson (2006) finds that U.S. financial markets and private sector forecasters have become both better able to forecast the federal funds rate at horizons out to several months and less uncertain about their interest rate forecasts *ex ante*, as measured both by interest rate options and by the cross-sectional variance of interest rate forecasts. Importantly, private sector forecasts of macroeconomic

²⁶ However, as more central banks begin to announce projected interest-rate paths, it will become possible to study the extent to which these forecasts are incorporated in yield curves.

variables have *not* shown similar improvement, which points toward a specific effect of communication about monetary policy rather than a general decline in macroeconomic volatility (the so-called Great Moderation).

Each of these authors argues that the Federal Reserve's practice of making same-day announcements of monetary policy decisions since February 1994 was an important factor in reducing uncertainty. Furthermore, Selma Demiralp and Oscar Jorda (2002) provide compelling evidence that announcing changes in the intended federal funds rate in real time enabled the Fed to move the actual funds rate with smaller open market operations—which suggests that greater transparency also helped make policy implementation more efficient.

Other types of central bank communication should also enhance predictability. Regardless of whether policymakers have superior information about the economy, communicating their macro forecasts, and possibly also offering indications about the future path of interest rates, should help financial markets predict future central bank actions better. A study by Andrea Fracasso, Hans Genberg, and Wyplosz (2003) sheds light on this issue. They develop a number of indicators of the *quality* of inflation reports for 19 countries and find that higher quality reports are associated with smaller policy surprises. In particular, three subjective indicators—how convincing the report is judged to be, how well it reflects the expertise of the staff, and the quality of the writing style—increase the predictability of interest-rate decisions. These results suggest that clearer communication, which creates a higher signal-to-noise ratio, reduces private agents' uncertainty. While its substantive concern (financial market volatility) is quite different, Jansen (2008) supports this suggestion. Using objective measures of readability to measure the clarity of the

Federal Reserve chairman's semi-annual Humphrey-Hawkins testimonies, he finds that greater clarity often reduces the volatility of interest rates.

Particularly strong effects can be expected if a central bank communicates its intentions about upcoming interest rate decisions. Unfortunately, we know of no research that analyses the effects of the publication of *quantitative* forward guidance, as practiced for years by the Reserve Bank of New Zealand (RBNZ) and, more recently, by Norges Bank and Sveriges Riksbank. New Zealand has the longest history of doing so by far, and David Archer (2004) provides some evidence that market reactions to the publication of the RBNZ's forward interest rate tracks are limited. He suggests that this might reflect the market's understanding of the conditionality of such publications: Market participants might adjust rates to match the Bank's forward path only if they share the underlying assumptions about the evolution of the economy. Beyond this, however, our knowledge of the effects of central bank interest rate projections on the market's understanding of monetary policy is minimal—which is inevitable given the short time span and the small number of central banks that have revealed such information. As more experience is accumulated, e.g., in Norway and Sweden, this will be a high priority area for future research. Already, Norwegian data show that markets do not always uncritically adopt the central bank's projection.

Another type of forward-looking information has been the subject of far more scholarly attention: the *qualitative* guidance provided by the Federal Reserve's (and other central banks') policy "bias" or "balance of risks." As we will see in the next subsection, these statements strongly affect financial markets. Surprisingly, however, their predictive power for future monetary policy is mixed.

In interpreting this evidence on the Fed, it is important to distinguish between bias statements made prior to and after May 1999. Until that date, the FOMC's policy directives were not public information. They were internal declarations of intent, focused narrowly on the inter-meeting period and released only after the *next* FOMC meeting. By contrast, the balance-of-risks assessments since May 1999 are external statements intended to provide markets with information about possible future policy decisions.

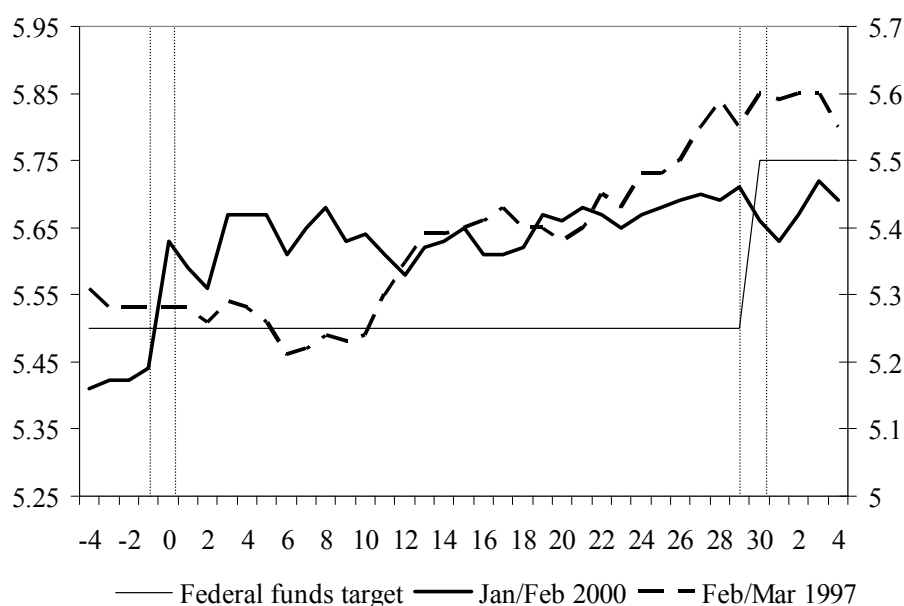
Consistent with their internal use, the pre-1999 bias statements have been found to be a statistically significant indicator of the likelihood and direction of changes in the fed funds target during the subsequent inter-meeting period (John Lapp and Douglas Pearce 2000), but not thereafter (Daniel Thornton and David Wheelock 2000). By contrast, Ehrmann and Fratzscher (2007d) focus on the period since May 1999 and do find consistency with subsequent interest rate moves. Similarly, Michael Pakko (2005) finds that the information content of these statements is a statistically significant variable predicting changes in the funds rate target in the context of an estimated Taylor rule.

Strikingly, however, Ehrmann and Fratzscher (2007d) find that policy decisions after May 1999 have *not* been anticipated better by financial markets than they were before. Chart 1 shows one case in point by displaying the adjustment of the three-month T-bill rate around two pairs of FOMC meetings: one prior to 1999, and one after. In both cases, there was no change at the first of the two meetings (marked as day 0 on the horizontal axis) and then a 25 basis points increase at the second (marked as day 30). Furthermore, in both cases, the FOMC had actually adopted a tightening bias at the meeting on day 0.

In both instances, the decision to raise the funds rate was well predicted by the market: T-bill rates had already increased substantially by the time the FOMC acted. But the

timing was very different in the two cases. When the tightening bias was released on day 0 (solid line), markets did most of the adjusting to the coming interest rate hike within one day. By contrast, when the bias was not released (dashed line), interest rates adjusted much later. Interestingly, T-bill rates started anticipating the Fed's next rate move on the day of Chairman Greenspan's testimony before the US Senate (day 11 in the chart).

Chart 1: Adjustment of market interest rates under alternative disclosure regimes: March 25, 1997 versus February 2, 2000



Source: Ehrmann and Fratzscher (2007d).

Note: Three-month money market rates for the 1997 tightening episode are shown on the right-hand scale whereas those for the 2000 episode are depicted on the left-hand scale. Both tightening days are scaled so as to be shown on day 30 on the horizontal axis. Day 0 refers to the corresponding previous FOMC meetings.

While the chart shows just two exceptionally clear cases, Ehrmann and Fratzscher's statistical tests confirm this as a general tendency. Markets anticipated the Fed's decisions rather well both before and after release of the "balance of risks," but the mechanisms were different. Nowadays, they extract information from the statements, whereas before they relied more on other types of Federal Reserve communication between meetings, such as speeches and testimonies by FOMC members.

A number of recent papers apply Pakko's (2005) approach to the case of the ECB, examining to what extent its communications add information to Taylor-type rules. There is general agreement that models based exclusively on communication variables perform worse than those that include relevant macroeconomic variables, like inflation and output gaps. However, whether communication can improve the fit of standard Taylor rules is in more dispute. Jansen and De Haan (2006a) find that the ECB's communications do not add informational value, but Rosa and Verga (2007) and Friedrich Heinemann and Karin Ullrich (2007) find that the press conferences do.

4.3 Do financial markets respond to (which form of) central bank communication?

The evidence obtained from various event studies demonstrates that central bank talk can move financial markets substantially. An early contribution to this literature is Graeme Guthrie and Julian Wright (2000), who, without distinguishing among different types of communication, provide compelling evidence that communication by the RBNZ has sizable and long-lasting effects on interest rates across the maturity spectrum.

Communication by the Federal Reserve also affects financial markets. As one indication of magnitudes, Table 1 reproduces the results of the seminal study by Kohn and Sack (2004). It is apparent that both FOMC statements and Greenspan testimonies move markets. The statements affect interest rates over short-to-medium-term horizons, while testimonies by then-Chairman Greenspan affect the entire yield curve. In contrast, Kohn and Sack find no significant effects of other Greenspan speeches on financial markets. Reeves and Sawicki (2007), following the same approach, find similar evidence for financial market effects of Bank of England communications. In particular, the release of the MPC

minutes and the Bank's *Inflation Reports* seem to move financial markets significantly.²⁷

But just like Kohn and Sack, Reeves and Sawicki find that speeches do not.

Table 1
Effects of Federal Reserve communication on the unconditional variance of asset prices

	Increase in unconditional variance due to		
	<i>FOMC statements</i>	<i>Greenspan testimony</i>	<i>Greenspan speeches</i>
Federal funds futures			
3 months ahead	24.1 ***	10.0 **	1.0
Treasury yields			
2-year	37.5 **	41.4 ***	4.3
10-year	16.4	37.1 ***	3.9
Treasury forward rates			
0 to 1 year ahead	28.9 **	21.8 **	2.1
1 to 2 years ahead	49.7 **	69.3 ***	6.2
2 to 3 years ahead	43.7	57.8 ***	4.1
3 to 4 years ahead	28.7	45.2 **	1.8

Source: Kohn and Sack (2004).

Numbers report the increase in variance (corrected for the effect of macroeconomic and monetary policy surprises) relative to that observed over the week preceding the communication events. Based on daily data.

***/**/* indicate significance at the 99%/95%/90% level.

Sample period: 1989-2003.

However, other studies have found significant effects of speeches on financial markets, perhaps due to different procedures for selecting communication events. Table 2, taken from Ehrmann and Fratzscher (2007b), displays the estimated effects of interviews and speeches by central bank committee members for the Federal Reserve, the Bank of England, and the ECB. It shows that speeches and interviews affect interest rates through most of the maturity spectrum, ranging from very short maturities up to five years. Since these results are based on coded communication events as explained above, they offer directional information, too. Ehrmann and Fratzscher (2007b) find that statements generally

²⁷ Details of timing may matter here. The *Inflation Reports* are found to move markets only when the frequency of the data is increased from daily (as in Kohn and Sack) to intraday. This is presumably because, with relatively low frequency data, the effects of other news gets mixed up with the communication effects. Using daily data, Connolly and Kohler (2004) and Jaghit Chadha and Charles Nolan (2001) also fail to identify effects of the *Inflation Report* on financial markets.

move financial markets in the intended direction: Statements suggesting tightening lead to higher rates, while statements suggesting easing lead to lower rates. They identify the largest effects for the ECB; statements containing some reference to monetary policy inclinations move interest rates an average of 1.5-2.5 basis points.

Musard-Gies (2006) finds similar results for the ECB, although the short end of the yield curve reacts more sharply to statements than the long end. In stark contrast, statements pertaining to the economic outlook are found to affect mainly US markets, especially at the medium-to-long end of the yield curve, but not (or much less in) markets in the UK or the euro area. Marek Rozkrut, Krzysztof Rybiński, Lucyna Sztaba, and Radosław Szwaja (2007) repeat this analysis for the Czech Republic, Hungary, and Poland. They find that speeches about monetary policy move markets, although to different degrees in each country, but speeches about the economic outlook do not. Finally, Andersson *et al.* (2006) find that speeches by the Riksbank's Executive Board members are important market movers.

Table 2
Effects of interviews and speeches by central bank committee members on interest rates

	Federal Reserve	Bank of England	ECB
3-month interest rates	0.97 ***	0.46 ***	2.05 ***
6-month interest rates	0.46	0.80 ***	1.57 ***
1-year interest rates	0.88 **	0.95 **	2.47 ***
2-year interest rates	1.01 *	0.13	2.48 ***
5-year interest rates	1.14 *	0.15	1.96 ***
10-year interest rates	0.76	-0.21	0.61
20-year interest rates	0.64	0.02	0.44

Source: Ehrmann and Fratzscher (2007b).

Note: The table shows the response of interest rates in basis points to speeches and interviews given by committee members of the different central banks (FOMC members, MPC members and Governing Council members, respectively), containing some non-neutral reference to monetary policy inclinations. Statements that are perceived as suggesting a policy tightening inclination coded as +1, statements that are perceived as suggesting a policy easing inclination as -1. Based on daily data.

*/**/** denote significance at the 90%/95%/99% level.
Sample period: 1999 (1997 for Bank of England) to 2004.

Overall, the results from several countries are qualitatively consistent, even though heterogeneity in both communication practices and monetary policy strategies makes direct comparisons difficult. Central bank statements and speeches do get the attention of financial market participants, which finds its way into market prices. The quantitative magnitudes naturally differ across central banks. For example, the comprehensive study of different communication tools in six central banks by Connolly and Kohler (2004) finds that monetary policy reports in Australia, Canada, New Zealand, and the US provide information that significantly affects markets' expectations, and thus interest rate futures.²⁸ Parliamentary hearings affect futures rates in Australia, New Zealand, the UK (albeit only marginally), and the US, but not in Canada or the euro area. However, where they have effects, the impacts of hearings on interest rate expectations are the largest among the various communication tools. There is also some evidence suggesting that the financial markets respond more strongly when communication is from the head of the central bank (Andersson *et al.*, 2006, Ehrmann and Fratzscher 2007b).

Central banks explain their policy decisions in different ways. As noted above, Kohn and Sack (2004) find that FOMC statements are important market movers—a result corroborated by Gürkaynak *et al.* (2005). In the principal components approach of the latter (described above), the “path factor,” which is related to the forward-looking communication in the statement, affects interest rates across the yield curve—and appears to be the dominant factor at the long end. Similarly, Brand *et al.* (2006) find that the effects of the ECB's communications are particularly sizable at the long end of the yield curve.

²⁸ For the US, this effect also incorporates any effects of the Congressional testimony that coincides with publication of the report, which might explain the relatively large effect that they find.

The fact that the ECB reveals its decisions 45 minutes before it provides explanations in press conferences offers an interesting opportunity to separate the effects of the two different types of communication events. Ehrmann and Fratzscher (2007a) find that press conferences have, on average, larger effects on asset prices than do announcements of policy decisions. Interestingly, these larger effects on interest rates are accompanied by smaller effects on volatility, indicating that the signal to noise ratio of the press conference communication is high. Why? Their results suggest that the Q&A session gives journalists the opportunity to digest the information provided, to compare it to their own prior information, and to ask clarifying questions where necessary. In fact, there is evidence for such a clarification role. When macroeconomic uncertainty—proxied by the diversity of expectations about data releases—is higher, the market's response to the release of the monetary policy decision is more muted, suggesting that market participants wait for the clarification provided in the press conference before they react.

Central banks often provide substantially more detailed explanations of monetary policy decisions in the minutes of policy meetings. For these to have meaningful news content for financial markets, however, they must be released before the subsequent meeting of the committee. In recent years, both the Federal Reserve and the Bank of England have shortened the lag in releasing their minutes, moving it from after to before the subsequent meeting. As shown by Reeves and Sawicki (2007) and Reinhart and Sack (2006), there are discernable financial market reactions only with more timely release.

4.4 Communication about exchange rates

Central bank communication is not confined to monetary policy proper. While it is beyond the scope of this survey, some central banks make occasional statements on

exchange rates, and this special type of central bank communication has spawned a rapidly-growing literature of its own. We cannot summarize the literature on “oral interventions” here, but a few findings are worth noting because they dovetail nicely with those on interest rates:

- Given the small scale of actual forex interventions relative to today’s massive and liquid markets²⁹—whether sterilized or unsterilized, words may be more effective than actions, perhaps because words serve as the focal point that coordinates the actions of market participants (Lucio Sarno and Mark Taylor (2001)).³⁰
- Communication can complement intervention as well as substitute for it (Fratzscher 2004, forthcoming).
- Central bank talk about exchange rates, just like central bank talk about interest rates, may have to substitute for interest rate cuts when the nominal interest rate reaches its zero lower bound (Lukas Burkhard and Andreas Fischer 2007).

In summary, while the evidence is mixed, on balance it seems fair to say that, if the central bank speaks clearly, its statements can (and apparently do) affect a variety of asset prices in non-negligible ways. While financial market reactions depend on the details of the communications, especially their timeliness and news content, central bank talk apparently does contain news that is quickly incorporated into asset prices.

²⁹ See Kathryn Dominguez and Jeffrey Frankel (1993).

³⁰ For some empirical evidence, see Michel Beine, Gust Janssen, and Christelle Lecourt (2006), Fratzscher (2006), Jansen and De Haan (2007), Dominguez and Freyan Panthaki (2007), and Siklos and Bohl (forthcoming).

4.5 Uncertainty in central bank communication

That said, we hasten to highlight an issue that has received scant attention in the literature on central bank communication, yet might be highly relevant to its success: namely, the role of uncertainty in central bank communication.

Uncertainty can arise from various sources. First, inconsistent signals can arise when different members of a monetary policy committee say different things—whether intentionally (e.g., by conducting a debate in public) or unintentionally (e.g., via uncoordinated communication). As Blinder (2007, p. 114) notes, “A central bank that speaks with a cacophony of voices may, in effect, have no voice at all.” On the other hand, Bernanke (2004) argues that “the willingness of FOMC members to present their individual perspectives in speeches and other public forums provides the public with useful information about the diversity of views and the balance of opinion on the Committee.” Both views have validity. Whether communicating individual committee members’ views to the public enlightens or confuses is ultimately an empirical issue. And whether doing so is advisable or inadvisable depends, *inter alia*, on whether the committee has group or individual accountability.

As indicated by Bernanke’s comment, FOMC members do indeed communicate with disparate voices (Ehrmann and Fratzscher, 2007b), whereas the ECB generally speaks more with a single voice.³¹ However, this has not always been so. Jansen and De Haan (2006b) show that communication about monetary policy inclinations by individual

³¹ Issing (1999, pp. 508 and 510) has justified this on the basis of the special circumstances in which the ECB operates: “What matters for transparency is therefore clarity as well as openness. For a new and supranational institution like the ECB, it is particularly important that it sends clear and coherent messages to the markets and the wider public. ... Speaking with one voice – or at least speaking ‘one language’ – is of particular importance for transparency and clarity in the case of the Eurosystem.”

members of the Governing Council was relatively high in the initial years of the ECB, but then declined over time.

To what extent do consistency and other characteristics of central bank communication practices affect the predictability of monetary policy? Ehrmann and Fratzscher (2007e) find that more dispersed communication on Federal Reserve monetary policy is associated with less predictable policy decisions at short- and medium-term horizons, and that the magnitude of this effect is sizeable. In another recent study, Rozkrut *et al.* (2007) corroborate this result for the central bank of Hungary; but for the Czech National Bank, more dispersed communication actually enhances the predictability of policy decisions.

There is also evidence that the voting records of the Bank of England's MPC members help predict future policy changes (Petra Gerlach-Kristen 2004). Casting a minority vote appears to be a bigger step, and therefore one that carries more information, than merely expressing a personal dissenting view in public.

Markets, of course, adapt to a central bank's communication style. When central banks give out relatively dispersed communications, financial markets attempt to identify pivotal committee members and attach more weight to their statements. For example, Andersson *et al.* (2006) find evidence that markets react more strongly to statements by the Riksbank's governor. Ehrmann and Fratzscher (2007b) show the same for the Fed chairman. But they find that, in the case of the ECB's more collegial approach to communication, markets react more equally to statements by all Governing Council members.

Central bank communication is also a two-way street: It must have both a transmitter and a receiver, and either could be the source of uncertainty or confusion. Moreover, on the receiving end, the same message might be interpreted differently by different listeners who may have different expectations or believe in different models. One good example is provided by Fracasso *et al.* (2003), who use survey data to analyze whether inflation reports of central banks reach different audiences equally well. They find that the same inflation report is perceived differently by different respondents, and that interest rate surprises tend to increase with the divergence in perceptions. Another example comes from De Haan, Fabian Amtenbrink, and Sandra Waller (2004), who report substantial differences between newspaper reports published the day after ECB policy decisions in the Financial Times (FT) and the Frankfurter Allgemeine Zeitung (FAZ). The British-based FT, which is critical of the money growth pillar in the ECB's monetary policy strategy, tends to pay relatively little attention to it. In sharp contrast, the home-town FAZ clearly supports the idea that money should have a prominent role in the ECB's strategy, and accordingly gives that pillar substantial attention.

A similar phenomenon can arise when the identical message is interpreted differently at different points in time. As one example, Berger, Ehrmann, and Fratzscher (2006) study the quantity and tone of reporting on the ECB's press conference in 57 international and national newspapers in the euro area. They find that the press seems to take its cues from both prior market expectations and the inflationary environment. The tone of the reporting is generally more critical when a policy decision takes markets by surprise. The decisions are also discussed less favorably if the most recent euro area inflation figures exceed 2%, thus violating the ECB's definition of price stability.

5. The impact of central bank communication on inflation performance

We turn now to the harder but perhaps more important question of whether and how central bank communication affects the ultimate goal variables of monetary policy. As we have noted, the combination of long lags in monetary policy and the myriad influences on macro outcomes make it virtually impossible to isolate a link between a specific communication event (such as a speech) and, say, inflation. So this section takes a longer-term perspective by summarizing the literature on how (if at all) differences in communication *strategies*, either over time or across central banks, influence economic outcomes. Since there is almost no evidence on the effects of central bank communication strategies on the real economy, we focus entirely on actual and expected inflation.

5.1 Anchoring inflation expectations

Since a large number of central banks have adopted formal inflation targeting, and others (such as the Swiss National Bank and the ECB) provide quantitative definitions of price stability, a substantial body of research has emerged to assess the effects of an explicit numerical inflation target on inflation outcomes. The central, but not the only, questions are whether clear and consistent communication on the long-term inflation objective (a) anchors the public's long-run inflation expectations and (b) reduces inflation forecast errors.

Before discussing the research findings, a number of caveats are in order. Michael Dueker and Fischer (2006) identify various problems encountered by studies comparing inflation targeters with non-targeters. First, even if a central bank is recognized as an inflation targeter, the dating of the start of the new policy regime is often contentious. For example, Bernanke *et al.* (1999) date the start of inflation targeting (IT) regimes by the *announcement* of the target, while Laurence Ball and Niamh Sheridan (2005) date it by its

implementation. Second, the classification of inflation targeters is not always clear. Some central banks might declare themselves to be inflation targeters, but in practice lack some of the institutional features that are generally associated with inflation targeting. Others might insist that they are not inflation targeters, but share in the characteristic practices (Kenneth Kuttner 2004). Third, results seem to depend crucially on the choice of control group, which varies widely across studies.

Last, and certainly not least, there is a potentially serious endogeneity problem. Just ask yourself: Does the adoption of IT cause inflation to decline, or does high inflation cause a country to adopt IT? Another version of this question is a bit more complex. The introduction of IT can be thought of as a commitment device that changes the central bank's policy and, therefore, economic outcomes. But an alternative interpretation is that the formal adoption of IT is a manifestation of a country's intent to focus more vigorously on reducing inflation. For example, Stephen Cecchetti and Ehrmann (2002) argue that central bankers' aversion to inflation variability increased during the 1990s in many countries, including both inflation targeters and non-targeters.

Subject to these caveats, what does the evidence show? A number of studies find that IT has succeeded in anchoring inflation expectations. Various approaches appear in the literature. David R. Johnson (2003) estimates the determinants of expected inflation (π^e) in the period *prior to* the announcement of an inflation target, and then uses the estimated model to predict π^e under the IT regime. The difference between actual and predicted π^e is then taken to measure the effect of inflation targeting. He finds large reductions in the level of expected inflation in the period after the announcement of inflation targets in Australia, Canada, New Zealand, and Sweden, but not in the United Kingdom.

Another approach, adopted in Johnson (2002) and in Andrew Levin, Fabio Natalucci, and Jeremy Piger (2004), compares targeting to non-targeting countries. Controlling for country, year, trend-inflation, and business-cycle effects, Johnson detects a reduction in inflationary expectations in the IT countries but not in the control group. Levin *et al.* provide evidence that long-term inflation forecasts exhibit a highly significant correlation with a three-year moving average of lagged inflation in the control group, but not in the IT group, suggesting that the inflation-targeting central banks have successfully de-linked expectations from realized inflation.

Gürkaynak, Levin, and Swanson (2006) take a different approach to the same question. They show that long-term inflation expectations derived from index-linked bonds are less responsive to macroeconomic data releases and monetary policy announcements in Sweden and the United Kingdom, two inflation targeting countries, than they are in the United States, which has no explicit inflation objective. Table 3 reports their results for the United States. The first column shows that one-year nominal interest rates respond to the surprise component of macroeconomic releases. The second column indicates that market expectations of inflation over 10 years are also affected significantly. Gürkaynak *et al.* find similar results for the United Kingdom prior to the Bank of England's independence, as shown by the first set of results in Table 4. However, since the BoE became an independent, inflation-targeting central bank in 1998, short-term nominal rates in the UK are still responsive to macroeconomic news but long-term inflation expectations are not—indicating that expectations have been successfully anchored. Interestingly, this evidence suggests that it is not just the existence of an explicit inflation objective that matters, but also the institutional setup of the central bank.

Finally, Jansen and De Haan (2007) find evidence that communication by the ECB regarding risks to price stability (measured by the frequency and intensity of the keyword “vigilance”) reduced high-frequency inflationary expectations slightly in the second half of 2005, when a change in the ECB’s policy stance became increasingly likely.

Table 3
Responsiveness of US interest rates and inflation expectations to macroeconomic news, 1998-2005

	1-year nominal rate	Inflation compensation
Capacity Utilization	1.57 ***	0.52
Consumer Confidence	1.46 ***	0.43
core CPI	0.98	1.42 **
real GDP (advance)	2.17 **	1.77 **
Initial Jobless Claims	-1.13 ***	-0.51 **
NAPM/ISM Manufacturing	2.28 ***	1.48 **
New Home Sales	0.53	1.42 ***
Nonfarm Payrolls	4.44 ***	0.52
Retail Sales	1.69 ***	0.88
Unemployment Rate	-0.97	-0.11
Monetary Policy	0.23 **	-0.12

Source: Gürkaynak *et al.* (2006).

The coefficients denote the response of, respectively, 1-year spot nominal rates and inflation compensation (based on the different reactions between the nominal and real one-year forward rate from nine to ten years ahead) to standardized macroeconomic surprises.

***/** indicate significance at the 99%/95% level.

Table 4
Responsiveness of UK interest rates and inflation expectations to macroeconomic news

	1993-1997		1998-2005	
	1-year nominal rate	Inflation compensation	1-year nominal rate	Inflation compensation
Average Earnings	3.23 ***	0.15	1.81 ***	-0.26
Real GDP (Preliminary)	1.75	1.80 **	2.04 ***	-0.49
Manufacturing Production	0.76	0.33	1.26 ***	-0.04
Producer Price Index	2.13 ***	2.22 **	0.21	-0.22
Core Retail Price Index	2.39 ***	2.60 ***	2.60 ***	-0.76
Retail Sales	2.17 ***	-0.19	1.58 ***	-1.18 ***
Monetary Policy	0.67 ***	-0.60 ***	0.72 ***	-0.13

Source: Gürkaynak *et al.* (2006).

The coefficients denote the response of, respectively, 1-year spot nominal rates and inflation compensation (based on the different reactions between the nominal and real one-year forward rate from nine to ten years ahead) to standardized

macroeconomic surprises.

***/** indicate significance at the 99%/95% level.

These studies all suggest notable effects of inflation targeting on inflation expectations. However, other authors find that expectations are equally well anchored in their control groups, casting doubt on whether the effect identified in the previous studies is causal. Efrem Castelnuovo, Sergio Nicoletti-Altimari, and Diego Rodriguez Palenzuela (2003) find that long-term inflation expectations are well-anchored in all countries in their sample except Japan—regardless of whether the central bank has an inflation target, a quantitative definition of price stability, or no quantified target at all.

A related strand of the literature focuses on the *uncertainty of inflation forecasts* and *inflation forecast errors* rather than on the forecast itself. Ippei Fujiwara (2005) demonstrates that the publication of the Bank of Japan (BoJ)'s inflation and growth forecasts influences those of professional forecasters; in particular, the heterogeneity across forecasters decreases after the BoJ's forecast is published. Pierre Siklos (2002) reports that the adoption of an inflation target leads to lower forecast errors in a panel study of 12 countries.

But subsequent studies do not support his result. Johnson (2002) compares the standard deviation of expected inflation and the average absolute size of inflation forecast errors in a panel of 11 countries, five with inflation targets and six without, over 1984 to 2000. He finds that, when actual inflation falls, uncertainty about future inflation falls in *both* targeting and non-targeting countries. There is also little evidence that average absolute forecast errors are lower in targeting countries. These findings are in line with those of Vittorio Corbo, Oscar Landerretche, and Klaus Schmidt-Hebbel (2002), who analyze how one-step-ahead inflation forecast errors (constructed from estimated country VARs) have

evolved over time. They find that countries that adopted inflation targeting have converged to levels of accuracy similar to those observed in the control group of non-targeters.

Overall, inflationary expectations appear to be generally well anchored, and inflation forecast errors small, in IT countries. And studies of countries undergoing regime changes suggest a causal link between adopting IT and anchoring inflation expectations. However, cross-sectional comparisons yield more ambiguous results; the choice of the control group is apparently crucial. So communication of an explicit inflation target is surely not the only way to anchor expectations.

5.2 Inflation and its dynamics

Building greater trust by credibly communicating a long-term inflation objective may also affect inflation itself. Most obviously, the introduction of IT might reduce the average *level* of inflation—which was certainly the intent of the inventors of IT in New Zealand and most (if not all) of its early adopters. IT might also affect the time-series properties of inflation. If agents believe that inflation will return to its target level more quickly when it deviates from that target, then inflation should be *less persistent*. King (2002) argues that UK inflation has been lower, more stable, and less persistent since inflation targeting was introduced. In support of this argument, Kuttner and Posen (1999) report that the introduction of inflation targeting in Canada and the UK led to lower inflation; but their findings for New Zealand are more mixed.

By contrast, taking a cross-sectional perspective, Ball and Sheridan (2005) find no empirical evidence that inflation targeting improves performance once you control for regression to the mean. (High inflation tends to come down.) IT leads neither to lower levels of inflation, nor to less inflation variability, nor to less persistence. It is true that IT-adopting

countries saw their inflation levels drop after targeting began. But, controlling for the initial level of inflation, the decline is similar for targeters and non-targeters. Ball and Sheridan suggest that this finding reflects the endogeneity issue mentioned earlier: Countries that adopted IT had above-average inflation prior to adoption.

Luke Willard (2006), after dealing with the endogeneity problem in a variety of ways, supports Ball and Sheridan's conclusions. Similarly, Hu Lin and Haichun Ye (2007) study 22 industrial countries over the period 1985–1999 and address the selection problem by using a variety of recently-developed propensity score matching methods. Their main result is that inflation targeting has no significant beneficial effects on targeting countries' inflation or inflation variability. However, Marco Vega and Diego Winkelried (2005), using a similar methodology as Lin and Ye, but for a larger set of countries, do find that IT has helped reduce the level and volatility of inflation. Their results are robust to alternative definitions of treatment and control groups. Analysing ten OECD countries, Alvaro Angeriz and Philip Arestis (forthcoming) also find that IT has gone hand in hand with low inflation. However, IT was often introduced after inflation had already begun its downward trend. They also find that non-targeting countries have succeeded in achieving and maintaining low inflation, but their control group consists of only two cases: the US and the European Economic and Monetary Union.

What is to be made of these disparate results? Mishkin and Schmidt-Hebbel (2007) emphasize that a judgment on the effectiveness of inflation targeting in bringing down inflation depends crucially on the choice of the control group. In particular, IT does not appear to lead to performance superior to that of a group of successful non-targeters. The main benefit they see in inflation targeting is as a disciplinary device that helps potentially

wayward countries move closer to the performance of this successful control group.

Bernanke *et al.* (1999) even argue that inflation targets have often been adopted *after* central banks have succeeded in lowering inflation. The primary purpose is to lock in earlier disinflationary gains.

Taking a broader perspective, Antonio Fatás, Ilian Mihov, and Andrew Rose (2007) find for a sample of 42 countries over 40 years that inflation is lower in the presence of *some* quantitative target when other determinants of inflation are taken into account. According to their results, it is *quantification* that matters, not so much the exact target; inflation, exchange rate, or monetary targets are all linked to lower inflation.

Turning to *inflation persistence*, Levin *et al.* (2004) and Luca Benati (forthcoming) find it to be considerably lower—sometimes even negative! —in the presence of inflation targets. Table 5 reports estimates of inflation persistence for a number of countries, separated by monetary regimes according to Benati’s classification. It is evident that inflation persistence is particularly low under inflation targeting. But it is also low under the Bretton Woods regime.

Table 5

Measures of inflation persistence

	Canada		Sweden		New Zealand		UK	
	ρ	90% confidence interval	ρ	90% confidence interval	ρ	90% confidence interval	ρ	90% confidence interval
Interwar period	0.59	[0.38;0.80]	0.70	[0.42;1.02]	1.00	[0.68;1.05]	--	--
Bretton Woods	0.71	[0.54;0.88]	0.29	[-0.01;0.58]	0.29	[0.03;0.55]	--	--
1971 to inflation targeting	0.90	[0.72;1.04]	0.52	[0.12;1.02]	0.82	[0.68;1.01]	0.78	[0.62;0.98]
Inflation Targeting	-0.33	[-0.76;0.14]	0.36	[-0.11;0.92]	0.41	[0.00;0.86]	-0.13	[-0.45;0.18]

Source: Benati (forthcoming).

The parameter ρ is the sum of the autoregressive coefficients in a regression of inflation on its own lags. If the confidence interval includes a value of 1, the null hypothesis of a unit root cannot be rejected.

In conclusion, the evidence suggests that adopting an inflation target may have beneficial effects by lowering inflation, by de-linking long-run inflation expectations from

short-run data, and by reducing inflation persistence. However, these estimated benefits may reflect a kind of selectivity bias: They seem to accrue primarily to countries that succeed in stabilizing inflation. There appears to be no systematic difference in the economic performance of low-inflation countries with and without explicit inflation targets.

Accordingly, we conclude that inflation targeting is one way, but certainly not the only way, to control inflation and inflationary expectations. One clear alternative is establishing an anti-inflation track record that allows economic agents to make reasonably accurate inferences about the central bank's objectives and strategy. For example, Linda Goldberg and Michael Klein (2005) analyze the response of euro-area asset prices to US inflation news, and find that the ECB's credibility in financial markets improved after it went into its first tightening cycle.

One issue that remains open is the role of communication during a disinflation. One interesting comparison was made by Michael Bordo, Christopher Erceg, Levin, and Ryan Michaels (2007), who show in three U.S. disinflation episodes that it is particularly important for a central bank to communicate an aggressive policy stance, if it starts with relatively low credibility. It would be nice to know whether the introduction of an inflation target can facilitate the disinflation process under these circumstances, and what alternatives a central bank should (and should not) consider.

6. Assessment and issues for future research

To what extent, then, is central bank communication a useful instrument for policy makers? In 2001, Blinder *et al.* (p. 9) wrote: "To date, there is no research to report on." Since then, there has been a veritable explosion of research on central bank communication. While the evidence reviewed here is not entirely one-sided, it seems safe to conclude that

communication can be an important and powerful part of the central bank's toolkit since it has the ability to move financial markets, to improve the predictability of monetary policy, and the potential to help the monetary authorities achieve macroeconomic objectives such as low and stable inflation.

More specifically, our review of the rapidly-growing empirical literature, virtually all of which was written in this decade, suggests that:

- No consensus has yet emerged on what communication policies constitute “best practice” for central banks. Practices, in fact, differ substantially and are evolving.
- The predictability of monetary policy decisions has improved notably in many countries. With only a few exceptions, the empirical studies to date suggest that more and better central bank communication contributed to this improvement by “reducing noise.” We are tempted to call this issue “closed” but, of course, future research can always overturn a previous conclusion.
- That said, the predictability of monetary policy appears to be degraded somewhat when central banks speak with too many conflicting voices—as sometimes happens at the Federal Reserve, for example.
- What might be called “short-run” central bank communication—that is, disclosing central bank views on, e.g., the outlook for the economy and monetary policy—has a wide variety of impacts on financial markets, including on the levels and volatilities of various interest rates. Official statements, reports, and minutes appear to have the clearest and most consistent empirical effects on financial markets. The evidence on the impacts of speeches is more mixed. But

it, too, is mainly supportive of the idea that central bank communication “creates news.” The distinctions among different forms of communication merit further empirical evaluation (e.g., what works best?)..

- The limited number of studies that try to assess the directional intent of the central bank’s messages generally find that markets move in the “right” direction—that is, what used to be called “announcement effects” help the central bank rather than hinder it. But there has been relatively little such research to date. We need more evidence in order to be convinced on this point, plus further analysis of how, if at all, creating this type of directional news raises welfare.
- Regarding what might be called “long-run” central bank communication, the empirical evidence so far is largely limited to one set of questions: the effects of inflation targeting (IT) on inflation outcomes. Those are good questions, but not the only ones. So research on the links between communication and other macro variables is essential.
- For a variety of reasons, isolating clear effects of IT turns out to be harder than might be expected. But there is clear evidence that IT helps anchor inflationary expectations. (However, it is not the only way to do so.) The evidence that adopting IT leads to lower or less variable inflation is far less compelling. On such questions, the choice of the control groups seems to be critical.

This list of research findings constitutes a quantum leap over what we knew at the start of the decade, which was almost nothing. But there is a lot more to learn. For example, the publication of projected paths for the central bank’s policy rate appears to be the “new

frontier” in central bank communication. But it has been practiced in so few countries for so few years that we have little empirical knowledge of its effects as yet. As more data accumulates, this should be a high-priority area for future research.

Another important, but barely explored issue is what constitutes “optimal” communication policy, and how that depends on the institutional environment in which a central bank operates, the nature of its decisionmaking process, and the structure of its monetary policy committee. For example, the Bank of England has a committee of nine members who are individually accountable, while both the FOMC and the ECB Governing Council are larger committees with group accountability, and the Reserve Bank of New Zealand still has a single decisionmaker. Central banks need to tailor their communication strategies to these and other institutional features. Research on that important topic has barely begun.

Finally, virtually all the research to date has focused on central bank communication with the financial markets. It may be time to pay some attention to communication with the general public. Admittedly, studying communication with the general public will pose new challenges to researchers—not least because financial market prices will be less relevant. But the issues are at least as important. In the end, it is the general public that gives central banks their democratic legitimacy, and hence their independence.

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