

THE MONETARY TRANSMISSION MECHANISM: SOME ANSWERS AND FURTHER QUESTIONS

INTRODUCTION

What are the mechanisms through which Federal Reserve policy affects the economy? And has financial innovation in recent years affected the monetary transmission mechanism, either by changing the overall impact of policy or by altering the channels through which it operates? These were the questions examined by the conference Financial Innovation and Monetary Transmission, sponsored by the Federal Reserve Bank of New York on April 5 and 6, 2001.¹ Our goal in this overview is to summarize the conference papers and distill from them some tentative answers to the questions posed at the outset.

The overall conclusion drawn from the research presented is that monetary policy appears to have less of an impact on real activity than it once had—but the *cause* of that change remains an open issue. The conference papers explored three hypotheses en route to that finding. First, the transmission mechanism may have changed as a result of the financial innovations that motivated the conference, such as the growth of securitization, shifts between sources of financing for residential investment, or changes in the strength of wealth effects. Second, a change in the conduct of monetary policy may explain what *appears* to be a change in the effectiveness of policy. Finally, the fundamental structural changes affecting the economy's stability (and by implication, monetary transmission) may be nonfinancial in nature. Also emerging

from the discussions was the consensus that a useful area for future research is to determine more precisely the role of each hypothesis in the evolution of the monetary transmission mechanism.

Negative findings are often as informative as positive ones, however, and the conference succeeded in identifying three areas where financial innovation has left the monetary transmission mechanism largely unchanged. The first of these areas is the reserves market, which has changed profoundly in recent years as lower reserve requirements, higher vault cash holdings, and innovations such as sweep accounts have dramatically reduced the size of aggregate reserve balances. Yet despite these changes, the Fed has retained its ability to influence overnight interest rates—and indeed has generally succeeded in keeping the effective federal funds rate closer to its target than in years past. Changes in the reserves market therefore may have had a significant effect on the day-to-day *implementation* of policy, but they have not diminished the Trading Desk's leverage over short-term interest rates. Second, there is no evidence to suggest that the quantitative importance of the wealth channel has changed much in recent years. Its contribution to the impact of monetary policy has always been modest, and that contribution has, if anything, decreased somewhat since 1980. Third, while the parallel trends of financial consolidation and globalization have had a dramatic impact on financial services industries, thus far the trends appear to have had no perceptible effect on monetary transmission.

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A MONETARY TRANSMISSION SCHEMA

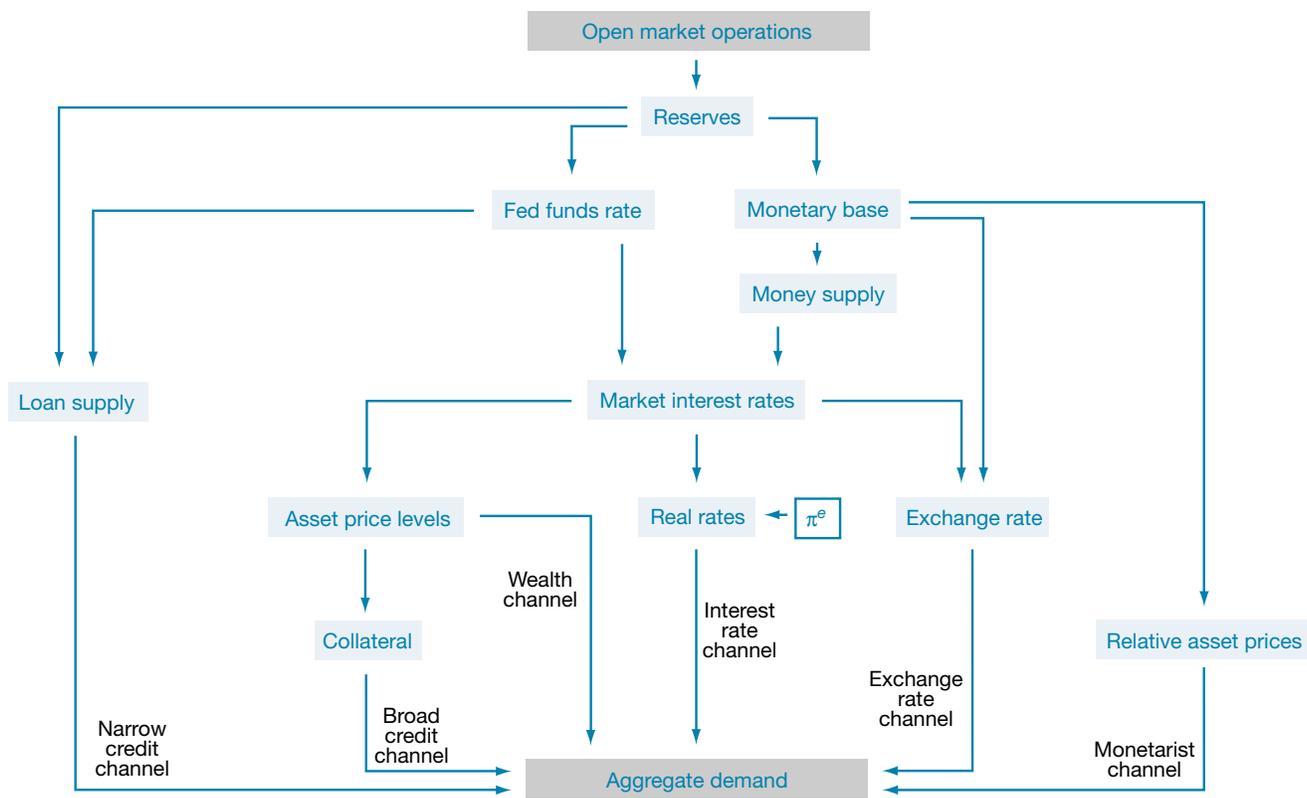
Monetary transmission is a complex and interesting topic because there is not one, but many, channels through which monetary policy operates. The exhibit depicts schematically an eclectic view of monetary policy transmission, identifying the major channels that have been distinguished in the literature.² The process begins with the transmission of open market operations to market interest rates, either through the reserves market or through the supply and demand for money more broadly. From there, transmission may proceed through any of several channels.

The *interest rate channel* is the primary mechanism at work in conventional macroeconomic models. The basic idea is straightforward: given some degree of price stickiness, an increase in nominal interest rates, for example, translates into an increase in the real rate of interest and the user cost of capital. These changes in turn lead to a postponement in consumption or a reduction in investment spending. This is precisely the mechanism embodied in conventional specifications of the “IS”

curve—whether of the “Old Keynesian” variety, or the forward-looking equations at the heart of the “New Keynesian” macro models developed by Rotemberg and Woodford (1997) and Clarida, Galí, and Gertler (1999), among others. But as Bernanke and Gertler (1995) have pointed out, the macroeconomic response to policy-induced interest rate changes is considerably larger than that implied by conventional estimates of the interest elasticities of consumption and investment. This observation suggests that mechanisms other than the narrow interest rate channel may also be at work in the transmission of monetary policy.

One such alternative path is the *wealth channel*, built on the life-cycle model of consumption developed by Ando and Modigliani (1963), in which households’ wealth is a key determinant of consumption spending. The connection to monetary policy comes via the link between interest rates and asset prices: a policy-induced interest rate increase reduces the value of long-lived assets (stocks, bonds, and real estate), shrinking households’ resources and leading to a fall in consumption.

Monetary Policy Transmission



Asset values also play an important role in the broad credit channel developed by Bernanke and Gertler (1989), but in a manner distinct from that of the wealth channel. In the broad credit channel, asset prices are especially important in that they determine the value of the collateral that firms and consumers may present when obtaining a loan. In “frictionless” credit markets, a fall in the value of borrowers’ collateral will not affect investment decisions; but in the presence of information or agency costs, declining collateral values will increase the premium borrowers must pay for external finance, which in turn will reduce consumption and investment. Thus, the impact of policy-induced changes in interest rates may be magnified through this “financial accelerator” effect.

Like the broad credit channel, the *narrow credit* or *bank lending channel* relies on credit market frictions, but in this version, banks play a more central role. This idea goes back at least to Roosa (1951) and was restated in an influential paper by Bernanke and Blinder (1988). The essential insight is that because banks rely on reservable demand deposits as an important source of funds, contractionary monetary policy, by reducing the aggregate volume of bank reserves, will reduce the availability of bank loans. Because a significant subset of firms and households relies heavily or exclusively on bank financing, a reduction in loan supply will depress aggregate spending.

The *exchange rate channel* is an important element in conventional open-economy macroeconomic models, although it is often neglected in the closed-economy models typically applied to the United States. The chain of transmission here runs from interest rates to the exchange rate via the uncovered interest rate parity condition relating interest rate differentials to expected exchange rate movements. Thus, an increase in the domestic interest rate, relative to foreign rates, would lead to a stronger currency and a reduction both in net exports and in the overall level of aggregate demand.

Finally, there is also what might be described as a *monetarist* channel—“monetarist” in the sense that it focuses on the direct effect of changes in the relative quantities of assets, rather than interest rates.³ The logic here is that because various assets are imperfect substitutes in investors’ portfolios, changes in the composition of outstanding assets brought about by monetary policy will lead to relative price changes, which in turn can have real effects. According to this view, interest rates play no special role other than as one of many relative asset prices. Although this mechanism is not part of the current generation of New Keynesian macro models, it is central to discussions of the likely effects of policy when, as in the case of Japan, there is a binding zero lower bound on nominal interest rates (see, for example, McCallum [2000]).

Needless to say, these channels are not mutually exclusive: the economy’s overall response to monetary policy will incorporate the impact of a variety of channels. In considering the possibility of changes in the transmission mechanism, however, it is useful to consider each one in turn. That is the approach taken by the papers in this volume, each of which focuses on a particular channel and the structural changes specific to it.

THREE MEASUREMENT CHALLENGES

It is a task for empirical research to assess the macroeconomic impact of the various channels of monetary transmission and to look for changes in the channels’ strength over time. Empirical work on these issues, however, immediately comes up against a number of challenges.

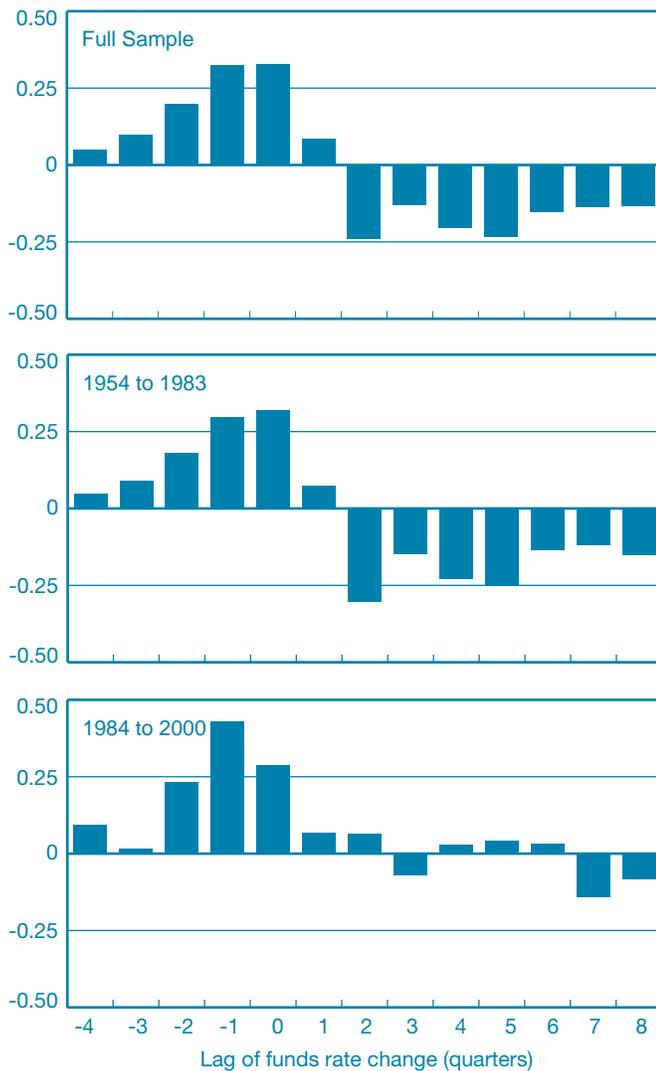
The first challenge is that of *simultaneity*. Typically, the Federal Reserve loosens policy when the economy weakens and tightens when the economy strengthens; this endogenous response of policy to economic conditions is one reason why it is difficult to identify the effects of policy. This pattern is illustrated by the correlations plotted in the top panel of the chart: over the 1954–2000 period, the correlation between real GDP and current and future (that is, negative lags of) funds rate changes is positive. This does not, of course, mean that interest rate increases are expansionary; rather, it reflects the tendency of the Fed to raise interest rates in response to unusually rapid real growth. The contractionary effect of higher rates is apparent only after a lag of two quarters, as shown by the negative correlation between GDP growth and funds rate changes lagged two quarters or more.

Even in this very simple view of the data, there is evidence that the link between policy and the economy has changed over time. Comparing the 1954–83 subsample (middle panel) with the 1984–2000 subsample (bottom panel), we note two apparent differences. First, the correlation between output growth and subsequent funds rate changes is *stronger* in the later period—evidence, perhaps, of more preemptive behavior on the part of the Fed. Second, the correlation between funds rate changes and subsequent quarters’ real GDP growth is *weaker* in the later period—near zero, in fact—lending plausibility to the notion that monetary policy has become less effective.

There is, however, an alternative explanation for the lower correlation between the funds rate and the real economy: monetary policy has actually become *more* effective in

dampening real economic fluctuations. To illustrate this point, we consider an extreme example. Suppose monetary policy could be used to offset completely any fluctuations in real GDP growth (leaving aside questions of whether this outcome is either feasible or desirable), so that GDP expanded at a constant rate. If GDP growth were completely stable, then it would not be correlated with movements in the funds rate.

Correlations between Real GDP Growth and Lagged Funds Rate Changes



Source: Authors' calculations, based on data from the U.S. Commerce Department's Bureau of Economic Analysis and the Board of Governors of the Federal Reserve System.

In the real world, of course, monetary policy did not (and *can* not) keep output growth constant, but greater success in using policy to stabilize output fluctuations could account for the decline in the correlation between GDP growth and the funds rate seen in the bottom panel of the chart. The two alternative interpretations of the chart demonstrate why the simultaneity problem creates a serious challenge for the interpretation of any changes in the observed relationship between monetary policy and the economy.

Economists have employed a variety of techniques to solve the simultaneity problem, but none is entirely satisfactory. Perhaps the most common approach, and one employed by several papers in this volume, is to use a vector autoregression (VAR) model to purge interest rate changes of systematic responses to economic activity and to focus instead on the response to exogenous monetary policy “shocks.” Typically, this is done by exploiting the presumed lag between policy and its effects on real activity, which is apparent from the chart. (Since financial markets respond immediately to policy, a nonrecursive structure is more appropriate for modeling asset prices.) However, critics of the VAR approach find it implausible that the Federal Reserve behaves randomly, and argue that the shocks really represent either model specification errors or changes in the overall policy regime.⁴ In addition, the VARs’ focus on shocks makes it hard to use them to analyze changes in the *systematic* element of monetary policy.⁵ Nonetheless, the method remains popular because it offers a straightforward solution to the simultaneity problem and appears to yield a reasonable characterization of the economy’s response to monetary policy.

Another way around the simultaneity problem is to use economic models with an explicit theoretical foundation, calibrated in such a way as to approximate the behavior of the economy.⁶ This approach, employed by two of the conference papers, is much more amenable to the analysis of the types of “what if” counterfactuals that arise in the context of investigating the transmission mechanism. Even these models, however, ultimately rely on estimates of economic parameters, and the simultaneity issue must be confronted at this stage. Hence, calibrated theory-based models are a useful complement to econometric models like VARs but cannot altogether substitute for them.

Microeconomic approaches offer yet another way to circumvent the simultaneity problem, but these too are fraught with difficulties. Firm-level studies, for example, have been used to estimate the interest and cash flow sensitivities of investment spending and thereby assess the strength of the interest rate and broad credit channels. By relying on cross-

sectional or within-firm differences in the user cost of capital, they eliminate the macro-level simultaneity problem described above. But firms' financing decisions can affect the user cost, and this introduces a degree of micro-level endogeneity that can complicate the interpretation of the results. The microeconomic approach has also been effectively deployed in assessing the bank lending channel, notably by Kashyap and Stein (2000). But here too micro-level endogeneity can be a problem, particularly when relationships with banks' other choice variables, such as holdings of liquid assets, are involved. Furthermore, with any micro study, extrapolating from micro-level results to macro-level effects will inevitably depend on assumptions about the response of market participants. A disproportionate impact of monetary policy on a particular group of firms, for example, will have no macro effect if other firms in the economy are able to "take up the slack." Ultimately, cross-sectional studies using micro data are probably more informative about the micro-level *distribution* of responses than they are about the overall macroeconomic impact.

The second challenge in assessing the strength of any particular channel of monetary transmission comes from the concurrent operation of multiple channels. For example, because we typically observe a fall in both output *and* bank lending after a policy-induced increase in interest rates, it is hard to tell how much of the loan decline to attribute to a decline in loan demand (resulting from the interest rate increase) and how much to the reduction in loan supply implied by the bank lending channel. An analogous problem confronts attempts to assess the strength of the wealth channel. A common, if not entirely satisfactory, solution to this problem is to compare policy's estimated effect with its impact, with the channel in question econometrically "turned off." If the remaining equations are assumed to be unchanged by this intervention, then the difference between the two responses can be interpreted as a gauge of the channel's contribution.

Adding to these two challenges is the problem of isolating a change in the strength of the channels of monetary transmission. This problem is particularly daunting for a number of the studies in this volume, thanks to the evolutionary nature of the changes under consideration. Changes in the use of securitization, the disintermediation of credit formation, households' equity holdings, and the financing of residential investment have all proceeded gradually, as has the consolidation in the financial services industry. Consequently, their effects on the transmission mechanism, if any, will only become evident over relatively long periods of time. Unfortunately, standard statistical

methods for detecting structural change work best for distinct, abrupt events, such as the October 1979 shift in Fed operating procedures or the oil shock of late 1973. Structural changes in the monetary transmission mechanism have tended to be more evolutionary; moreover, many of these changes have occurred concurrently, making it even more difficult to separate out their effects cleanly. Therefore, the scope for formal tests of structural change is rather limited, and the studies in this volume instead tend to emphasize assessments of the economic (as opposed to statistical) significance of the changes.

SURVEY AND SYNTHESIS

Taken together, the papers presented indicate that there have indeed been significant changes in the linkages between the basic instrument of monetary policy—reserves—and macroeconomic outcomes. But these changes do not necessarily imply a change in the efficacy of policy. Reasons for these changes can be found at two stages: first, in the linkages between reserves and interest rates (the top half of the exhibit) and second, in the connection between interest rates and economic activity.

From Reserves to Interest Rates

The epicenter of monetary policy in the United States is the reserves market: it is here that the overnight interest rate targeted by the Fed is determined and open market operations have their impact. Sandra Krieger's contribution to the volume provides an overview of some of the changes that have taken place in this market in recent years, and in particular, the declining volume of reserve balances and the diminishing reliance on open market operations to effect rate changes. Reasons for the decline in reserve balances include the decline in required reserves as well as the adoption of "sweep accounts" in the mid-1990s. In their paper, Paul Bennett and Stavros Peristiani show that one side effect of these trends is that reserve requirements are no longer binding for many banks, and that this has weakened the link between the fed funds rate and banks' desired reserve balances.

The implications of these changes for the link between open market operations and interest rates are documented empirically by Selva Demiralp and Oscar Jordá. Their main finding is that prior to 1994, changes in the fed funds target

were accompanied by systematic patterns in open market operations. These patterns are no longer evident after 1994, yet the effective federal funds rate seems to track its target more closely than it did in the past. Meanwhile, the timing of announced policy changes seems to have become a factor in the response of term interest rates. From this evidence, Demiralp and Jordá conclude that “announcement effects” have taken on increased importance in recent years. These findings challenge the conventional view that open market operations are central to the implementation of policy changes, but they are consistent with Krieger’s description of the process.

Observing these trends, one could argue that the trends’ continuation could eventually undermine altogether the Fed’s leverage over interest rates. Contributions by Michael Woodford and by Marvin Goodfriend address this possibility at a conceptual level. Each paper starts with the observation that recent innovations to reserve management have decreased the demand for the level of reserves, and that this may eventually create some technical difficulties for Desk operations. Neither author sees these innovations as a fundamental threat to the Fed’s ability to influence interest rates, however, and both note that further erosion in reserve demand could easily be offset by changes to Desk operating procedures. Based on other central banks’ experience, Woodford suggests that a “corridor” system with interest-bearing reserves and a Lombard-style lending facility would effectively solve any foreseeable problems created by the further evaporation in reserve demand. Goodfriend’s proposal also involves interest-bearing reserves, but differs from Woodford’s by envisioning an expansion in the level of reserves sufficient to satiate the market. The result would be a system that, in theory, allows for separate control over both the overnight interest rate and the quantity of bank reserves.

Interest Rates and Output

The relationship between the Federal Reserve’s target federal funds rate and the behavior of the macroeconomy is the subject tackled by another group of papers. The volatility of real GDP has declined markedly since the mid-1980s, as documented by McConnell and Perez-Quiros (2000). In this volume, Jean Boivin and Marc Giannoni show that the economy’s response to monetary policy also appears to have declined over roughly the same period.⁷ What was responsible for these changes? Are changes in the transmission mechanism responsible, or were they brought about by a change in the conduct of monetary policy? Or was the cause perhaps some other structural change

in the economy, such as an innovation in firms’ management of inventories with monetary policy passively responding?

In thinking about this question, it is useful to recall the Frisch (1933) distinction between *shocks* and *propagation*: a change in volatility may come about either because the size of the shocks has diminished or because of weaker propagation. Monetary *transmission* can be thought of as encompassing the various ways in which monetary policy shocks propagate through the economy. But monetary *policy* is more than just a source of shocks: the systematic response of policy to macroeconomic conditions also affects the propagation of monetary (and other) shocks. A more strongly countercyclical policy, for example, will attenuate the impact of shocks on output.

Boivin and Giannoni address this “shocks-versus-propagation” issue directly, using a VAR analysis to assess the effects of the reduced size of monetary shocks, changes in monetary propagation, and other changes in the economic environment. They find that the variance of monetary policy shocks has indeed declined sharply since the early 1980s, but this decline cannot account for the reduced volatility of output. Instead, a change in the systematic response of policy to macroeconomic conditions (a greater degree of “leaning against the wind”) seems to account for most of the diminished response to the shocks in their VAR. By implication, this finding casts doubt on nonpolicy explanations for the attenuation.⁸

Monetary policy is not the *only* factor in the propagation of shocks, of course; other changes in the economic environment may be at work as well. James Kahn, Margaret McConnell, and Gabriel Perez-Quiros analyze the possible role of inventories, which have historically been a major contributor to macroeconomic volatility. The authors’ hypothesis is that better inventory management, which has been made possible by improvements in information technology, has attenuated the propagation of demand shocks through inventories. Specifically, the technology has allowed firms to anticipate sales fluctuations better, so that production responds more quickly—but less sharply—to sales fluctuations. Using simulations of a small equilibrium model, the authors show that such a change in inventory behavior can account for the observed behavior of output and inventories, whereas a change in the monetary policy rule cannot. These results stand in contrast to those of Boivin and Giannoni, who ascribe a greater role for monetary policy. The sharp differences in the papers’ findings exemplify the difficulties in measuring and testing for changes in the transmission mechanism discussed earlier. Further research using a framework that nests the two papers’ approaches is needed to resolve this issue.

Financial Intermediation

In the past twenty years, a number of significant regulatory and structural changes in the financial system have affected monetary policy transmission. Regulatory changes—such as the repeal of Regulation Q in the early 1980s and the bank capital requirements mandated by the Basle Accord in 1988 and the Federal Deposit Insurance Corporation Improvement Act in 1991—dramatically altered the incentives and the ability of banks to lend as policy changed. Moreover, the steady diminution of banks' role in credit formation in the United States—both via direct borrowing in financial markets and via securitization of financial institution assets—has been associated with increased competition in many lending markets and has increased the importance of the price of credit in the transmission mechanism. While most of the regulatory and structural changes have reduced the importance of outright credit rationing, their overall impact on the transmission mechanism remains an open question.

Several papers in this volume consider the role of financial intermediation in the transmission of monetary policy. In one, Cara Lown and Donald Morgan directly examine the role of bank lending standards to businesses as a determinant of real economic activity, and provide new evidence on banks' relevance to the transmission mechanism. Using a VAR approach, they find that lending standards have important predictive power for both loan volume and economic output. These results provide strong support for the view that shocks to bank *lending* are important, but because monetary policy has little effect on lending standards, they give less support for the bank lending channel as a central part of the transmission mechanism. Lown and Morgan do, however, find that when lending standards are added to the VAR model, they partially displace monetary policy shocks in predicting real economic activity. The authors hypothesize that this result reflects policymakers' use of "moral suasion" to reduce credit formation during periods of monetary policy tightening. The use of moral suasion has become less common in recent years, however, raising the question whether lending standards will continue to predict economic activity going forward; tentative results for the 1990s, however, suggest that standards have retained their predictive power. This raises the possibility that bank lending standards may be a proxy for broader credit conditions at other financial institutions and in financial markets. If so, then the continued predictive content of standards is somewhat less surprising.

The effects of securitization are examined by Arturo Estrella, who considers the degree to which asset securitization—and mortgage securitization in particular—have affected the

transmission mechanisms of monetary policy. Using an estimated structural IS equation, he finds that the sensitivity of both real output and housing investment to the real federal funds rate declined significantly as the degree of asset securitization increased in the 1980s and 1990s. Because the sensitivity of mortgage interest rates to fed funds changes has, if anything, increased, he suggests that securitization has largely affected those channels not directly related to interest rates, such as the bank lending or credit channels.

Jonathan McCarthy and Richard Peach also study securitization's effects, but they focus more directly on the housing market, using a structural model of housing investment to examine how regulatory changes and other innovations in housing finance have affected the transmission of policy shocks to housing investment. Like Estrella, they find that interest rates—as opposed to quantity constraints—have taken on a larger role since the dismantling of Regulation Q and the shift from thrift-based intermediation to a more market-oriented system of housing finance. Perhaps as a consequence of these changes, mortgage interest rates now respond more quickly to monetary policy than they did prior to 1986. Residential investment, however, responds more *slowly*, and now fluctuates more or less concurrently with the overall level of economic activity. An important implication of the McCarthy-Peach paper is that the housing sector is no longer in the vanguard of monetary transmission.

Skander Van den Heuvel and William English are more forward-looking in their outlooks. The authors focus on two factors—bank capital requirements and consolidation in the financial services industry, respectively—that may well have significant effects on the transmission mechanism, but have received little attention from researchers to date. English discusses how the inexorable trend toward consolidation in the financial industry might affect both the implementation and the transmission of monetary policy. He zeroes in on the ways in which consolidation might undermine central banks' ability to implement monetary policy and how the size and timing of policy's effects may change as the financial system becomes increasingly dominated by a small number of very large institutions. These concerns appear to be largely unwarranted, at least at present. A recent collaborative study by the Group of Ten central banks, summarized by English, suggests that financial consolidation has thus far had small effects on the implementation of policy and virtually no effect on the transmission of policy changes through the financial system.

Van den Heuvel probes the role of bank capital and capital requirements in the transmission mechanism, and proposes a "bank capital" channel of monetary policy. This channel is related to the bank lending channel described above in that it

involves policy-induced changes in bank loan supply. Instead of viewing bank reserves as the relevant binding constraint, however, it emphasizes the role of banks' capital structure in shaping the response of policy-induced interest rate changes. Because poorly capitalized banks are less likely to lend than well-capitalized institutions, the macroeconomic impact of policy's effects through the bank capital channel will depend on both the distribution and the level of bank capital ratios when the policy change occurs. Bank capital requirements may therefore interact with monetary policy in subtle and hard-to-predict ways. Moreover, to the extent that it affects banks' exposure to interest rate risk, the maturity distribution of bank assets will also affect the transmission of policy.

The Role of Asset Prices

The transmission of monetary policy through asset prices is analyzed from two different angles. Sydney Ludvigson, Charles Steindel, and Martin Lettau scrutinize the empirical basis for the wealth channel in the United States; Kosuke Aoki, James Proudman, and Gertjan Vlieghe also analyze the role of wealth in monetary transmission, but in the context of the broad credit channel.

Using a structural VAR model, Ludvigson, Steindel, and Lettau examine the response to federal funds rate shocks; to assess the strength of the wealth channel, they compare the estimated impact on consumption with the impact assuming no response of asset prices. The authors find only small differences in the response of consumption, and conclude from this that the wealth channel is weak—much weaker than it is in conventional structural macro models. In fact, their evidence suggests that the wealth channel is slightly weaker now than it was in the 1960s and 1970s, despite the growing importance of equities in households' portfolios. The reason for this may be attributed to the transitory nature of asset values' response to funds rate shocks and the fact that consumption responds strongly only to more permanent changes in wealth. The Ludvigson-Steindel-Lettau findings suggest that rather than a causal link from monetary policy to consumption by way of asset prices, the apparent relationship between the three variables may reflect the simultaneous response of asset values and monetary policy to common, underlying inflation pressures.

In their study, Aoki, Proudman, and Vlieghe assess the impact of monetary policy on the real economy through its effect on housing prices, using a variant of the financial accelerator model developed by Bernanke, Gertler, and

Gilchrist (1999) calibrated to U.K. data. The Aoki-Proudman-Vlieghe model indicates that policy-induced changes in house prices have in fact played a significant role in the transmission of monetary policy in the United Kingdom. The authors also find that recent financial innovations, such as more flexible refinancing terms and increased consumer access to unsecured credit, may have altered the transmission mechanism via housing prices. Easier access to housing collateral in particular has raised the sensitivity of consumption to house prices and policy shocks, while increased access to credit cards has weakened the link. Overall, the paper concludes that monetary policy shocks now have smaller effects on housing investment and housing prices in the United Kingdom, but slightly larger effects on consumption.

CONCLUSIONS AND OPEN QUESTIONS

A number of broad policy conclusions can be drawn from the papers collected in this volume:

- Monetary policy's effects appear to be somewhat weaker than they were in past decades. Financial innovation is one possible cause of this change, but not the only one: improved inventory management and the conduct of monetary policy itself are others.
- Thanks to financial innovation and institutional changes in housing finance, the housing sector is no longer on the leading edge of the transmission mechanism. However, judging from the evidence presented for the United Kingdom, the role of housing assets on households' balance sheets warrants further study.
- Neither financial consolidation nor the shrinking reserve volume appears to be a major factor affecting monetary transmission—at least not yet.

Some loose ends and lacunae remain, however. First, although monetary policy seems to have retained its effectiveness, the economy's sensitivity to interest rates remains an open question. A comparison of the Estrella and Boivin-Giannoni papers illustrates this issue. Both find that the response of real activity to interest rates has diminished, Estrella using a "structural" IS equation and Boivin and Giannoni in the context of a monetary VAR. Estrella attributes this to a change in intermediation brought about by securitization, and as Kahn, McConnell, and Perez-Quiros suggest, improved inventory management may also have played a role. Yet as Boivin and Giannoni show, the diminished response may result not from less sensitivity to interest rates per se, but

from the endogenous reaction of monetary policy. We thus return to the simultaneity question: how is it possible to isolate the effect of interest rates on economic conditions when interest rates are themselves a function of economic conditions?

Second, given the decline in the relative importance of banking, the corresponding growth in securitized lending described by Estrella resists easy explanation, as do the changes in housing finance documented by McCarthy and Peach and the durability of the predictive content of bank lending standards shown by Lown and Morgan.

Third, the absence of attention to an open-economy channel running through the exchange rate is an important lacuna. The omission does not mean that this channel is

unimportant; indeed, movements in net exports have played an increasingly large role in U.S. macroeconomic fluctuations. But a firm connection between economic fundamentals and short-run exchange rate movements continues to elude researchers, and this has frustrated efforts to pin down the exchange rate channel empirically.⁹

These are, of course, not the only questions left unanswered by the research presented at this conference, and the evolution of the economy and the financial system is sure to raise new questions. Consequently, the monetary transmission mechanism will continue to be an important and fruitful area for future research.

ENDNOTES

1. The contents of this volume are also available at www.newyorkfed.org/rmaghome/econ_pol/2002/.
2. A similar description of the channels of monetary transmission appears in Mishkin (1995).
3. Meltzer (1995) summarizes this viewpoint. This monetarist channel is similar in spirit, but considerably more sophisticated than the earlier strand of monetarist thought based on the equation of exchange, $MV=PY$.
4. Cochrane (1994) and Rudebusch (1998), among others, have made these points.
5. Hard, but not impossible: see Boivin and Giannoni (2002b), Bernanke, Gertler, and Watson (1997), and Sims and Zha (1995). Hoover and Jordá (2001) provide a review and propose an alternative method for assessing the effects of systematic policy.
6. The most commonly used models for this purpose are the New Keynesian variety, such as those based on Rotemberg and Woodford (1997) and Clarida, Gali, and Gertler (1999).
7. The decline in the response of output to monetary policy is also documented by Taylor (1995), who uses an estimated structural model of the economy.
8. In a separate paper, Boivin and Giannoni (2002a) consider non-policy sources of structural change more rigorously, but find that the sources fail to provide a satisfactory explanation for the observed change in the economy's behavior.
9. See, for example, Flood and Rose (1995, 1999) and Kuttner and Posen (2001).

REFERENCES

- Ando, Albert, and Franco Modigliani.* 1963. "The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests." *AMERICAN ECONOMIC REVIEW* 53, no. 1: 55-84.
- Bernanke, Ben S., and Alan S. Blinder.* 1988. "Credit, Money, and Aggregate Demand." *AMERICAN ECONOMIC REVIEW* 78, no. 2 (May): 435-9. Papers and Proceedings of the 100th Annual Meeting of the American Economic Association.
- Bernanke, Ben S., and Mark Gertler.* 1989. "Agency Costs, Net Worth, and Business Fluctuations." *AMERICAN ECONOMIC REVIEW* 79, no. 1 (March): 14-31.
- . 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." *JOURNAL OF ECONOMIC PERSPECTIVES* 9, no. 4 (fall): 27-48.
- Bernanke, Ben S., Mark Gertler, and Simon Gilchrist.* 1999. "The Financial Accelerator in a Quantitative Business Cycle Framework." In John B. Taylor and Michael J. Woodford, eds., *HANDBOOK OF MACROECONOMICS*. Amsterdam: Elsevier.
- Bernanke, Ben S., Mark Gertler, and Mark W. Watson.* 1997. "Systematic Monetary Policy and the Effects of Oil Price Shocks." *BROOKINGS PAPERS ON ECONOMIC ACTIVITY*, no. 1: 91-142.
- Boivin, Jean, and Marc Giannoni.* 2002a. "Has Monetary Policy Become Less Powerful?" Federal Reserve Bank of New York *STAFF REPORTS*, no. 144, March.
- . 2002b. "Assessing Changes in the Monetary Transmission Mechanism: A VAR Approach." Federal Reserve Bank of New York *ECONOMIC POLICY REVIEW* 8, no. 1 (May): 97-111.
- Clarida, Richard, Jordi Galí, and Mark Gertler.* 1999. "The Science of Monetary Policy: A New Keynesian Perspective." *JOURNAL OF ECONOMIC LITERATURE* 37, no. 4 (December): 1661-1707.
- Cochrane, John H.* 1994. "Shocks." *CARNEGIE-ROCHESTER CONFERENCE SERIES ON PUBLIC POLICY* 41 (December): 295-364.
- Flood, Robert, and Andrew Rose.* 1995. "Fixing Exchange Rates: A Virtual Quest for Fundamentals." *JOURNAL OF MONETARY ECONOMICS* 36, no. 1: 3-37.
- . 1999. "Understanding Exchange Rate Volatility without the Contrivance of Macroeconomics." *ECONOMIC JOURNAL* 109 (November): F660-72.
- Frisch, Ragnar.* 1933. "Propagation Problems and Impulse Problems in Dynamic Economies." In *ECONOMIC ESSAYS IN HONOR OF GUSTAV CASSEL*. London: Allen and Unwin.
- Hoover, Kevin, and Oscar Jordá.* 2001. "Measuring Systematic Monetary Policy." Federal Reserve Bank of St. Louis *REVIEW* 83 (July/August): 113-37.
- Kashyap, Anil K., and Jeremy C. Stein.* 2000. "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" *AMERICAN ECONOMIC REVIEW* 90, no. 3 (June): 407-28.
- Kuttner, Kenneth N., and Adam S. Posen.* 2001. "Inflation, Monetary Transparency, and G-3 Exchange Rate Volatility." In M. Balling, E. Hennessy, and E. Hochreiter, eds., *ADAPTING TO FINANCIAL GLOBALIZATION*, 229-58. London: Routledge.
- McCallum, Bennett S.* 2000. "Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates." *JOURNAL OF MONEY, CREDIT, AND BANKING* 32, no. 4: 870-904.
- McConnell, Margaret M., and Gabriel Perez-Quiros.* 2000. "Output Fluctuations in the United States: What Has Changed since the Early 1980s?" *AMERICAN ECONOMIC REVIEW* 90, no. 5 (December): 1464-76.
- Meltzer, Allan H.* 1995. "Monetary, Credit and (Other) Transmission Processes: A Monetarist Perspective." *JOURNAL OF ECONOMIC PERSPECTIVES* 9, no. 4 (fall): 49-72.
- Mishkin, Frederic S.* 1995. "Symposium on the Monetary Transmission Mechanism." *JOURNAL OF ECONOMIC PERSPECTIVES* 9, no. 4 (fall): 3-10.
- Roosa, Robert V.* 1951. "Interest Rates and the Central Bank." In *MONEY, TRADE, AND ECONOMIC GROWTH: IN HONOR OF JOHN HENRY WILLIAMS*, 270-95. New York: Macmillan.

REFERENCES (CONTINUED)

Rotemberg, Julio J., and Michael Woodford. 1997. "An Optimization-Based Econometric Framework for the Evaluation of Monetary Policy." In Ben S. Bernanke and Julio J. Rotemberg, eds., *NBER MACROECONOMICS ANNUAL 1997*, 298-361. Cambridge: MIT Press.

Rudebusch, Glenn D. 1998. "Do Measures of Monetary Policy in a VAR Make Sense?" *INTERNATIONAL ECONOMIC REVIEW* 39, no. 4 (November): 907-31.

Sims, Christopher A., and Tao Zha. 1995. "Does Monetary Policy Generate Recessions?" Unpublished paper, Yale University.

Taylor, John B. 1995. "The Monetary Transmission Mechanism: An Empirical Framework." *JOURNAL OF ECONOMIC PERSPECTIVES* 9, no. 4 (fall): 11-26.

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