

The monetary transmission mechanism in the United States: some answers and further questions

Kenneth N Kuttner and Patricia C Mosser,¹
Federal Reserve Bank of New York

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 are the questions which were addressed by a conference on “Financial Innovation and Monetary Transmission” sponsored by the Federal Reserve Bank of New York on 5 and 6 April 2001.² The goal of this article is to provide a general summary of the papers presented at that conference, and to distil from those papers some tentative answers to the questions posed at the outset.

The overall conclusion to be drawn from the research is that the impact of monetary policy on real activity appears to be less than it once was - but the *cause* of that change remains an open issue. The conference papers considered three possibilities. The first candidate explanation attributes changes in the linkage to the financial innovations that motivated the conference, such as the growth of securitisation, shifts between sources of financing for residential investment, or changes in the strength of wealth effects. But this is not the only possibility: other papers considered the hypothesis that a change in the conduct of monetary policy can explain what *appears* to be a change in the effectiveness of policy. A third hypothesis considered is that the fundamental structural changes affecting the economy’s stability (and by implication, monetary transmission) are non-financial in nature. Research supportive of each of these three hypotheses was presented at the conference, suggesting that a useful area for future research will be to determine more precisely the role each has played 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 is the reserves market, which has changed profoundly in recent years. Yet in spite of these changes, the Fed has retained its ability to influence overnight interest rates - and indeed has actually become more accurate in hitting the Fed funds target. Changes in the reserves market therefore may have had an effect on the day-to-day *implementation* of policy, but they have not diminished the 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. And third, while the parallel trends of financial consolidation and globalisation have had a dramatic impact on financial services industries, the trends appear to have had no perceptible effect on monetary transmission.

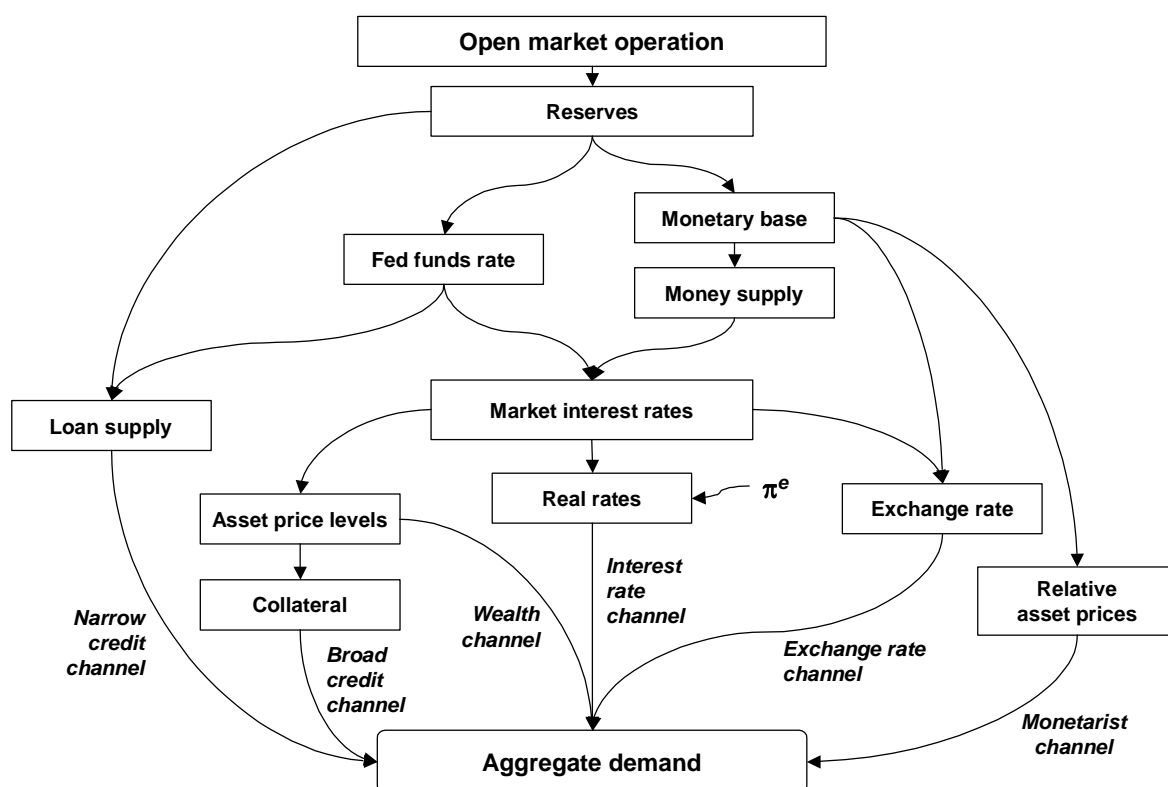
¹ Research Department, Federal Reserve Bank of New York, 33 Liberty Street, New York, NY 10045. E-mail: kenneth.kuttner@ny.frb.org and patricia.mosser@ny.frb.org. The views expressed here are solely those of the authors, and not necessarily those of the Federal Reserve Bank of New York or the Federal Reserve System.

² The papers are available online from http://www.newyorkfed.org/rmaghome/econ_pol/2002/, and will be published in a forthcoming issue of the Federal Reserve Bank of New York *Economic Policy Review*.

A taxonomy of transmission channels

What makes monetary transmission a complex and interesting topic is the fact that there is not one, but many channels through which monetary policy operates. Figure 1 depicts schematically an eclectic view of monetary policy transmission, identifying the major channels that have been distinguished in the literature.³ 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 one (or more) of the following channels.

Figure 1
Schematic view of monetary transmission



The *interest rate channel* is the primary mechanism at work in conventional macro models. The basic idea is straightforward: given some degree of price stickiness, an increase in the nominal interest rates (for example) translates into an increase in the real rate of interest and the user cost of capital. These changes lead in turn to a postponement of consumption, or a reduction of 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 et al (1999), among others. But as Bernanke and Gertler (1995) 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.

³ A similar description of the channels of monetary transmission appears in Mishkin (1995).

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 rates increase reduces the value of long-lived assets (stocks, bonds and real estate), shrinking households' resources and leading to a fall in consumption.

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 will in turn 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. And because a significant subset of firms and households rely 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 (UIP) 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 in net exports and a reduction 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.⁴ The logic 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. In this view, interest rates play no special role, other than as one of many relative asset prices. Although this mechanism is not a 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 eg McCallum (2000)).

Three measurement challenges

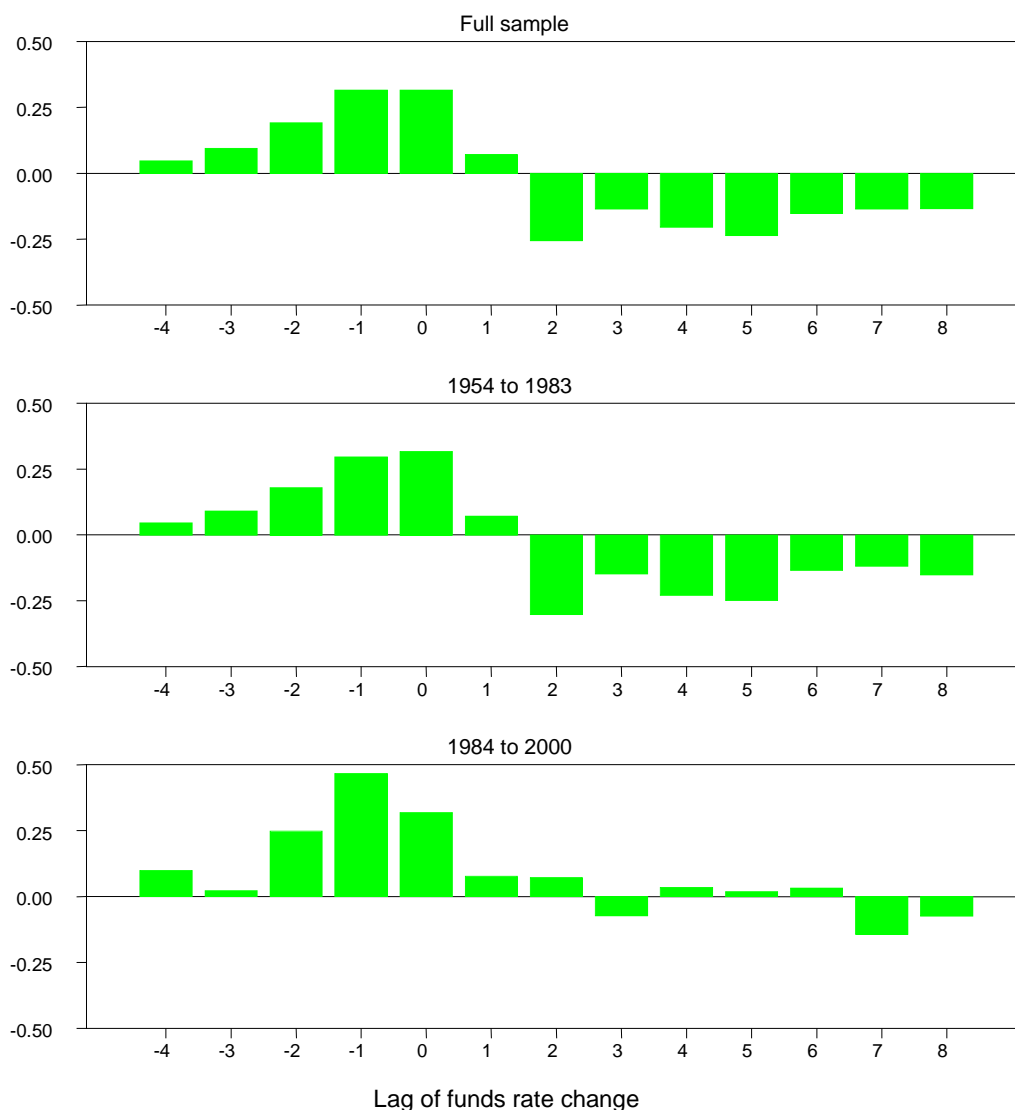
Having categorised the various channels of monetary transmission, it is a task for empirical research to assess the macroeconomic impact of each channel, and to look for changes in the channels' strength over time. Empirical work addressing these questions immediately comes up against a number of challenges, however.

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 what makes it difficult to identify the effects of policy. This pattern is illustrated by the correlations plotted in the top panel of Figure 2: over the 1954-2000 period, the correlation between real GDP and current and future (ie negative lags of) funds rate changes is positive. This does not, of course, mean that interest rate increases are expansionary; rather it reflects

⁴ Meltzer (1995) summarises this viewpoint. This monetarist channel is similar in spirit to, but considerably more sophisticated than, the earlier strand of monetarist thought based on the equation of exchange, $MV = PY$.

the tendency for the Fed to raise interest rates in response to unusually rapid real growth. The contractionary effect of higher rates is only apparent after a lag of two quarters, as shown by the negative correlation between GDP growth and funds rate changes lagged two quarters or more.

Figure 2
Correlations between real GDP growth and lagged funds rate changes



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 (centre panel) to the 1984-2000 subsample (bottom panel), two differences are apparent. First, the correlation between output growth and subsequent funds rate changes is *stronger* in the later period than in the earlier period - evidence, perhaps, of more pre-emptive behaviour on the part of the Fed. And second, the correlation between funds rate changes and subsequent quarters' real GDP growth is *weaker* in the latter period - near zero, in fact - raising the provocative possibility that monetary policy has become ineffective. But an alternative explanation is that monetary policy has actually become *more* effective in dampening real economic fluctuations. (After all, if policy managed to completely eliminate any variation in the pace of economic activity, the correlation between the funds rate and real GDP growth would be zero.) Thus, 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 of them is entirely satisfactory. Perhaps the most common approach, and one employed by several papers at the conference, is to use a vector autoregression (VAR) model to purge interest rate changes of systematic responses to economic activity, and 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 in Figure 2. (Since financial markets respond immediately to policy, a non-recursive structure is more appropriate for modelling 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.⁵ In addition, the VARs’ focus on shocks makes it hard to use them to analyse changes in the *systematic* element of monetary policy.⁶ Nonetheless, the method remains popular because it offers a straightforward solution to the simultaneity problem, and appears to yield a reasonable characterisation 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 behaviour of the economy.⁷ This approach, which was employed by two conference papers, is much more amenable to the analysis of the sorts of “what if” counterfactuals that come up 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 results’ interpretation. 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, like 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 how other firms or banks respond in equilibrium. Ultimately, these sorts of studies may therefore be more informative about the micro-level *distribution* of responses than they are on the overall macroeconomic impact.

The second challenge to 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 what share of the output 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 to its impact with the channel in question econometrically “turned off”. If the remaining equations are assumed 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 challenge is particularly daunting for a number of the studies undertaken for the conference, thanks to the evolutionary nature of the changes under consideration. Changes in the use of securitisation, 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

⁵ Cochrane (1994) and Rudebusch (1998), among others, have made these points.

⁶ Hard, but not impossible; see Boivin and Giannoni (forthcoming), Bernanke et al (1997) and Sims and Zha (1995).

⁷ The most commonly used models for this purpose are those based on Rotemberg and Woodford (1997) and Clarida et al (1999).

time. Statistically detecting structural changes is generally easier when those changes are abrupt, as was the October 1979 shift in Fed operating procedures. Moreover, the fact that many of these gradual changes occurred concurrently makes it even harder to cleanly separate out their effects.

Survey and synthesis

Taken together, the papers presented at the conference documented significant changes in the linkages between the basic instrument of monetary policy - reserves - and macroeconomic outcomes. But these changes do *not* 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 (ie the top half of Figure 1), and second in the connection between interest rates and economic activity.

From reserves to interest rates

The epicentre 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. Krieger's contribution provided an overview of some of the changes that have taken place in this market in recent years, 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. The Bennett and Peristiani contribution showed 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 Demiralp and 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 Fed funds rate seems to track its target more closely than 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, they conclude that "announcement effects" have taken on increased importance in recent years.

Observing these trends, one possible conjecture is that their continuation could eventually undermine altogether the Fed's leverage over interest rates. Woodford's and Goodfriend's contributions addressed this conjecture at a conceptual level. Both start with the observation that the effect of recent innovations to reserve management has been to decrease the demand for the level of reserves, and that this may eventually create some technical difficulties for Desk operations. Neither 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 in that it envisions an expansion in the level of reserves sufficient to satiate the market. The result would be a system that allowed for separate control over both the overnight interest rate and the quantity of bank reserves.

Interest rates and output

The volatility of real GDP has declined markedly since the mid-1980s, as documented by McConnell and Perez-Quiros (2000). Over roughly the same period, Boivin and Giannoni's conference paper showed that the economy's response to monetary policy also appears to have declined.⁸ What was responsible for these changes? Are changes in the transmission mechanism responsible, or were they

⁸ This decline in the response of output to monetary policy is also documented by Taylor (1995) using an estimated structural model of the economy.

brought about by a change in the conduct of monetary policy? Or perhaps the cause was some other structural change in the economy, such as an innovation in firms' management of inventories?

In thinking about this question, it is useful to recall the Frisch (1933) schema of *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" are propagated 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 shocks' impact on output.

The Boivin and Giannoni conference paper addressed this "shocks-versus-propagation" issue directly, using VAR analysis to assess the effects of the reduction in the size of monetary shocks, changes in monetary propagation and other changes in the economic environment. They found 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, changes in the systematic response of policy to macroeconomic conditions seem to account for most of the diminished response to shocks. The paper also considered - and dismissed - the view that changes elsewhere in the economy were responsible.

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. The Kahn, McConnell and Perez-Quiros paper analysed 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 - including those from monetary policy - through inventories. Specifically, the technology has allowed firms to better anticipate sales fluctuations, so that production responds more quickly - but less sharply - to sales fluctuations. Using simulations of a small equilibrium model, the authors showed that such a change in inventory management can account for the observed behaviour of output and inventories, whereas a change in the monetary policy rule cannot.

Financial intermediation

A number of papers at the conference dealt with role of financial intermediation in the transmission of monetary policy: those by Lown and Morgan, Van den Heuvel, McCarthy and Peach, Estrella, and English. In the last 20 years, a number of significant regulatory and structural changes in the financial system have affected monetary policy transmission. Changes in regulation such as the repeal of Regulation Q in the early 1980s and the changes in structural of bank capital regulations during the 1980s and early 1990s dramatically altered the incentives and the ability of banks and other institutions to lend as policy changed. Moreover, the steady disintermediation of credit formation in the United States - both via direct borrowing in financial markets and via securitisation of financial institution assets - has increased competition in many lending markets, and thus 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.

Lown and Morgan directly examined the role of bank lending standards to businesses in the transmission mechanism, and provide new evidence on the relevance of the bank lending channel. Using a VAR approach, they find that lending standards have important predictive power for both loan volume and economic output. The link between monetary policy shocks and lending standards appears to be more tenuous, however. They found that innovations to the Fed funds rate are not particularly important in explaining lending standards, although when lending standards are added to the VAR model, they appear to "substitute" for monetary policy shocks in predicting real economic activity. The authors hypothesise that lending standards in part reflect "moral suasion" by policymakers to reduce credit formation at the same time as monetary policy tightening via open market operations. Episodes of moral suasion have become less common in recent years, however, raising the question of whether lending standards will continue to predict economic activity going forward; tentative results for the 1990s do, however, suggest that standards have retained their predictive power.

The disintermediation of credit formation via securitisation was examined by two papers at the conference. Estrella examined to what degree asset securitisation (and mortgage securitisation in particular) has affected the transmission mechanisms of monetary policy. Using an estimated structural "IS" equation, he found that the sensitivity of both real output and housing investment to the

real Fed funds rate declined significantly as the degree of asset securitisation increased in the 1980s and 1990s. Because the sensitivity of mortgage interest rates to Fed funds changes has, if anything, increased, he suggests that securitisation has largely affected the “non-interest rate” transmission mechanisms such as the bank lending or credit channels of monetary policy.

McCarthy and Peach focused 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 found 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, on the other hand, responds more *slowly*, and now fluctuates more or less concurrently with the overall level of economic activity. An important implication is that the housing sector is no longer in the vanguard of monetary transmission.

The papers by Van den Heuvel and by English are more forward-looking in their outlook. They focused on two factors, bank capital requirements and consolidation in the financial services industry, which may well have significant effects on the transmission mechanism, but which have received little attention from researchers to date. English discussed how the inexorable trend towards consolidation in the financial industry might affect both the implementation and the transmission of monetary policy. He focused in particular 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. At least thus far, however, these concerns appear to be largely unwarranted: a recent collaborative study by the G10 central banks, summarised by English, suggests that financial consolidation has thus far had minimal effects on the implementation of policy and the transmission of policy changes through the financial system.

Van den Heuvel examined 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 emphasises the role of banks’ capital structure in shaping the response of policy-induced interest rate changes. Because poorly capitalised banks are less likely to lend than well capitalised 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 their exposure to interest rate risk, the maturity distribution of banks’ assets will also affect the transmission of policy.

On the role of asset prices

Two papers at the conference dealt with the transmission of monetary policy through asset prices. The Lettau, Ludvigson and Steindel contribution scrutinised the empirical basis for the wealth channel in the United States. Using a structural VAR model, they estimated the response to Fed funds rate shocks, and to assess the strength of the channel they compared the estimated impact to the impact assuming no response of asset prices. Overall, they concluded that the wealth channel is relatively weak - smaller than what typically comes out of experiments with conventional large-scale structural 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 lie in 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 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 instead the simultaneous response of asset values and monetary policy to common, underlying inflation pressures.

The contribution by Aoki, Proudman and Vlieghe also analysed the role of wealth in monetary transmission, but in the context of the broad credit channel rather than the wealth channel. Specifically, they used a variant of the financial accelerator model developed by Bernanke et al (1999), calibrated to UK data, to assess the impact of monetary policy on the real economy through its effect on housing prices. Their 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. They also found that recent financial innovations, such as easier 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 increased the sensitivity of consumption to house prices and policy shocks, while better access to credit cards has weakened the link. Overall, they conclude 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 presented at the conference. The first is that monetary policy's effects appear to be somewhat weaker than in past decades. Financial innovation is one possible cause of this change, but not the only one: others are improved inventory management and the conduct of monetary policy itself. The second is that 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 for the United Kingdom, the role of housing assets on households' balance sheets warrants further study. Finally, it appears that neither financial consolidation nor shrinking reserve volume appears to be a major factor affecting monetary transmission - at least not yet.

Some loose ends and lacunae remain, however. First, while 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 securitisation, and as Kahn, McConnell and Perez-Quiros suggest, improved inventory management may also have played a role. Yet as Boivin and Giannoni show, it may be that the diminished response results not from less sensitivity to interest rates per se, but instead as a result of the endogenous reaction of monetary policy. We thus come back 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 securitised lending described in Estrella's paper, and the changes in housing finance documented by McCarthy and Peach, the durability of the predictive content of bank lending standards resists easy explanation. Similarly, the weak apparent link between lending standards and monetary policy remains something of a puzzle, perhaps reflecting the endogenous response of policy to credit conditions.

Third, the absence of attention to an open economy channel running through the exchange rate is an important lacuna. There are two reasons for this. The first is that despite the growth of trade in recent years, the external sector has remained a relatively small part of the US economy. (Exports and imports currently represent 10% and 14% of nominal GDP, respectively, a modest increase from 9% and 10% shares two decades ago.) And the second is that a firm connection between economic fundamentals and short-run exchange rate movements continues to elude researchers, frustrating efforts to pin down the exchange rate channel empirically.⁹

Clearly, the evolution of the monetary transmission mechanism will remain, as always, an important and fruitful area for future research.

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: 55-84.
- Aoki, Kosuke, James Proudman and Gertjan Vlieghe (forthcoming): "Houses as collateral: has the link between house prices and consumption in the UK changed?", Federal Reserve Bank of New York, *Economic Policy Review*.
- Bennett, Paul and Stavros Peristiani (forthcoming): "Are US reserve requirements still binding?" Federal Reserve Bank of New York, *Economic Policy Review*.
- Bernanke, Ben S, and Alan S Blinder (1988): "Credit, money, and aggregate demand", *American Economic Review*, 78, no 2 (May): 435-39.
- Bernanke, Ben S and Mark Gertler (1989) "Agency costs, net worth, and business fluctuations", *American Economic Review*, 79: 12-31.
- (1995): "Inside the black box: the credit channel of monetary policy transmission", *The 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", *Handbook of Monetary Economics*, Amsterdam: North Holland.
- Bernanke, Ben S, Mark Gertler and Mark Watson (1997): "Systematic monetary policy and the effects of oil price shocks", *Brookings Papers on Economic Activity*, 1997:1.
- Boivin, Jean and Marc Giannoni (forthcoming): "Assessing changes in the monetary transmission mechanism", Federal Reserve Bank of New York, *Economic Policy Review*.
- 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): 1661-707.
- Cochrane, John H (1994): "Shocks", *Carnegie Rochester Conference Volume on Public Policy* 41: 295-364.
- Demiralp, Selva and Oscar Jordá (forthcoming): "The announcement effect: evidence from open market desk data", Federal Reserve Bank of New York, *Economic Policy Review*.
- English, William B (forthcoming): "Financial consolidation and monetary policy", Federal Reserve Bank of New York, *Economic Policy Review*.
- Estrella, Arturo (forthcoming): "Securitization and the efficacy of monetary policy", Federal Reserve Bank of New York, *Economic Policy Review*.
- Flood, Robert and Andrew Rose (1995): "Fixing exchange rates: a virtual quest for fundamentals", *Journal of Monetary Economics*, 36: 3-37.
- Flood, Robert and Andrew Rose (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 economics", in *Economic Essays in Honor of Gustav Cassel*.
- Goodfriend, Marvin (forthcoming): "Interest on reserves and monetary policy", Federal Reserve Bank of New York, *Economic Policy Review*.
- Kahn, James, Margaret M McConnell and Gabriel Perez-Quiros (forthcoming): "On the causes of the increased stability of the US economy", Federal Reserve Bank of New York, *Economic Policy Review*.
- Kashyap, Anil and Jeremy Stein (2000): "What do a million observations on banks say about the transmission of monetary policy?", *American Economic Review*, 90 (June): 407-28.
- Krieger, Sandra (forthcoming): "The implementation of monetary policy: a view from the desk", Federal Reserve Bank of New York, *Economic Policy Review*.
- Kuttner, Kenneth N and Adam S Posen (2001): "Inflation, monetary transparency, and G-3 exchange rate volatility", in Balling, Hochreiter and Hennessy eds, *Adapting to financial globalization*, London: Routledge.

- Lettau, Martin, Sydney Ludvigson and Charles Steindel (forthcoming): "Monetary policy transmission through the wealth channel", Federal Reserve Bank of New York, *Economic Policy Review*.
- Lown, Cara and Don Morgan (forthcoming): "Credit effects in the monetary mechanism", Federal Reserve Bank of New York, *Economic Policy Review*.
- 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.
- McCarthy, Jonathan and Richard W Peach (forthcoming): "Monetary policy transmission to residential investment", Federal Reserve Bank of New York, *Economic Policy Review*.
- 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: 1464-76.
- Meltzer, Allan H (1995): "Monetary, credit and (other) transmission processes: a monetarist perspective", *The Journal of Economic Perspectives*, 9, no 4 (Fall): 49-72.
- Mishkin, Frederic S (1995): "Symposium on the monetary transmission mechanism", *The Journal of Economic Perspectives*, 9, no 4 (Fall): 3-10.
- Rotemberg, Julio J and Michael Woodford (1997): "An optimization-based econometric framework for the evaluation of monetary policy", *NBER Macroeconomics Annual*, 1997: 297-346.
- Roosa, Robert V (1951): "Interest rates and the central bank", in *Money, trade, and economic growth: in honor of John Henry Williams*, New York: Macmillan, 270-95.
- 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?", manuscript, Yale University.
- Taylor, John B (1995): "The monetary transmission mechanism: an empirical framework", *The Journal of Economic Perspectives*, 9, no 4 (Fall): 11-26.
- Van den Heuvel, Skander (forthcoming): "Does bank capital matter for monetary transmission?", Federal Reserve Bank of New York, *Economic Policy Review*.
- Woodford, Michael (forthcoming): "Financial market efficiency and the effectiveness of monetary policy", Federal Reserve Bank of New York, *Economic Policy Review*.

