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7 Monetary Policy and Bank Lending

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In this paper, we survey recent theoretical and empirical work that relates to the "lending" channel of monetary policy transmission. To begin, we need to define clearly what is meant by the lending channel. It is perhaps easiest to do so by contrasting the lending view of monetary policy transmission with the simpler, and better-known, "money" view.

In what we take to be the polar, pure money version of the monetary transmission mechanism, there are effectively only two assets—money and bonds. In this world, the banking sector's only special role has to do with the liability side of its balance sheet—the fact that it can create money by issuing demand deposits. On the asset side of their balance sheets, banks do nothing unique—like the household sector, they too just invest in bonds.

In this two-asset world, monetary nonneutrality arises if movements in reserves affect real interest rates. The transmission works as follows: a decrease in reserves reduces the banking sector's ability to issue demand deposits. As a matter of accounting, this implies that the banking sector must also hold (on net) fewer bonds. Thus the household sector must hold less money, and more bonds. If prices do not adjust fully and instantaneously, households will have less money in *real* terms, and equilibrium will require an increase in real

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interest rates. This in turn can have real effects on investment, and ultimately, on aggregate economic activity.

Note that as we have defined the pure money view of the transmission mechanism—solely by reference to the fact that it is characterized by the simple two-asset feature—there is a wide range of alternative formulations that capture its essence. These include the textbook IS-LM model, as well as the dynamic equilibrium/cash-in advance models of Rotemberg (1984), Grossman and Weiss (1983), Lucas (1990), and Christiano and Eichenbaum (1992). Although these two classes of models differ along a number of dimensions (for example, in the way they generate incomplete price adjustment), they share the two-asset feature.

By contrast, we say there is a distinct lending channel of monetary policy transmission when the two-asset simplification is inappropriate in a specific sense. In the lending view, there are three assets—money, publicly issued bonds, and intermediated "loans"—that differ from each other in meaningful ways and must be accounted for separately when analyzing the impact of monetary policy shocks. The banking sector now can be special in two relevant ways: in addition to creating money, it makes loans, which (unlike buying bonds) the household sector cannot do.

In this three-asset world, monetary policy can work not only through its impact on the bond-market rate of interest, but also through its *independent* impact on the supply of intermediated loans. To think about the distinction between the money and lending channels, take an extreme example where households view the two assets that they do hold—money and bonds—as very close substitutes. In this case, a decrease in reserves that leads to a decline in the money supply will have a minimal impact on the interest rate on publicly held bonds. Thus the money channel is very weak. However, the decrease in reserves can still have important real consequences, if it leads banks to cut back on loan supply: the cost of loans *relative* to bonds will rise, and those firms that rely on bank lending (say, because they do not have access to public bond markets) will be led to cut back on investment. Put differently, monetary policy can have significant real effects that are not summarized by its consequences for open-market interest rates.

A couple of points about the lending view should be emphasized right away, to prevent further confusion. First, as we have defined it, the lending view centers on the premise that bank loans and publicly issued bonds are not perfect substitutes. It *does not* hinge critically on whether or not there is quantity rationing in the loan market. As a matter of practical reality, shifts in bank loan supply may well be accompanied by variations in the degree of rationing, but this is not necessary for there to be a meaningful lending channel.

Second, much like with the pure money view, the essence of the lending view can probably be captured in a wide range of models. This may not be immediately apparent, because the lending channel has received much less modeling attention than the money channel. Indeed, the only recent modeling

attempts that we know of are essentially extensions of the IS-LM framework, most notably Bernanke and Blinder (1988). However, as we will argue below, the important aspects of the lending view transcend the specific IS-LM style formulation adopted by Bernanke and Blinder; for example, they could in principle be captured in dynamic equilibrium/cash-in-advance models also.

Having defined (loosely) what we mean by the distinction between the money and the lending channels, much of the remainder of this paper focuses on the following two sets of questions:

1. As a matter of theory, what "microfoundations" are required for a distinct lending channel to exist? Does it appear that the necessary preconditions for a lending channel are satisfied in today's financial environment? Are they apt to be satisfied in the future?

2. Is there any direct evidence that supports the existence of a distinct lending channel? If so, how important in magnitude is the lending channel?

Before proceeding, however, there is a logically prior question that must be addressed, namely: Why is the distinction between the money and lending channels an interesting or important one? Although we must defer a complete answer until later in the paper, we can offer several brief observations:

1. If the lending view is correct, monetary policy can have important effects on investment and aggregate activity without moving open-market rates by much. At the least, this suggests that one might wish to look to alternative indicators to help gauge the stance of policy.

2. Standard investment and inventory models—which typically use open-market rates as a measure of the cost of financing—may give a misleading picture of the extent to which different sectors are directly affected by monetary policy. For example, most empirical work fails to find a significant connection between inventories and interest rates. As we argue below, it is probably wrong to conclude from this work that tight monetary policy cannot have a strong direct impact on inventory behavior.

3. The quantitative importance of the lending channel is likely to be sensitive to a number of institutional characteristics of the financial markets (for example, the rise of "nonbank banks," the development of the public "junk bond" market, etc.). Thus understanding the lending channel is a prerequisite to understanding how innovation in financial institutions might influence the potency of monetary policy.

4. Similarly, the aggregate impact of the lending channel may depend on the financial condition of the banking sector. As we argue below, when bank capital is depleted (and particularly when bank loan making is tied to risk-based capital requirements), the lending channel is likely to be weaker. This has obvious implications for the ability of monetary policy to offset particular sorts of adverse shocks.

5. Finally, the lending view implies that monetary policy can have distributional consequences that would not arise were policy transmitted solely through a money channel. For example, the lending view suggests that the

costs of tight policy might fall disproportionately on smaller firms that are unable to access public capital markets. Such distributional considerations may be important to bear in mind when formulating policy.

Although this list is far from exhaustive, it hopefully gives some idea of the potential usefulness of understanding and quantifying the lending view. With this motivation in mind, the remainder of the paper is organized as follows. Section 7.1 gives a very brief history of the thought surrounding the lending view. Section 7.2 examines its microfoundations. Section 7.3 reviews the evidence that bears most directly on the lending view.

7.1 Early Work on the Lending View

The lending view of monetary policy transmission has, in one form or another, been around for a long time. Much of the early work tended to blur together two logically distinct issues: (*a*) whether monetary policy works in part by changing the relative costs of bank loans and open-market paper; and (*b*) whether such shifts in bank loan supply are accompanied by variations in the degree of nonprice credit rationing.

Roosa's (1951) "availability doctrine" is a classic example of this line of thinking. He takes issue with the simple money channel view that "changes in market rates of interest provided a satisfactory explanation for cyclical economic disturbance. . . . The postwar experience suggests that yield changes of scarcely ⅛ of 1 percent for the longest-term bonds have considerable market effects." Rather, Roosa argues, "it is the lender, neglected by the monetary theorists, who does most to put new substance in the older doctrine. . . . Rate changes brought about by the open market operations of the central bank influence the disposition or the ability of lenders to make funds available to borrowers. . . . It is principally through effects upon the position and decision of lenders . . . that central bank action . . . achieves its significance." Although Roosa's observations came in the midst of the debate over whether monetary policy effectiveness after the impending Federal Reserve-Treasury Accord would necessitate large swings in open-market interest rates, the importance of bank credit continued to be a hotly debated topic long after the accord was signed.

Over the next dozen years the argument was refined, and a number of investigators, notably, Tobin and Brainard (1963), Brunner and Meltzer (1963), and Brainard (1964), proposed models that included as a central feature the imperfect substitutability of various assets including bank loans. Thus, Modigliani (1963) was able to more precisely summarize the role of banks in a world of imperfect information: "Suppose the task of making credit available to units in need of financing requires specialized knowledge and organization and is therefore carried out exclusively by specialized institutions which we may label financial intermediaries. . . . Intermediaries in turn lend to final debtors of the economy at some rate . . . [which] adjusts at best only slowly to market

conditions. . . . The single rate of the perfect market model is replaced by a plurality of rates."[1]

Despite the fact that the Modigliani rendition of the lending view is very close to the one we are now advocating, the lending view began to fall out of favor during the 1960s. In part, this lack of acceptance seems attributable to the fact that many early accounts relied heavily (and unnecessarily, in our view) on a credit-rationing mechanism, while at the same time failing to provide a satisfying theoretical role for such rationing to exist. For example, Samuelson rebutted Roosa by arguing that the credit rationing implicit in the availability doctrine was at odds with profit maximization by lenders (see testimony of Samuelson in U.S. Congress 1952). More importantly, as Gertler (1988) points out, the Modigliani and Miller results on the irrelevance of capital structure seemed to undermine the basic premise that lending arrangements could be important. Furthermore, on the empirical front, Friedman and Schwartz (1963) were supplying strong evidence in favor of the money view.

As we will discuss in the remainder of the paper, each of these objections has subsequently been addressed. For instance, work by Jaffee and Russell (1976), Stiglitz and Weiss (1981), and many others has demonstrated that credit rationing can occur in models where all agents are maximizing.[2] More generally, as we argue in the next section, research in the theory of credit-market imperfections and financial intermediation has helped put the lending view on much firmer microfoundations. Still, the failure of the lending view to be widely embraced cannot be completely ascribed to theoretical discomfort—it has also suffered until recently from a lack of clear-cut, direct empirical support. Thus, perhaps even more so than the theoretical developments, the recent empirical work reviewed in section 7.3 has helped to renew interest in the lending view.

7.2 Building Blocks of the Lending View

Perhaps the best-known recent formulation of the lending view is a model due to Bernanke and Blinder (1988). Their model makes it clear that there are three necessary conditions that must hold if there is to be a distinct lending channel of monetary policy transmission:

1. Intermediated loans and open-market bonds must not be perfect substitutes for some firms on the liability side of their balance sheet. In other words, the Modigliani-Miller capital-structure invariance proposition must break down in a particular way, so that these firms are unable to offset a decline in the supply of loans simply by borrowing more directly from the household sector in public markets.

1. See also Tobin and Brainard (1963) and Brainard (1964) for early general equilibrium models of financial intermediation with imperfect substitutability across assets.

2. Indeed, Blinder and Stiglitz (1983) and Fuerst (1992b) outline models of monetary policy transmission that capture the credit-rationing aspects of Roosa's (1951) availability doctrine.

2. By changing the quantity of reserves available to the banking system, the Federal Reserve must be able to affect the supply of intermediated loans. That is, the intermediary sector as a whole must not be able to completely insulate its lending activities from shocks to reserves, either by switching from deposits to less reserve-intensive forms of finance (for example, certificates of deposit [CDs], commercial paper, equity, etc.) or by paring its net holdings of bonds.

3. There must be some form of imperfect price adjustment that prevents any monetary policy shock from being neutral. If prices adjust frictionlessly, a change in nominal reserves will be met with an equiproportionate change in prices, and both bank and corporate balance sheets will remain unaltered in real terms. In this case, there can be no real effects of monetary policy through either the lending channel or the conventional money channel.

If either of the first two necessary conditions fails to hold, loans and bonds effectively become perfect substitutes, and we are reduced back to the pure money view of policy transmission. If condition 1 fails, Modigliani-Miller corporations will completely arbitrage away any cost differentials between loans and bonds. If condition 2 fails, intermediaries will do the arbitrage. In either case, the net result will be that loans and bonds will always be priced identically in equilibrium.

Although the Bernanke-Blinder formulation is very helpful in illustrating the necessary conditions that are required for the existence of a distinct lending channel, it does not directly address whether each of these three conditions can be given solid microfoundations. Nor does it ask whether any such microfoundations appear plausible given the current financial environment. For example: what sort of technological and/or informational assumptions must one make about the structure of intermediation to generate condition 2? Do these assumptions seem reasonable in light of what we actually observe?

In the rest of this section, we take up these questions relating to microfoundations. To preview the discussion a bit: We begin by arguing that condition 1 is probably easiest to justify, both in the context of a widely accepted, well-articulated theoretical paradigm, and in terms of what is observed in practice. On the other hand, condition 2 is quite a bit trickier—there are a number of possible factors that could conceivably limit the Fed's ability to affect the supply of intermediated loans. Our bottom line here is that it is nonetheless highly unlikely that condition 2 will fail to hold completely, although one can imagine circumstances in which Fed policy might have only a small impact on aggregate loan supply.

Finally, the question of the microfoundations for condition 3 is much broader in scope than just the lending channel—this question is central to *any* account of monetary policy, and has accordingly received an enormous amount of attention. Thus we do not attempt a detailed treatment here. Instead, we focus on a much narrower issue: the *interaction* between the microfoundations for condition 3 and those for conditions 1 and 2. In particular, we focus on a class of models—those of the dynamic equilibrium/cash-in-advance variety—

where the frictions driving imperfect price adjustment can be one and the same as those driving intermediary lending policy. We ask whether these sorts of models are likely to be successful in providing a realistic account of both price adjustment and intermediary lending patterns.

7.2.1 Why Do Some Firms "Depend" on Intermediated Loans?

In the last decade or so, a large body of theoretical literature has developed on the subject of financial intermediation. One broad theme of this work (seen, for example, in Diamond 1984; Boyd and Prescott 1986; and Fama 1990) is that intermediaries can represent efficient vehicles for conserving on the costs of monitoring certain types of borrowers. The basic idea is this: Due to asymmetric information and/or moral hazard, lending without any monitoring can involve large deadweight costs. Given these costs, it would be efficient to devote some resources to monitoring activities. However, if there are a large number of lenders—that is, if the credit is extended in public markets—free-rider problems will confound attempts to monitor. Thus it can make sense to create an intermediary to serve as a single "delegated monitor," thereby circumventing these free-rider problems and conserving on aggregate monitoring costs.

While ultimately correct, this argument is, by itself, incomplete. Although having a single intermediary do all the monitoring would seem to represent an obvious cost savings, there is a potential difficulty, namely, the introduction of a second layer of agency. This point is addressed by Diamond (1984), who asks the critical question: "Who monitors the delegated monitor?" In other words, what is to prevent the intermediary from taking investors' money and squandering it by making bad loans (that is, by lending without going to the effort of actually doing any monitoring)? Diamond shows that this second-tier agency problem can be mitigated if the intermediary holds a large, diversified portfolio of loans, and finances itself largely with publicly issued debt.

Diamond's conclusions about the optimal capital structure for an intermediary raise an issue that is central for monetary policy. Although Diamond argues that intermediaries ought to be largely debt-financed, there is nothing in his model—or in many of the other models of financial intermediation—that suggests that intermediaries must be financed with demand deposits. Indeed, the institutions in many of these models can equally well be thought of as "nonbank banks," that is, finance companies such as G.E. Capital that makes loans but do not finance themselves at all with deposits.

Thus while it seems relatively straightforward to argue from first principles that some firms—particularly those for whom monitoring costs are likely to be high—will be to some degree *intermediary dependent,* it is less obvious that they will necessarily be *bank dependent,* in the sense of relying on institutions that themselves are financed with demand deposits. In terms of the necessary conditions we have defined above, this distinction implies some initial doubts about whether one should expect condition 2 to hold across a wide

range of circumstances. If intermediation can just as easily be done through institutions that fund themselves with nonreservable forms of finance (for example, commercial paper, long-term debt, etc.), then it is unclear how the Federal Reserve could ever affect the aggregate supply of intermediated loans. This question will be taken up in detail in section 7.2.2 below; for the moment we will put aside the important distinction between deposit-taking banks and intermediaries more generally.

In addition to the theoretical work, there have recently been a number of empirical papers that support the notion that intermediated loans are "special" for some borrowers. First, Fama (1985) and James (1987) show that bank borrowers effectively bear the cost of reserve requirements, which suggests that they are getting a service which cannot be replicated by nonbank providers of finance, such as the public markets. Second, James (1987) and Lummer and McConnell (1989) find that bank loans agreements are taken as "good news" by the stock market, consistent with the notion that banks provide an information-gathering function. Finally, Hoshi, Kashyap, and Scharfstein (1991) show that Japanese firms with close banking relationships are less likely to be liquidity constrained. This finding fits with the argument that monitoring by intermediaries reduces the information and/or incentive problems that typically create a wedge between the costs of internal and external finance.

It is one thing to believe that certain firms will be dependent on the services of the intermediary sector. It is quite another to believe that firms may come to rely on a *particular* intermediary with whom they have an established relationship—in other words, that there are lock-in effects that make it costly to switch lenders. However, as we argue below, if lender-specific lock-in does indeed exist, it can have important consequences for the transmission of monetary policy—all else equal, such lock-in will tend to make the lending channel more potent.

A few recent papers, both theoretical and empirical, provide some support for the hypothesis that banking relationships involve a degree of lock-in. On the theoretical side, Sharpe (1990) and Rajan (1992) argue that the very fact that a bank does monitoring creates the potential for lock-in. In the course of a relationship, a bank will acquire an informational monopoly with respect to its client, a monopoly which puts other potential lenders at a comparative disadvantage.

On the empirical side, Sushka, Slovin, and Polonchek (1993) conduct an interesting event study of Continental Bank's customers during the period when Continental was in danger of failing and was ultimately bailed out by the government. During this time, their customers' stock prices moved in concert with Continental's own fortunes, falling with bad news about Continental, and rising sharply with the announcement of the bailout. This suggests that these customers were somewhat locked in to Continental, and could not costlessly switch to another lender. Further evidence for the importance of banking relationships comes from Petersen and Rajan (1992). They find that the availability

of credit to a small business is, all else equal, an increasing function of the length of its relationship with its bank.

Of course, even if one accepts that condition 1 is both theoretically and empirically plausible, there remains the question of its aggregate importance, not only today, but looking into the future. Certainly there are a substantial number of U.S. firms that cannot be considered intermediary dependent in any sense. Moreover, the evidence from the United States as well as other countries suggest that there is a strong secular trend away from intermediated finance, and toward securities markets.

In spite of such trends, the data show that intermediaries—and banks in particular—continue to play a dominant role in financing U.S. corporations, particularly medium-sized and smaller ones. (We review some evidence to this effect below.) Thus it seems reasonable to believe that shocks to the supply of intermediated loans might have important aggregate implications, even in today's environment.

7.2.2 Can the Fed Affect the Supply of Intermediated Loans?

The second necessary condition for the existence of a distinct lending channel is that the Fed be able to affect—by manipulating the amount of reserves available to the banking sector—the aggregate supply of loans made by intermediaries. We examine four factors that could conceivably weaken or even break the link between reserves and loan supply: (*a*) the existence of nonbank intermediaries; (*b*) banks' ability to react to changes in reserves by adjusting their holdings of securities rather than loans; (*c*) banks' ability to raise funds with nonreservable forms of financing; and (*d*) the existence of risk-based capital requirements.

The Significance of Nonbank Intermediaries

As noted above, many theories of financial intermediation leave open the possibility that lending to "information-intensive" borrowers could be accomplished by nondeposit-taking institutions. If such institutions play an important role, the link between Fed policy and aggregate loan supply might be weakened, or even severed. First, and most obviously, if nonbank intermediaries are responsible for most of the lending volume in the economy, the Fed will be unable to have much of an impact on the overall supply of intermediated loans, even if it can influence *bank* loan supply.

Second, and more subtly, one might argue that even if nonbank intermediaries do not have a large market share, they may effectively be the "marginal" lenders in the economy—that is, they may be able to pick up much of the slack if bank loan supply is cut back. However, we view this marginal lender argument as not completely compelling, particularly with regard to its short-run implications. It implicitly assumes that there are negligible costs incurred when borrowers switch from one lender to another. As seen in the previous section, there are both theoretical and empirical reasons to believe that such

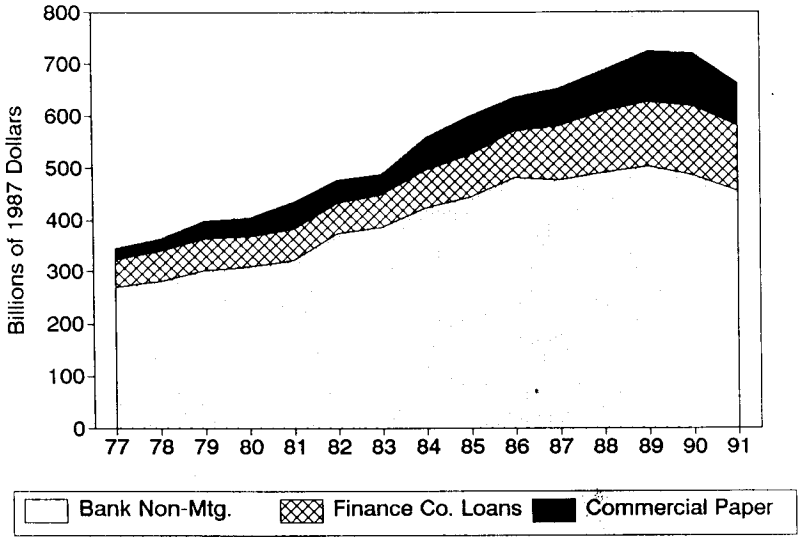

Fig. 7.1 Composition of Credit (nonfinancial corporations)

an assumption is inappropriate—that there is indeed a significant degree of lock-in between specific banks and their customers.

Thus if one is interested in understanding relatively short-run behavior, there may be something useful to be learned from comparing the relative sizes of the bank and nonbank intermediary sectors.

Figure 7.1 addresses this question, showing how the composition of intermediated loans to nonfinancial corporations breaks down into bank Commercial and Industrial loans (C and I loans) and finance-company loans over the period 1977–91. In addition, the figure also sheds some light on the issue raised above—the substitution of open-market borrowings for intermediated loans—by including data on the growth of the commercial paper market over this period.

The figure illustrates that while both finance-company loans and commercial paper have grown very rapidly in percentage terms over the last fifteen years, traditional commercial banks are still by far the most important of these three sources of finance, representing over 68 percent of the combined total in 1991. (The share was on the order of 78 percent in 1977). Thus it would be premature to say that growth in either the commercial paper market or in the nonbank intermediary sector has rendered the commercial banking sector of significantly less aggregate importance than it was, say, a couple of decades ago.

Table 7.1 presents more detail on how corporate financing patterns have evolved over the last twenty or so years. Using data from the *Quarterly Financial Report,* we break down manufacturing firms into three size categories—small, medium, and large—and look at how the balance sheets of firms in each category have changed between 1973 and 1991.

Table 7.1 Bank and Nonbank Sources of Debt for Manufacturing Corporations, 1973, 1991

	1973:4				1991:4			
	Total	Large	Medium	Small	Total	Large	Medium	Small
Bank debt/Total debt								
Short-term	78.8%	64.9%	93.1%	84.0%	44.9%	22.8%	77.0%	82.9%
Long-term	24.6%	17.1%	36.1%	43.3%	31.2%	21.1%	51.7%	59.3%
Total	34.4%	23.4%	49.8%	55.3%	33.0%	21.3%	54.9%	65.5%
Commercial paper as % of								
Short-term debt	12.7%	26.1%	2.1%	1.7%	N.A.	62.8%	6.9%	N.A.
Nonbank short-term debt	59.7%	74.3%	31.0%	10.4%	N.A.	81.3%	30.1%	N.A.
Total debt	2.3%	3.4%	0.5%	0.5%	N.A.	7.5%	0.9%	N.A.
Total nonbank debt	3.5%	4.5%	1.0%	1.1%	N.A.	9.6%	1.9%	N.A.

Source: Quarterly Financial Report.

Note: In 1991:4, Small was under $25 million (20.6 percent of total manufacturing assets), Medium wa $25 million–$1 billion (7.9 percent), and Large was above $1 billion in assets (71.4 percent). In 1973:4 Small was under $5 million (10.4 percent of total), Medium was $5–250 million (22.7 percent), and Larg was above $250 million (66.9 percent). N.A. = not available.

Again, the most striking finding is that if we take the overall manufacturing-wide ratio of bank debt to total debt, there is virtually no change over time. Bank debt represents 34.4 percent of total debt in 1973, and 33.0 percent in 1991. This aggregate number reinforces the conclusion drawn above—that one should not exaggerate the extent to which changes in financing practices have diminished the role of banks.

Of course, banks have lost substantial ground in some areas. First, if one focuses only on short-term lending, banks have seen their overall share fall from 78.8 percent to 44.9 percent. (This is offset by the fact that banks have actually gained share in overall long-term lending.) Moreover, this loss of short-term market share is almost exclusively concentrated among large corporations—the one place where the commercial paper market has made very substantial inroads.[3] Short-term bank loans as a fraction of all short-term debt of large manufacturing corporations fell from 64.9 percent in 1973 to 22.8 percent in 1991.

3. These figures may somewhat overstate the true economic extent of disintermediation, as approximately 8 percent of commercial paper issues are backed by irrevocable standby letters of credit from banks (see Gorton and Pennacchi 1990). In such cases, banks still bear the full credit risk, and presumably engage in monitoring. More generally, a number of other financial innovations—for example, the loan sales market—have blurred the line between intermediated and public-market sources of finance.

While the gains of the commercial paper market among large borrowers are certainly impressive, their aggregate impact should not be overstated. Commercial paper has not yet penetrated the medium- and small-firm categories to any perceptible degree, and banks' share of short-term debt for these firms is still overwhelming, at 77.0 percent and 82.9 percent, respectively.

The Future of Nonbank Intermediaries

Looking to the future, the rise of nonbank intermediaries documented in figure 7.1 raises a number of difficult questions. At one extreme, some observers—particularly advocates of "narrow banking"—have concluded that there is no longer any reason (other than perhaps historical accident or bad regulation), to glue together in a single institution the deposit-taking and loan-making functions, as opposed to their being carried out separately, say, by money market mutual funds and finance companies, respectively. What exactly, ask these observers, are the synergies between deposit taking and loan making? If no clear-cut synergies can be identified, one might expect the nonbank sector to grow rapidly in the future, thereby diluting the potency of any lending channel of policy transmission. (See Gorton and Pennacchi 1990 for a forceful rendition of this argument.)

The work of Diamond and Dybvig (1983) provides something of a counterpoint to the Gorton-Pennacchi argument. The Diamond-Dybvig model suggests that there may indeed be a link between the deposit-taking and loan-making functions of banks. In their model, banks perform a "liquidity transformation" role. All individual investors would like to invest in highly liquid assets, because they may suddenly wish to consume all of their wealth. But the economy's productive investment opportunities require tying up resources in long-lived projects. In this setting, it is optimal for a bank to issue demand deposits—thereby satisfying individuals' liquidity needs—and to invest the proceeds in the long-lived assets.[4]

Thus a synergy between deposit taking and loan making arises out of a fundamental mismatch between individuals' desire to hold liquid assets and the economy's need to invest in illiquid projects. However, the Diamond-Dybvig model probably overstates the importance of the liquidity transformation synergy, since it simply *assumes* that all investment opportunities are long-term and all savers want to keep all their wealth in liquid assets. In reality, there may not be nearly as much of a mismatch between savers' portfolio preferences and the underlying investment technology—there will be both some investment opportunities that are relatively short-term, and some investors who are not unwilling to tie up their assets for a longer period of time. Gorton and Pennacchi present some evidence that bears on this point. One fact they emphasize is

4. Diamond and Dybvig show that, in this setting, bank deposits perform a role that cannot be duplicated by other tradable claims, such as equity shares issued against the long-lived projects.

that the sum of outstanding Treasury bills and nonfinancial commercial paper is now roughly twice as large as the level of checkable bank deposits. This is a recent development—bank deposits were larger until around 1980—and it suggests that it might soon be possible to have a world in which deposit taking is done largely by institutions (like money market mutual funds) that invest primarily in high-quality, short-term liquid assets. Inevitably, however, these sorts of thought exercises run into difficult general equilibrium considerations. As Gorton and Pennacchi themselves point out, simply showing that the volume of T-bills and commercial paper greatly exceeds bank deposits is not conclusive proof that there is no role in equilibrium for traditional "liquidity transforming" banks in the Diamond-Dybvig spirit. After all, T-bills and commercial paper outside the deposit-taking system may already be satisfying some of the economy's demand for liquidity, so it would be wrong to posit that one could take them and use them as backing for deposits without losing anything.

Our own view is that while the Gorton-Pennacchi argument has a great deal of merit, it is hard to predict with any confidence that we will soon see anything like a disappearance of traditional dual-function commercial banks. Perhaps the greatest uncertainties have to do not with the economic considerations sketched above, but with regulation. Even if one completely accepts the hypothesis that there are no real economic synergies holding deposit taking and loan making together, government regulations can provide a powerful glue. For example, deposit-insurance subsidies may be effectively larger for those banks that invest in risky loans rather than T-bills, thereby encouraging a combination of the two activities.

In this regard, one important regulatory innovation is the introduction of risk-based capital requirements. As we discuss below, these may have the effect of accelerating any natural separation of deposit taking and loan making.

Banks' Holdings of Securities as a Buffer against Reserve Shocks

Even ignoring the issues raised by the existence of nonbank intermediaries, it is still possible that bank lending might be decoupled from open-market operations. Suppose that as a result of a monetary tightening, a bank finds that its deposits have been reduced by one dollar. How will the bank respond? Basically, it can adjust along one of three dimensions: (*a*) it can cut back on the number of loans it makes; (*b*) it can sell some of its securities holdings (for example, T-bills); or (*c*) it can attempt to raise more nondeposit financing (for example, CDs, medium-term notes, long-term debt, or equity). In order for condition 2 to be satisfied, it must be that the bank wishes (for a given configuration of rates on the different instruments) to do some of the adjustment by reducing loans. Or said differently, it must be that the bank is not wholly indifferent to variations in the quantity of T-bills and/or CDs, and thus does not use such variations to completely "shield" its loan portfolio from

monetary shocks. (Note that selling T-bills and issuing CDs are closely related strategies—either can be thought of as reducing the bank's net holding of "bonds," broadly defined.)

Why might a bank not be indifferent to variations in T-bills or CDs? We will start with T-bills. The argument here is straightforward, and has been made by many authors. (See, for example, Bernanke and Gertler 1987.) At any point in time, a bank faces the possibility of random depositor withdrawals. If the bank holds all its assets (other than required reserves) in illiquid loans, it will have a difficult time accommodating these withdrawals while still meeting reserve requirements. In particular, it will be forced to liquidate loans on short notice, which could be very costly. By holding easily marketable securities such as T-bills, the bank avoids these illiquidity costs.

Of course, there is a trade-off involved in holding T-bills, since they offer a lower return than intermediated loans. This suggests that for any given level of deposits, and any given configuration of interest rates on loans and bills, there will be a unique optimal quantity of bill holdings. In other words, banks will not be indifferent to the amount of T-bills they hold.[5]

Table 7.2 presents some data on banks' holdings of securities, taken from the *Call Reports*. The data show that there are persistent cross-sectional differences in banks' portfolio composition. In particular, large banks—those in the top 1 percent as measured by total assets—hold significantly less in the way of securities than do medium-sized banks, who in turn hold less than small banks. These well-defined cross-sectional patterns would be very unlikely if portfolio composition was a matter of indifference to banks. In contrast, they are exactly what one might expect if banks traded off the liquidity of securities against their lower returns: smaller banks, with fewer depositors, are more vulnerable to large (percentage) withdrawals, and hence must protect themselves by holding more securities.[6]

Banks' Ability to Make Use of Nonreservable Forms of Finance

We now turn to the question of why a bank does not offset a loss in deposits solely by issuing more CDs—that is, why it is not indifferent to variations in the quantity of CDs it has outstanding. Romer and Romer (1990) argue that banks *are* likely to be indifferent, which would mean that condition 2 fails to hold.

However, the Romer-Romer argument embodies a highly simplified view of the CD market. Implicitly, it assumes that the supply of CDs available to any bank is perfectly elastic at the current market rate—that is, a bank can issue

5. See Greenwald and Stiglitz (1992) for an extension of these arguments and a general analysis of the consequences of risk aversion by banks.

6. Another reason one might expect small banks to hold more securities is if information problems made it more difficult for them to raise nondeposit external finance on short notice. See the arguments below.

Table 7.2 **Median Securities-to-Assets Ratios, for Banks in Different Size Classes, 1976–1990**

	Large Banks (largest 1 percent)	Medium Banks (75–99 percentile)	Small Banks (below 75 percent)
1976	18.1%	26.5%	27.2%
1978	17.4%	23.7%	24.0%
1980	17.2%	25.3%	26.4%
1982	15.7%	24.8%	27.8%
1984	12.4%	23.5%	27.6%
1986	15.2%	22.3%	26.5%
1988	15.0%	21.8%	28.5%
1990	15.1%	22.3%	28.9%

Source: Call Reports.

as many CDs as it wants without paying any premium. There are a number of reasons why this is unlikely to be true in practice.

Given that large-denomination CDs (or other instruments that a bank might use to finance itself in the public capital markets, such as medium-term notes, long-term debt, or equity) are not federally insured, investors must concern themselves with the quality of the issuing bank. If there is some degree of asymmetric information between the bank and investors, the standard sorts of adverse selection problems (see, for example, Myers and Majluf 1984) will arise. These considerations will tend to make the marginal cost of external financing an increasing function of the amount raised.[7]

All the available evidence supports the notion that default risk is important in the pricing of wholesale CDs. Large banks' CDs are evaluated by five rating agencies, and the rates paid by different quality issuers can vary considerably. Moreover, there is considerable intertemporal variation in the spread between average marketwide CD rates and the rate on riskless T-bills. To take just one example, the troubles of Continental Illinois in 1984 led to widespread worries about bank health, and an increase in this spread from 40 basis points in April to nearly 150 basis points in July.[8]

The implications of increasing marginal costs of CD financing can be illustrated with a very simple partial-equilibrium model. (The model also captures the earlier argument that banks need to hold some securities for liquidity pur-

7. See Lucas and McDonald (1992) for a recent model of the banking sector in which adverse selection problems interfere with banks' ability to raise nondeposit external finance.

8. See Cook and Rowe (1986). Fama (1985) documents that CD rates move very closely with commercial paper rates. Indeed, both appear to rise relative to T-bill rates during times of tight monetary policy (Stigum 1990). In the case of CDs, one possible interpretation is that banks attempt to issue more CDs as a substitute for deposits during periods of tight money, and that this increased supply pushes up the rates they must pay.

poses.) Consider a representative bank that holds as assets reserves (R), loans (L), and bonds (B), and finances itself with deposits (D) and CDs (C). The bank seeks to maximize

$$\text{Max } r_L L + r_B B - r_C C, \tag{1}$$

where r_L, r_B, and r_C represent the interest rates on loans, bonds, and CDs, respectively. (This formulation assumes that demand deposits are non-interest bearing.) The bank is a price taker with respect to the first two rates, but perceives r_C to be an increasing function of C. The bank faces the following constraints:

$$R \geq kD \text{ (reserve requirement)} \tag{2}$$

$$R + B \geq jD \text{ (liquidity constraint)} \tag{3}$$

$$R + L + B = C + D \text{ (assets = liabilities)} \tag{4}$$

Inequality (2) implicitly assumes that CDs are not subject to any reserve requirement, but it is easy to generalize the argument to the case where they are just subject to a lower requirement than deposits. Inequality (3) is meant to capture in as simple a fashion as possible the sorts of liquidity arguments for holding bonds made in the previous section. To justify it, one might imagine that a fraction j of the bank's deposits may be redeemed at any point in time, and that it is prohibitively costly to liquidate loans immediately. Thus the bank must hold enough bonds so that the sum of bonds and reserves is sufficient to meet redemptions.[9] Clearly, one can develop a somewhat more sophisticated version of this story if one is interested in making the portfolio demand for bonds less degenerate.

So long as $r_B < r_L$, all three constraints will be met with equality, and the bank's first order condition is given by

$$r_L - r_C = Cr_c'. \tag{5}$$

If, as assumed by Romer and Romer, there are no increasing marginal costs of CD financing, then the loan rate must be exactly equal to the CD rate in equilibrium—in other words, loans and CDs (or, alternatively, loans and bonds) are perfect substitutes from the perspective of the banking sector, and condition 2 fails.

Things are very different when banks perceive increasing costs of CD issuance. Now, if the spread between loan and CD rates remains unchanged, then the *quantity* of CDs is pinned down. Thus the "first-round" response of the banking sector to a one-dollar decrease in reserves is to decrease deposits by $1/k$, bonds by $(j/k - 1)$, and loans by $(1-j)/k$, while leaving CDs fixed. Of course, in general equilibrium, these effects may be attenuated, as the spread

9. Bernanke and Gertler (1987) derive something very similar to our liquidity constraint in the context of a much more fully specified model of the banking sector.

between loan rates and CD rates may widen, thereby encouraging more CD issuance. But in any case, loans and CDs are no longer perfect substitutes, and the spread between them will be affected by shocks to reserves.[10]

The Impact of Risk-Based Capital Requirements

We argued above that a bank's asset mix of loans and securities was likely to represent an interior optimum of a portfolio choice problem. The important implication that follows from this is that the bank will not want to do all of the adjustment to a contractionary shock by selling securities—in order to preserve optimality, it will also wish to decrease its holdings of loans. However, there is an important caveat to this argument. Risk-based capital requirements (of the sort that have been phased in over the last several years under the Basle Accords) can tie a bank's ability to extend loans to its level of equity capital. If a bank's lending is constrained by such regulation, then it may do all of its marginal adjustments by buying and selling securities.

This can be easily illustrated in the context of the model sketched above. Risk-based capital requirements essentially impose an additional constraint of the form

$$pL \leq E, \tag{6}$$

where p is the capital requirement on loans, and E is the bank's equity. This simple version of the constraint implicitly (and realistically) assumes that T-bills are not subject to *any* capital requirement.

If it is costly for a bank to adjust the amount of equity financing it has (say because of the information problems that accompany new equity issues—see Myers and Majluf 1984), then (6) may bind. It is easy to see that in this case, the liquidity constraint in (3) will be slack—that is, the bank will hold more bonds than it needs for liquidity purposes. This is simply because it does not have enough capital to support more of the higher-yielding loans. Under these circumstances, monetary policy will have no effect on the bank's desire to invest in loans. Loans are tied down by (6), and all marginal changes in the bank's portfolio are accomplished by buying and selling T-bills. (See Bernanke and Lown 1991 for empirical evidence that bank capital can be a constraining factor in lending behavior.)

Of course, it is highly unlikely that all or even most banks will face binding capital constraints at any point in time. What is the effect of such unconstrained banks? At one extreme, it might be argued that as long as there are any capital-unconstrained banks, they will effectively be the "marginal" lenders in the economy, and hence the banking sector as a whole will behave as if it were capital-unconstrained. However, such an argument runs into the sorts of

10. The magnitude of the ultimate general equilibrium effect will depend on the magnitude of r_c'. If r_c' is very small, loan rates will rise only slightly relative to CD rates, and a large volume of new CD issuance will take place. Conversely, if r_c' is large, loan rates will rise by relatively more, and fewer new CDs will be issued.

problems raised earlier—it implicitly disregards the potential for switching costs when borrowers attempt to move from one bank to another. Our view is that even if just a fraction of the banks in the economy are capital-constrained, this will affect the potency of monetary policy. Essentially, we are saying that if Bank A is capital constrained, then Fed easing will not have the same expansionary effects it otherwise might, because Bank A will not lend any more than it already is, and because Bank A's customers cannot frictionlessly switch to another unconstrained bank that is easing its lending policy.

This sort of logic may help to explain why monetary policy was thought by many to be relatively ineffectual during the 1990–91 recession. To the extent that many (though certainly not all) banks found their capital positions impaired by large losses on their existing loan portfolios, and hence found (6) to be binding, the lending channel of monetary transmission would be weakened. More subtly, if regional shocks were in part responsible for the loan losses, then monetary policy might have a more powerful effect in some parts of the country—those less hard hit by the adverse shocks—than in others.

Similar reasoning also suggests that accounting and regulatory decisions can have important effects on the potency of monetary policy. If regulators are more aggressive in forcing banks to acknowledge loan losses, this will tend to reduce bank capital, and again dilute the effectiveness of the lending channel. Conversely, if capital requirements are relaxed, monetary policy might be made somewhat more potent.

Looking to the future, risk-based capital requirements may also play a significant role in the evolution of the banking system. We noted earlier that an important open question for monetary policy is the extent to which deposit taking and loan making will tend to grow apart in the years to come. Risk-based capital requirements would seem to have the potential to accelerate any natural separation of the two activities. In the past, there was a regulation-induced reason to keep the two together—by taking deposits and making risky loans, a bank could raise the value of the subsidy it received from the Federal Deposit Insurance Corporation (FDIC). Risk-based capital requirements reduce this incentive, as would risk-based insurance premiums.

7.2.3 Imperfect Price Adjustment and the Lending View

As noted earlier, the requirement of imperfect price adjustment is not unique to the lending view—it is a prerequisite for *any* theory in which monetary policy has real effects. Accordingly, we do not attempt to survey the enormous literature on the microfoundations of imperfect price adjustment. Rather, we focus on a much narrower issue: the extent to which the frictions responsible for imperfect price adjustment might *interact* with those responsible for conditions 1 and 2.

The Bernanke-Blinder formulation of the lending view, like traditional IS-LM models, implicitly assumes that prices are sticky, without providing any explicit microeconomic justification for this assumption. Moreover, the sticky-price assumption is completely separated from the assumptions driving firms' and intermediaries' preferences across loans and bonds—one can imagine varying the horizon over which prices adjust without modifying the rest of the model in any substantive way.

As we have already emphasized, however, the essence of the lending view can probably be captured in a wide range of models. For example, if one is uncomfortable with simply assuming that prices are temporarily fixed, one might appeal to the type of "limited participation" dynamic general equilibrium models introduced by Grossman and Weiss (1983) and Rotemberg (1984) to generate imperfect price adjustment, while still preserving the other necessary building blocks for the lending view.[11]

Although we are not aware of any limited participation models that explicitly set out to capture the distinction between the money and lending channels, there are a couple that seem to be quite close to addressing it. Two recent papers by Fuerst (1992a, 1992b) are especially relevant. In both papers the monetary mechanism works roughly as follows: There are "households," "firms," and "intermediaries." Both households and firms are subject to cash-in-advance constraints in all of their transactions.

A monetary shock takes the form of the central bank injecting cash directly into the intermediary sector. The important distinction between households and firms is that firms are "closer" to the intermediary sector, in the sense that they can transact with intermediaries without any time lag. Households, in contrast, must wait a period to revise their investment decisions. This implies that the immediate consequence of a monetary injection is that the firms wind up holding all the extra cash for one period. In other words, the firms are the only participants in this limited participation model, and monetary injections are funneled to them via the banking sector.

Monetary policy is nonneutral in this setting (thanks to the limited participation feature), and it has compositional effects. The interest rate in the firm lending market will be lower after a positive monetary shock than the (shadow) interest rate in the household market, since the firms absorb all of the shock in the short term. In one version of the model (Fuerst 1992a), the interest rate clears the firm lending market; in the other there is some degree of credit rationing.

Although Fuerst does not suggest that these models bear specifically on the lending channel, it seems to us that with a bit of reinterpretation, they might be thought of in this way. Suppose we relabel Fuerst's "firms" as "bank-dependent firms," and his "households" as "non-bank-dependent firms." The model would now have very much the feeling of the lending view. In particular, the effects of monetary policy would be transmitted via bank lending policy, and these effects would fall more heavily on the shoulders of bank-dependent firms.

11. We are unaware of any empirical evidence that supports the limited-participation assumption. Thus, both the IS-LM and limited-participation models can be criticized for the mechanisms used to produce price rigidity.

It is interesting to see where our necessary conditions (1, 2, and 3) would show up in such a model. It turns out that all three are actually embedded in a single timing assumption—namely, that only bank-dependent firms and intermediaries can transact with each other without any lag. First, note that since bank-dependent and non-bank-dependent firms are effectively "walled off" from each other in the short run, they cannot arbitrage away differences in borrowing costs. This is condition 1. Second, intermediaries are also walled off from non-bank-dependent firms in the short run. Thus they can only unload a central-bank injection on bank-dependent firms, and they too cannot arbitrage away differences in borrowing costs across the bank-dependent and non-bank-dependent markets. So condition 2 is satisfied. Finally, as we have already seen, the limited participation feature also generates the imperfect price adjustment required in condition 3.

In one sense, such a formulation of the lending view is quite elegant, since it traces everything back to a single friction—the (exogenous) cost that prevents non-bank-dependent firms from participating continuously in the bank lending market. However, this compact elegance may come at a cost in terms of empirical realism. For example, banks' portfolio "preferences" in this sort of model are purely a short-run phenomenon—in the short run, banks have no choice other than to funnel all of an injection to a subset of firms, but this changes completely once a "period" elapses. This implies that if monetary policy is ever going to impact the volume of bank lending, we should see these effects unfold very quickly. As will be shown in section 7.3 below, this implication runs counter to what is seen in the data.

In contrast, in the Bernanke-Blinder formulation of the lending channel, banks (and firms) are assumed to have well-defined *long-run* portfolio preferences between loans and bonds. This formulation therefore does not carry with it the strong implication that any of the changes in bank-lending volume that accompany a monetary policy shock should be manifested immediately. Thus on this score at least, it does a better job of fitting the facts.

We do not at all mean to suggest that the limited participation/dynamic equilibrium class of models will ultimately be unable to capture the salient aspects of the lending view. Rather, we are simply pointing out that there may be some problems in interpreting *current versions* of these models as providing an accurate and complete description of the lending view, even if they capture some of its basic essence. Richer formulations, which still use limited participation as a device to generate imperfect price adjustment, but that provide a more detailed account of intermediary portfolio choice, may well prove to be very successful in modeling the lending view.

7.3 Empirical Work on the Lending Channel

There are a variety of ways to organize a discussion of the evidence that pertains to the lending channel. We will begin by reviewing some suggestive, simple correlations that are open to many interpretations and then progressively introduce more focused tests that can be used to distinguish between competing explanations. Most of the literature either exclusively considers time-series correlations or cross-sectional correlations. While we too divide our discussion along these lines, we believe it is important to keep both bodies of evidence in mind in assessing the overall plausibility of the lending channel. After reviewing the evidence, we wrap up with some simple calculations aimed at quantifying the importance of the lending channel.

7.3.1 Tests Using Aggregate Time-Series Data

Perhaps the simplest implication of the lending channel is that bank loans should be closely correlated with measures of economic activity. Figure 7.2 graphs the change in nonfarm inventories (as reported in the National Income and Product Accounts) along with the change in commercial and industrial bank loans. The two series are highly correlated—the correlation is 0.4. Similar pictures can be drawn to show a strong correlation between bank loans and unemployment, gross national product (GNP), and other key macroeconomic indicators.

In terms of establishing support for the lending channel, however, such correlations are inconclusive, because although they are consistent with the implications of conditions 1 and 2, they also admit other interpretations. For example, it may be that the correlations are driven by changes in the demand for bank loans rather than the supply of bank loans (as required by condition 1).

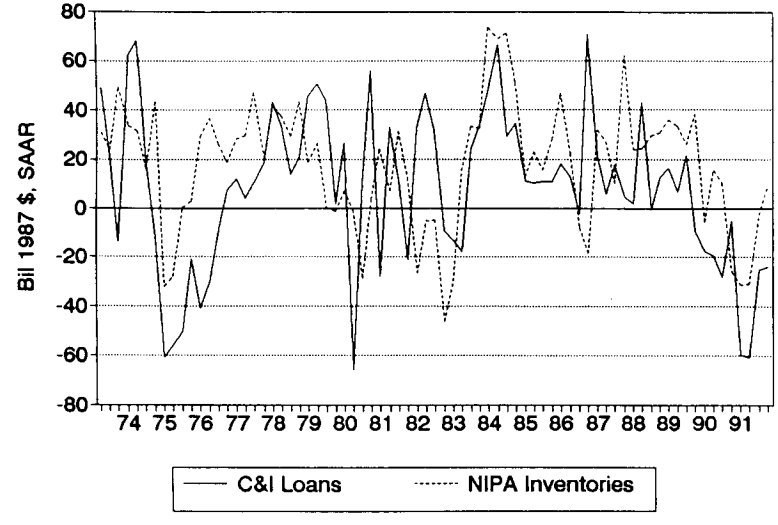

Fig. 7.2 C and I loans and National Income and Product Accounts (NIPA) nonfarm inventories (changes, in billions of 1987 dollars, SAAR)

That is, bank loans and inventories might move together because banks always stand willing to lend, and firms finance desired changes in level of inventories with bank loans. And even if the evidence does in part reflect the impact of variations in loan supply, it does not establish that these variations can be attributed to changes in monetary policy, as required by condition 2.

We thus start by reviewing the data that bear more directly on condition 1—the question of whether shifts in loan supply matter. In fact, there is considerable evidence that disruptions in the banking sector and the attendant shifts in bank loan supply are sometimes responsible for significant fluctuations in economic activity. One of the most influential of these studies is Bernanke's (1983) examination of the Great Depression in the United States. Bernanke examines the extent to which the money view of monetary policy transmission can account for the decline in U.S. output between 1930 and 1933. He finds that while a standard monetary model would predict a large drop in output, a significant amount of the decline cannot be explained by appealing purely to monetary influences. Moreover, not only can much of the unexplained decline be rationalized by recognizing the disruptive effects of bank panics, but these panics (and associated financial crises) also seem capable of explaining the persistence of the Depression. The Bernanke interpretation has become part of the conventional explanation for the depth and persistence of the Depression in the United States and is one of the strongest pieces of evidence supporting the view that shifts in loan supply can be quite important.

Bernanke, in subsequent work with James (1991), has extended this work to analyze the role of Depression-era banking panics in countries besides the United States. Studying a sample of twenty-four countries, Bernanke and James (1991) find that there are large output declines during periods of banking panics that cannot be explained by standard factors, such as trade effects, interest rates, fiscal policy, etc. Similar results have been uncovered in studies of different historical episodes in a number of countries.

The literature on credit controls also suggests that disruptions of the lending process can be quite important (see Owens and Schreft 1992). Perhaps the clearest example is the 1980 Credit Controls initiated by President Carter. Although the six-point credit-restraint program was only in place from March 14 through July 3, it had a remarkable effect on borrowing and purchasing patterns (see Schreft 1990 for details). While the controls sought to discourage all types of credit extensions, in Schreft's words, "the consumer credit controls were largely symbolic and without teeth." However, the impact on bank lending was very powerful. She reports that bank loans, which had been growing at an annualized rate of between 15 and 20 percent prior to the controls, dropped to an annual growth rate of only 2.5 percent for the month of March. In April, total bank loans outstanding fell 5 percent (at an annual rate). The decline in activity was equally sharp. Real gross domestic product (GDP) contracted at a 9.9 percent annual rate in the second quarter of the year. Once the controls were lifted, loan growth and GDP growth resumed at a healthy pace.

Finally, evidence from structural vector autoregressions (VARs) also supports the notion that shocks to loan supply have significant real effects. A noteworthy example is Bernanke (1986). Bernanke proceeds by imposing enough covariance restrictions on the disturbance terms in his equations to allow him to identify a structural shock to the intermediation process. A representative example of his restrictions is that shocks to aggregate loans are contemporaneously uncorrelated with shocks to military spending and money. Thus his identifying assumptions permit a direct investigation of whether condition 1 holds. As he notes, a change in monetary policy is one of several candidates for factors that might disturb the lending process. The resulting instrumental-variable estimates suggest that lending shocks do seem to have a sizable effect on aggregate demand. In a similar vein, Kuttner (1992) also finds that lending shocks are important for spending.

Of course, for the lending view to be relevant we must go one step further and demonstrate that condition 2 also holds, that is, that monetary policy has the power to shift loan supply. This observation suggests examining the comovements in the stance of monetary policy, loans, and activity, which in turn requires one to quantify the stance of monetary policy. Fortunately, the conclusions do not seem very sensitive to the use of any particular indicator of policy. For instance, Bernanke and Blinder (1992) find that increases in the federal funds rate (their measure of the stance of Federal Reserve policy) lead banks to slowly downsize by shedding loans, and that as loans decline the economy slows. These findings are reproduced in figure 7.3.[12]

Others researchers have also found that loans adjust gradually (but noticeably) following a shift in policy. For instance, Romer and Romer (1990) report a similar finding when they date shifts in policy by studying the language in Federal Open Market Committee directives. Thus, there does seem to be solid evidence that loan volume responds (albeit with a lag) to changes in the stance of monetary policy.

The slow adjustment of loans to policy may initially seem to undercut the plausibility of important effects coming through shifts in loan supply. For example, King (1986) runs a horse race between loans and monetary aggregates and finds that the latter do a better job of predicting activity; or said differently, money tends to lead output while loans tend to move roughly contemporaneously with output. Romer and Romer (1990) find similar results, and interpret them as cutting against the lending view. And recently, Ramey (1992) has reconfirmed these findings using a horse race based on a set of error-correction models.[13]

12. These results seem to be a bit sensitive to the choice of loan series. Bernanke and Blinder look at a loan series that captures all types of bank lending. If one instead focuses on lending to businesses (for example, Commercial and Industrial loans), loan volume initially increases following an interest-rate hike, but then turns around and begins to decline. As we discuss later, Morgan's (1992) work suggests that this is due largely to the presence of loan commitments.

13. Most of these contests show that M2 is the best monetary aggregate for predicting future output movements. However, from a theoretical perspective, M2 contains many nontransaction components and therefore is not the most obvious candidate to use to defend the money view.

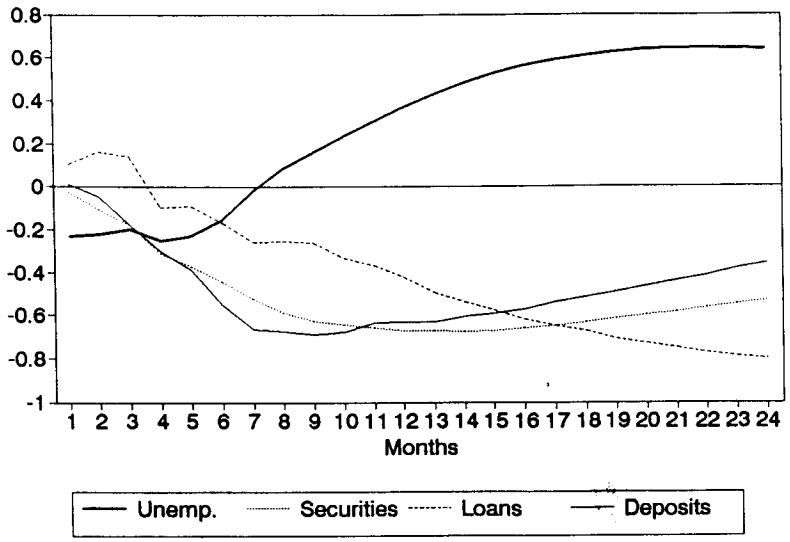

Fig. 7.3 Responses to increase in funds rate (estimated 59:12–90:12)

However, for a couple of reasons we do not think these timing differences are particularly damaging for the lending view. First, it is natural to believe that the most immediate consequence of a slowdown would be an undesired buildup of firms' inventories. This would lead to a short-run increase in the demand for loans to finance the excess inventories. Thus even if loan supply is contracting, we may not observe a rapid decline in loan volume.[14]

A second consideration, emphasized by Bernanke and Blinder, is that the contractual nature of loan agreements limits the speed with which loan volume can shrink. Recent work by Morgan (1992) confirms that much of the sluggishness in loan volume is indeed due to loan commitments. Specifically, Morgan contrasts movements in C and I loans made *under commitment* with movements in C and I loans made *without any commitment.* In figure 7.3, we saw that rising interest rates are often followed initially by slightly lower unemployment (higher activity); and Morgan finds that the loans made under commitment largely track these movements in activity. In contrast, he finds that customer loans that do not have commitments begin to fall relatively quickly, responding about as fast and as sharply as monetary aggregates. Thus, the response of loan supply to movements in monetary policy does seem quite plausible.

However, even taking the effect of loan commitments into account, it appears that loan supply responds to monetary policy with some lag. This is important to note if one is interested in applying the Lucas-Fuerst style models discussed in section 7.2.3 to capture the lending view. As noted earlier, current versions of these models generally predict very rapid responses of loans to monetary policy: the nonparticipation constraints implicit in these models are temporary. Thus, one challenge in applying this class of models in this context will be to come up with a plausible modification that can rationalize the timing patterns between shifts in policy and changes in lending and output.

14. Diamond (1991) also offers a theoretical model that suggests that the demand for intermediated credit should increase during a downturn.

Unfortunately, the observation that changes in monetary policy are followed by changes in both loan quantities and economic activity still does not prove that condition 2 holds. For example, one way to read these results is that tight monetary policy operates through standard interest channels to depress economic activity and to reduce the *demand* for credit. Consequently, there can be an induced correlation between activity and bank lending even if there is no lending channel.[15] This identification problem means that although correlations between policy indicators, bank loans, and activity are consistent with the view that monetary policy works through loan supply, such evidence cannot provide unambiguous support of the lending view.

One approach to dealing with this identification problem is proposed by Kashyap, Stein, and Wilcox (1993) (KSW). They consider the relative fluctuations in bank loans and a leading substitute for bank loans: commercial paper. The central KSW insight is that movements in substitutes for bank financing should contain information about the demand for bank financing. For example, if bank loans are falling while commercial paper issuance is rising, then KSW infer that bank loan supply has contracted.

Having made this identifying assumption, KSW propose testing both conditions 1 and 2. To verify that the central bank can affect loan supply (condition 2), KSW examine movements in the "mix" between bank loans and loan substitutes following changes in the stance of monetary policy.[16] Using both the Federal Funds rate and the Romers' policy proxy, KSW find that when the Fed tightens, commercial paper issuance surges while loans (slowly) decline—that is, the move in the mix indicates loan supply has shifted inward.[17] To study whether the implied shifts in loan supply are important (conditions 1 and 3), they add their mix variable to a set of structural equations for inventory and fixed investment. Their tests boil down to checking whether the proxy for loan-

15. However, this alternative explanation has to be stretched to explain Morgan's findings: one must argue that the demand for loans from noncommitted borrowers falls much faster than the demand of the borrowers with commitments.

16. KSW define their mix variable to be the ratio of bank loans to the sum of bank loans plus commercial paper.

17. Miron, Romer, and Weil (chap. 8 in this volume) find that movements in the CP-loan mix are less clear cut in response to earlier historical episodes of tight policy, for example, those in the early part of the century. However, given the very different institutional makeup of the markets in these periods, it is unclear whether the results are directly comparable with those of KSW. See also Bernanke's Comment on chap. 8.

supply shifts has any additional explanatory power for investment once other fundamental factors such as the cost of capital are taken into account.[18]

KSW find that the mix does seem to have independent predictive power for investment, particularly inventory investment. Since swings in inventory investment are central to business cycles and because conventional interest-rate effects have proved difficult to find for inventories, these results are noteworthy. In other words, the KSW findings provide some support for the view that monetary policy and financial factors may be important for inventory movements even though standard security market interest rates do not have much predictive power for inventories.

Hoshi, Scharfstein, and Singleton (1991) conduct an analogous set of tests using aggregate Japanese data. Specifically, they compare the behavior of bank loans which were subject to informal control by the Bank of Japan with loans from insurance companies which were the main alternative to bank financing. They find that when the Bank of Japan tightens, the fraction of industrial loans coming from banks drops noticeably, confirming condition 2. They also find that in a four-variable VAR (which includes interest rates) the mix is a significant determinant of both fixed investment and finished goods inventories. Thus, the Japanese and U.S. data give the same basic message.[19]

An alternative way of using information regarding substitutes for bank loans to resolve the identification problem is to study movements in *relative prices* rather than *relative quantities*. Specifically, changes in loan supply could be identified by checking whether the price of loans increases relative to the price of an alternative such as commercial paper. However, some care must be taken here since the nonprice terms of bank credit (for example, collateral, covenants, etc.) may vary systematically over time. In this case, one might expect data such as the prime rate to be relatively uninformative about the true cost of bank loans, and hence less useful in resolving the identification problem.[20]

Perhaps surprisingly, KSW also find evidence supporting both conditions 1 and 2 using the gap between the prime rate and the commercial paper rate to gauge loan supply: when the Fed tightens, the prime rate rises relative to the commercial paper rate. Furthermore, movements in this spread help forecast investment, even controlling for the cost of capital. In contrast, however, Kuttner (1992), using simple VAR-type causality tests, shows that the spread between the prime rate and the commercial-paper rate is a poor predictor of output (much worse than the KSW quantity-based mix variable, which continues to perform strongly in the VAR-type tests.)[21] Thus, the tests with price-based indicators lead to qualitatively similar conclusions as the tests using quantity-based indicators, although the findings with the rate spreads seem to be less robust.

Overall, we find the existing results based on aggregate data fairly supportive of the lending view. We see a coherent body of evidence, starting with very simple correlations and moving through a fairly precise set of tests, that suggests that monetary transmission operates at least partially through induced shifts in loan supply. However, we also recognize some important limitations that accompany this type of time-series analysis. For instance, one difficulty is that there are relatively few episodes where monetary policy shifts. In almost all of these cases, the shifts occur near recessions, so that many of the correlations we have discussed also could be uncovered by contrasting behavior during booms and busts. Since this sort of ambiguity is likely to be very difficult to resolve using only aggregate data, we think it is essential to examine other types of evidence.

7.3.2 Tests Using Cross-Sectional Data

There are good reasons to believe that studying cross-sectional data might be particularly helpful in this respect. For one, there is added variation that can be exploited in cross-sectional data. More specifically, there are a rich set of cross-firm implications of the lending view that are masked at the aggregate level. One key example is that not all firms are likely to be bank dependent, so some of the hypothesized effects implied by the lending view should occur for some firms but not for others. The combination of more data and more precise implications of the theory suggests a powerful set of tests using microdata that can be used to complement the aggregate findings.

While tests using cross-sectional data do offer considerable promise, they also come at a higher cost because these data require more effort to work with than do aggregate time-series data. At this point there has been relatively less work using microdata to specifically examine the lending view. A couple of notable exceptions are the recent papers by Gertler and Gilchrist (1992) and Oliner and Rudebusch (1992) that use information from the *Quarterly Financial Report*, a survey of over seven thousand manufacturing firms, to contrast the behavior of small and large firms. Under the assumption that small firms

18. A similar approach could be used to extend the work by Morgan. For instance, with an additional assumption that the demand for credit is the same for firms with and without bank commitments, the difference between the loans extended to the two sets of firms could be used to isolate shifts in loan supply. The gap between the two types of loans could then be used as a proxy for loan supply instead of the KSW mix variable.

19. Arguably, the Japanese evidence is less surprising since the Bank of Japan appears to exert some direct control over loan volume in addition to any indirect control that might come from changing reserves.

20. See Kashyap, Stein, and Wilcox (1993) for further discussion on this point.

21. Work by Friedman and Kuttner (1992, 1993) and Stock and Watson (1989) suggests that a different interest-rate spread, the difference between commercial paper and Treasury-bill rates, is a very reliable predictor of activity. These results might be interpreted as providing some indirect evidence on the lending view. For instance, if monetary policy does move loan supply and thus changes firms' financing patterns, then it seems likely that part of the movement in the bills/paper spread is due to shifts in monetary policy (see Bernanke 1990 and Friedman and Kuttner 1993 for details). However, in terms of the lending view, it is not clear why the bills/paper spread would perform so much better than the paper/prime spread in different forecasting contests. This suggests that one area for future work will be to combine the information in different price and quantity indicators to provide a more complex assessment of the lending view.

are much more likely to be bank dependent than larger firms, the comparisons bear on the lending view.

Gertler and Gilchrist (1992) begin by showing that bank loans to small firms decline significantly when the Fed raises interest rates, while large firms' aggregate external financing actually rises. One explanation for the Gertler and Gilchrist findings might be that some large firms issue commercial paper to finance trade credit that they want to offer to their smaller customers, who have been cut off from bank financing. In this case, commercial paper and bank loans are aggregate substitutes (as assumed by KSW) even though only certain firms can directly issue commercial paper.[22]

Moreover, Gertler and Gilchrist find that the inventory investment of small firms is much more sensitive to monetary policy shocks than that of large firms. This finding is compatible with the KSW aggregate evidence on inventories, and we will return to it shortly when we attempt to calibrate the magnitude of the lending channel. Oliner and Rudebusch (1992) conduct a similar investigation using imputed investment data for small and large manufacturing firms. They too find that small firms' investment is more sensitive to movements in a proxy for the stance of the monetary policy.

While this line of work produces conclusions that fit with the cross-sectional implications of the lending view, the relatively coarse level of disaggregation leaves open some other possibilities. For example, it might simply be that for technological reasons, small firms are more recession sensitive than large firms.[23] This sort of objection can be partially addressed by using firm-level data.

Several recent papers can be interpreted as firm-level tests of the lending view. In each case, the authors first identify a set of liquidity-constrained firms and then investigate whether these liquidity constraints become more binding in the wake of a shift in monetary policy. To the extent that the liquidity-constrained firms are to some degree bank dependent, this evidence bears on the lending view.

Hoshi, Scharfstein, and Singleton (1991) (HSS) focus on a set of Japanese firms that would be susceptible to being cut off from banks during times of tight credit—firms that are not part of bank-centered industrial groups. HSS investigate whether these "independent" firms' fixed investment becomes more sensitive to cash flow when monetary policy tightens. Until recently in Japan, assessing the stance of monetary policy was relatively straightforward because the Bank of Japan (BOJ) explicitly made suggestions to banks about how much

22. KSW do not commit to any particular microeconomic story to rationalize their assumption of the substitutability of commercial paper and bank loans. However, as long as the substitution of trade credit for bank loans is imperfect, the KSW story makes sense. In other words, the KSW story in no way hinges on the existence of marginal firms that shift between borrowing through banks or borrowing through the commercial paper market.

23. See, however, Gertler and Hubbard (1989), who take issue with the view that small firms are more recession sensitive than large firms.

lending to undertake. When the BOJ wanted to tighten it would urge banks to curtail their lending. And indeed, HSS find that when monetary policy is tight, liquidity is more important for independent firms' investment than in normal times.

Gertler and Hubbard (1989) conduct a similar study with U.S. data. They build on the Fazzari, Hubbard, and Petersen (1988) (FHP) result that the fixed investment of firms that do not pay dividends is much more sensitive to cash flow and liquidity than is the fixed investment of firms that have high dividend payout ratios. Accepting the FHP interpretation that this is evidence of liquidity constraints, it is possible to ask whether such constraints become more severe during periods of tight money.

Studying the FHP sample from 1970 to 1984, Gertler and Hubbard find that the investment of the low-payout firms does indeed become more sensitive to cash flow during the 1974–75 and 1981–82 recessions. Given that tight monetary policy was a factor in both recessions (see Romer and Romer 1990), these findings lend further support to the lending view. However, as Gertler and Hubbard note, the following alternative interpretation is also possible. If information about some borrowers is incomplete, they may be able to borrow more easily by posting collateral. During a recession, it may be that collateral values fall. In this case, even if bank loan supply does not shift inward, the decrease in collateral values would lead banks to lend less in equilibrium. Discriminating between this "collateral shock" explanation for the Gertler and Hubbard finding and the lending view is not easy. Both explanations stress the importance of a cutoff in bank lending as a contributing factor to the decline in investment, and differ only with respect to the source of this cutoff.

Kashyap, Lamont, and Stein (1992) (KLS) conduct a similar set of tests using firm-level inventory data. They focus on the differences between publicly traded companies that do and do not have bond ratings. The nonrated companies are typically much smaller than the rated companies and are likely bank dependent. Because of the myriad of evidence suggesting that Federal Reserve policy was restrictive prior to 1982, KLS begin their study with an examination of the 1982 recession. They find that during this episode, the inventory movements of the nonrated companies were much more dependent on their own cash holdings than were the inventory movements of the rated companies. (In fact, there is no significant liquidity effect for the rated companies.)

In contrast, KLS find that during subsequent periods there is little relation between cash holdings and inventory movements for the nonrated companies. For instance, during 1985 and 1986, when KLS argue that monetary policy was particularly loose, the correlation between inventory investment and cash holdings is negative and completely insignificant. These findings further support the KSW suggestion that financial factors beyond those captured by open-market interest rates play an important role in inventory movements during recessions.

As with the Gertler and Hubbard results, however, the KLS finding might

also be interpreted as supporting the importance of collateral shocks rather than the lending view. KLS present some additional tests that try to distinguish between the two explanations. KLS reason that if the collateral deterioration story is correct, then the cutoff in bank lending ought to be more pronounced for firms that have high debt levels (that is, firms that have limited amounts of uncommitted collateral available). However, KLS find no systematic relation between debt levels (relative to total assets) and the sensitivity of inventory investment to cash holdings.

Overall, we read the firm-level evidence as echoing the story that emerges from both the aggregate data and the partially disaggregated *Quarterly Financial Report* data. Several different studies yield the same basic conclusion: during periods when monetary policy is tight, it appears that bank-dependent firms' spending becomes more closely tied to the availability of internal finance.

7.3.3 Quantifying the Impact of the Lending Channel

While we are quite confident in asserting that the lending channel exists, we are much less certain about its overall quantitative significance. The ideal way to assess the strength of the lending channel would be to estimate a fully specified structural model that captures both the lending and money channels and then to simulate the impact of tightening of monetary policy. Unfortunately, at this point no such model exists. As a second best alternative, we discuss three imperfect but quite different approaches to calibrating the importance of the lending channel.

One set of estimates can be inferred from the work of Kashyap, Stein, and Wilcox. Recall that they use a set of standard structural models for inventory and fixed investment—that already control for open-market interest rates and output—and test whether their financing mix variable provides any additional explanatory power. The rough idea is that the mix captures that part of overall financing costs attributable to the lending channel. KSW find that the coefficients on the mix are sufficiently big that a shock similar to the one that followed the Fed's October 1979 shift in policy results in an extra 1 percent decline in GNP. As noted earlier, most of this extra adjustment takes place in inventories. It is also worth noting that by construction this estimate ignores any possible effects that might operate through other channels, such as consumers' expenditures on durables.

An alternative strategy would be to begin with the Gertler-Gilchrist comparison of the inventory behavior of small and large manufacturing firms. Using a VAR framework, they find that there is a sharp difference in the way the two types of firms respond to a Romer date impulse: eight quarters after a Romer date, large-firm inventories are usually up by 5 percent, while small-firm inventories are typically down by about 11 percent. The cumulative impact of the small firms is significant: they bring the aggregate inventory accumulation down from 5 percent to roughly 2 percent.

Making the (perhaps strong) assumption that the large-small differential is entirely attributable to the lending channel, this result suggests that the lending channel causes manufacturing inventories to be 3 percent lower than they would be otherwise. This implies a fairly modest effect in terms of GNP. For example, considering again the October 1979 shift in Fed policy, according to the *Quarterly Financial Report* the stock of manufacturing inventories was roughly 250 billion as of the fourth quarter of 1979. A 3 percent decline in this stock therefore represents about 0.30 percent drop in GNP. According to Blinder and Maccini (1991, 76) manufacturing firms held an average of about 60 percent of total manufacturing and trade inventories (between 1959 and 1986). So, if one assumes further that the inventory behavior of the nonmanufacturing firms is similar to that of the manufacturing firms, then the total economywide inventory effect would be about 0.5 percent of GNP (.5 = .30/.60). Thus, the size of the effect as calibrated from the Gertler-Gilchrist data is roughly consistent with the effect reported by KSW using aggregate data.

Finally, to take a different tack, one might ask how much of the potency of monetary policy can be confidently ascribed to the money view of transmission. In other words, one might try to calibrate the magnitude of the lending view by working backwards: make an estimate of the importance of monetary policy, decide how much of this can be traced to open-market interest-rate effects, and then impute any remaining effects to the lending channel. Of course this approach puts the "burden of proof" squarely on the money view, and therefore highlights the choices that one implicitly must make in calibrating the size of these effects.

This example is particularly provocative because interest-rate effects are notoriously hard to find for many categories of investment spending. For instance, Blinder and Maccini (1991, 82), in surveying the literature on inventories conclude that empirical research "generally fails to uncover any influence of real interest rates on inventory investment, especially for finished goods in manufacturing." Given the large role of inventories in cyclical fluctuations, this should force a diehard believer in the money view to ask whether it is plausible to maintain that monetary policy has no direct effect on inventories.

Similarly, direct attempts to estimate the relationship between real interest rates and aggregate output (usually under the guise of estimating the slope of the IS curve) often find that there is little relationship between the two. For instance, Hirtle and Kelleher (1990) survey the literature on the interest sensitivity of the economy (and how it might have changed because of financial market deregulation) and note that there is little consensus on whether real interest rates matter much. For instance, their own results suggest that there is no significant relationship between (short-term) real interest rates and output. This sort of finding suggests that one could take an extreme stand and claim that all of monetary policy's potency comes via a lending channel! While we think this claim is too strong, we think it is equally disingenuous to tilt a calcu-

lation so that the money channel by default gets the bulk of any unexplained variation.

On the whole, the literature on the lending channel thus far does not very precisely pin down the quantitative importance of the effects. Some of this problem arises because there is still no widely accepted theoretical model that both satisfactorily captures all the important potential channels and can be estimated. Not surprisingly the result is that one can come up with a wide range of estimates. The KSW and Gertler-Gilchrist numbers suggest a meaningful though moderate impact, while the "name the residual strategy"—claiming all of the non-interest-rate effects for the lending channel—suggests a potentially huge impact. More careful attempts to narrow the range are likely to be one of the leading topics of work in this area.

7.4 Conclusions

This paper was designed to accomplish three goals. First, we wanted to clarify what is meant by the lending view of monetary policy transmission. Ultimately, the lending view boils down to the two-part assertion that (*a*) open-market operations affect the supply of bank loans; and (*b*) that these loan supply shifts in turn affect both the magnitude of aggregate output and its composition. The essential ingredient that underlies this mechanism is the imperfect substitutability of bank loans and publicly issued bonds, both as corporate liabilities *and* as bank assets.

In contrast, quantity rationing in the loan market is not necessary for there to be a meaningful lending channel, although in practice such rationing is likely to be present to some degree. Thus, as we have defined things, the lending view of monetary policy transmission is a subset of the larger literature that connects financial market imperfections and the real economy. Of course, even if our narrow version of the lending channel does not apply, there may be other ways in which financial market imperfections shape the consequences of monetary policy (for example, Bernanke and Gertler 1989).

Similarly, the lending view need not imply that the more traditional money channel of policy transmission is inoperative; clearly the two channels can coexist and can complement each other. Nonetheless, the distinction between the two is an important one: as we have stressed, the existence of a lending channel can influence both the potency and the distributional consequences of monetary policy, as well as the information content of a variety of indicators that policymakers look to.

A second goal of the paper was to outline the microfoundations that are needed to rationalize the existence of the lending channel. The bottom line here is that while the large existing literature on financial contracting and intermediation already provides much of what is needed, there remain some thorny problems that have thus far received little formal modeling attention. One particular area that would appear to require further work is that which corresponds

to condition 2—the link between Fed-induced shocks to reserves and the aggregate supply of intermediated loans.

Our final goal was to collect the empirical evidence that bears on the lending view. In our view, the evidence for the *existence* of a lending channel is already quite strong—there are a number of papers that document facts that would be very difficult to explain under the pure money view of monetary policy transmission. Importantly, this evidence comes from a number of sources, uses both aggregate and cross-sectional data, and for the most part produces results that complement each other.

While there is surely more work to be done in terms of building a definitive case for the existence of the lending channel, a perhaps more important (and difficult) task for future research is to provide a relatively precise assessment of its quantitative importance. At this point, we remain quite uncertain about the exact magnitude of the lending channel impacts across a variety of sectors. Learning more about these magnitudes will be of vital importance if this line of research is ever to provide anything more than qualitative help to policymakers.

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