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IS THERE A 'CREDIT CHANNEL' FOR MONETARY POLICY?

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ABSTRACT

This paper argues that the terms "money view" and "credit view" are not always well defined in theoretical and empirical debates over the transmission mechanism of monetary policy. Recent models of information and incentive problems in financial markets suggest the usefulness of decomposing the transmission mechanism into two parts: one related to effects of policy-induced changes on the overall level of real costs of funds, and one related to "financial accelerator" effects stemming from impacts of policy actions on the financial positions of borrowers or intermediaries. The results presented here support the idea that the spending decisions of a significant group of borrowers are influenced by their balance sheet condition. Whether a bank-lending channel is operative is less clear, however. More micro evidence at the level of individual borrower-lender transactions is needed to resolve this question.

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Understanding the channels through which monetary policy affects economic variables has long been a key research topic in macroeconomics and a central element of economic policy analysis. At an operational level, a "tightening" of monetary policy by the Federal Reserve implies a sale of bonds by the Fed and an accompanying reduction of bank reserves. One question for debate in academic and public policy circles in recent years is whether this exchange between the central bank and the banking system has consequences in addition to those for open market interest rates. At the risk of oversimplifying the debate, the question is often asked as whether the traditional interest rate or "money view" channel presented in most textbooks is augmented by a "credit view" channel.[1]

There has been a great deal of interest in this question in the past several years motivated both by developments in economic models (in the marriage of models of informational imperfections in corporate finance with traditional macroeconomic models) and recent events (*e.g.*, the so-called "credit crunch" during the 1990-1991 recession[2]). However, as I elaborate below, it is not always straightforward to define a meaningful "credit view" alternative to the conventional interest-rate transmission mechanism. Similar

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[1]For descriptions of the debate, see Bernanke and Blinder (1988) and Bernanke (1993).

[2]For an analysis of the "credit crunch" episode, see Kliesen and Tatom (1992) and the studies in Federal Reserve Bank of New York (1994). The paper by Cantor and Rodrigues in the New York Fed volume considers the possibility of a credit crunch for nonbank intermediaries.

difficulties arise in structuring empirical tests of "credit view" models.

This paper describes and analyzes a broad, though still well-specified version of "credit view" alternative to the conventional monetary transmission mechanism. In so doing, I sidestep the "credit view" language *per se*, and instead focus on isolating particular frictions in financial arrangements and on developing testable implications of those frictions. To anticipate that analysis a bit, I argue that realistic models of "financial constraints" on firms' decisions imply potentially significant effects of monetary policy beyond those working through conventional interest-rate channels. Pinpointing effects of a narrow "bank lending" channel of monetary policy is more difficult, though some recent models and empirical work are potentially promising in that regard.

The paper is organized as follows. I begin reviewing the assumptions and implications of the "money view" of the monetary transmission mechanism and by describing the assumptions and implications of models of "financial constraints" on borrowers and models of "bank-dependent" borrowers. The balance of the paper discusses transition from alternative theoretical models of the transmission mechanism to empirical research, and examines implications for monetary policy.

HOW REASONABLE IS THE "MONEY VIEW"?

Before discussing predictions for effects of monetary policy

of alternative approaches, it is useful to review assumptions about intermediaries and borrowers in the traditional interest-rate view of the monetary transmission mechanism. In this view, financial intermediaries ("banks") offer no special services on the asset side of their balance sheet. On the liability side of their balance sheet, banks perform a special role; the banking system creates money by issuing demand deposits. Underlying assumptions about borrowers is the idea that capital structures do not influence real decisions of borrowers and lenders, the result of Modigliani and Miller (1958). Applying the intuition of the Modigliani-Miller theorem to banks, Fama (1980) reasoned that shifts in the public's portfolio preferences among bank deposits, bonds, or stocks should have no effect on real outcomes; that is, the financial system is merely a veil.[3]

To keep the story simple, suppose that there are two assets -- "money" and "bonds."[4] In a monetary contraction, the central bank reduces reserves, limiting the banking system's ability to sell deposits. Depositors ("households") must, then, hold more bonds and less money in their portfolios. If prices do not instantaneously adjust to changes in the money supply, the fall in household money holdings represents a decline in real money balances. To restore

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[3]Fama's insight amplifies the earlier contribution of Brainard and Tobin (1963) that monetary policy can be analyzed through its effects on investor portfolios.

[4]More generally, in a model with many assets, this description would assign to the money view of the transmission mechanism effects on spending arising from any changes in relative prices of assets.

equilibrium, the real interest rate on "bonds" increases, raising the user cost of capital for a range of planned investment activities and interest-sensitive spending falls.[5,6]

While the money view is widely accepted as the benchmark or "textbook" model for analyzing effects of monetary policy on economic activity, it relies on four key assumptions: (1) The central bank must control the supply of "outside money," for which there are imperfect substitutes. (2) The central bank can affect real as well as nominal short-term interest rates; that is, prices do not adjust instantaneously. (3) Policy-induced changes in real short-term interest rates affect longer-term interest rates influencing household and business spending decisions. (4) Plausible changes in interest-sensitive spending in response to a monetary policy innovation match reasonably well with observed output responses to such innovations.

In this stylized view, "monetary policy" is represented by a change in the nominal supply of outside money. Of course, the quantity of much of the monetary base is likely to be endogenous.[7] Nonetheless, legal restrictions (*e.g.*, reserve requirements) may

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[5]While this simple two-asset-model description of the money view is highly stylized, it is consistent with a number of alternative models beyond the textbook *IS-LM* model (see, *e.g.*, Hubbard, 1994, Chapter 24), including, dynamic equilibrium cash-in-advance models (*e.g.*, Rotemberg, 1984; and Christiano and Eichenbaum, 1992).

[6]For an empirical description of this transmission mechanism in the context of the Federal Reserve's forecasting model, see Mauskopf (1990).

[7]See, for example, "limited participation" models as in Lucas (1990) and Christiano and Eichenbaum (1992).

compel agents to use the outside asset for some transactions. In practice, the central bank's influence over nominal short-term interest rates (*e.g.*, the federal funds rate in the United States) is uncontroversial. There is also evidence that the real federal funds rate responds to a shift in policy (see, *e.g.*, Bernanke and Blinder, 1992).

Turning to the other assumptions, that long-term rates used in many saving and investment decisions should increase or decrease predictably in response to a change in short-term rates is not obvious *a priori* based on conventional models of the term structure. Empirical studies, however, have documented a significant positive relationship between changes in the (nominal) federal funds rate and the ten-year Treasury bond rate (see, *e.g.*, Cohen and Wenninger, 1993; and Estrella and Hardouvelis, 1990). Finally, while many components of aggregate demand are arguably interest-sensitive (such as consumer durables, housing, business fixed investment, and inventory investment), output responses to monetary innovations are large relative to the generally small estimated effects of user costs of capital on investment.[8]

I shall characterize the "money view" focusing on *aggregate* as opposed to *distributional* consequences of policy actions. In this view, higher default-risk-free rates of interest following a monetary contraction depress desired investment by firms and

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[8]See, for example, analyses of inventory investment in Kashyap, Stein, and Wilcox (1992) and Gertler and Gilchrist (1993). See also the review of empirical studies of business fixed investment in Chirinko (1993) and Cummins, Hassett, and Hubbard (1994).

households. While desired investment falls, the reduction in business and household capital falls on the least productive projects. Such a view offers no analysis of distributional, or cross-sectional, responses to policy actions, nor of aggregate implications of this heterogeneity. I review these points not to suggest that standard interest-rate approaches to the monetary transmission mechanism are incorrect, but to suggest strongly that one ought to expect that they are incomplete.

HOW REASONABLE IS THE "CREDIT VIEW"?

The search for a transmission mechanism broader than that just described reflects two concerns, one "macro" and one "micro." The "macro" concern, mentioned earlier, is that cyclical movements in aggregate demand -- particularly business fixed investment and inventory investment -- appear too large to be explained by monetary policy actions that have not generally led to large changes in real interest rates. This has pushed some macroeconomists to identify financial factors in propagating relatively small shocks, factors that correspond to "accelerator" models that explain investment data relatively well.[8] Indeed, I

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[8]This current fashion actually has a long pedigree in macroeconomics, with important contributions by Fisher (1933), Gurley and Shaw (1955, 1960), Minsky (1964, 1975), and Wojnilower (1980). Some econometric forecasting models have also focused on financial factors in propagation mechanisms (see, *e.g.*, the description for the DRI model in Eckstein and Sinai, 1986). Cagan (1972) provides an empirical analysis of "money" and "bank lending" views. An early contribution to the contemporary credit view literature is Bernanke (1983).

use the term "financial accelerator" (put forth by Bernanke, Gertler, and Gilchrist, 1994) to refer to the magnification of initial shocks by financial market conditions.

The "micro" concern relates to the emergence of a growing literature studying informational imperfections in insurance and credit markets. In this line of inquiry, problems of asymmetric information between borrowers and lenders lead to a gap between the cost of external finance and internal finance. The notion of costly external finance stands in contrast to the more complete-markets approach underlying the conventional interest-rate channels, which does not consider links between real and financial decisions.[9]

While a review of this literature is beyond the scope of this paper, I want to mention three common empirical implications that have emerged from models of the financial accelerator.[10,11] The

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[9]Potential effects of adverse selection problems on market allocation have been addressed in important papers by Akerlof (1970) and Rothschild and Stiglitz (1976), and have been applied to loan markets by Jaffee and Russell (1976) and Stiglitz and Weiss (1981) and to equity markets by Myers and Majluf (1984). Research on principal-agent problems in finance has followed the contribution of Jensen and Meckling (1976). Gertler (1988), Bernanke (1993), and King and Levine (1993) provide reviews of related models of informational imperfections in capital markets.

[10]See also the review in Bernanke, Gertler, and Gilchrist (1994). These implications are consistent with a wide class of models, including those of Townsend (1979), Blinder and Stiglitz (1983), Farmer (1985), Williamson (1987), Bernanke and Gertler (1989, 1990), Calomiris and Hubbard (1990), Sharpe (1990), Hart and Moore (1991), Kiyotaki and Moore (1993), Gertler (1992), Greenwald and Stiglitz (1988, 1993), and Lamont (1993).

[11]Strictly speaking, the models in this literature are generally partial equilibrium models of firm-level investment decisions. In the literature on monetary growth models, Boyd and

first, which I just noted, is that uncollateralized external finance is more expensive than internal finance. Second, the spread between the cost of external and internal finance varies inversely with the borrower's net worth -- internal funds and collateralizable resources -- relative to the amount of funds required. Third, an adverse shock to a borrower's net worth increases the cost of external finance and decreases the ability of the borrower to implement investment, employment, and production plans. This channel provides the financial accelerator magnifying an initial shock to net worth. Links between internal net worth and investment broadly defined (holding constant investment opportunities) have been corroborated in a number of empirical studies.[12,13]

Let me now extend this argument to include a channel for "monetary policy."[14] In the money view, policy actions affect the

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Smith (1994) derive a general equilibrium monetary model with credit markets, a credit market friction, and an allocative role for financial intermediaries.

[12]See, for example, Fazzari, Hubbard, and Petersen (1988); Gertler and Hubbard (1988); Cantor (1990); Hoshi, Kashyap, and Scharfstein (1991); Calomiris and Hubbard (1993); Hubbard and Kashyap (1992); Oliner and Rudebusch (1992); Fazzari and Petersen (1993); Hubbard, Kashyap, and Whited (forthcoming); Bond and Meghir (1994); Cummins, Hassett, and Hubbard (1994); Carpenter, Fazzari, and Petersen (1994); and Sharpe (1994). For households, Mishkin (1977, 1978) and Zeldes (1989) provide evidence of effects of household balance sheet conditions on consumer expenditures.

[13]The Appendix presents a simple model that illustrates these predictions.

[14]For broader descriptions of "credit view" arguments, see Bernanke (1993), Friedman and Kuttner (1993), Gertler (1993), Gertler and Gilchrist (1993), and Kashyap and Stein (1993). An early exposition of a role for "credit availability" appears in

overall level of real interest rates and interest-sensitive spending. The crux of models of information-related financial frictions is a gap between the cost of external and internal finance for many borrowers. In this context, the credit view offers channels through which monetary policy (open market operations or regulatory actions) can affect this gap. That is, the credit view encompasses distributional consequences of policy actions, because the costs of finance respond differently for different types of borrowers. Two such channels have been discussed in earlier work: (1) financial constraints on borrowers, and (2) the existence of "bank-dependent" borrowers.

Financial Constraints On Borrowers

Any story describing a credit channel for monetary policy must have as its foundation the idea that some borrowers face high costs of external finance. In addition, models of a financial accelerator argue that the spread between the cost of external and internal funds varies inversely with the borrowers' net worth. It is this role of net worth which offers a channel through which policy-induced changes in interest rates affect borrowers' net worth (see, *e.g.*, Gertler and Hubbard, 1988). Intuitively, increases in the real interest rate in response to a monetary contraction increase borrowers' debt-service burdens and reduce the present value of collateralizable net worth, thereby increasing the marginal cost of external finance and reducing firms' ability to

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Roosa (1951).

carry out desired investment and employment programs. This approach offers a "credit channel" even if open market operations have no direct quantity effect on banks' ability to lend. Moreover, this approach implies that spending by low-net-worth firms is likely to fall significantly following a monetary contraction (to the extent that the contraction reduces borrowers' net worth).

The Existence of Bank-Dependent Borrowers

The second channel stresses that some borrowers depend upon *banks* for external funds, and that policy actions can have a direct impact on the supply of loans. When banks are subject to reserve requirements on liabilities, a monetary contraction drains reserves, possibly decreasing banks' ability to lend. As a result, credit allocated to bank-dependent borrowers may fall, causing these borrowers to curtail their spending. In the *IS-LM* framework of Bernanke and Blinder (1988), both the *IS* and *LM* curves shift to the left in response to a monetary contraction. Alternatively, an adverse shock to banks' capital could decrease both banks' lending and the spending of bank-dependent borrowers. Such bank lending channels magnify the decline in output as a result of the monetary contraction, and the effect of the contraction on the real interest rate is muted. This basic story raises three questions, relating to: (1) why certain borrowers may be "bank-dependent" (that is, unable to access open market credit or borrow from nonbank financial intermediaries or other sources), (2) whether exogenous

changes in banks' ability to lend can be identified, and (3) (for the analysis of open market operations) whether banks have access to sources of funds not subject to reserve requirements.

The first question is addressed, though not necessarily resolved, by the theoretical literature on the development of financial intermediaries[15]. In much of this research (see especially Diamond, 1984; and Boyd and Prescott, 1986), intermediaries offer low-cost means of monitoring some classes of borrowers. Because of informational frictions, non-monitored finance entails deadweight spending resources on monitoring. A free-rider problem emerges, however, in public markets with a large number of creditors. The problem is mitigated by having a financial intermediary hold the loans and act as a "delegated monitor." Potential agency problems at the intermediary level are reduced by having the intermediary hold a diversified loan portfolio financed principally by publicly issued debt.[16] This line of research argues rigorously that borrowers for which monitoring costs are significant will be dependent upon intermediaries for external finance,[17] and that costs

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[15]Models of equilibrium credit rationing under adverse selection (*e.g.*, Stiglitz and Weiss, 1981) offer another mechanism through which an increase in the level of default-risk-free real interest rates reduces loan supply. Credit rationing is not required for the bank-dependent-borrower channel to be operative; instead, what is required is that loans to these borrowers are an imperfect substitute for other assets and that the borrowers lack alternative sources of finance.

[16]Calomiris and Kahn (1991) offer a model of demandable debt to finance bank lending.

[17]A substantial body of empirical evidence supports the idea that banks offer special services in the lending process. For example, James (1987) and Lummer and McConnell (1980) find that the

of switching lenders will be high.[18] It does not, however, necessarily argue for *bank* dependence (*e.g.*, finance companies are intermediaries financed by non-deposit debt).

Second, even if one accepts the premise that some borrowers are bank-dependent in the sense described earlier, one must identify exogenous changes in banks' ability to lend. Four such changes have been examined in previous research. The first focuses on the role played by banking panics, in which depositors' flight to quality -- converting bank deposits to currency or government debt -- reduces banks' ability to lend (for empirical evidence, see Bernanke, 1983, and Bernanke and James, 1991, for the 1930s and Calomiris and Hubbard, 1989, for the National Banking period). A second argument emphasizes regulatory actions, such as that under binding Regulation Q ceilings in the United States (see, *e.g.*, Schreft, 1990; Kashyap and Stein, 1992; and Romer and Romer, 1993) and regulation of capital adequacy (see, e.*g.*, Bernanke and Lown, 1991; and Peek and Rosengren, 1992).[19] Empirical evidence for this channel is quite strong. Third, Bizer(1993) suggests that

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announcement of a bank loan, all else equal, raises the share price of the borrowing firm, likely reflecting the information content of the bank's assessment. In a similar spirit, Fama (1985) and James (1987) find that bank's borrowers, rather than banks' depositors, bear the incidence of reserve requirements (indicating that borrowers must not have easy access to other sources of funds). Petersen and Rajan (1994) show that small businesses tend to rely on local banks for external funds.

[18]See, for example, the discussion in Petersen and Rajan (1994).

[19]Owens and Schreft (1990) discuss the identification of "credit crunches." See also the description in Hubbard (1994, Chapter 27).

increased regulatory scrutiny decreased banks' willingness to lend in the early 1990s, all else equal.

The fourth argument stresses exogenous changes in bank reserves as a result of shift in monetary policy. In principle, such a shift in monetary policy could be identified with a discrete change in the federal funds rate in the aftermath of a dynamic open market operation or with a change in reserve requirements. Because effects on reserves of changes in reserve requirements are generally offset by open market operations, bank-lending-channel stories are generally cast in terms of open market operations.

An illustration of the gap between models and practice surfaces in addressing the third question of the ease with which banks can raise funds from non-deposit sources (*e.g.*, certificates of deposit, CDs), when the Fed decreases reserves. Romer and Romer (1990) have pointed out, for example, that if banks see deposits and CDs as perfect substitutes, the link between open market operations and the supply of credit to bank-dependent borrowers is broken. Banks are unlikely, however, to face a perfectly elastic supply schedule for CDs at the prevailing CD interest rate. Since large-denomination CDs are not insured at the margin by federal deposit insurance, prospective lenders must ascertain the quality of the issuing bank's portfolio. Given banks' private information about at least a portion of their loan portfolio, adverse selection problems will increase the marginal cost of external finance as more funds are raised (see, *e.g.*, Myers and Majluf, 1984; and Lucas and McDonald, 1992). In addition, as long as *some* banks face

constraints on issuing CDs and those banks lead to bank-dependent borrowers, a bank lending channel will be operative.

While the foregoing discussion centers on open market operations, regulatory actions by the central bank -- credit controls, for example -- represent another way in which monetary policy can have real effects through influencing the spending decisions of bank-dependent borrowers. Here the effects are likely to be more pronounced than for the case of open market operations, since the question of the cost of non-deposit sources of funds is no longer central, and effectiveness of such regulatory actions depends only on the existence of bank-dependent borrowers.

GOING FROM MODELS TO EMPIRICAL RESEARCH

Both the "financial constraints on borrowers" and "bank lending channel" mechanisms imply significant cross-sectional differences in firms' shadow cost of finance and in the response of that cost to policy-induced changes in interest rates. Accordingly, empirical researchers have attempted to test these cross-sectional implications. As I examine this literature, I explore how Modigliani-Miller violations for nonfinancial borrowers, financial intermediaries, or both offer channels for monetary policy beyond effects on interest rates. The Appendix frames this discussion using a simple model; an intuitive presentation appears below.

Empirical Research on the "Credit View"

Studies Using Aggregate Data

The microeconomic underpinnings of both financial accelerator models and the credit view of monetary policy hinge on certain groups of borrowers (perhaps including banks or other financial intermediaries) facing incomplete financial markets. Examining links between the volume of credit and economic activity in aggregate data (with an eye toward studying the role played by bank-dependent borrowers) requires great care. Simply finding that credit measures lead output in aggregate time-series data is also consistent with a class of models in which credit is passive, responding to finance expected future output (as in King and Plosser, 1984). Consider the case of a monetary contraction, for example. The effect of the contraction on interest rates could depress desired consumption and investment spending, reducing the demand for loans.

In a clever paper that has stimulated a number of empirical studies, Kashyap, Stein, and Wilcox (1993) -- henceforth, KSW -- examine relative fluctuations in the volume of bank loans and a close open-market substitute, issuance of commercial paper. In the KSW experiment, upward or downward shifts in both bank lending and commercial paper issuance likely reflect changes in the *demand* for credit. However, a fall in bank lending while commercial paper issuance is rising might suggest that bank loan *supply* is contracting. To consider this potential co-movement, KSW focus on changes over time in the "mix" between bank loans and commercial

paper (defined as bank loans divided by the sum of bank loans and commercial paper). They find that, in response to increases in the federal funds rate (or, less continuously, at the times of the contractionary policy shifts identified by Romer and Romer, 1989), the volume of commercial paper issues rises, while bank loans gradually decline. They also find that policy-induced changes in the mix have independent predictive power for inventory and fixed investment, holding constant other determinants.[20]

The aggregate story told by KSW masks significant firm-level heterogeneity, however. The burden of a decline in bank loans following a monetary contraction is borne by smaller firms (see Gertler and Gilchrist, 1994).[21] Moreover, the evidence in Oliner and Rudebusch (1993) indicates that once trade credit is incorporated in the definition of small firms' debt and once firm size is held constant, monetary policy changes do not alter the mix.

It also does not appear that bank-dependent borrowers switch to the commercial paper market following a monetary contraction. Instead, the increase in commercial paper issuance reflects borrowing by large firms with easy access to the commercial paper

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[20] Oliner and Rudebusch (1993) and Friedman and Kuttner (1993) have disputed the KSW interpretation of the mix as measuring a substitution between bank loans and commercial paper; they argue that, during a recession, shifts in the mix are explained by an increase in commercial paper issuance rather than by a decrease in bank loans.

[21] Morgan (1993) finds a similar result in an analysis of loan commitments. After an episode of monetary contraction, firms without loan commitments receive a smaller share of bank loans.

market, possibly to smooth fluctuations in their flow of funds when earnings decline (Friedman and Kuttner, 1993) or to finance loans to smaller firms (Calomiris, Himmelberg, and Wachtel, 1994).

Studies Focusing on Cross-Sectional Implications

More convincing empirical tests focus on the *cross-sectional* implication of the underlying theories -- namely that the credit-market imperfections affect investment, employment, or production decisions of some borrowers more than others. At one level, existing cross-sectional empirical studies have been successful: There is a substantial body of empirical evidence documenting that proxies for borrowers' net worth affect investment more for low-net-worth borrowers than for high-net-worth borrowers (holding constant investment opportunities). This suggests that, to the extent that monetary policy can affect borrowers' net worth, pure interest-rate effects of open market operations will be magnified.

The second body of empirical analysis of information-related imperfections focuses on effects of monetary policy on borrowers' balance sheets. Gertler and Hubbard (1988) conclude that, all else equal, internal funds have a greater effect on investment by non-dividend-paying firms during recessions. The evidence of Gertler and Gilchrist (1994) is particularly compelling here. Analyzing the behavior of manufacturing firms summarized in the *Quarterly Financial Reports* data, Gertler and Gilchrist consider differences in "small" and "large" firms' responses to tight money (as measured by federal funds rate innovations or by the dates identified by

Romer and Romer, 1989). In particular, small firms' sales, inventories, and short-term debt decline relative to those for large firms over a two-year period following a monetary tightening, results consistent with the financial accelerator approach. They also demonstrate that effects of shifts in monetary policy on the small-firm variables are sharper in periods when the small-firm sector as a whole is growing more slowly, also consistent with the financial accelerator approach. Finally, they show that the ratio of cash flow to interest expense (a measure of debt-service capacity) is associated positively with inventory accumulation for small, but not for large, manufacturing firms.

The Gertler-Gilchrist results, which are very much in the spirit of the earlier cross-sectional tests of financial accelerator models, have borne out for studies of fixed investment by Oliner and Rudebusch (1994) and for inventory investment by Kashyap, Lamont, and Stein (1994).[22] In addition, Ramey (1993)

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[22]Toward this end, more direct comparisons of borrowing by bank-dependent and non-bank-dependent borrowers have been offered. Using firm-level data, Kashyap, Lamont, and Stein (1992) -- henceforth KLS -- follow the Fazzari-Hubbard-Petersen (1988) approach of classifying groups of firms as *a priori* finance-constrained (in this case, bank-dependent) or not. In particular, they study inventory investment by publicly traded firms with and without bond ratings, as a proxy for bank dependence. Focusing on the 1982 recession (as an indirect means of identifying a period following a "tight money" episode), they find that inventory investment by non-rated firms was influenced, all else equal, by the firms' own cash holdings, an effect not present for the inventory investment by rated firms. In subsequent "boom" years (which KLS identify with an "easy money" episode), they find little effect of cash holdings on inventory investment for either non-rated or rated companies. These patterns lead KLS to conclude that a bank lending channel was operative in response to the monetary contraction. However, the KLS results are consistent with a more general model in which low-net-worth firms face more costly

shows that, for forecasting purposes, the ratio of the sales growth of small firms to that for large firms offers significant information about future GDP.

Finally, using the firm-level data underlying the aggregates summarized in the *Quarterly Financial Reports*, Bernanke, Gertler, and Gilchrist (1994) analyze large-small manufacturing firm differences in sales and inventories by two-digit industry. They find that fluctuations in the large firm-small firm differences are roughly the same size as fluctuations in the corresponding aggregate fluctuations for the manufacturing sector. Because small firms' sales (as they define small firms) comprise about one-third of the sales of the manufacturing sector, roughly one-third of cyclical fluctuations in manufacturing sales can be explained by large firm-small firm differences.

Assessing the Bank Lending Channel

While the principal empirical predictions of the financial accelerator approach have been corroborated in micro-data studies and low-net-worth firms appear to respond differentially to monetary contractions, the question of the role of *banks* remains. I consider this question below in three steps. First, is there evidence of significant departures from Modigliani-Miller results for certain groups of *banks* in the sense that have been identified for firms? Second, is there evidence that small or low-net-worth firms are more likely to be the loan customers of such banks?

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external finance in downturns.

Finally, do low-net-worth firms have limited opportunities to substitute credit from unconstrained financial institutions when cut off by constrained financial institutions?

Applying the Modigliani-Miller Theorem for Banks. Kashyap and Stein (1994) apply the intuition of the models of effects of internal net worth on investment decisions by nonfinancial firms to study financing and lending decisions by *banks*. This is an important line of inquiry in the "bank lending channel" research agenda, because it addresses the ease with which banks can alter their financing mix in response to a change in bank reserves and the effect of changes in the financing mix on the volume of bank lending. Just as earlier studies focused on cross-sectional differences in financing and real decisions of *nonfinancial firms* of different size, Kashyap and Stein analyze cross-sectional differences in financing and lending decisions of *banks* of different size. To do this, they use data drawn from the quarterly "Call Reports" collected by the Federal Reserve.

Kashyap and Stein construct asset size groupings for "large banks" (in the 99th percentile) and "small" banks (defined as those at or below the 75th, 90th, 95th, or 98th percentiles). They first show that contractionary monetary policy (measured by an increase in the federal funds rate) leads to a similar reduction in the growth rate of nominal core deposits for all bank size classes. They find significant heterogeneity across bank size classes, however, in the response of the volume of lending to a change in

monetary policy. In particular, a monetary contraction leads to an increase in lending in the short run by very large banks. This is in contrast to a decline in lending in the short run by smaller banks. These do not simply reflect differences in the type of loans made by large and small banks. A similar pattern emerges when loans are disaggregated to include just commercial and industrial loans.

One possible explanation for the Kashyap-Stein pattern is that a monetary contraction weakens the balance sheet positions of small firms relative to large firms. If small firms tend to be the customers of small banks and large firms tend to be the customers of large banks, a fall in loan demand (by small borrowers) for small banks could be consistent with the differential lending responses noted by Kashyap and Stein. To examine this possibility, Kashyap and Stein analyze whether small banks increase their holdings of securities relative to large banks during a monetary contraction. They actually find that small banks' securities holdings are less sensitive to monetary policy than large banks' securities holdings (though the responses are not statistically significantly different).

The use of bank size as a measure to generate cross-sectional differences does not correspond precisely to the underlying theoretical models, which stress the importance of "net worth." In this context, bank capital may be a better proxy. Peek and Rosengren (forthcoming) analyze the lending behavior of New England banks over the 1990-1991 recession. Their results indicate that

the loans of well capitalized banks fell by less than the loans of poorly capitalized banks.[23] Hence, as with the Kashyap-Stein findings, their evidence supports the idea of effects of informational imperfections in financial markets on the balance sheets of intermediaries as well as borrowers.

Matching Borrowers and Lenders. The last two questions relate to the matching of borrowers and lenders. The former asks whether the firms identified by empirical researchers as "finance-constrained" are the loan customers of the constrained (small) banks such as those identified by Kashyap and Stein. This line of inquiry requires an examination of data on individual loan transactions, with information on characteristics of the borrower, lender, and lending terms.[24] One could establish whether "constrained" firms are the customers of "constrained" banks and whether "constrained" firms switch from "constrained" banks to "unconstrained" banks during episodes of monetary contractions. Theories emphasizing the importance of ongoing borrower-lender relationships imply that such switches are costly and unlikely. If true, part of the monetary transmission mechanism takes place

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[23]Using data on commercial banks nationwide over the 1979-1992 period, Berger and Udell (1994) found little evidence that the introduction of risk-based capital requirements *per se* affected credit allocation. Hancock, Laing, and Wilcox (1994) also use quarterly data on individual banks' portfolios to estimate the responsiveness of portfolio composition to changes in capital requirements. They find that "capital shortfall" institutions reduced their C&I loan's response by larger total amounts, all else equal, than "capital surplus" institutions.

[24]Anil Kashyap, Darius Palia, and I are currently engaged in such an analysis.

through reductions in loan supply by "constrained" banks.

The latter of the two questions suggests the need to study a broader class of lenders than "banks." If borrowers from "constrained" banks can switch at low cost to *nonbank* lenders following a monetary contraction, the narrow bank credit channel of monetary policy is frustrated. In this vein, Calomiris, Himmelberg, and Wachtel (1994) analyze firm-level data on commercial paper issuance and argue that large, high-quality commercial-paper-issuing firms increase paper borrowings during downturns in order to finance loans to smaller firms.[25] They note that accounts receivable rise for paper-issuing firms, supporting the notion that these firms may serve as trade credit "intermediaries" for smaller firms in some periods. From the standpoint of the bank lending channel, it is important to establish what happens to the costs and terms imposed by these intermediaries. If, on the one hand, such terms are no more costly than bank intermediary finance, then the switch of borrowers from being "bank customers" to being "trade credit customers," entails very limited macroeconomic effects. On the other hand, if large, paper-issuing firms accept their "intermediary" role reluctantly, very costly trade credit may exacerbate a downturn by raising the cost of funds for constrained firms. More empirical investigation of trade credit terms is needed to resolve this question.

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[25]Another possibility is that the weakened balance sheet positions of many borrowers precipitates a "flight to quality" by lenders generally, increasing the demand for commercial paper issues of large firms.

Empirical Research on Conventional Interest-Rate Channels

More empirical research is also needed to assess the validity of the basic money view. A central problem is that, while most empirical studies focus on monetary aggregates such as *M2*, the theoretical description offered in section II suggests an emphasis on outside money, and, importantly, on components of outside money over which the central bank can exercise exogenous control. First identifying exogenous changes in monetary policy is difficult.[26] Recent research by Bernanke and Blinder (1992) Christiano, Eichenbaum, and Evans (forthcoming) offers promising strategies for studying the effects of monetary policy shocks.

In addition, recent analyses of policy-reduced-form models document a significant negative relationship in quarterly data between the percentage change in real GDP relative to potential GDP and the change in the federal funds rate.[27] Such studies must first confront the possibility that the measured interest sensitivity of

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[26] The dates of monetary policy contractions suggested by Romer and Romer (1989) have generated significant controversy. Shapiro (1994) argues, for example, that empirical evidence favors the hypothesis that several Romer dates are predictable using measures of unemployment and inflation as determinants of actions by the Federal Open Market Committee; see also the discussion in Cecchetti (1994). Hoover and Perez (1994) offer a number of criticisms of the Romers' approach.

[27] Such relationships are typically estimated as:

$$Y(t) = a + bY(t - i) - cH(t - i) - dF(t - i),$$

where Y is the percentage change in real GDP relative to potential GDP, H is the percentage change in the high-employment federal budget surplus, F is the change in the federal funds rate, t is the current time period, and i denotes lags. See, for example, Hirtle and Kelleher (1990), Perry and Schultze (1992), and Cohen and Wenninger (1993).

output reflects links between interest rate and net worth changes for certain groups of borrowers/spenders. A second issue, noted by Morgan (1993) and Cohen and Wenninger (1993), is that quarterly residuals from estimated policy-reduced-form equations display large negative errors during recessions, suggesting the possibility of an asymmetric response of economic activity to increases or decreases in the federal funds rate.[28] Finally, more theoretical and empirical research is needed to examine links between changes in short-term real interest rates (which are significantly influenced by policy actions) and changes in long-term real interest rates (which affect firms' cost of capital).

CONCLUSION AND IMPLICATIONS FOR MONETARY POLICY

This survey argues that the terms "money view" and "credit view" are not always well defined in theoretical and empirical debates over the transmission mechanism of monetary policy. Recent models of information and incentive problems in financial markets suggest the usefulness of decomposing the transmission mechanism into two parts: one related to effects of policy-induced changes on the overall level of real costs of funds, and one related to magnification (or "financial accelerator") effects stemming from impacts of policy actions on the financial positions of borrowers and/or intermediaries.

Two observations emerge clearly from the literature: First,

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[28]Cover (1992) finds still stronger evidence of asymmetric effects when monetary aggregates are used as the policy indicator instead of the federal funds rate.

the spending decisions of a significant group of borrowers are influenced by their balance sheet condition in the ways described by financial accelerator models. Second, even in the presence of more sophisticated financial arrangements, there are still information costs of screening, evaluation, and monitoring in the credit process, imparting a "special" role for intermediaries (be they banks or other lenders) with cost advantages in performing these tasks.[29]

The first observation suggests that financial factors are likely to continue to play a role in business fluctuations. The second suggests that regulatory policies affecting information-specializing intermediaries are likely to affect the cost of credit for at least some borrowers. In part because of interest in alternative views of the monetary transmission mechanism and in part because of concern over effects of institutional change in the financial system, academics and policymakers are analyzing whether the scope for monetary policy to affect real outcomes is becoming narrower. Both observations noted above are consistent with a heightened role for monetary policy in affecting real decisions of firms with weak balance sheet positions. Developing ways to incorporate borrower heterogeneity in both economic models of money and credit and in forecasting is an important practical task for economic modelers and policymakers.

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[29]For recent analyses of the future of banking, see Gorton and Pennacchi (1993), Edwards (1993), and Boyd and Gertler (1994). Thornton (1994) discusses likely effects on the bank lending channel of recent financial innovations.

Whether the simplest "bank lending channel" -- that a fall in banks' reserves following contractionary open market operations decreases both banks' ability to lend and borrowers' ability to spend -- is operative is not clear, however. More micro evidence at the level of individual borrower-lender transactions is needed to resolve this question. At the same time, proponents of the simplest characterization of an interest-rate channel must address both the cross-sectional heterogeneity in firms' response to monetary policy and the extent to which observed interest-rate effects on output reflect differentially large effects of policy on certain classes of borrowers.

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APPENDIX: THE "FINANCIAL ACCELERATOR" AND THE "CREDIT VIEW"

There are three basic conclusions of models of financial frictions relating to asymmetric information between borrowers and lenders: (1) uncollateralized external finance is more costly than internal finance; (2) the spread between the cost of external and internal funds varies negatively with the level of the borrower's internal funds; and (3) a reduction in internal funds reduces the borrower's spending, holding constant underlying investment opportunities. I illustrate these conclusions (and link them to empirical tests of "credit view" models) below in a simple model of firm investment decisions adapted from Gertler and Hubbard (1988).

Consider two periods -- zero and one. In the first, a risk-neutral borrower uses inputs to produce output Y to sell in the second period. These inputs are hard capital K -- say, machinery -- and soft capital C -- inputs which improve the productivity of hard capital (such as organizational or maintenance expenditures). The production technology is risky, with "good" and "bad" possible productivity states; uncertainty is realized after the investment decision is made.

To make the example as simple as possible, suppose the firm can increase the chance of a good output realization if it uses a sufficient quantity of soft capital, where "sufficient" is defined by a level proportional to the quantity of hard capital used. In particular, let output

$$Y = f(K), \text{ with probability } \pi^g, \qquad \text{(A1a)}$$

and

$$Y = \alpha f(K), \text{ with probability } \pi^b,$$

if

$$C \geq \upsilon K,$$

and

$$Y = \alpha f(K), \tag{A1b}$$

if

$$C < \upsilon K,$$

where $f(K)$ is twice continuously differentiable, strictly increasing, and strictly concave (where $f(0) = 0$, $f'(0) = \infty$, and $f'(z) \rightarrow 0$ as $z \rightarrow \infty$); $\pi^g + \pi^b = 1$; $0 < \alpha < 1$; $\upsilon > 0$; and the random productivity realization is idiosyncratic.

The structure of the problem guarantees that the firm will either use υK units of soft capital or none. For simplicity, assume that it is always efficient to employ soft capital. (Formally, this requires one to assume that $(\pi^g + \pi^b\alpha)/(1 + \upsilon) > \alpha$).

If there were no informational imperfections, the firm's investment decision is intuitive. It chooses K to satisfy

$$(\pi^g + \pi^b\alpha)f'(K) - (1 + \upsilon)r = 0, \tag{A2}$$

where r is the gross interest rate faced by the firm. Equation (A2) simply states that, at the optimum, the expected marginal benefit from an additional unit of hard capital (given a complementary addition of υ units of soft capital) equals the marginal cost of investing. The value of K that satisfies equation (A2) -- call it K^* -- does not depend on any financial variables; that is, the Modigliani-Miller theorem applies.

The traditional interest-rate channel often identified with the "money view" mechanism is easy to illustrate in this example. Suppose for simplicity that the interest rate paid on deposits is zero, so that r represents the gross required rate of return on lending. To the extent that an open market sale raises r, investment demand falls. This is the usual textbook interest-rate channel for monetary policy.

Under asymmetric information, the story is more complicated. Consider, for example, a simple agency problem: Expenditures on "hard capital" are observable by outside lenders, while expenditures on "soft capital" are not. In this case, the manager may be tempted to divert soft capital funds to personal gain. Such perquisite consumption can take a number of forms; for simplicity, assume that the manager can invest the funds (say, in a Swiss bank account) to yield a gross interest rate r.

Lenders understand this temptation, and modify the financial contract to mitigate incentives to cheat. As shown below, one consequence of this modification is that desired capital K^* may exceed actual capital K, and this gap will depend inversely on the borrower's net worth. Suppose the firm signs a loan contract with a competitive financial intermediary. The firm has some initial liquid asset position W and collateralizable future profits V in period one, worth a present value of V/r. Hence the firm's initial net worth is $(W + V/r)$. To make the story interesting, assume that $W < K^*$; that is, the firm would like to borrow. (For a richer description of the role of internal net worth in the contracting

problem, see Gertler, 1992.)

The firm-intermediary loan contract specifics the amount borrowed (in this case, $(1 + v)K - W)$), a payment P^g to the intermediary in the event that the project yields the "good" output level, and a payment P^b in the event of the "bad" output level. These contractual features are chosen to maximize the firm's expected profits:

$$(\pi^g + \pi^b\alpha)f(K) - \pi^g P^g - \pi^b P^b. \qquad \text{(A3)}$$

From the intermediary's perspective, the loan contract must offer an expected return equal to its opportunity cost of funds, equal to the gross interest rate r times the quantity borrowed:

$$\pi^g P^g + \pi^b P^b = r[(1 + v)K - W]. \qquad \text{(A4)}$$

That is, for simplicity, assume that the intermediary simply channels funds from savers to borrowers, and uses no resources.

Given the underlying incentive problem, the contract must five the firm the incentive to invest in soft capital as a complementary input to hard capital. That is, the contract must satisfy the "incentive constraint":

$$(\pi^g + \pi^b\alpha)f(K) - (\pi^g P^g + \pi^b P^b) \geq (\alpha f(K) + P^b) + rvK. \qquad \text{(A5)}$$

Equation (A5) just states that the manager's expected gain from honest action exceeds the gain from diverting the soft capital funds to personal use.

One way in which the intermediary could reduce the entrepreneur's temptation to cheat is to increase the amount P^b that the firm must pay the intermediary in the event of a bad

outcome. The firm, however, can only credibly promise to pay available assets in the bad state. That is, a "limited liability" constraint influences the contract:

$$P^b \geq \alpha f(K) + V. \qquad \text{(A6)}$$

To summarize, the contracting problem involves the selection of K, P^g, and P^b to maximize (A3) subject to (A4), (A5), and (A6). One case is easy: As long as the incentive constraint does not bind, actual investment K simply adjusts to desired investment K^*. In addition, the pattern of contract payments is indeterminate. (For simplicity, we are abstracting from a richer structure that would lead to both debt and equity contracts and tax considerations; see, for example, Gertler and Hubbard, 1993, for such a treatment.)

When the incentive constraint (in (A5)) binds, financing and investment decisions are no longer independent. First, note that when the incentive constraint binds, it is desirable to raise P^b to the maximum extent possible; therefore, the limited liability constraint (in (A6)) also binds. Using (A4) and (A6), one can eliminate P^g and P^b from equation (A5), and thereby obtain a relation among K, the interest rate, and internal net worth:

$$(\pi^g + \pi^b\alpha)f(K) - [r(1 + 2v)]K + r(W + V/r) = 0. \qquad \text{(A7)}$$

As long as equation (A7) holds, investment K is an increasing function of the borrower's net worth $(W + V/r)$, holding constant investment opportunities:

The explanation for this effect is that, when the incentive

$$\frac{\partial K}{\partial (W + V/r)} = [(1 + 2v) - (\pi^g + \pi^b \alpha) f'(K)/r]^{-1} > 0. \qquad \text{(A8)}$$

constraint binds, an increase in internal net worth increases the amount of investment feasible.

The existence of the net worth channel precludes neither the traditional interest-rate channel nor the bank lending channel. To see the former, note an increase in lenders' opportunity cost of funds on account of a monetary contraction reduces desired investment K^* (since K^* is determined by $(\pi^g + \pi^b \alpha) f'(K) = (1 + v)r$). To see the latter, note that, to the extent that banks face a higher marginal opportunity cost of funds because of a less than perfectly elastic supply schedule for managed liabilities (and borrowers lack access to non-bank finance), the increase in r lowers both desired and actual investment.

This simple framework is consistent with the description of the "financial accelerator" mechanism: The cost of uncollateralized external finance exceeds that for internal finance; this gap varies inversely with the internal net worth of the borrower; and a decline in net worth reduces the borrowers' spending, all else equal. The framework also yields simple testable predictions related to "money view" and "credit view" arguments:

(1) When informational imperfections are ignored, an increase in real interest rates following a monetary contraction should affect investment (broadly defined) similarly for borrowers of a given type (*e.g.*, with similar technology

and risk characteristics).

(2) If informational imperfections are significant only on the borrower side, all else equal, spending by borrowers with lower levels of internal net worth should fall relative to spending by borrowers with higher levels of internal net worth.

(3) For bank-dependent borrowers, the availability of monitored bank credit can be thought of as a substitute for internal new worth. Changes in the availability of bank credit can influence the ability of bank-dependent borrowers to finance spending.

(4) The model's intuition can apply to banks as well as nonfinancial borrowers. A decline in banks' net worth raises banks' opportunity cost of external funds (say, in the CD market). As a result, the cost of funds to bank-dependent borrowers rises.

(5) If relationships between borrowers and specific banks are important, shocks to the balance sheet positions of individual lenders affect credit availability (at any given open market interest rate) to their borrowers.