Financial Structure and Aggregate Economic Activity: An Overview

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MOST OF MACROECONOMIC THEORY PRESUMES that the financial system functions smoothly—and smoothly enough to justify abstracting from financial considerations. This dictum applies to modern theory. The currently popular real business cycle paradigm proceeds under the working hypothesis that financial structure is irrelevant. To a first approximation, it also applies to the traditional literature. The main real/financial interaction in conventional Keynesian, Monetarist, and Classical models stems from activity in the market for the medium of exchange, and not from the performance of markets for borrowing and lending.

Recently, interest has grown in exploring the possible links between the financial system and aggregate economic behavior. This interest partly reflects the ongoing beliefs of applied economists and policymakers that financial markets and institutions deserve serious attention—that they play important roles in the growth and fluctuation of output. (See Kaufman 1987 and Eckstein and Sinai 1986, for example.) It also arises for two reasons connected to developments in academic work: first, new empirical research, examining both historical and postwar data, provides support for further pursuit of this topic; second, progress in theory over the last decade has made it possible to address these kinds of questions using the same degree of rigor that is currently being applied elsewhere in macroeconomics.

In this paper, I survey recent developments in the study of the real/financial interaction and try to place a perspective on where it currently stands. Many of

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the ideas in this new literature have appeared earlier, though in less formal statements. My discussion thus includes earlier work as well, beginning with the period of the Great Depression. The survey is in two parts: the first reviews the traditional literature and the second discusses new work.

In Part 1, I argue that Depression-era economists believed that the behavior of the financial system was largely responsible for the extraordinary events of the time. However, the Keynesian revolution supplanted further immediate research in this direction. While Keynes believed that financial elements were important, his direct disciples focused on other issues. Moreover, they devoted attention to Keynes's liquidity preference theory which emphasized the importance of money, as opposed to credit. Friedman and Schwartz's (1963) empirical work provided further impetus for viewing the money supply as the key financial aggregate.

Part 1 continues by discussing the counter-movement, led by Gurley and Shaw and others, which stressed the significance of the financial system and, in particular, the importance of financial intermediation in the credit supply process. The relevance for our purposes is that modern theories of the real/financial interaction and of the role intermediaries play incorporate many of the ideas in this literature. The section also discusses the reasons why this movement died down in the 1970s. A major factor was the methodological revolution which stressed the importance of using first principles to construct macroeconomic frameworks; at the time, it was not feasible to use this approach to study issues of financial structure. Another factor was the increasing use of vector-autoregressions to study the money/output relation. The statistical success of money in reduced-form output equations helped rejuvenate the case for money as the central financial aggregate. The section concludes by discussing the empirical and theoretical work that redirected interest toward studying the relevance of the rest of the financial system.

Part 2 begins with recent literature that examines the real/financial interaction at a general abstract level. A common theme in this new work is that informational asymmetries may introduce inefficiencies in financial markets which may have quantitatively significant real effects. A number of basic conclusions arise relevant to aggregate behavior: first, the informational problems typically reduce the level of market activity and increase its sensitivity to disturbances such as changes in the riskless interest rate or in productivity; second, financial contracts and institutions are determined simultaneously with real variables; third, financial variables such as balance sheet positions and cash flow affect individuals' and firms' spending decisions, creating the analogue of income-accelerator effects on demand. The section continues by discussing some empirical work which bears on these various hypotheses.

The current research on intermediation and banking is reviewed next. This work is best understood in the context of the broader literature just mentioned; the common approach is to endogenously motivate intermediaries as optimal responses to the informational problems which may disrupt financial markets,

described in the more general literature. In this vein, the main conclusion is that intermediaries are important to aggregate activity. It must be added that the models are somewhat abstract, but do nonetheless characterize basic features of intermediation and banking. (Banks are distinguished from other intermediaries by their role in liquidity provision.) However, while the literature offers considerable insights, it is still well short of providing precise policy advice. The section discusses why policy recommendations vary dramatically among frameworks, and what issues require further attention to resolve the debate.

Finally, this section examines the work which has focused directly on the role of financial factors in output fluctuations. This research integrates advances in the literature on financial market inefficiencies and intermediation with recent advances in business cycle analysis. While the work is still largely in a primitive form, it does suggest rigorous ways to address some puzzles left currently unexplained by existing models.

A final section offers some concluding remarks.

Before beginning, let me note that for tractability, I am restricting attention to papers which have a macroeconomic emphasis, at the expense of literature in finance which overlaps considerably in some areas.

1. THE TRADITIONAL LITERATURE

1A. From Fisher and Keynes to Friedman and Schwartz

The idea that financial structure and output determination may be interrelated phenomena is not new. It is easily traceable to the time of the Great Depression. The collapse of the financial system along with real economic activity struck the attention of economists contemporary to the period. It motivated Fisher (1933) to argue (in the first volume of *Econometrica*) that the severity of the economic downturn resulted from poorly performing financial markets.

What made the economy initially so vulnerable, in Fisher's view, was the high leverage of the borrowing class in the wake of the prosperity preceding 1929. In his word, "they (debts) were great enough to not only 'rock the boat' but to start it capsizing." The ensuing business downturn precipitated a wave of bankruptcies, enhancing the downturn. Beyond this direct propagation mechanism, according to Fisher, was an indirect one which was probably of greater empirical significance because it involved the entire borrowing class. The deflation accompanying the slowdown redistributed wealth from debtors to creditors. This decline in net worth induced borrowers to cut back on current expenditures and future commitments, sending the economy further down, continuing the spiral of falling output and deflation. Fisher calculated that by March 1933, real debt burdens increased by roughly 40 percent due to the sharp decline in prices and incomes. In his eyes, the fact that this massive deterioration in borrower balance sheets occurred simultaneously with the free fall in output and prices lent credibility to the "debt-deflation" story.

Many others also perceived a link between the financial system and aggregate real activity. Indeed, as Fisher noted in his article, ideas related to debt-deflation appeared in the works of Veblen (1904), Hawtrey (1926), and others.

The financial system did not have such an explicit central role in Keynes's theory of output determination. It was, however, an integral part of the broad picture. Financial considerations played a part in the theory of investment behavior characterized in the General Theory. A key factor in the Keynesian investment story was the "state of confidence." As Minsky (1975) notes, Keynes was careful to distinguish two basic determinants of this state. The first was borrowers' beliefs about prospective yields from investment projects. The second was the "state of credit," which Keynes argued was governed by the confidence that lenders had in financing borrowers. Lenders' confidence depended on their perceptions of how well borrowers' incentives were aligned with their own and, relatedly, of how well secured were borrower liabilities. Keynes concluded that a collapse in the confidence of either borrowers or lenders was sufficient to induce a downturn, but that a return to prosperity required that both be in good repair.

The macroeconomics literature following the General Theory largely ignored potential links between output behavior and the performance of credit markets. These papers (e.g., Hicks 1937, Modigliani 1944) did, however, stress the indirect connection between financial markets and real activity resulting from Keynes's liquidity preference theory. By doing so, they shifted the emphasis to money as the financial variable most relevant to aggregate economic behavior. The models in these papers demonstrated how the demand and supply for real money balances could determine the real interest rate (presuming price stickiness, so that the interest rate rather than the price level was the equilibrating force in the money market).

Considerable debate arose over the empirical significance of the mechanism linking money to real activity. Indeed the early Keynesians emphasized the importance of "real factors" such as the multiplier/accelerator mechanism and fiscal policy. The monetarists, with an intellectual foundation tied closest to classical theory but nonetheless influenced by Keynesian thinking, provided the main support for the importance of the monetary mechanism.

The famous study by Friedman and Schwartz (1963) of the historical relationship between money and output became the cornerstone for the monetarist case. The money/output correlation was particularly transparent in the Great Depression. From the start of the downturn in 1929 to the trough in 1933, the money supply declined sharply along with output. Thus, one important outcome of Friedman and Schwartz' work was an alternative explanation for the role of financial markets in the Great Depression; the story emphasized the central importance of money and, as a consequence, deemphasized the significance of all other aspects of the financial system.

Overall, the theory of liquidity preference and the time series work of Friedman and Schwartz provided motivation for the preoccupation with money. The net effect was that the quantity of the medium of exchange was the only financial

aggregate to appear regularly in macroeconomic frameworks. Further, commercial banks were the only financial institutions to receive any attention from macroeconomists, and they obtained this distinction only because a component of their liabilities entered the money supply.

1B. From Gurley and Shaw to Tobin

Beginning with Gurley and Shaw (1955), an attempt began to redirect attention toward the overall interaction between financial structure and real activity. A distinctive feature of the theory Gurley and Shaw offered was an emphasis on financial intermediation, and particularly on the role of intermediaries in the credit supply process as opposed to the money supply process.

The authors began by underscoring the following difference between developed and underdeveloped countries: In the former, and not in the latter, there typically exists a highly organized and broad system of financial intermediation designed to facilitate the flow of loanable funds between savers and investors. (In fact, this correlation between economic development and financial sophistication has appeared regularly across time and across countries. (See Goldsmith [1969] for an early and comprehensive study.) The implication, Gurley and Shaw argued, was that the role intermediaries play in improving the efficiency of intertemporal trade is an important factor governing general economic activity.

A corollary argument was that restricting attention to the money supply made it impossible to properly characterize the link between real and financial activity, and that this distortion worsens as the economy evolves financially. In the early stages of financial development, Gurley and Shaw noted, commercial banking is typically the only major form of intermediation, so that most intermediaries provide both transactions and lending services. In this environment, the money stock might be a useful proxy for financial activity since the supply of inside money—a major component of commercial bank liabilities—is closely related to the overall level of financial intermediation. However, as the intermediary system evolves, and lending institutions with nonmonetary liabilities arise, the exclusive focus on money becomes less justified. The importance of money diminishes for two reasons: first, the money stock becomes a less exact measure of the flow of intermediary credit; second, the liabilities of the nonbank intermediaries provide an alternative form for holding liquid balances.

In the simple Keynesian and Monetarist models, money could have important real effects not only because prices were sticky, but importantly also because the nominal money stock was fixed and therefore could not adjust endogenously to changes in money demand. Gurley and Shaw argued that the latter assumption ignored the realities of modern financial markets; in such environments, even if the central bank can control the narrowly defined money stock, the supplies of close money substitutes may freely adjust to offset changes in money supply or demand. This movement mitigates the response of interest rates. Thus, changes in the supply and demand for transactions media may be of minimal importance

to aggregate activity in a financially sophisticated economy, regardless of whether prices are sticky.[1] (Note that this argument does *not* suggest that monetary policy is unimportant to real activity—it suggests only that the principal channels of monetary policy may be different from the conventional one which stresses effects on the quantity of the medium of exchange. See section 2B.)

More relevant to macroeconomic behavior than the money stock, according to Gurley and Shaw, was the economy's overall "financial capacity." This was the measure of borrowers' ability to absorb debt, without having to reduce either current spending or future spending commitments (in order to avoid default or costly rescheduling). In the Gurley/Shaw world, financial capacity was an important determinant of aggregate demand. The ramifications for business fluctuations reminded one of the debt-deflation theory. The behavior of balance sheets—key determinants of financial capacity—assumed an important role, one that tended to enhance movements in spending, and thus enhance the cycle.

Intermediaries were relevant to the mechanism because they extended borrowers' financial capacity. By helping overcome impediments to the flow of funds between savers and investors, these institutions made it feasible for certain classes of borrowers to obtain both greater quantities of credit and better credit terms than they could otherwise get from directly issuing securities to lenders. To this extent, intermediaries performed important services for the economy, services which the market did not perfectly duplicate elsewhere. (See Patinkin [1961] for a related discussion of how intermediaries facilitate borrowing and lending.)

The notion that financial considerations could be relevant to macroeconomic behavior evolved through the literature. For example: Kuh and Meyer (1963) and others presented evidence linking investment to balance sheet variables. Tobin and Dolde (1963) stressed that capital market imperfections provided an avenue for reconciling the Keynesian and life cycle theories of consumption; borrowing constraints could explain why current income might have a more important role in consumption decisions than predicted by the naive version of the life cycle model, which stressed the importance of the individual's intertemporal budget constraint. Brainard and Tobin (1963) and others elaborated the financial sectors of macroeconomic models, and formally integrated some of the ideas in Gurley and Shaw with existing theory. Minsky (1975) and Kindleberger (1978) described how crises in financial markets could severely disrupt real activity. Finally, Tobin (1975) argued that Fisher's debt-deflation theory was a natural complement to the Keynesian theory of income determination; it provided a rationale for why expansionary policy may dominate deflation as a way to restore equilibrium output to its full capacity value.

[1]This argument seems even more applicable to the contemporary economy, given the rapid pace of financial innovation. See Hester (1985) for a recent discussion.

1C. Consequences of the Modigliani-Miller Theorem, the Methodological Change in Macroeconomics, and Vector-Autoregression Studies

Shortly after Gurley and Shaw (1955) emphasized the importance of the financial system, Modigliani and Miller (MM) (1958) derived the formal proposition that real economic decisions were independent of financial structure. The proposition held for a setting of perfect markets. While Gurley and Shaw had in mind a different economic environment than the Arrow-Debreu world underlying the MM theorem, they, and others at the time, did not have a formal counterpart to offer. They accordingly could not provide arguments at the same level of rigor as those suggesting the unimportance of financial structure.

Apart from its formal elegance, the MM theorem was attractive because it provided researchers with a rigorous justification for abstracting from the complications induced by financial considerations. For example, the developers of neoclassical investment theory (e.g., Hall and Jorgenson 1967) took this approach. They used the MM theorem as a convenient rationale for ignoring capital market considerations when solving the firm's intertemporal investment choice problem. For similar reasons, financial variables started disappearing from empirical investment equations.

The methodological revolution in macroeconomics in the 1970s also helped shift attention away from financial factors, in a less direct but probably more substantial way. The resulting emphasis on developing macroeconomic models explicitly from individual optimization posed an obstacle. At the time, the only available and tractable model suitable for pursuing this methodological approach—the stochastic competitive equilibrium growth model, developed by Brock and Mirman (1972) and others—was essentially an Arrow-Debreu model, and thus had the property that financial structure was irrelevant.

Modifying the Brock/Mirman framework—which would eventually become the core for real business cycle theory—to consider financial issues was a formidable task (and remains so today). Modeling imperfections in intertemporal trade obviously requires having an environment where there exists motivation for trade; this necessitates introducing heterogeneity among agents, which is difficult to accomplish in a way which is both interesting and tractable. The representative agent formulation used in the competitive growth models—and subsequently in real business cycle theory—effectively abstracts from trade, or more precisely, abstracts from any possible complications in the trading process.

In addition, abiding strictly by the rules of the game requires endogenously deriving the financial system—after all, financial institutions and financial contracts are ultimately endogenous variables and, except in the frictionless environment for which the MM theorem is relevant, determined jointly with real activity. At the time, however, the theoretical techniques required for accomplishing this task and others related were not adequately developed, or perhaps more accurately, not widely understood by macroeconomists.

Empirical considerations also affected the course of research. The widespread

use of vector autoregressions to analyze macroeconomic time series shifted the focus back to money as the key financial aggregate. Led by Sims (1972), researchers paid considerable attention to the reduced-form bivariate model of money and output. The common result they obtained was that lagged values of money were important for forecasting variation in output. (This general statistical pattern appears to remain true today, though it is sensitive to the form of the estimated equations—see Eichenbaum and Singleton [1986].) While this reduced-form evidence did not have any unambiguous structural interpretation, it nonetheless provided motivation for developing models of output fluctuations where money was an important driving variable, in a true causal sense.

Even the classical/rational expectations macromodels of the 1970s—the forerunners of real business cycle models—focused on the money-output correlation, and tried to explain this relationship by formulating a true causal role for money. The monetary transmission mechanism they emphasized, however, differed substantially from the earlier Keynesian and Monetarist theories: Only unanticipated movements in the money supply mattered, and did so by creating misperceptions about movements in nominal versus relative prices. This conclusion sparked a controversy about the monetary transmission mechanism that moved quickly to the center stage in macroeconomics, and which remains there today in an updated form. (See Blanchard [1987] for a review.) Significantly for our purposes, in all the debate over this issue, the implicit common view was that any important real/financial interaction involved the market for the medium of exchange. The rest of the financial system was largely ignored.

1D. Revival of Interest

New empirical work and new developments in theory rekindled interest in studying financial aspects of the business cycle. The empirical work involved a reconsideration of two earlier issues: first, the role of financial factors in the Great Depression and, second, the significance of the postwar time series relationship between money and output. On the theoretical side, techniques useful for formalizing financial market problems became available due to progress in the economics of information and incentives.

The new empirical literature began with Mishkin (1978), who analyzed data from the Great Depression to determine whether financial factors affected consumer spending. Mishkin studied the interaction between output, consumer balance sheets, and consumer spending. He found that the behavior of household net financial positions in fact had a significant influence on consumer demand. Further, the results provided evidence for a financial aspect to the business cycle propagation mechanism, reminiscent of the one present in Fisher's debt-deflation theory. Specifically, Mishkin found that the rise in consumer real indebtedness resulting from declining incomes and deflation induced consumers to lower spending on durables and housing, which in turn magnified the decline.

In an influential paper, Bernanke (1983) analyzed the relative importance of

monetary versus financial factors in the Great Depression. His central conclusion was that the collapse of the financial system was an important determinant of the depression's depth and persistence—and that monetary forces alone were "quantitatively insufficient" to explain these phenomena. The paper chronicled the breakdown of credit markets over the period 1930–33. It detailed both the crisis in banking—nearly half the banks failed over the period and many of the surviving ones suffered major losses— and the crisis in security markets—the ratio of debt service to national income more than doubled in 1932–33. Reasoning as Gurley and Shaw might have, Bernanke argued that the breakdown in banking affected real activity by choking off financial flows to certain sectors of the economy, sectors consisting of borrowers who did not have easy access to nonintermediated forms of credit. And there was more: the precipitous worsening of balance sheets resulting from the jump in debt service—the "debt crisis"—shrank borrowers' collateral, greatly reducing their ability to obtain funds on the open market. Overall, as Bernanke stressed, the principal arteries facilitating capital flows were severely eroded.

The alternative hypothesis, due to Friedman and Schwartz, was that the decline in bank liabilities (money) was the main disrupting factor resulting from the banking/financial crisis, and not the associated decline in bank assets or other forms of credit. To test the competing propositions, Bernanke estimated Barro's (1978) model of unanticipated money and output, modified to include proxies for financial distress. He found that the financial variables—(i) liabilities of failed banks and businesses and (ii) spreads between risky and safe bond rates—added considerable explanatory power to the output equations. He argued further that the informal evidence suggested that these financial variables were not simply responding to anticipations of future output decline; consequently, it was consistent with the evidence to conclude that the disruption of credit markets was important to the collapse in real activity. (See Hamilton [1987] for further evidence supporting this view and Haubrich [1987] for a parallel study of financial factors in the Canadian Depression.)

A number of studies, beginning with Sims (1980) and Litterman and Weiss (1985), reexamined the postwar time series interactions between money and output, and presented evidence that questioned the interpretation that money was an important driving force. While there remains no consensus view on how the results bear on the importance of money (see e.g., McCallum 1983), useful lessons did arise. It became widely appreciated that making definitive inferences about causation from reduced-form time series correlations was generally difficult, if not impossible. It accordingly became unacceptable to justify a preoccupation with money simply by appealing to its ability to forecast well in reduced-form output equations. (Tobin [1970], of course, argued this point much earlier.)

Another effect of this empirical literature was to motivate the need to consider alternatives to the simple Keynesian and Monetarist stories of the real/financial interaction. In this capacity, some interesting factors emerged. King and Plosser (1984) found that inside money had significantly more explanatory power for

output than did the monetary base. (See also Lacker 1987.) This suggested the possibility that much of the covariation between money and output was due to the money supply adjusting endogenously to movements in money demand. An implication of this possibility was that the statistical success of money in vector auto-regressions may have resulted from its strong endogenous component.

A series of papers by Friedman (1980, 1982) developed another set of relevant facts. The papers compared the performance of money versus debt in reduced-form output equations, and concluded that the ratio of debt to output was considerably more stable than the ratio of money to output. Of course, this evidence alone did not yield sharp conclusions about the roles of money versus credit. It was, however, at least consistent with a Gurley/Shaw interpretation; the existence of money substitutes could explain the instability in monetary velocity, while the importance of credit flows could underlie the stable connection between debt and output.

At the same time, developments in the economics of information and incentives facilitated making theoretical progress on these types of issues. A basic theme of the new work in information economics was that inefficiencies in trade could arise when either of the parties involved had an informational advantage; in addition, contracts—or possibly other types of institutional devices such as screening or monitoring—may be desirable to structure incentives in a way that minimizes these inefficiencies.[2] The formal apparatus devised to analyze trade under imperfect information extended naturally to the study of financial markets. Indeed, beginning with Jensen and Meckling (1976), Leland and Pyle (1977), and others, the finance literature quickly used this methodology to develop theories of capital structure and intermediation. Only in recent years has the approach been widely applied in the macroeconomics literature.

2. CURRENT LITERATURE

I will divide the discussion of current research into three sections. It is useful to begin with the literature that examines the allocative consequences of informational asymmetries in financial markets at the micro level. This is so because much of the new theory on the real/financial interaction at the aggregate level rests on insights that emanate from these papers. A discussion of intermediation will follow naturally, since the new developments in this area center on attempts to explain intermediaries as optimal institutional responses to financial market inefficiencies. A final section will review the literature that focuses directly on macroeconomic behavior.

[2]The literature distinguishes two general types of information problems: first, adverse selection—where trading parties have asymmetric information prior to contracting—and second, moral hazard—where the asymmetries arise after contracting. See Gale (1987) for a recent discussion of the behavior of markets under adverse selection, and Hart and Holmstrom (1986) for a treatment of moral hazard.

2A. Allocative Effects of Informational Problems in Financial Markets

Many of the ideas in this literature can be best understood in the context of Akerlof's (1969) paper on the "lemons" problem. The paper illustrates how asymmetric information between buyers and sellers about product quality can cause a market to malfunction .The argument runs as follows: Since the market price reflects buyers' perceptions of the average quality of the product being sold, sellers of low-quality goods (lemons) will receive a premium at the expense of those selling high-quality goods. This distortion in turn will affect the level of market activity; some high-quality sellers will stay out of the market, and possibly enough to preclude the market from opening.

The literature on financial market inefficiencies applies Akerlof's basic idea that "lemons" problems may distort economic behavior. An early example is Jaffee and Russell (1976), which explains how unobserved differences in borrower quality can induce credit rationing. The paper constructs a setting where borrower default probabilities increase with loan size. Further, for any given loan size, default probabilities differ across borrowers due to factors lenders cannot observe. Since borrowers are indistinguishable ex ante, the market interest rate incorporates a lemons premium. Consequently, good-quality borrowers (those with low default probabilities) suffer at the expense of bad-quality borrowers. Credit rationing in the form of restrictions on loan size can emerge for the following reason: Good borrowers may prefer the restrictions because the smaller loan sizes may lower the market average default probability, reducing the lemons premium; bad borrowers have to follow along in order not to reveal themselves.[3]

In a very influential paper, Stiglitz and Weiss (1981) exploit informational asymmetries to motivate a form of credit rationing where the market denies funds to borrowers with characteristics identical to those receiving loans. The key unobserved factor is the riskiness of borrowers' projects. It is also assumed that borrowers issue standard risky debt that pays lenders a fixed interest rate if the project yield is sufficiently high, and pays the net yield otherwise. Thus, for a given loan rate, lenders earn a lower expected return on loans to bad-quality borrowers (those with riskier projects) than to good. This occurs because an unobserved mean-preserving spread in a borrower's project return distribution reduces the expected payment to lenders under default. (Lenders receive no offsetting compensation in the nondefault state, since the loan rate is unchanged.)

Stiglitz and Weiss show that, given their assumptions, the loan supply curve may bend backwards and that credit rationing can emerge as a consequence. Essentially, the lemons principle is at work. A rise in the interest rate lowers the average borrower quality, as those with relatively safe projects are the first to drop out. Thus, after a point, further increases in the interest rate may lower lenders' expected return, making the loan supply curve bend backwards. Ration-

[3]The reasoning is similar to Rothschild and Stiglitz's (1976) and Wilson's (1977) description of how adverse selection may disrupt insurance markets.

ing arises—where some borrowers are arbitrarily denied credit—when the loan demand and supply curves do not intersect.[4] The quantity of loans offered is the maximum the supply curve permits. The excess demand for loans persists because adjustments in the interest rate cannot equilibrate the market; further increases in the interest rate only lower the supply of loans offered.

Many papers elaborate on the theme initiated by Jaffee/Russell, Stiglitz/Weiss and others.[5] The results often depend greatly on the particular informational asymmetries posed between borrowers and lenders. Nonetheless, two basic conclusions usually emerge: first, the postulated incentive problems distort the market equilibrium, most often toward underlending; second, they make the equilibrium quantity of lending more sensitive than otherwise to exogenous disturbances. A recent example is Mankiw (1986) who analyzes a credit market plagued by lemons problems and shows how a small rise in the riskless interest rate can lead to a large reduction in lending, possibly even a collapse. The result occurs because the increase in the riskless rate forces up the loan rate, which reduces the average quality of borrowers as in Stiglitz and Weiss. This in turn forces the loan rate up further to offset the lemons effect. If the lemons problem is severe enough, the market will collapse.

A notable distinction of Mankiw's results is that they do not hinge on the existence of credit rationing, narrowly defined. There are no loan ceilings for individual borrowers (since all project sizes are fixed). Also, identical borrower types receive identical treatment, in contrast to Stiglitz and Weiss. It is true, however, that market forces exclude a number of borrowers who would otherwise obtain loans in the absence of informational problems. The important point is that the basic insights from this literature need not be tied to particular forms of credit rationing.

Another strand of this literature emphasizes that lemons problems may affect equity markets as well as debt markets. Myers and Majluf (1984) and Greenwald, Stiglitz, and Weiss (1984) discuss how asymmetric information about the value of a firm's existing assets can restrict its ability to issue new shares. Outside lenders must discern whether the share issue is a legitimate effort to either obtain new financing or diversify risk, or is instead simply an attempt to pass off bad assets. This problem may lower the price the firm can obtain for its equity, and in extreme cases, make it prohibitive to issue new shares. Evidence for this phenomenon, according to Greenwald, Stiglitz, and Weiss, is that a firm's announcement of a new issue typically leads to a significant decline in its market value. The authors also emphasize the analogy between "equity rationing" and credit rationing more generally. As is true for the latter, the former may affect a firm's real

[4]Bester (1985) argues that banks may be able to screen the good borrowers through collateral requirements, and thus eliminate the rationing. Inefficiencies will remain, however, since good borrowers will be exposing themselves to greater risk relative to the perfect information case. Further, Hellwig (1986) discusses how Bester's conclusions are very sensitive to the form of the game between banks and borrowers.

[5]An equally innovative but far less publicized treatment of the subject is Keeton 1979. A more recent example is Smith (1983), who embeds the Jaffee/Russell model into a simple general equilibrium framework to evaluate the effects of central bank discount window policies.

investment decisions by constraining its ability to raise external funds or to suitably diversify risk.

Particular results in literature discussed thus far are sometimes highly sensitive to exogenous restrictions made on the forms of the relevant financial contracts. For example, in some models, allowing borrowers to issue a richer menu of liabilities than the simple risky debt contract described earlier can eliminate the incentive problems. (See deMeza and Webb [1987] for an illustration of this point.) This is troublesome, since real world financial arrangements are largely endogenous outcomes. Even introducing empirically motivated restrictions on contract forms is worrisome, given the rapid pace of financial innovation; what is true in financial markets today need not be true tomorrow. These problems have stimulated a recent literature that attempts to explore the effects of financial market inefficiencies without making a priori assumptions about financial structure.

Under this new approach the real/financial interaction is a purely endogenous outcome, which arises explicitly from assumptions about the information structure and other primitive factors, such as preferences and technology. An important early paper is Townsend (1979), which derives circumstances where standard risky debt contracts may be optimal. He considers the problem of a lender and borrower interested in formulating a bilateral loan agreement. Two key premises are, first, that the lender must pay a fixed cost to observe the returns to the borrower's project—in Townsend's terminology there is "costly state verification"—and, second, that the borrower does not have sufficient collateral to fully secure the loan. The dilemma the lender faces is that the borrower who is unmonitored has the incentive to misreport the project outcome, but that it is inefficient to commit to auditing the borrower under all circumstances.

Townsend formally proves that the optimal contract has the following features. It specifies a "no-default" yield r. If the project yield is sufficiently high, the lender receives r and does not audit. If not, the borrower declares "default" and the lender monitors. Thus, the efficient contract is debt with possible costly default.[6] While the analysis does not provide a complete description of bankruptcy, it does offer a very tractable and explicit way to illustrate how incentive problems can add real costs to the lending process.

Several recent papers have used the costly state verification framework to study how financial considerations may have allocative consequences. Gale and Hellwig (1985) analyze the interaction between the real and financial decisions of

[6]The argument assumes that the lender only uses deterministic monitoring strategies and that he commits to monitoring in the default state even though it may not be in his interest to do so ex post. See Mookherjee and Png (1987) and Townsend (1987) who generalize the analysis to allow for random monitoring schemes. See Moore (1987) who relaxes the commitment assumption. One implication of these analyses is that the optimal contract form need not be debt.

In addition, to obtain simple debt contracts as the exclusive financial instrument, it is also necessary that the borrower's returns not be correlated with aggregate variables. Otherwise, the optimal financial contract will include contingencies based on the movements in these aggregates.

It should be stressed that these caveats do not alter the basic point that the information asymmetries reduce the efficiency of the financial process.

a firm that must borrow to finance factor inputs. In analogy to Townsend, lenders cannot costlessly observe the firm's output. Gale and Hellwig show how this informational problem ultimately constrains the firm's input demand. Input investment is lower than otherwise because the marginal cost of funds includes the change in expected default costs; the optimal financial contract compensates lenders for the greater probability of default resulting from a rise in (leveraged) input demand.

Williamson (1987) analyzes a related problem in a market context, and demonstrates how it is possible to explain the type of credit rationing characterized by Stiglitz and Weiss, without a priori restrictions on financial contracts. Rationing may occur because the expected default costs stemming from costly state verification may make it prohibitively expensive for borrowers to obtain funds from lenders with high opportunity costs. (Borrowers are identical ex ante, but lenders vary according to their opportunity costs of funds.) As with Gale and Hellwig, the allocative effects arise because the informational problems effectively increase the marginal cost of funds.

There are, of course, good reasons for not taking the costly state verification model as literal description of many lending situations. There exist many circumstances were auditing and other default costs are insubstantial and where borrowers issue liabilities other than standard risky debt contracts. However, similar types of qualitative conclusions regarding the link between informational asymmetries, the joint determination of real and financial variables, and the inefficiency of the investment process emerge in settings with richer descriptive features.

For example, Bernanke and Gertler (1987b) examine the endogenous interaction between financial structure and real activity in a market with a general type of lemons problem present. In their setting, entrepreneurs (or, possibly corporate managers) evaluate potential investment projects and proceed with those profitable to them. Because of insufficient resources, they must obtain at least some outside funding. Importantly, however, the information they obtain about project quality (i.e., the project's success probability) is private knowledge to them. This provides entrepreneurs with too strong an incentive to proceed with the project they have initiated, since they can pass off to lenders poor-quality projects as good-quality ones.

The optimal financial contract accounts for the lemons problem by structuring the payoffs in a way to discourage this activity. Because it is not possible to completely eliminate the problem—see the paper for the details—the cost of capital entrepreneurs face incorporates a lemons premium. In analogy to the earlier literature (with exogenous contract forms), this lemons-induced rise in borrowing costs reduces the efficiency of the investment process and in severe cases may induce an investment collapse. An implication is that informational distortions can in theory have quantitatively significant effects on investment behavior. In addition, the conclusions extend beyond situations where simple debt contracts are the exclusive financial instruments. The optimal contracts that emerge in the

analysis are general state-contingent contracts, which have a variety of institutional representations (e.g., combinations of debt and equity, intermediary credit lines).

As with the previous literature, conclusions from this recent work are often sensitive to the postulated incentive problem. The question arises, what types of general testable predictions can these models make, particularly ones relevant to aggregate behavior? Bernanke and Gertler (1986) argue that for a wide class of environments the following proposition holds: The market equilibrium level of investment depends positively on borrower balance sheet positions, defined as the ratio of net worth to liabilities. In this regard there is a strong connection between the conclusions of this new literature and the ideas that arose much earlier from the informal discussions of Fisher, Gurley and Shaw, and others.

The argument proceeds roughly as follows: A strengthened balance sheet implies a borrower has more resources available to either use directly for project finance or as collateral in obtaining outside funds. This reduces the borrower's cost of obtaining external funds by lowering the informational risk that outside lenders face, and in turn stimulates investment. Examples of this theoretical link between balance sheets and investment appear in Bernanke and Gertler (1986, 1987b) and Calomaris and Hubbard (1987). The two former papers emphasize the cyclical interaction of these two variables and how a financially induced investment collapse is possible. The latter uses the Stiglitz/Weiss model to illustrate how borrower balance sheet positions affect the degree of credit rationing. In the end, one may view these analyses as attempts at formal underpinnings for the Gurley/Shaw notion that "financial capacity" matters to private spending.

An equivalent prediction of these papers is that borrower investment decisions will be "excessively sensitive" to current cash flow, that is, more sensitive than they would be absent capital market problems. In a setting of perfect markets, cash flow and investment may be positively correlated because movements in the former may signal movements in the firm's future earnings potential. With capital market imperfections there is an additional effect: a rise (fall) in cash flow strengthens (weakens) the firm's balance sheet and thus lowers (increases) its cost of capital. In this vein, it is possible to rationalize income-accelerator effects on investment. (By making a related appeal to capital market imperfections, one can also explain why consumption spending may be excessively sensitive to current income. See, for example, Scheinkman and Weiss [1986] for a theoretical analysis and Zeldes [1985] for an empirical treatment.)

Another prediction relevant to the empirical implementation of these models is that new borrowers will face tighter financial constraints than those with long and reasonably successful track records, everything else equal. In a frictionless environment, for example, young firms and mature firms should be able to obtain funds equally well at risk-corrected interest rates. The same need not be true when informational asymmetries are relevant, for several reasons. First, lenders will generally know more about mature firms, since they will have had some time and experience to learn about relevant characteristics. Second, mature firms may

credibly enter repeated relationships with lenders, the significance being that long-term relationships help mitigate informational problems. The reasons for this is that multiperiod contracts permit more flexibility in structuring incentives to curb against deviant behavior. For example, Stiglitz and Weiss (1983) provide an example of how lenders may use the threat to cut off credit in the future to improve the current behavior of borrowers.

A final testable implication is, ceteris paribus, that financial constraints are likely to have more impact on the real decisions of individual borrowers and small firms than on large firms. First, the class of large firms consists primarily of mature firms who have the advantages described above. Second, there may be an informational economy of scale in lending to large firms, to the extent that lenders may face fixed costs of gathering certain types of critical data about borrowers.

In a very interesting and ambitious paper, Fazzari, Hubbard, and Peterson (1987) find empirical support for these various propositions. Using Value Line data, they conduct a time series and cross-sectional analysis of a broad class of firms. The main result is that, overall, investment is significantly more sensitive to current cash flow than a frictionless neoclassical model would predict. Further, the conclusions are most dramatic for new firms and small firms. The authors buttress their arguments by reporting evidence from a case study of corporate financing behavior over the period 1960–1980, by Srini Vasan (1986). The study shows that small- to medium-size manufacturing firms—which account for roughly a quarter of all manufacturing assets—relied heavily on internal funds; they used this source to finance 85 percent of their new investments. (In addition, see Calomiris, Hubbard, and Stock [1986] for an empirical analysis of how credit market problems afflict the agricultural sector and Chirinko [1987] for a recent econometric study of liquidity effects on investment.)

2B. Models of Financial Intermediation

Current research on the macroeconomic implications of financial intermediation incorporates many of the earlier ideas of Gurley and Shaw and others. It stresses the role of these institutions in overcoming imperfections in markets which transfer funds between savers and investors. Differences with the traditional literature largely reflect advances in methodology. The new work applies first principles to explain the existence and structure of intermediaries, and to describe how these institutions may interact with aggregate real activity.

Because the objective is so ambitious, this new literature is still at an early stage. While the models developed thus far capture basic features of intermediation, they are still not rich in detail. Whether it is necessary to enhance certain descriptive aspects of these models before arriving at substantive behavioral and policy conclusions is an important and open question.

As a prelude to further discussion, it is interesting to compare two papers on intermediation by Fama, spaced five years apart. The first, Fama (1980), charac-

terizes the role of intermediaries, taking the frictionless competitive markets model as a working hypothesis. The paper describes how, in this environment, banks and other financial institutions are simply veils over real economic behavior. This follows since the Modigliani-Miller theorem applies in this setting, and hence financial structure—including the structure of intermediation—is both indeterminate and irrelevant.

The second, Fama (1985), takes an alternative route and considers why intermediaries might indeed play an important role in the economy, particularly commercial banks. The starting point is the casual observation that borrowers who obtain bank loans typically pay a higher return than the market rate on directly placed securities of similar maturity. The inference drawn is that, for certain classes of borrowers, bank credit is "special"—open market credit is not available as a perfect substitute. Fama then argues that this feature of bank lending arises because of the comparative advantage banks develop in gathering information about borrowers. This advantage implies that intermediation is often not simply a veil, and is instead for many situations the most efficient way to minimize the types of informational distortions described in the previous section.

Diamond (1984) provides an early example of how it is possible to formally explain intermediary-like institutions. He considers a setting with an information structure similar to the one in Townsend's costly state verification model: lenders cannot freely observe the returns to borrowers' projects. As with Townsend, the optimal bilateral financial arrangement is a risky debt contract, under which the lender monitors the borrower in the event of default. An important difference from Townsend is that project sizes and endowment patterns are fixed so that borrowers need to obtain funds from many individuals.

Diamond then proves that, in order to economize on monitoring costs, it is optimal for a competitive financial institution to channel funds between savers and borrowers. Further, the structure of this institution—which arises endogenously—shares basic features of a conventional intermediary. This institution (i) writes loan contracts with individual borrowers and monitors borrowers who default; (ii) holds a heavily diversified portfolio; (iii) transforms assets for savers—in particular, the individual liabilities which the institution issues to savers have smoother payoff patterns than the individual securities they obtain from borrowers.

Diamond shows that the latter two characteristics arise to solve a potential incentive problem between the financial institution and its depositors. To avoid duplication of monitoring costs, it is clearly efficient for the institution to perform as a "delegated monitor" of borrowers, on behalf of the depositors. But the issue arises, how do the depositors monitor the monitor? Diamond's argument is that the institution can circumvent this problem by holding a heavily diversified portfolio. Diversification eliminates the need for depositors to audit the intermediary because it permits the intermediary to credibly offer savers a return that is unaffected by any of the independent risks that borrowers face.

A number of papers have followed Diamond's path to study the link between

intermediation and real activity. For example, Williamson (1986) uses a similar environment to illustrate how intermediation and credit rationing may be interrelated phenomena. Rationing emerges in his framework because costly state verification adds a premium to loan rates (see the previous section); intermediation arises simultaneously as way to minimize this premium—and thus minimize rationing—by economizing on monitoring costs, in analogy to Diamond's argument.

Boyd and Prescott (1986) stress the role intermediaries play in evaluating loan projects ex ante and, relatedly, in minimizing the types of lemons problems described in the earlier section. They consider an environment where each individual is endowed with both a limited amount of wealth and a project. The latter is either of good or bad quality, and its type is the individual's private information. Endogenous intermediary coalitions emerge, and these coalitions structure incentives so that those with bad-quality projects become savers while those with good-quality ones seek funding. The devices that these intermediaries use are project evaluations and financial contract structure. Further, diversification is desirable because it allows the intermediary to implement the optimal incentive scheme with certainty.[7]

Other papers have attempted to enrich the description of intermediation that these types of frameworks offer. Moore (1987) emphasizes that intermediaries, particularly commercial banks, often enter repeated relationships with lenders. He constructs an environment where multiperiod loan contracts help mitigate informational distortions (see the previous section). He then shows that intermediaries help maximize the efficiency gains from long-term relationships by matching large quantities of lenders and borrowers, and thus diversifying the risk that individual lenders or borrowers may disrupt multiperiod arrangements by having to suddenly leave the market (e.g., to meet liquidity needs).

Morgan (1987) considers another prevalent phenomenon, namely that most commercial bank loans are made under loan commitment agreements, as opposed to being negotiated on the spot. Further these agreements typically do not specify fixed loan quantities in advance, only ceiling levels instead. Morgan first adds uncertainty about project costs to the basic costly state verification model. This uncertainty about funding needs makes borrowers face the risk of being rationed by lenders, since default probabilities and thus expected default costs vary positively with loan size. Morgan then shows how in the competitive equilibrium intermediaries will offer borrowers contracts that have the basic features of loan commitments. These contracts arise to provide borrowers partial insurance against the rationing risk. (See also Veitch [1987] and Greenbaum et al. [1987] for related approaches.)

[7]A central feature of the Boyd/Prescott analysis is that it uses the theory of mechanism design (see, e.g., Harris and Townsend 1981 and Townsend 1986) to endogenously motivate intermediation. Roughly speaking, the optimal intermediary structure emerges as the institutional scheme that implements the optimal allocation resulting from a social planning problem, which is to maximize welfare subject to the relevant informational and technological constraints. See also Haubrich (1987).

One striking feature of the behavioral theories presented thus far is that intermediation works extremely well, so well that—taking the models literally—a laissez-faire policy toward financial intermediaries is optimal. This conclusion, however, is at odds with the position taken by policymakers since the Depression that the smooth functioning if intermediation, and of commercial banking in particular, requires some form of regulation.

One possibility, of course, is that these policymakers simply have been wrong, and that any problems with financial intermediation instead stem from unwise government policy. Gorton and Haubrich (1986) adopt this view, and present a formal analysis of how regulations that restrict the ability of intermediaries to diversify or to write contracts—such as the Glass/Steagall Act—can introduce inefficiencies that might not otherwise exist.

An alternative possibility is that there exist natural factors that can disrupt the intermediation process, not captured in the basic frameworks of Diamond and others.[8] A leading candidate for concern is a liquidity crisis. Indeed, traditional arguments for intervention (see e.g., Friedman and Schwartz 1986) cite the need to protect financial institutions exposed to liquidity risk.

Diamond and Dybvig (1983) explore the idea that liquidity considerations may justify the types of interventions in commercial banking currently in effect, such as federal deposit insurance. They begin with a framework that emphasizes the importance of banks in the provision of liquidity. In their setting, individuals face uncertain liquidity needs. Further, these needs are not publicly observable and therefore not directly insurable. The incompleteness in markets for liquidity insurance creates a role for banks. These institutions are able to provide this insurance by offering individuals deposits that give them flexibility over the timing of withdrawal.

The story is not over, however, since the portfolios of these institutions are potentially subject to liquidity risk. Because the banks issue liabilities requiring payment on demand, circumstances may arise in which they cannot honor the claims of all those who decide to withdraw. Diamond and Dybvig demonstrate that as a result "sunspot" panics can arise; depositors may withdraw simply in anticipation of others withdrawing, making the prophecy self-fulfilling. Further, the panic disrupts real activity to the extent that it forces banks to liquidate productive loan projects. Diamond and Dybvig conclude that there is a strong justification for policies such as deposit insurance which prevent costly liquidity crises by eliminating the incentive for depositors to panic.[9]

The Diamond/Dybvig paper has stimulated a lengthy debate in the literature. At issue is whether private financial institutions, if left to their own devices, can make the types of arrangements necessary to avoid problems like liquidity panics. Jacklin (1985) and others, for example, demonstrate that the bank run equil-

[8]This possibility has motivated a number of researchers to study historical episodes of free banking. See Rolnick and Weber (1984) for a treatment of the U.S. experience.

[9]See Bryant (1980) and Smith (1986) for related analyses. In addition, Bental, Eckstein, and Peled (1987) study the problem in a international setting. For a different perspective on the problem, see McCulloch (1981).

ibrium in the Diamond/Dybvig model arises because of exogenous restrictions on deposit contracts that banks can offer savers. The critical assumption is the "sequential service constraint" which requires that banks honor deposit withdrawals at face value until they no longer have funds. This makes depositors' payoffs depend critically on their respective places in line, which makes a panic possible. A bank could—in theory—avert a panic by eliminating the sequential service constraint and instead offering contracts with equity-like features; in particular, by making deposit returns contingent on the total number of withdrawals, the bank could eliminate the depositors' incentive to run.[10]

Resolving this debate is difficult. While in the context of these types of models there typically exist private contractual arrangements that eliminate the need for any government intervention, these types of arrangements are often not observed in practice, as Diamond and Dybvig argue. (See Gorton [1985] for an opposing position.) Whether this is because the current regulatory environment either precludes these arrangements or makes them unnecessary, or is instead because the existing models of intermediary behavior are still incomplete is an issue that requires further attention.

In an interesting paper, Bhattacharya and Gale (1987) make a case for government intervention to insure the smooth flow of liquidity, without appealing to arbitrary restrictions on private contracts. In their framework, banks are able to structure deposit contracts to preclude sunspot runs; however, individual banks face withdrawal risk because they are not sufficiently diversified across depositors (perhaps for geographic reasons). This creates the need for a clearinghouse arrangement among banks, under which those banks suffering heavy withdrawals can borrow from those who do not. Bhattacharya and Gale then show that if it is costly to monitor individual bank portfolios, banks will invest suboptimally in liquid assets. The private scheme encourages banks to hold a very illiquid portfolio, and instead rely heavily on the clearinghouse to meet withdrawal risk. This occurs because the clearinghouse rate is lower than the rate banks can earn on illiquid assets, for insurance purposes. Since all banks hold too few liquid assets, less than the desired amount of funds are available to the clearinghouse to meet legitimate loan requests. Bhattacharya and Gale then show it is optimal for the government to provide subsidized liquidity insurance to private banks; the optimal policy is interpretable either as deposit insurance or subsidized discount window lending.

Implicit in the Bhattacharya/Gale paper is the following important point: Any case for government intervention into particular forms of intermediation probably rests on the absence of well-functioning secondary markets for the assets of the relevant financial institutions.[11] Liquidity risk is not a problem for banks or other intermediaries if they can easily obtain funds by marketing their assets.

[10]Needless to say, my confidence in arguments that private institutional arrangements can avert panics has dwindled a bit, after the events of last October.

[11]An alternative discussed by Smith (1984) is that legal restrictions such as interest ceilings may be necessary to ensure that an equilibrium exists in the presence of adverse selection problems.

Bhattacharya and Gale proceed by assuming banks cannot trade their assets. But they are not without support; many recent authors (e.g., Fama [1985] and Bernanke and Gertler [1987a]) argue that an important feature of commercial banks is that a good fraction of the assets they hold are information-intensive loans, securities that are nonmarketable due to being highly idiosyncratic and imperfectly collateralized.[12] Moreover, it is this feature that may make them candidates for special attention, and not their role in money provision—many other financial institutions provide transactions and liquidity services to depositors, and function perfectly well because they have marketable assets.[13]

In this spirit, Bernanke and Gertler (1987a) develop a model of banking and macroeconomic behavior which stresses the role of banks in facilitating credit flows. The analysis first demonstrates how the financial health of the banking sector itself may be important to the macroeconomy and second discusses how monetary policy can matter to real activity by affecting the flow of bank credit.

In their setting, bank capital plays an important role in securing the liabilities banks issue to depositors. It is assumed that banks have private information about the returns to their portfolio, but that they cannot perfectly diversify independent risks from loan projects, due to spatial considerations (in analogy to Bhattacharya and Gale). Having larger quantities of net worth permits a bank to obtain more deposits and, correspondingly, to allocate a larger fraction of its portfolio to risky loans; it provides the bank with more collateral to guarantee its liabilities and to therefore mitigate the informational risk that depositors face.[14] Thus, overall, bank net worth positions govern the scale of banking and hence the flow of bank credit. This in turn has implications for investment and output.

The framework Bernanke and Gertler develop is essentially a formalized version of an extreme Gurley/Shaw environment. There exist perfect substitutes for bank liabilities, but not for bank assets.[15] Using reasoning similar to Blinder and Stiglitz (1983), the authors then demonstrate how monetary policy can matter by affecting the availability of bank credit, in contrast to the traditional Keynesian and Monetarist stories. This transmission mechanism arises to the extent that, first, the level of bank reserves constrains bank lending and that, second, the central bank can control the real quantity of reserves (e.g., due to temporary price stickiness). (See Farmer [1986] for a description of a "credit-based" monetary transmission mechanism which relies on reserve requirements, but not on price inertia.)

[12]Bank assets that are securitized and sold on secondary markets are typically collaterized relatively well (e.g., car loans and mortgages). See Pennacchi (1987) for an argument why moral hazard problems may inhibit an active secondary market for idiosyncratic and unsecured business loans.

[13]One puzzle left unexplained (in theory) is why certain financial institutions combine transactions and lending services. One possibility, suggested by Black (1975), is that banks can better monitor their loan customers if they are as well processing their transactions accounts. See Fischer (1983) as well for a discussion of this issue.

[14]See also Samolyk (1987), who analyzes the connection between net worth and banks' ability to withstand interest-rate risk.

[15]See James (1987) and Chirinko and King (1987) for empirical support for the view that banks have a special role in the credit supply process.

Whether monetary policy matters by affecting bank liabilities or bank assets is another issue which deserves further scrutiny. The empirical evidence thus far is mixed. (See King [1985] and Bernanke [1985] for opposing conclusions.) Part of the problem may be due to the general difficulty of discerning structural relationships from time series data.

2C. Models of Business Fluctuations

Only recently have macroeconomists regained an interest in exploring issues of financial structure. Interestingly, they contrast with many economists in the private sector who have continuously stressed the importance of financial variables in output determination. In the DRI econometric forecasting model, for example, procyclical movements in balance sheet positions and other related constructs feed back into output behavior. As Eckstein and Sinai (1986) argue, this financial mechanism is important for predicting business fluctuations. The current research in this area tries to formalize the types of propagation mechanisms discussed in Eckstein and Sinai's paper and in the earlier academic literature, described previously. In this regard, it attempts to provide theories emphasizing financial factors using the same level of rigor as real business cycle analysis.

Scheinkman and Weiss (1986) provide an early example of the new approach that demonstrates how borrowing constraints can increase the variability of consumption, output and employment. The paper considers an environment where two representative individuals face negatively correlated productivity risks. In a frictionless environment, the individuals can either directly insure these risks or accomplish the same through lending and borrowing; in this case, individual risks do not induce aggregate fluctuations. In a setting where these markets do not exist, the individuals must self-insure by adjusting consumption, saving, and labor supply. Scheinkman and Weiss demonstrate how this behavior at the individual level leads to cycles in aggregate behavior.[16]

Other papers focus on motivating the financial structure endogenously in analogy to the literature discussed in the previous two sections. Farmer (1984) presents a model where informational problems between lenders and borrowers magnify the effects of changes in the riskless interest rate on output. Entrepreneurs privately observe the productivity and ex post returns of their loan projects. Moreover, they have limited liability, so that the optimal financial arrangement with lenders is a debt contract with a default option, for reasons roughly similar to Townsend's argument. A change in the riskless rate has an enlarged effect on loan rates—and therefore on output—because it alters the default rate. A subsequent paper, Farmer (1985), uses similar reasoning to suggest why interest rate movements might have magnified effects on employment demand and layoff probabilities, to the extent that firms need leverage to finance factor demands.

[16]See also Blinder (1987) who illustrates how borrowing constraints may add to the variability of output, in the context of an IS/LM model.

Related approaches emphasize the role of intermediation. For example, Williamson (1987) incorporates his model of intermediation and credit rationing (described earlier) into a simple business cycle framework to study the interaction between financial and real variables. Productivity disturbances—in the form of mean-preserving spreads to project returns—change default probabilities, thereby affecting the degree of credit rationing and the levels of investment and output.

Finally, a number of papers attempt to formulate explicitly the balance sheet and cash flow effects on investment and output fluctuations described by Eckstein and Sinai and earlier by Fisher, Gurley and Shaw, and others. Bernanke and Gertler (1986) develop a framework in which endogenous procyclical movements in entrepreneurial net worth magnify investment and output fluctuations. Prior to the introduction of informational asymmetries, the framework resembles a simple real business cycle model; financial structure is irrelevant. Adding the asymmetries, however, makes financial arrangements determinate and also makes the borrowers' net worth positions key factors governing their capacity to obtain external funds, for reasons discussed in section 2A. Further, Bernanke and Gertler structure the framework so that movements in output produce positively correlated changes in borrower balance sheets. As a result, the wedge between the cost of external versus internal funds moves countercyclically, thus magnifying swings in investment and output. Essentially, an income-accelerator effect on investment emerges because increases in income relax borrowing constraints.

The paper also provides some formal support for Fisher's debt-deflation story. In the theoretical framework, redistributions between borrowers and lenders matter to aggregate real activity. A transfer from debtors to creditors—due, for example, to an unanticipated decline in the price level—weakens debtors' balance sheets and thus reduces their ability to externally finance investments; because the debtor class includes those most efficient at managing investment projects, the redistribution lowers investment and real activity.

Greenwald and Stiglitz (1986) present a related analysis, which illustrates the cyclical implications of constraints on firms' abilities to issue new equity. They appeal to equity rationing—as described in Greenwald, Stiglitz, and Weiss (1984) (see section 2A)—to motivate an environment where each firm finances labor input exclusively with debt. Because default is costly to managers (e.g., it adversely affects their reputations), a firm's employment demand depends on how well it can secure its debt, and hence on its equity position. Movements in cash flow affect employment demand by altering the quantity of internal funds available. Also, wealth redistributions and relative price changes affect borrowing constraints and, in this capacity, can matter to aggregate activity.

One limitation of these models—one that needs to be overcome before they can explicitly confront time series data in the way real business cycle frameworks do—is that they typically abstract from multiperiod financial arrangements. This is done to avoid the technical problems inherent in general equilibrium modeling

of long-term relationships. An important exception is Green (1985). This paper derives the optimal contract structure for an economy of infinitely lived individuals who face independent and privately observed income disturbances. The informational problems preclude individuals from perfectly insuring against these risks. Green proves that under the optimal contractual arrangement individuals can obtain partial insurance by entering a long-term borrower/lender relationship with a diversified intermediary. Further, the amount an individual can borrow depends on his net worth position. As a result, individuals' spending patterns will depend on the evolution of their respective net worth positions. The next level of theoretical development in this literature will, I think, involve extensions of Green's work.

Another current limitation is that these frameworks have very ambiguous policy implications. In analogy to the intermediation literature, the basic issue involves whether the government can improve on the types of contractual arrangements that would arise in an unfettered private economy. The results are highly sensitive to the postulated information structure. (See Townsend [1987] for a general discussion of the sensitive connection between the information structure and private equilibrium contractual arrangements.)

Finally, the analyses are not well integrated with monetary theory. The major obstacle is probably the general difficulty of incorporating money into general equilibrium frameworks. As a result, it is difficult to sharply evaluate the effects of monetary policy. Townsend (1983) has made some progress in this direction by appealing to inefficiencies in trade resulting from spatial separation to develop a unified treatment of money, credit, and output growth. Understanding the exact link between these phenomena requires further study.

CONCLUDING REMARKS

Summers (1986) has recently argued that historical experience suggests that recessions, and certainly depressions, involve breakdowns in trade in one form or another—and that any theory of output determination must ultimately be able to address this phenomenon. At the same time, Prescott (1986) has restated the importance of internal consistency. The new literature on the real/financial interaction proceeds in the spirit of both these arguments.

At this preliminary stage, it offers rigorous explanations for how inefficiencies in intertemporal trade may arise. It suggests how these inefficiencies manifest themselves in the behavior of financial markets and institutions and, most importantly, why they may be significant factors in aggregate economic activity. There are as well a rich set of testable implications about the co-movement between a broad array of real and financial variables. And some initial empirical work has yielded encouraging results (e.g., Fazzari, Hubbard, and Peterson [1987]).

A major obstacle remains, nonetheless. The theoretical models developed thus far are highly stylized and capable of generating only qualitative predictions.

Due to methodological limitations, there currently does not exist a unified framework that can directly confront data as, for example, is possible with a real business cycle model. This tractability problem appears common to all theories that appeal to (rigorously motivated) market inefficiencies to explain aspects of macroeconomic behavior. It alone, however, is not grounds for abandoning the general approach.

LITERATURE CITED

Akerlof, George. "The Market for Lemons: Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics* 84 (August 1970), 488–500.

Barro, Robert J. "Unanticipated Money, Output and the Price Level in the United States." *Journal of Political Economy* 86 (August 1978), 549–80.

Bental, Ben, Zvi Eckstein, and Dan Peled. "Competitive Banking with Confidence Crisis and International Borrowing." Mimeo, Carnegie-Mellon University, 1987.

Bernanke, Ben S. "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73 (June 1983), 257–76.

_____. "Alternative Explanations of the Money/Income Correlation." Mimeo, Princeton University, 1985.

Bernanke, Ben S., and Mark Gertler. "Agency Costs, Collateral, and Business Fluctuations." National Bureau of Economic Research, Working Paper No. 2015, September 1986.

_____. "Banking and Macroeconomic Equilibrium." In *New Approaches to Monetary Economics,* edited by William A. Barnett and Kenneth Singleton, pp. 89–111. New York: Cambridge University Press, 1987.(a)

_____. "Financial Fragility and Economic Performance." National Bureau of Economic Research, Working Paper No. 2318, 1987.(b)

Bester, Helmut. "Screening vs. Rationing in Credit Markets with Imperfect Information." *American Economic Review* 75 (1985), 850–55.

Bhattacharya, Sudipto, and Douglas Gale. "Preference Shocks, Liquidity and Central Bank Policy." In *New Approaches to Monetary Economics,* edited by William A. Barnett and Kenneth Singleton, pp. 69–88. New York: Cambridge University Press, 1987.

Black, Fischer. "Bank Funds Management in an Efficient Market." *Journal of Financial Economics* 2 (December 1975), 325–39.

Blanchard, Olivier J. "Why Does Money Affect Output? A Survey." Massachusetts Institute of Technology, Working Paper No. 453, June 1987.

Blinder, Alan. "Credit Rationing and Effective Supply Failures." *The Economic Journal* 97 (June 1987), 327–52.

Blinder, Alan, and Joseph E. Stiglitz. "Money Credit Constraints and Economic Activity." *American Economic Review* 73 (May 1983), 297–302.

Boyd, John, and Edward Prescott. "Financial Intermediary-Coalitions." *Journal of Economic Theory* 38 (April 1986), 211–32.

Brainard, William, and James Tobin. "Financial Intermediaries and the Effectiveness of Monetary Control." *American Economic Review* 53 (May 1963), 383–400.

Brock, William A., and Leonard J. Mirman. "Optimal Economic Growth and Uncertainty: The Discounted Case." *Journal of Economic Theory* 4 (June 1972), 479–513.

Bryant, John. "A Model of Reserves, Bank Runs, and Deposit Insurance." *Journal of Banking and Finance* 4 (1980), 335–44.

Calomiris, Charles, and Glenn Hubbard. "Imperfect Information, Multiple Loan Markets, and Credit Rationing." Mimeo, Northwestern University, 1987.

Calomiris, Charles, Glenn Hubbard and James Stock. "The Farm Debt Crisis and Public Policy." *Brookings Papers on Economic Activity* (1986), 441–79.

Chirinko, Robert S. "Tobin's Q and Financial Policy." *Journal of Monetary Economics* 19 (1987), 69–87.

Chirinko, Robert S., and Stephen R. King. "Bank Loans and Information Accumulation." Mimeo, University of Chicago, 1987.

deMeza, David, and David Webb. "Too Much Investment: A Problem of Asymmetric Information." *Quarterly Journal of Economics* 102 (May 1987), 281–92.

Diamond, Douglas. "Financial Intermediation and Delegated Monitoring." *Review of Economic Studies* 51 (July 1984), 393–414.

Diamond, Douglas, and Philip Dybvig. "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91 (June 1983), 401–19.

Eckstein, Otto, and Allen Sinai. "The Mechanisms of the Business Cycle in the Postwar Era." In *The American Business Cycle: Continuity and Change,* edited by Robert Gordon, pp. 39–132. Chicago: University of Chicago Press for NBER, 1986.

Eichenbaum, Martin, and Kenneth Singleton. "Do Equilibrium Real Business Cycle Theories Explain Post War Business Cycles?" *NBER Macroeconomics Annual,* 1 (1986), 91–134.

Fama, Eugene. "Banking in the Theory of Finance." *Journal of Monetary Economics* 6 (January 1980), 39–57.

_____. "What's Different About Banks?" *Journal of Monetary Economics* 15 (January 1985), 29–40.

Farmer, Roger. "A New Theory of Aggregate Supply." *American Economic Review* 74 (December 1984), 920–30.

_____. "Implicit Contracts with Asymmetric Information and Bankruptcy: The Effect of Interest Rates on Layoffs." *Review of Economic Studies* 52 (July 1985), 427–42.

_____. "Money and Contracts." Mimeo, University of Pennsylvania, 1986.

Fazzari, Stephen, Glenn Hubbard, and Bruce Peterson. "Financing Constraints and Corporate Investment." Mimeo, Northwestern University, 1987.

Fischer, Stanley. "A Framework for Monetary and Banking Analysis." *Economic Journal* 92 (March 1983), 1–16.

Fisher, Irving. "The Debt-Deflation Theory of Great Depressions." *Econometrica* 1 (October 1933), 337–57.

Friedman, Benjamin M. "Postwar Changes in the American Financial Markets." In *The American Economy in Transition,* edited by Martin Feldstein, pp. 9–78. Chicago: University of Chicago Press, 1980.

_____. "Debt and Economic Activity in the United States." In *The Changing Roles of Debt and Equity in Financing U.S. Capital Formation,* edited by Benjamin Friedman, pp. 91–110. Chicago: University of Chicago Press, 1982.

Friedman, Milton, and Anna J. Schwartz. *A Monetary History of The United States: 1867–1960.* Princeton: Princeton University Press, 1963.

_____. "Has Government Any Role in Money?" *Journal of Monetary Economics* 17 (January 1986), 37–62.

Gale, Douglas. "A Walrasian Theory of Markets with Adverse Selection." Mimeo, University of Pittsburgh, 1987.

Gale, Douglas, and Martin Hellwig. "Incentive-Compatible Debt Contracts I: The One-Period Problem." *Review of Economic Studies* 52 (October 1985), 647–64.

Goldsmith, Raymond. *Financial Structure and Development.* New Haven: Yale University Press, 1969.

Gorton, Gary. "Check Clearing, Banking Panics, and the Structure of the Banking Industry." Mimeo, University of Pennsylvania, 1985.

Gorton, Gary, and J. Haubrich. "Bank Deregulation, Credit Markets and the Control of Capital." Mimeo, University of Pennsylvania, 1986.

Green, Edward. "Lending and the Smoothing of Uninsurable Income." Mimeo, University of Pittsburgh, 1985.

Greenbaum, Stuart, George Kamatas, and Itzhak Venezia. "Loan Commitments and Credit Demand Uncertainty." Mimeo, Northwestern University, 1987.

Greenwald, Bruce, and Joseph E. Stiglitz. "Information, Finance Constraints, and Business Fluctuations." Mimeo, Princeton University, 1986.

Greenwald, Bruce, Joseph E. Stiglitz, and Andrew Weiss. "Informational Imperfections in the Capital Market and Macroeconomic Fluctuations." *American Economic Review* 74 (May 1984), 194–200.

Gurley, John, and Edward Shaw. "Financial Aspects of Economic Development." *American Economic Review* 45 (September 1955), 515–38.

Hall, Robert, and Dale Jorgenson. "Tax Policy and Investment Behavior." *American Economic Review* 57 (1967), 391–414.

Hamilton, James. "Monetary Factors in the Great Depression." *Journal of Monetary Economics* 19 (March 1987), 145–70.

Harris, Milton, and Robert Townsend. "Resource Allocation under Asymmetric Information." *Econometrica* 49 (January 1981), 33–64.

Hart, Oliver, and Bengt Holmstrom. "The Theory of Contracts," Mimeo, Massachusetts Institute of Technology, 1986.

Haubrich, Joseph G. "Optimal Financial Structure in Exchange Economies." Mimeo, University of Pennsylvania, 1986.

_____. "Money Supply, Bank Failures, and Credit Crunches: Lessons from the Great Depression in Canada." Mimeo, University of Pennsylvania, 1987.

Hawtrey, Ralph G. "The Trade Cycle." *Economist* (Rotterdam). 1926. Reprinted in *Readings in Business Cycle Theory,* pp. 330–49. Homewood: Irwin, 1951.

Hellwig, Martin. "Some Recent Developments in the Theory of Competition in Markets with Adverse Selection." Mimeo, University of Bonn, 1986.

Hester, Donald. "Monetary Policy in Evolutionary Disequilibrium." Social Systems Research Institute, Working Paper No. 8506, University of Wisconsin, 1985.

Hicks, John R. "Mr. Keynes and the 'Classics': A Suggested Interpretation." *Econometrica* 5 (April 1937), 147–59.

Jacklin, Charles. *Essays in Banking,* Ph.D. dissertation. Stanford Graduate School of Business, 1985.

Jaffee, Dwight, and Thomas Russell. "Imperfect Information, Uncertainty, and Credit Rationing." *Quarterly Journal of Economics* 90 (November 1976), 651–66.

James, Christopher. "Some Evidence on the Uniqueness of Bank Loans." *Journal of Financial Economics* 19 (1987), 217–36.

Jensen, Michael and William Meckling. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* 3 (October 1976), 305–60.

Kaufman, Henry. "Debt: The Threat to Economic and Financial Stability." Federal Reserve Bank of Kansas City *Economic Review* (December 1987), 3–11.

Keeton, William. *Equilibrium Credit Rationing.* New York: Garland, 1979.

Kindleberger, C. *Manias, Panics, and Crashes.* New York: Basic Books, 1978.

King, Robert, and Charles Plosser. "Money, Credit, and Prices in a Real Business Cycle." *American Economic Review* 74 (June 1984), 363–80.

King, Stephen R. "Monetary Transmission: Through Bank Loans, or Bank Liabilities?" Mimeo, Stanford University, 1985.

Kuh, Edwin, and John Meyer. "Investment, Liquidity and Monetary Policy." In *Commission on Money and Credit: Impacts of Monetary Policy,* 1963, 339–474.

Lacker, Jeffrey. "Inside Money and Real Output." Mimeo, Purdue University, 1987.

Leland, Hayne, and Douglas Pyle. "Informational Asymmetries, Financial Structure, and Financial Intermediation." *Journal of Finance* 32 (May 1977), 371–87.

Litterman, Robert, and Lawrence Weiss. "Money, Real Interest Rates, and Output: A Reinterpretation of Postwar U.S. Data." *Econometrica* 53 (January 1985), 129–56.

Mankiw, N. Gregory. "The Allocation of Credit and Financial Collapse." *Quarterly Journal of Economics* 101 (August 1986), 455–70.

McCallum, Bennett T. "A Reconsideration of Sims' Evidence Concerning Monetarism." *Economics Letters* 13 (1983), 167–71.

McCulloch, J. Huston. "Misintermediation and Macroeconomic Fluctuations." *Journal of Monetary Economics* 8 (July 1981), 103–16.

Minsky, Hyman. *John Maynard Keynes.* New York: Columbia University Press, 1975.

Mishkin, Frederic. "The Household Balance Sheet and the Great Depression." *Journal of Economic History* 38 (December 1978), 918–37.

Modligliani, Franco. "Liquidity Preference and the Theory of Interest and Money." *Econometrica* (January 1944), 45–88.

Modigliani, Franco, and Merton Miller. "The Cost of Capital, Corporation Finance and the Theory of Investment." *American Economic Review* 48 (June 1958), 261–97.

Mookherjee, Dilip, and Ivan Png. "Optimal Auditing, Insurance, and Redistribution." Stanford University Graduate School of Business Research Paper No. 887, (1987).

Moore, Robert. *Three Essays on Asymmetric Information and Financial Contracting.* Ph.D. dissertation. University of Wisconsin, 1987.

Morgan, Donald. "Credit Commitments and Credit Rationing." Mimeo, University of Wisconsin, 1987.

Myers, Stewart C., and N. S. Majluf. "Corporate Financing and Investment Decisions when Firms Have Information that Investors Do Not Have." *Journal of Financial Economics* 13 (June 1984), 187–221.

Patinkin, Don. "Financial Intermediaries and the Logical Structure of Monetary Theory." *American Economic Review* 51 (March 1961), 95–116.

Pennacchi, George. "Loan Sales and the Cost of Capital." Mimeo, University of Pennsylvania, 1987.

Prescott, Edward C. "Theory Ahead of Measurement." Minneapolis Federal Reserve Bank *Quarterly Review,* (Fall 1986), 9–22.

Prescott, Edward C., and Robert M. Townsend. "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard." *Econometrica* 52 (January 1984), 21–45.

Rolnick, Arthur J., and Warren Weber. "The Causes of Free Bank Failures: A Detailed Examination." *Journal of Monetary Economics* 14 (October 1984), 267–91.

Rothschild, Michael, and Joseph Stiglitz. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." *Quarterly Journal of Economics* 90 (November 1976), 630–49.

Samolyk, Katherine. "Portfolio Risks and Bank Asset Choice." Mimeo, University of Wisconsin, 1987.

Scheinkman, Jose, and Laurence Weiss. "Borrowing Constraints and Aggregate Economic Activity." *Econometrica* 54 (January 1986) 23–46.

Sims, Christopher. "Money, Income and Causality." *American Economic Review* 62 (September 1972), 540–52.

_____. "Comparison of Interwar and Postwar Business Cycles: Monetarisum Reconsidered." *American Economic Review* 70 (May 1980), 250–57.

Smith, Bruce. "Limited Information, Credit Rationing, and Government Lending Policy." *American Economic Review* 73 (June 1983), 305–18.

_____. "Private Information, Deposit Insurance Rates, and the 'Stability' of the Banking System." *Journal of Monetary Economics* 14 (November 1984), 293–317.

_____. "Bank Panics, Suspension and Geography: Some Notes on the 'Contagion of Fear' in Banking." Mimeo, Carnegie-Mellon University, 1986.

Srini Vasan, Philip. *Credit Rationing and Corporate Investment.* Ph.D. dissertation, Harvard University, 1986.

Stiglitz, Joseph, and Andrew Weiss. "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71 (June 1981) 393–410.

_____. "Incentive Effects of Terminations: Applications to Credit and Labor Markets." *American Economic Review* 73 (December 1983), 912–27.

Summers, Lawrence. "Some Skeptical Observations on Real Business Cycle Theory." Minneapolis Federal Reserve *Bank Quarterly Review,* (Fall 1986), 23–27.

Tobin, James. "Money and Income: Post Hoc Ergo Propter Hoc." *Quarterly Journal of Economics* 84 (May 1970), 301–17.

_____. "Keynesian Models of Recession and Depression." *American Economic Review* 65 (May 1975), 195–202.

Tobin, James, and William Dolde. "Wealth, Liquidity and Consumption." In *Consumer Spending and Monetary Policy: The Linkages,* Monetary Conference Series 5, pp. 99–146. Boston: Federal Reserve Bank of Boston, 1963.

Townsend, Robert M. "Optimal Contracts and Competitive Markets with Costly State Verification." *Journal of Economic Theory* 21 (October 1979), 265–93.

_____. "Financial Structure and Economic Activity." *American Economic Review* 73 (December 1983), 895–911.

_____. "Arrow-Debreu Programs as Microfoundations for Macroeconomics." Mimeo, University of Chicago, 1986.

_____. "Private Information and Limited Insurance: The Revelation Principle Extended." Mimeo, University of Chicago, 1987.

Veblen, Thorsten. *Theory of Business Enterprise,* Ch. VII. New York: Charles Scribner's Sons, 1904.

Veitch, John. "Credit Rationing, Moral Hazard, and Noisy Signalling." Mimeo, University of Southern California, 1987.

Williamson, Stephen D. "Costly Monitoring, Financial Intermediation, and Equilibrium Credit Rationing." *Journal of Monetary Economics* 18 (September 1986), 159–79.

_____. "Costly Monitoring, Optimal Contracts, and Equilibrium Credit Rationing." *Quarterly Journal of Economics* 102 (February 1987), 135–45.

_____. "Financial Intermediation, Business Failures, and Real Business Cycles." Working paper, University of Western Ontario, 1985.

Wilson, Charles A. "A Model of Insurance Markets with Incomplete Information." *Journal of Economic Theory* 16 (December 1977), 167–207.

Zeldes, Stephen. "Consumption and Liquidity Constraints: An Empirical Investigation." Mimeo, University of Pennsylvania, 1985.