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BANKS AS SOCIAL ACCOUNTANTS AND SCREENING DEVICES  
FOR THE ALLOCATION OF CREDIT

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ABSTRACT

This paper presents an alternative perspective on the role of banks. We emphasize the ways in which banks act as social accountants and screening devices. In this view monetary disturbances have their effects through the disturbances which they induce in society's accounting system and in the mechanisms by which it is ascertained who is credit worthy. Because of asymmetric information, giving rise to credit rationing, interest rates do not play the simple allocative role ascribed by the conventional paradigm, and as a result the equilibrating forces provided by market mechanisms may be weak or virtually absent. The paper provides a critique of the transactions based approach to monetary theory, and sketches a general equilibrium formulation of the theory. The paper traces out some of the policy implications of the theory. We show that certain financial innovations, such as allowing for the more rapid recording of transactions, may actually be welfare reducing.

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Banks as Social Accountants and Screening Devices .

for

The Allocation of Credit<sup>1</sup>

J. E. Stiglitz and A. Weiss<sup>2</sup>

1. Introduction

Perhaps no thinker has contributed as much to the understanding of monetary economics during the past half century as Sir John Hicks. His formulation of the IS-LM curves (Hicks, 1937), translating the Keynesian model into a simple and manipulable form in which changes in the money supply could be easily and directly related to changes in the level of economic activity, provided not only a textbook paradigm, but a tool of

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<sup>1</sup> Paper prepared for a volume on The Monetary Economics of John Hicks, edited by A. Courakis and C. Goodhart, to be published by Macmillan, 1988.

<sup>2</sup>Department of Economics, Stanford University and the National Bureau of Economic Research; and Department of Economics, Boston University and the National Bureau of Economic Research. Financial support from the National Science Foundation and the Olin Foundation are gratefully acknowledged. Our thinking on the issues discussed here has been greatly influenced by conversations with Bruce Greenwald. Some of the results reported below are based on joint work with Bruce Greenwald.

An earlier version of this paper was presented to the American Economic Association at its meetings in Chicago, December, 1987. We are greatly indebted to Tony Courakis, Charles Goodhart, George Akerlof, and Axel Leijonhuvud for their helpful and insightful comments.

Both authors wish also to acknowledge a general intellectual indebtedness to Sir John Hicks, an indebtedness which they share with all those who work in the area of monetary economics.

In addition to this general indebtedness, the first author wishes to express a personal indebtedness to Professor Hicks for the many insightful conversations over the past fifteen years, both during the years which they spent together at All Souls College, and during the subsequent years, at intermittent meetings, including those at Oxford, Taipei, and Spoleto.

analysis employed by policy makers. Moreover, it has served as a framework in which those who disagreed with Keynesian prescriptions could recast their arguments. The monetarist debate became a controversy over the shape of the relevant curves--an empirical debate about the magnitude of the relevant elasticities<sup>3</sup>; and the Cambridge-Fisher identity was at last raised to the level of a "theory."

But Hicks went further, and was an important contributor to the general equilibrium approach to the analysis of money (Hicks, 1933, 1935, 1938). Money became an object, like peanuts, corn, and tobacco, for which there was a demand and supply; the money rate of interest was the "price of money," the opportunity cost of holding money as opposed to other short term assets. The ability to analyze monetary phenomenon within the same general framework used to analyze other market phenomena not only lent stature to the general theory, showing the power of these tools and concepts, but also gave to monetary economics a sense of analytic rigor, precision, and generality which previously had been missing. There were, to be sure, "problems" remaining to be resolved, but these gave to the subject a scientific aura: significant progress had been made, and there remained but a few unresolved, yet precisely stated, issues to which ongoing research was directed.<sup>4</sup>

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<sup>3</sup> Though it was seen this way by the Keynesians, the monetarists, such as Friedman, denied that the debate was just about magnitudes of elasticities. Leijonhuvud (personal correspondence) interprets Friedman to have meant that both the IS and LM curves shift when the money supply changes. See Friedman (1971) and Laidler (1971).

<sup>4</sup>These included, for instance, the question of why money had value: in a finitely-lived economy, no one would want to hold money in the final period; and by backward induction, no one would ever want to hold it.

Another question was why individuals held money when there seemed to be dominating assets, assets which yielded higher returns and for which

Hicks was perfectly aware of the limitations of his approach<sup>3</sup> (some of which were discussed at great length by Leijonhuvud), and his later writings have provided a much richer picture of monetary economics (Hicks, 1967, 1979, 1980, 1982, 1986). Unfortunately, the forcefulness of his earlier writings, and the ease with which those ideas could be cast in the formal models which were to become so much the fashion in the half century following, seemed (at least until recently) to have inhibited deeper research by others in the profession into the mechanisms by which money and monetary policy affect the economy, an enquiry which Hicks has continued to pursue.

This essay has four objectives: to present an alternative view of the mechanisms by which money and monetary policy affect the economy; to explain what is inadequate with the standard approach; to point out some of the new insights that may be gleaned from this alternative approach; and to suggest how the new approach can be cast into a general equilibrium form, of no less rigor than that of the conventional formulation. The essay is,

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transactions costs were no higher than with money, or at least not sufficiently higher to offset the higher returns.

The dictates of standard economic theory do not allow an open admission of the prevalence of irrationalities. The facts, for instance, that numerous experiments suggest that even for a fairly limited number of periods individuals do not perform the required backward induction, or that there are numerous examples of individuals retaining funds in savings accounts (with aggregate values in the billions of dollars) yielding substantially lower returns than other bank accounts, with absolutely no advantage in flexibility or safety, are either ignored, left as anomalies eventually to be reconciled with rationality by some unexpected and presumably quite deep insight, or explained tautologically in terms of "psychological transactions costs."

<sup>3</sup>Indeed, there is an often forgotten institutional part to Hicks' classic 1937 paper concerning the structure of intermediaries, a theme which he later elaborated in his "Two Triads" (1967).

accordingly, divided into four parts, with a concluding section in which the major themes and results of the essay are summarized.

## Part I.

### CREDIT AND THE BANKING SYSTEM

Our basic hypothesis is that the central means by which the banking system (and the monetary authorities) affect the level of economic activity is through control of the availability of credit, not through control of the medium of exchange. We maintain, moreover, that credit differs from conventional commodities in several essential ways. For instance, at least at certain critical junctures, the demand and supply for credit are not equilibrated by changes in the market rate of interest: there is credit rationing.<sup>5</sup> Our theory provides insights into why the alleged equilibrating mechanisms of the price system, which are supposed to ensure that resources

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<sup>5</sup>Earlier institutional literature stressed the importance of credit rationing and credit availability. But the more recent literature dismissed such discussions as being theoretically unsound, or, (as in the case of the loanable funds theories) as being simply equivalent, within a general equilibrium model, to the standard monetary theory. The earlier work of Modigliani and Jaffee (1969) is an important exception.

In a series of earlier papers Stiglitz and Weiss (1981, 1983, 1986, 1987a, 1987b) showed that credit rationing could, in fact, occur in markets with imperfect information. See also Keeton (1980).

For a partial survey of this literature, and how it relates to earlier work, see Jaffee and Stiglitz (1988). For a survey of the relationship between these and other theories of credit rationing, and between these and other models of markets with asymmetric information, see Stiglitz (1987).

Other recent theoretical and empirical work stressing that it is through the credit mechanism that monetary authorities affect the level of economic activity can be found in Blinder and Stiglitz (1983), B. Friedman (1988), and Nakamura (1985).

are fully and efficiently used, so frequently seem to work so poorly, and seem to have such difficulties in adjusting to disturbances. We argue, furthermore, that while for many purposes the alternative perspectives yield similar predictions and policy prescriptions, there are some important instances in which they differ. We detail three: the use of interest rates as targets (though the view that we will put forward has some superficial similarities to more conventional monetarists positions [Friedman (1968)]); differences in the efficacy of monetary policy in the short and long run; and the desirability of certain financial innovations which increase the speed with which transactions may be recorded.

In our perspective banks provide several central informational roles: they provide a system of accounts; they screen various potential borrowers, to put them into the appropriate risk categories; and they undertake (limited) monitoring of borrowers' actions.<sup>7</sup> These are among their principal functions. Banks are, from this perspective, agents specializing in the acquisition and dissemination of information. In the following sections, we describe each of these roles in greater detail.

The various information roles of lenders are features not only of monetary economies with less than full reserve requirements. Consider a barter economy. There would in general be a role for some institution that collects resources and loans them to investors with the best opportunities,

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<sup>7</sup>This is a view that has also recently been stressed by Nakamura (1985), Diamond (1984), Leland and Pyle (1977), Courakis (1986) and Goodhart (1987). While we agree with Fama (1980) in emphasizing the role of accounting services, we disagree on the importance attached to the transactions services and portfolio management services provided by banks; that is, while banks may perform those services, their performance does not distinguish them from other financial intermediaries, and does not explain the special role that the banking system plays in economic fluctuations.

or certifies to other potential investors that the entrepreneur is "credit worthy". In this barter economy a bank loan or line of credit would also increase the confidence of potential customers and suppliers that a firm was likely to remain in business, thus encouraging customers and suppliers to enter into long-term relationships with the firm. Bank credit would also encourage providers of complementary products and services to make investments that depend for their profitability on the continued operation of the firm. For example, software developers are more likely to develop software for equipment manufacturers that they believe will continue to sell hardware in the future; lines of bank credit or long-term bank loans increase the likelihood of these continuing sales and thus encourage networking externalities.

If we allow for sorting and incentive effects of loan contracts (in either a barter or monetary economy) the market equilibrium can be characterized by credit rationing--an excess demand for credit (see Stiglitz-Weiss [1981, 1983, 1986, 1987]). Our earlier analyses showed further that the presence of sorting and incentive effects implies that even if there is not credit rationing, the allocation of credit both across investors and over time may be inefficient.

By screening and monitoring borrowers, banks facilitate non-bank interactions among firms<sup>8</sup>, thus leading firms to make use of bank credit even if incentive or sorting considerations make debt finance less desirable than equity finance. (Of course, recent research on the adverse selection effects of equity finance and the older literature on the adverse effects of

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<sup>8</sup> And between firms and households: the fact that a bank has shown itself willing to extend credit to a firm may make it more likely that individuals will be willing to do so.



equity finance on managerial effort (Stiglitz [1974]) suggests that even in the absence of these certifying and monitoring roles of banks, the adverse selection and moral hazard problems associated with equity finance may be sufficiently severe as to make equity finance undesirable. See Greenwald, Stiglitz and Weiss [1984], Stiglitz [1982], and Myers and Majluf [1984]).)

Now consider the case in which banks can create credit by printing claims against assets that they hold in reserves. Since these claims are not likely to be redeemed all at once, banks can affect aggregate demand by varying the quantity of claims (vouchers) they issue. The terms at which banks make credit available will be a function of their expectations of default risks and these will depend on demand conditions in the economy. These expectations may be self-fulfilling. If banks think the economy is likely to be in an inflationary period, so that loans at a given nominal interest rate are more likely to be repaid, more loans will be made. This will, in turn, cause inflation making it more likely that the loans indeed are repaid. When each bank treats the vouchers of other banks as equivalent to real assets, changes in the availability of bank credit have their familiar multiplier effects on the levels of aggregate demand, and consequently on the price level.

An important question to be raised at this juncture is, what impedes the standard equilibrating forces from working? In particular, why does not the interest rate adjust to equilibrate the demand and supply for credit at a full employment, non-inflationary level. Our previous argument has already provided the answer: Considerations of imperfect information impede the use of the interest rate as an equilibrating mechanism.

The main point to note, and one that we shall stress throughout this paper, is that the information-providing roles of banks are extremely diverse and are of major importance for the effective functioning of a modern economy. While allowing banks to have only partial reserves amplifies the macro-economic impact of bank policies, the positive externalities provided by the screening and monitoring actions of banks suggest that allowing banks seigniorage rights (less than 100% reserve requirements) may be justified as a third-best solution to the problem of providing the proper incentives for bank financed investment in the presence of important positive externalities generated by bank debt. We term this third-best because political considerations may preclude direct subsidies to banks.

## 2. Banks as Social Accountants

It is imperative for any economy to have a system of accounts. Without a system of accounts, some individuals would attempt to take out more than they contribute--there would be no incentives. Without a system of accounts, we would not be able to tell whether resources were being well utilized, or which managers were good managers. Systems of accounts are thus necessary both for allocating resources efficiently and for providing incentives. A great deal of our society's resources are spent on making sure that our accounting system works: the check out clerks at grocery stores and the transactions recorded by our banking systems are but two of the most obvious examples. There are a variety of ways by which accounts may be kept. Children's games typically use play money to keep accounts. Rather than adding and subtracting points from a central "banker's" ledger, an initial endowment of money is distributed, and the score, at the end of the game, is taken by counting how much money each individual has. This is the simplest accounting system, and a version of this is employed in simple economies. The fact that an individual has positive cash means that he has

a positive "account" balance, and is therefore entitled to more resources.<sup>9</sup>

But such systems are inadequate for more complex economies because they do not allow for intertemporal trades, where some individuals wish to have access to more resources than they have previously earned the right to, by earlier sales. Credit is central to any economy in which investments play an important role and in which there are intertemporal exchanges.

### 2a. The Importance of the Credit Function

At least since Bohm-Bawerk economists have recognized the advantages of roundabout means of production, the advantages, in other words, of using capital in production. But there is no reason that those who are willing to postpone consumption are necessarily those who are most able to make use of the resources, the best resource managers. Even if all individuals were of

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<sup>9</sup>Ekkehart Schlicht has drawn our attention to the fact the Schumpeter had a very similar interpretation of money in primitive economies. "Und deshalb ist auch die Geldzirkulation ihrem Wesen unter ihrer verkehrswirtschaftlichen Hauptfunktion nach--eine andere, die kapitalistische Funktion wird uns später begegnen--nichts anderes als ein erstens automatisches und zweitens sehr primitives und zahllosen Mangeln und Missbrauchen unterworfenen Abrechnungssystem." (The circulation of money is therefore in its essence and with regard to its exchange function--another, its capitalistic function will be discussed later--nothing else than, first, an automatic, and second, a very primitive system for clearing accounts with numerous flaws and abuses. ) (From J. A. Schumpeter, Aufsätze zur ökonomischen Theorie, ed. Erich Schneider and Arthur Spiethoff, Tübingen: J.C.B. Mohr, 1952, p. 39, reprinted from Archiv für Sozialwissenschaft und Sozialpolitik, 44 (1917/18), pp. 627-715. Later, in his posthumous book "Das Wesen des Geldes" (Göttingen: Vandenhoeck und Ruprecht, 1970), Schumpeter went further: "In dieser Methode, eine--grundsätzlich beliebige-Rechen- und zugleich Anspruchseinheit zu gewinnen, liegt aber, wie wir sehen werden, der Kern der Geldinstitution der Erwerbswirtschaft." (This method to devise a --fundamentally arbitrary--accounting and entitlement unit is, as we shall see, the core of the institution of money in an economy based on earnings.)

equal ability, the returns to scale associated with many capitalist enterprises and the returns from specialization in identifying and managing good investment opportunities imply that there are returns from some savers turning over their resources to others.<sup>10</sup>

(The literature has emphasized, of course, the absence of the double coincidence of wants, that the goods that the borrower will eventually be able to deliver are not necessarily the goods that the lender would wish to receive; accounting systems facilitate such multi-lateral trades. Credit is essential because of the absence of the intertemporal double coincidence of wants, and it is this aspect which we emphasize here.)

Thus, to gain access over current resources, one does not have to have previously "earned" the right, through prior sales of, say, labor services; one simply has to convince others that one will fulfill one's promise to deliver goods (money) in the future in return for what one receives today-- that one is, in other words, credit worthy. And it is natural, given the economic importance of ascertaining whether individuals or firms are credit worthy, that institutions develop which specialize in ascertaining credit worthiness. Because banks are in a position to monitor so many of the transactions of individuals or firms, they are a natural institution for ascertaining credit worthiness.<sup>11</sup>

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<sup>10</sup>Credit exists, of course, in pre-capitalist economies. Some individuals may wish to consume more than their current income (as a result of marriages, medical emergencies, etc.).

<sup>11</sup>This argument suggests that there are "economies of scope" between ascertaining credit worthiness and providing transactions services. See also Nakamura (1985).

### The Corn Economy: An Example.

To repeat, in the absence of economies of scale, if all individuals were identical, with respect to tastes, endowments, and investment opportunities, there would be no need for credit. The need for credit arises from the discrepancy between individual's resource endowments and investment opportunities.<sup>12</sup> This can be seen most simply if we imagine a primitive agricultural economy, where different individuals own different plots of land and have different endowments of seed with which to plant the land. (For simplicity, we assume that seed is the only input.) The marginal return to additional seed on different plots of land may differ markedly. National output can be increased enormously if the seed can be reallocated from plots of land where it has a low marginal product to plots where it has a high marginal product. But this requires credit, that is, some farmers will have to get more seed than their endowment in return for a promise to repay next period, when the crop is harvested.<sup>13</sup> Banks are the institutions within this society for screening the loan applicants, for determining which plots have really high marginal returns, and for

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<sup>12</sup> Or desired consumption profiles. We shall focus in this paper on investment rather than consumption loans.

<sup>13</sup> One might think that, in the absence of credit markets, farmers with the more productive land would produce more and hence would accumulate a greater surplus with which to invest and that consequently in the long run these resource misallocations would disappear. Unless land is freely sold, this is incorrect. In a primitive agricultural economy, surplus is likely to accrue to owners that had relatively large initial endowments even if their land is not productive. For wide ranges of inputs, increases in capital inputs will increase the surplus available for investment, even if there are decreasing returns to scale in production. This is because, at low consumption levels, increases in output would be consumed while, at moderate consumption levels, increases in output would be saved. Thus, in the absence of capital markets, capital would tend to be allocated according to historic quirks that determined initial capital endowments rather than according to where the return to capital was greatest.

monitoring, for ensuring that the seeds are actually planted, rather than, say, consumed by the borrower in a consumption binge.<sup>14 15</sup>

## 2b. Sorting of Borrowers

In traditional economic theory, as represented by the Arrow-Debreu model, individuals have certain endowments and those endowments determine the claims that individuals can make against society's resources. There is no bankruptcy and individuals always deliver on their promises. Promises may, of course, be contingent, i.e., the individual may borrow with an understanding that in a particular state of nature (not under his control) the loan will not be repaid. But there is no incentive problem--the individual cannot affect the likelihood of the events under which he does not repay. Nor is there an adverse selection problem--whether the individual repays or not is not dependent on who the individual is. The need to screen loan applicants and to monitor loans that are granted should be self-evident: there are always charlatans and cheats willing to use or misuse others' resources for their own benefit or in any case, in ways for which there are low social returns.

Once adverse selection problems become evident, it becomes important to identify which of the potential borrowers are most likely to pay (or more accurately, to ascertain the expected repayments associated with different

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<sup>14</sup>Even in a pure exchange economy, there is a role for credit, if individuals' marginal rates of substitution between consumption at different dates differ.

<sup>15</sup>As we emphasized in the introduction, the credit certification function of banks has important externalities; when credit is granted, others are encouraged to undertake investments, the profitability of which depends on the continued operation of the borrower.

borrowers in different states of nature, so that the contract terms they are offered can be adjusted accordingly). Screening is, of course, never perfect: potential borrowers are placed into different loan categories but the bank is fully aware that, within any loan category, there are some risks (loans) which are much better, or much worse, than others. Separating these good and bad risks perfectly is, however, if not impossible, at least too costly.

### 2c. Banks and Monitoring of Borrowers

Once incentive problems become evident, it becomes important to monitor the actions of the borrower, to ensure that he uses the funds in the manner intended, and that he does not undertake undue risks.<sup>16</sup> Monitoring, like screening, is, of course, never perfect<sup>17</sup>. Some actions of the borrower are restricted. Often, the bank exercises only indirect control, that is, it imposes restrictions which are not so much of interest in their own right, but because of the effect the restrictions (compliance with which is more easily observable) have on the (less directly observable) actions of interest. Thus, banks will seek to limit the amount that the borrower can borrow from other sources, knowing that the amount of indebtedness affects the borrower's willingness to undertake risks.<sup>18</sup> The rate of interest they

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<sup>16</sup>See Stiglitz (1985) for a discussion of why it is that banks play a central role in monitoring, and why it is that owners of equity play such a limited role in joint stock companies with widely diversified ownership.

<sup>17</sup>Monitoring is costly, so that even were it feasible to monitor perfectly, it would not be desirable to do so.

<sup>18</sup>See, for instance, Arnott and Stiglitz (1983), Kletzer (1984), Eaton, Gersovitz, and Stiglitz (1986).



charge and the collateral requirements they impose are other aspects of the loan contract which affect the behavior of the borrower.

#### 2d. Certification and Lending

There are three economic functions which banks might perform in extending credit. They could just obtain information about borrowers' credit worthiness and monitor their actions; they could provide guarantees about credit worthiness; or they could actually extend funds. The question we now ask is why a bank's information activities take on the particular form that they do.

The reason that banks do not only supply information is simple: it is related to the difficulties of ensuring that the information is credible. The fact that banks not only say that the individual is credit worthy, but show it through their willingness, in effect, to provide insurance, is important. By making long-term loans, the bank says to society (to others with whom the borrower deals): give this individual resources and we insure that he will be able to pay for them. The supplier is paid immediately, the customer pays for the goods, in effect, when the loan is repaid later. Banks not only certify that the customer has the resources (endowment) to make the repayment when indicated; they also stand behind that commitment. If the individual cannot make the repayment, they, the bank--not those who have supplied him with goods--bear the loss. They know, of course, that there are certain contingencies in which the individual will not be able to repay the indicated amount; and they accordingly charge him an insurance premium: when he can repay, he repays more than he would if there were no risk associated with his repaying. It is not an easy matter

to provide appropriate incentives for information providers to evaluate accurately what the appropriate insurance premium should be and to communicate that evaluation.<sup>19</sup> Functions of providing insurance and obtaining information about the borrowers' riskiness are linked so that the supplier of information (the bank) bears the cost--the loss in returns resulting from default--for any failure to obtain accurate information.<sup>20</sup>

In short, by linking the certification process with either guarantees or actually granting loans, the certification process gains credibility and partially ameliorates the problem of "who audits the auditors".

#### 2e. The Credibility of Banks as Certifying Institutions

Lines of credit, or guarantees as opposed to loans, have greater value the greater is the credit worthiness of the certifier and the more certain are third parties that these lines of credit will not be withdrawn when the firm has cash flow difficulties. This problem does not arise in the case of loans. Thus, for sufficiently small reserve requirements, we would expect to see credit extended directly as loans rather than through indirect guarantees. When a bank makes a loan, it does not merely guarantee the credit but actually extends the credit. A firm "A" which supplies some purchaser "B" more resources than he has previously earned the right to, accepts a "deposit"; rather than the purchaser being in debt to the

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<sup>19</sup>We have perhaps somewhat overstated the case for the interlinking of these two activities: there are some institutions which do sell information; their desire to maintain their reputation (and the rents they earn on that) is what makes the information they supply credible.

<sup>20</sup>Clearly, if the bank has insufficient reserves, prior to FDIC, depositors would have had to bear some of the costs as well. Presently those risks are borne by taxpayers and large (uninsured) depositors.

supplier X, the bank X pays the supplier, and the purchaser owes the bank money. In very simple terms, it is equivalent to the purchaser owing the seller resources, but the intermediary has provided an essential insurance function.

#### 2f. Other Credit Institutions.

The fact that so much of credit is intermediated through the banking institutions should not obscure the fact that much of it is extended in other ways; on the one hand there is trade credit, the extension of credit by one party to a transaction to the other; and on the other hand credit is extended through markets, through commercial paper markets and loan markets, not intermediated by a guarantor.<sup>21</sup> But even in these cases the certifying role of banks may prove crucial. Firms will be more willing to extend trade credit to customers with substantial bank balances (even if those customers also have significant long-term debts).

#### 3. Market Clearing and the Failure of the Interest Rate Mechanism

The question now needs to be posed: why do we need banks? Why doesn't the market mechanism solve this resource allocation problem, just as it solves other resource allocation problems? Can't we think of a market as an auction? Won't those who value the resources (the corn today) the most be willing to bid the most for it? If they are wrong, they (the borrowers) bear the consequences of their errors in judgement.

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<sup>21</sup>There are good reasons for the variety of forms in which credit is extended. The fact, for instance, that information concerning attributes of potential borrowers is very diffuse provides a partial explanation of trade credit.

This reasoning--based on the analogy between credit and other "goods"-- is flawed, because credit is fundamentally different from goods such as peanuts. When individuals exchange commodities contemporaneously, the price has a tangible meaning: it denotes the ratio of the number of units of one good that are given up in exchange for the number of units of the other good that are received. The interest rate, however, is nothing more than a promise, an agreement that a certain amount will be repaid, if possible, at some date in the future. While some might claim that promises are made to be broken, we need not go so far: all that we need to claim is that the relationship between what is promised and what is actually delivered is tenuous.<sup>22</sup> In particular, as we argued in our earlier papers, promising more does not necessarily mean delivering more. Those who offer to pay more are not necessarily those who, ex post, will actually deliver more. That is why thinking about the allocation of credit as being like an auction market is so misleading. And that is why banks do not allocate credit to the highest bidders. They see themselves as screening and monitoring institutions, not as auctioneers.<sup>23</sup>

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<sup>22</sup>Of course, similar issues arise in virtually all intertemporal trades and long term relationships. Thus, an employer "promises" to provide certain job amenities, the worker "promises" to provide certain services. The wage or price of labor certainly affects the probability that those promises are honored. The insurance firm "promises" to pay a certain amount, if a particular type of accident occurs. Even in commodity markets, automobile manufacturers promise to make certain repairs.

<sup>23</sup>We suggested in the previous footnote that similar problems arise in a variety of other economic relationships. By the same token, one of the important functions performed by many firms is screening, identifying for instance, which suppliers are likely to deliver on the date required, or which purchasers are actually likely to be able to pay for the goods ordered. (In this context, the producer is acting as a lender, performing an informational role analogous to that performed by the bank. As we remark later, there are good reasons for this credit allocation process to be decentralized.)

Indeed, it is not only that those offering to pay the highest interest may not, on average, deliver (yield) the highest expected return; but there may be systematic reasons for suspecting that those who are willing to offer to pay the highest interest rates are not among the best credit risks.

Some of these reasons we alluded to in our earlier papers: among those who are most likely to bid high interest rates are risk lovers (who are willing to undertake very risky projects, with a small probability of success, but high returns if successful); optimists (who overestimate the probability of projects succeeding and the return if successful); and crooks (who, because they do not plan to pay back the money anyway, are virtually indifferent to the interest rate which they "promise").

As a consequence, as the bank raises the rate of interest, there is an adverse selection effect; the mix of loan applicants changes adversely, so much so that the expected return from those receiving loans may actually decrease as the interest rate charged increased. And there may be an adverse incentive effect; borrowers take riskier actions, which increases the probability of default. The relation between the interest rate charged and the expected return per dollar loaned may not be monotonic, as in figure 1.

It should thus be apparent why it is that credit is not allocated in an auction market, and why institutions, such as banks, which screen and monitor loan applicants, arise.<sup>24</sup>

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<sup>24</sup>It should be noted, of course, that banks do not necessarily lend to those whose projects have the highest expected return; the bank is only concerned with the fraction of the total returns that it can appropriate, and projects with higher expected returns may have lower returns to the bank. Moreover, it is not even the case that the market equilibrium is constrained Pareto optimal. See Stiglitz and Weiss (1981), Ordoover and Weiss (1981) and Greenwald and Stiglitz (1986).

### 3a. Credit Rationing and Interest Rate Rigidities

The fact that the return received by lenders may decrease with an increase in the interest rate has one further effect: it means that there may be credit rationing; the demand for loans may not equal the supply of loans. Changes in the real rate of interest do not serve to equilibrate demand and supply for funds (or, more generally, the demand and supply for goods). Banks will not raise the rate of interest, even though there is an excess demand for loans.<sup>25</sup> Lenders charge the interest rate  $r^*$  at which their expected return is maximized (so long as they can obtain borrowers at that rate of interest). If they raise the interest rate in response to the excess demand for funds, the bank's expected return may fall.

Thus, market equilibrium may be characterized by credit rationing and interest rate rigidities. Similarly, increases or decreases in (the) loan supply (function) may have no effect on the interest rate charged. As we comment later, the market rate of interest may change with changing economic circumstances, but not necessarily in ways which would be stabilizing, or in the manner which would be suggested by the conventional supply and demand analysis.

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Indeed, it has often been observed that the (subjective) expected real returns that firms require in order to undertake a project are far in excess of real rates of interest, sufficiently far in excess that variations in the real rate of interest (of the magnitude observed at least prior to 1980) are of negligible significance; the error made by ignoring these variations would be swamped by other errors inevitably made by firms in the process of estimating the returns on a project. That is why surveys repeatedly show that firms pay relatively little attention to the real rate of interest (although they are concerned about the availability of credit and a change in their credit standing).

It should be emphasized that these arguments apply so long as the bank does not have perfect information concerning borrowers. Banks categorize potential borrowers. This process of assigning risk categories to different borrowers is, as we have noted, one of the main functions of banks. But the categorization is never perfect, and so long as that is the case, interest rates (and other terms of the loan requirement, including collateral) may be used to convey and obtain information about characteristics of borrowers. By the same token, so long as there is not perfect monitoring of borrowers, as we have noted, the interest rate charged may affect the actions which the borrowers undertake. So long as either the adverse incentive or selection effects from raising interest rates is sufficiently strong, interest rates will not be used to equilibrate the loan market.

## PART II.

### MACRO-ECONOMIC IMPLICATIONS

Our interest in the banking system is largely motivated by our concern to understand better the cyclical fluctuations that have characterized capitalist economies. There is a widespread belief that banking institutions have played a role in those fluctuations, though there are disagreements about whether the interaction of an activist monetary policy working through a modern banking system has done more to alleviate or exacerbate business cycles. The issues are complex, and to make progress we need to divide the analysis into two stages, first considering the role of credit markets in a corn economy and then in a modern monetary economy.

#### 4. Macro-economic adjustments in a corn economy

In the previous section, we argued that one of the main functions of banks was to categorize loan applicants, to judge their credit worthiness, and to monitor their actions; that they performed these information gathering functions imperfectly;<sup>28</sup> and that in the presence of imperfect information there were adverse selection and incentive effects associated with increasing the interest rate, so that the interest rate might not adjust, even in the presence of an excess demand for funds. The interest rate does not perform the "equilibrating" role usually assigned to prices in conventional price theory.

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<sup>28</sup>That is, they cannot specify precisely the actions the borrower is to undertake: there remain areas of discretion. And while banks divide loan applicants into categories, within each category, not all potential borrowers have the same probability of default. But it is too costly to further delineate those with low default probabilities from those with higher default probabilities.



Using the interest rate as a "decentralized regulating mechanism" in a macro-economic context is even more problematical. For, what borrowers care about--or would care about in the absence of credit rationing--is the long term interest rate (that is, the interest rate over the length of life of the investment project). So long as there are not heavy penalties for refinancing, an individual who is optimistic about long term real interest rates falling would be willing to borrow, even if the current short term real interest rate is high.<sup>27</sup> Moreover, loan contracts are not made on the basis of real interest rates, but nominal interest rates; and those with the highest expectations of inflation will view themselves as confronting the lowest real interest rates.<sup>28</sup> In short, amongst those willing to bid the highest nominal interest rates for credit are not just those who view themselves as having the best investment opportunities; these individuals are mixed together with those who have the highest estimates of the rate of inflation and the lowest estimates of future real interest rates. It is neither privately profitable nor socially desirable to allocate credit--scarce investment resources--on the basis of these expectations, on the willingness of the borrower to "promise" to pay high interest rates.

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<sup>27</sup>Believers in the rational expectations hypothesis might claim that such behavior is irrational, that all the relevant information about future interest rates is contained in the current market rates, and that, accordingly, individuals should not hope to "gamble" against the market. The fact of the matter is that many individuals do believe that they can outsmart the market, and so long as that is the case, and so long as those beliefs affect individual actions (including their willingness to undertake investment projects) lenders must take this into account.

<sup>28</sup>One of the long-standing conundrums of monetary economics is why loan contracts are not made in real terms. We do not resolve that question here. Our analysis does, however, point to some of the consequences of the failure to index which have so far received insufficient attention.

(Of course, even ignoring these differences in expectations, the borrowers which, from the perspective of the bank, represent the best candidates for loans (that is, for whom the expected return to the bank is highest) are not necessarily the borrowers whose projects have the highest expected gross returns, as we showed in Stiglitz-Weiss [1981].

4a. Cyclical adjustments of interest rates with rational expectations.

Even with perfectly rational expectations concerning the course of future interest rates, interest rates charged on loans may not adjust over the business cycle in a way which serves to stabilize the economy.

Indeed, banks may respond to a downturn either by leaving interest rates charged to borrowers unchanged, or even by increasing interest rates. (See Stiglitz-Weiss 1987.) Moreover, the greater uncertainty associated with downturns may lead to lower expected returns to bank loans, because with greater uncertainty,<sup>29</sup> banks may be able to capture a smaller fraction of the total returns; these expected returns themselves are likely to be lower in a recession. The lower return on bank loans leads to lower rates of interest paid to depositors, and to a reluctance on the part of banks to lend money (as opposed, say, to purchasing government bonds. The net result is a lower supply of bank loans. This is true even if individuals are risk neutral. Thus, the equilibrium response to greater uncertainty may be a lower level of investment and a lower national income.

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<sup>29</sup>That is, Stiglitz and Weiss [1981] show that a mean preserving spread in the returns to an investment will, at a fixed interest rate charged by a bank, lower its expected return.

In our corn economy, even small changes in expectations (whether rational, i.e., based on "true" changes in probabilities of success of various types of investment projects, or not) may lead to marked changes in the level of investment, and accordingly, in subsequent years, in the level of output.<sup>30</sup> Yet resources remain fully employed. There is no excess capacity or unemployment usually associated with business slumps in capitalist economies. The reason for this is simple: banks can only lend out corn to potential "investors" if savers have deposited the corn with them. Our corn economy is essentially a 100% reserve banking system, with no states in which banks have excess reserves.<sup>31</sup>

#### 5. Adjustment Dynamics in Monetary Economies

More serious problems arise in economies either where the process of certification is divorced from the extension of credit, or (in monetary economies) where there is fractional reserve banking.

What ensures that the number of individuals certified to be credit worthy, combined with those with cash resources, generates a demand for current resources equal to current supplies? Remember, in our decentralized market economy, certification is being done by hundreds, perhaps thousands, of separate agencies, paying no attention to the aggregate balances.

The answer provided by traditional micro-economic analysis is simple: if there is an excess demand for current resources, the real rate of

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<sup>30</sup>Greenwald and Stiglitz (1987, 1988) provide further arguments for why, with equity rationing (but even without credit rationing) small disturbances to the economy may be amplified.

<sup>31</sup>Our previous analysis only showed the possibility of an excess demand for credit, not the possibility of an excess supply of credit.

interest will rise; as this happens, the demand for credit, i.e., the number of individuals seeking certification from the banking institutions (or other credit certifying agencies) is reduced until demand equals supply at full employment for current resources.<sup>32</sup> Similarly, potential borrowers with high expected yield projects will bid more for resources, resulting in an efficient allocation of resources.

In previous sections we have argued that banks will not adjust the rates of interest charged, even in the presence of an excess demand for credit. Our analysis was an equilibrium analysis; the statements made in the previous section concerning changes in interest rates were based on how the equilibrium interest rate would change with a change in the relevant parameters of the economy (a standard comparative statics exercise).

There is a long tradition of arguing that the price system provides important signals for the adjustment of the economy. If the demand for pencils exceeds the supply, the price of pencils is bid up, and this induces pencil producers to produce more pencils, until equilibrium is attained. This informal argument provides an important basis for our belief in the desirability of the decentralized price system, in spite of the fact that attempts to model formally this view of the price system as an information gathering, processing and dissemination mechanism in a dynamic context (with an economy facing a variety of shocks) have met with so little success.

We now argue that, in economies characterized by the information imperfections with which we have been concerned here, the price system may well not serve the information-equilibrating role assigned to it by

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<sup>32</sup>This is obviously an over simplification; these demands and supplies depend, of course, on the whole vector of future expected prices.

conventional theory; we argue, for instance, that if it should turn out that the "decentralized" process of credit allocation results in too many or too few individuals receiving credit, so that there is over-all an excess demand or an excess supply of goods, the adjustment process is not one which is likely to restore the economy to equilibrium quickly. Thus, while decentralization makes sense from the perspective of ensuring that those who are most credit worthy have access to resources, the absence of the coordinating function provided by prices (interest rates) has important macro-economic consequences: the adjustment dynamics associated with an excess supply of credit may not be self-correcting.

To see this, note that because the supply of credit created by the banking system determines (in part) the level of aggregate demand, an increase in the supply of credit may lead to inflationary pressures,<sup>33</sup> which in fact means that the likelihood of borrowers fulfilling their promises is actually increased. The number of credit worthy individuals appears to be enhanced.<sup>34</sup> In addition, if real assets are used as collateral, during inflationary periods the fall in the real value of the loan will be accompanied by an increase in the fraction of the outstanding loan that is collateralized. . . This change in the proportion of the loan that is collateralized will lead borrowers to choose safer technologies. These effects will partially offset the cost to the lender from loans being repaid in cheaper dollars. Because loan repayments of one borrower make

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<sup>33</sup>So long as loans are denominated in money terms--as they conventionally are.

<sup>34</sup>These unexpected changes in prices have, of course, redistributive effects, which may in turn have further real effects on the economy. For a discussion of these, see Greenwald and Stiglitz (1987).

loan repayments of others more likely, generating positive externalities for the economy as a whole, a (moderate) degree of unanticipated inflation may make both lenders and borrowers better off.

Conversely, an unanticipated fall in the rate of inflation may make both borrowers and lenders worse off. When an insufficient number of individuals are certified as credit worthy, full-employment savings will exceed investment; the downturn in the economy will serve to confirm lenders' views concerning the shortage of credit worthy borrowers.

Thus, the effect of imperfect indexing of loan contracts is ambiguous. Unanticipated price declines (in the absence of indexed loan contracts) redistribute income between lenders and borrowers. To the extent that lenders are better off, their willingness to lend will be enhanced; to the extent that borrowers are worse off, their willingness to invest is decreased<sup>35</sup> and lenders' willingness to lend to them--their belief in borrowers' credit worthiness--is decreased.<sup>36</sup>

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<sup>35</sup>As Greenwald, Stiglitz, and Weiss (1984) have argued, firms often face equity rationing; that is, the marginal cost associated with raising additional funds through additional equity is so high (either because of moral hazard or adverse selection effects) that firms choose not to raise additional funds by this means; it as if they are equity rationed. And as Greenwald and Stiglitz (1987) have argued, in the presence of equity rationing, firms' willingness to borrow will depend on their net worth. Hicks, in recent work (1986) has emphasized the importance of firms' balance sheets as a determinant of their behavior.

<sup>36</sup>There are other reasons to believe that the equilibrating forces within credit systems may, at best, be weak. Greenwald and Stiglitz (1987) argue that because of imperfect equity markets, the shadow price associated with investment is higher in recessions. Screening potential loan applicants is an investment, and hence banks' incentives to engage in these screening activities is reduced in recessions.

The nature of information implies that it will be efficient for only a few firms to be informed concerning the credit characteristics of a potential borrower. Thus, when banks fail in a recession, it may not pay new potential lenders to perform the required screening to ascertain the credit worthiness of the borrower. This compounds the deflationary

This process might be contrasted with how resources might be allocated in a more centralized banking system, where the single bank was aware of, and concerned about, the supply of available resources. Assume for simplicity that full employment output is  $Y^*$ , and that consumption is simply a function of  $Y^*$  (e.g. the interest elasticity of consumption is zero),  $C = C(Y^*)$ . For full employment to be maintained (absent government expenditures), investment must equal  $Y^* - C(Y^*)$ . The central bank would then review the available list of loan applicants and choose the best from among these applicants, allowing them the claims on current resources remaining after consumption. In short, the central bank would be directly involved in the allocation of resources; it would not rely on the decentralized "price" system to allocate investment.

#### 6. Centralization vs. decentralization in the provision of credit

In the preceding section, we argued that credit was not allocated by "prices" (interest rates) and that, as a result, there was no obvious mechanism by which the supply of credit was "equilibrated" to the level of available savings. We contrasted a decentralized credit allocation mechanism with how a centralized system might work.

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problems.

Moreover, credit interdependencies result in disturbances having multiplier effects. See Stiglitz (1987).

There are offsetting effects: to the extent that collateral is denominated in nominal terms, declining prices mean that the real value of the collateral is increased, thus making banks more willing to lend in periods of declining prices. By the same token, they will be less willing to lend in inflationary periods.

In market economies, there is good reason that the allocation of credit is highly decentralized, in spite of the obvious advantages (from macro-economic balance) that might come from centralization. The information that is required to assess whether a particular individual or firm is credit-worthy is very localized information; it is highly diffuse. Moreover, competition among lending authorities is critical if the process of credit allocation is not to become corrupted. It is difficult for outsiders to tell whether a particular loan has been put into the appropriate loan category; putting a loan into a better category than it deserves is, of course, equivalent to providing a gift to the borrower. The incentives for individuals lending out money that is not their own to make such gifts (in return for other favors) has, in the absence of the checks of the market place, proven irresistible in instance after instance.

The system towards which modern capitalist economies have evolved represents an attempt to take advantage of the virtues of both the centralized and decentralized credit systems. Credit is allocated in a decentralized manner. But central banks use a variety of instruments to affect the magnitude of credit extended. They do not simply rely on the price system to equilibrate demand and supply, to ensure full employment.

#### 6a. Externalities and other inefficiencies in Credit Creation

Though our discussion of decentralized provision of credit has focused on some of the issues related to macro-economic adjustment, there are other problems with the efficiency of decentralized credit. For instance, credit creation--the fact that one bank is willing to extend credit to a firm--



generates an externality, even within a full employment model.<sup>37</sup> Others make inferences from that. Customers and suppliers that contemplate making costly long-term commitments associated with an economic relationship with a firm will care both about the liquidity of the firm and about the banks' assessment of the firm's long-run probability of bankruptcy. Bank credit provides both functions, as well as ensuring third parties of ongoing monitoring of the firm (including the riskiness of the firm's investments).

And credit runs--the withdrawal of credit--can similarly have large negative external effects. (See Diamond and Dybvig (1983) and Stiglitz (1987).)

Further, as we have already noted, banks do not necessarily lend to borrowers with projects yielding the highest expected return. They care only about that fraction of the returns which they can appropriate (though the loan contract.) Elsewhere, we have shown that systematic misallocations may result. (Stiglitz and Weiss, 1981, 1983, 1987)

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<sup>37</sup>That is, ignoring the potential multipliers to which credit creation can give rise in the presence of underemployment.

### III.

#### CREDIT VERSUS THE STANDARD THEORY

In this part, we address two questions: what is the relationship between our theory and the standard monetary theory, and what is it that accounts for the success (measured by the prevalence of its use) of that theory.

As we have noted, the view of banks which we are putting forth here is hardly new. Theories emphasizing credit availability were popular both before and after Keynes.<sup>38</sup> But economists have had a hard time dealing with these theories of credit availability, particularly within a general equilibrium framework.

#### 7. Money and Credit

Credit is not like an ordinary good. It is not only that credit is not allocated by the price system. It is possible to create credit seemingly out of thin air. And by the same token, credit can disappear: a confidence crisis can suddenly lead to the shrinking of credit. Thus, the magnitude of credit outstanding may not be easily predictable though changes in the level of credit outstanding may itself have predictable consequences, or at least correlations, say, with the level of economic activity.

Simple monetary models, in which money provides a service (transactions) enables the tradition-bound economist to use his standard tool kit to analyze monetary phenomena. In standard micro-economic theory courses we learn about the power of the price system as an allocative mechanism: we learn not only how the market system works, but that it has

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<sup>38</sup> For a partial survey, see Jaffee and Stiglitz (1988).

certain desirable attributes. It was thus natural that economists would think in the same terms when they came to think of the allocation of investment and credit. All that was required was a change of notation, from "x" (representing the quantity of goods) to "M" (representing the quantity of money) from "p" (for price) to "r" (for interest rate). While this way of thinking may be useful for some purposes, we argue below that it may be seriously misleading for others.

#### 7a. The Informational Role of Money

The "confusion" about what the function of the banking system is, is compounded by the close empirical relationship between money and credit creation, and by the fact that, to some extent, in primitive, pre-capitalist economies, as we have already noted, money performs an informational role not unlike that performed by the banking system and credit in modern capitalist economies.

#### 7b. Money and credit creation.

In the normal course of affairs, there is a close link between credit and money creation. One means by which banks create credit is by extending a credit line. When the potential borrower wants to make use of the credit line, an entry is made to the deposit account of the borrower. Credit creation thus becomes money creation. (For a brief account of these links, see Blinder and Stiglitz, 1983.) Note that in this perspective, it is the demand for goods (the desire to make use of one's credit line) which gives rise to the creation of money, not the other way around.

The monetary authorities can affect both banks' capacities (in ways by which by now are familiar) and willingness<sup>39</sup> to create credit. But the fact that there is thus this link between money and credit creation should not obscure the fact that credit can be created in other ways not controlled directly by the banking system or monetary authorities; the recognition of this has important implications for the design of monetary policy.

#### 8. A Critique of Conventional Monetary Theory

The fact that there is a close link between credit and money, on the one hand, and credit and economic activity, on the other, means of course that there is a close link between money and economic activity, a link which has been at the center of much work in macro-economics during recent decades. We do not wish to undertake an assessment here of the empirical work, of whether, for instance, the relationship between (some appropriately defined measure of) money and output is stronger or weaker than that between (some appropriately defined measure of) credit and output. Rather, we want to focus our remarks on the "reasonableness" of the

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<sup>39</sup>This aspect of bank behavior has recently been emphasized by Greenwald and Stiglitz, who argue that banks can be viewed as equity-constrained firms, whose productive activity is "extending credit." Just as conventional firms' willingness to produce, to undertake risks, is affected by their balance sheet, by their net worth, so too for banks.

Note, however, that governmental authorities are more concerned with banks' capital adequacy than they are with that of other firms, so they may be required to restrict "production" (that is, lending) if their equity falls.

alternative theories,<sup>40</sup> and on the circumstances under which the alternative theories are likely to yield different predictions.<sup>41</sup>

In particular, we wish to focus our remarks on those theories which emphasize the transactions demand for money. The simplest, and cleanest, form which such theories take is that in which there is a cash in advance constraint;<sup>42</sup> transactions cannot be completed unless the purchaser has

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<sup>40</sup>Some "monetarists" take a seemingly agnostic view of the mechanism by which money affects the economy. They are only concerned with noting the presence of an empirical regularity. In this view, then, the theory which we present here is but an alternative "mechanism," providing an explanation of the empirical regularities.

<sup>41</sup>Recent years have seen the disappearance of the regular relationship between money and economic activity: the velocity of circulation appears to have changed dramatically, and in ways quite unexpected. Though the relationship between credit and economic activity appears no worse than that between money and economic activity, it has not fared much better. For an excellent survey of the empirical evidence, see Friedman (1988).

The erratic relationship between money and income is possibly due to several factors working in different directions. One dramatic change in the 1980's may be the increased extent to which money may be used as a store of value for illicit gains. (This may be due both to the increase in trade in illegal drugs, improved monitoring of the banking system, both domestically and internationally, the cessation of new issues of bearer (unregistered) bonds, and the growth in tax avoidance activities. Thus, the demand for liquid anonymous assets has increased while the supply of substitutes (for these purposes) for cash has decreased.

Moreover, as the percentage of trade conducted with money decreases, the proportion of money that is used as a store of value increases, thus causing a fall in velocity.

In a similar vein, the erratic relation between credit (particularly bank credit) and income may be due to the availability of new close substitutes. For example, many brokerage accounts let individuals write checks against the value of the securities in the account. Individuals having such accounts or home equity lines of credit might, on the one hand, be more likely to incur debts, since credit is more readily available; on the other hand, they would borrow exactly the amount needed at every moment, thus possibly decreasing their demand for credit.

<sup>42</sup>This constraint can be viewed as informationally based, rather than related to transactions technology: having cash certifies that the individual has a rightful claim over resources, as we noted in the preceding section. But as we also noted in the preceding section, in modern capitalist economies this is a sufficient, but hardly necessary, basis for certifying individuals' claims on resources.

cash. The government controls the money supply. And there is a well-defined technology which determines the velocity of circulation; if the velocity is fixed, then by controlling the money supply, the value of transactions is precisely determined.

Our contention is that cash is simply not needed for most transactions.<sup>43</sup> All that is required is credit. And, in fact, the proportion of transactions that are consummated via credit appears to be increasing.

Theories which assume that money is required are, at best, ad hoc--for they leave unexplained why it is that money (cash) is required--and at worst, wrong. Advocates of this view today generally admit that many transactions do not require money, but they point to the transactions, such as taxi cabs, which do. Yet as they point to such examples, instances arise where credit cards are beginning to be accepted.

These theories do not provide a clear articulation of the technologies which limit the velocity of circulation. The new computer technologies have allowed the velocity potentially to be extremely high, as funds are instantaneously deposited into one's money market checking account (the source of these funds could range from loans against the value of one's equities, to cash from the sale of shares in interest bearing mutual funds which have been invested in short term treasury bills) and credited to

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<sup>43</sup>Our list of objections to the conventional approach is not meant to be exhaustive. For instance, a persuasive case can be made that the government does not control the supply of money, or of at least near-money substitutes. If the government attempted to restrict the supply of the medium of exchange in a way which had important economic consequences, firms would have an incentive to devise alternative arrangements for exchange.

another account, from which the funds are then instantaneously withdrawn, to be used to purchase, say, some other financial asset, or goods.

Nor is there a clear link between the volume of transactions and the level of economic activity. For most transactions are exchanges of assets, not sales of labor services or goods currently being produced. Of course, most such asset transactions do not use money. And this is precisely the point: transactions do not require money. Determining which transactions do should be a subject of theoretical and empirical enquiry. But the assumption that "income generating" transactions do, and asset transactions do not, require money is neither plausible, theoretically explained, nor empirically verified. This is particularly important because the magnitude of asset transactions is highly volatile, and indeed may exhibit cyclical variability.

## Part IV

### Contrasting Implications of the Alternative Theories

So long as the link between money and credit does not change much, predictions based on using money as an explanatory variable may do well. The question is, are there policies or structural changes in the economy from which we might expect a change in the relationship?

There are three issues to which we would like to call attention here: the effects (and desirability) of certain financial innovations; the role of interest rates in monetary policy; and the long run viability of monetary policy as an effective instrument of government control.

#### 9. Financial Innovation

Changes in financial institutions have affected both credit creation and transactions technologies. The fact that changes such as the development of improved transactions technologies have not had the expected effects on velocity during the past five years remains a puzzle. The fact that recent changes in the technologies by which transactions are made and recorded has had so little effect on the money/income relationship reinforces our belief that what is central is credit, not money-as-a-means of exchange.

Our view on banks as social accountants provides an alternative perspective on the role of financial innovations. Many of these take on the form of speeding the timing of the recording of certain accounts. We would argue that, although it is essential for a capitalist economy to have a good accounting system, the social gains from improving the speed with which



transactions are recorded are minimal (though they may reduce "unnecessary" precautionary balances), and in any case, far less than the private returns. Recording transactions rapidly does not, in itself, create more goods; it simply changes the accounts to which interest is credited.

The following simple model illustrates this. Consider a three period (life cycle) model, in which individuals receive one unit of manna the first period. Each unit of manna is planted and yields, in two periods,  $1 + G$ . Individuals only value consumption in the last period of their lives. Population is constant. Individuals sell their current manna supply in exchange for a promise to receive manna in the future. The government intermediates this market, borrowing from the current young to finance the payments to the elderly. Assume initially that it takes one period to record a transaction. Then there is a steady state equilibrium in which the government pays an interest rate of  $1 + G$ . Now assume some individual succeeds in getting his bond transaction recorded instantaneously. Since the bonds yield a return per period of  $(1+G)$ , he gains by doing so, but really at the expense of others. Assume, in fact, that all switch to recording their transactions instantaneously. Then the new steady state equilibrium entails exactly the same flow of consumption, but the interest rate paid on the bond falls to  $g$ , where

$$(1+g)^2 = 1 + G.$$

In fact, if there are net transactions costs from the speed-up in recording, the change is Pareto inferior. Assume that it costs  $t$  more to record a transaction in one period than in two; then steady state consumption is reduced by  $t$  but the equilibrium will entail the speedier recording, so long as  $G > t$ . (Of course, some of the increases in speed in

recording, such as a shift from paper transfers to electronics, involve fewer resources.<sup>44</sup>)

It is easy to construct other examples showing that improving the speed with which transactions are recorded may yield little social return. Assume that the pay that workers receive for work at date  $t$  is not recorded until  $t + 2$ . Prices are rising at the rate of  $(1 + i)$ . Workers consume everything that they receive in the first period in which they can. The wage they are paid takes into account the fact that there is a two period delay in recording. Thus, if the equilibrium real (consumer) wage is  $w^*$ , and  $p^t$  is the price level in period  $t$ , the wage they receive in period  $t$  is  $w^t = w^* p^t (1+i)^2$ , to compensate for the increase in prices which will occur between  $t$  and  $t+2$ . Now, if some bank can take some individual's check, and clear it in one period, the individual will be better off; the real wage he receives will have increased. But when all individuals do this, wages will adjust to  $w^* p^t (1+i)$ , and none will be better off; if there is a cost associated with the increased speed of recording, all individuals will be worse off.<sup>45</sup>

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<sup>44</sup>And the opposition to such changes arises from those who lose from the technology change, e.g., those who make their money off the float.

<sup>45</sup>There is a certain similarity between these arguments, that the social and private returns to recording transactions quickly may differ markedly, and the arguments that the social and private returns to the acquisition of information quickly may differ markedly.

## 10. Interest Rates and Economic Activity

A basic difference between our perspective and that of standard Keynesian economics lies in the role ascribed to interest rates. Admittedly, in traditional Keynesian analysis, there was some confusion between real and nominal interest rates. The real interest rate was relevant for investment and savings. The nominal interest rate was relevant for determining the quantity of savings that would be held as money. If inflationary expectations were given, then there was a simple link between the two, and a consistent IS-LM analysis emerged. But if inflationary expectations were linked to the level of economic activity and/or to the nominal interest rate, then the IS-LM framework is, at best, confusing, and at worse, misleading.

But the irrelevance of this theory for understanding the role of monetary policy has become increasingly apparent with the growth of interest bearing deposit accounts: today, most money is interest bearing. To our knowledge, no serious theory of monetary policy is based on the restrictive definition of money, currency. Though money market checking accounts and similar financial instruments are not conventionally included in the money supply, they serve virtually all the transactions functions of bank checking accounts. It is the difference between the interest rate paid on money market accounts and the expected (risk adjusted) return available on the best relevant alternative investments (where best is a subjective evaluation of the individual saver) that determines the proportion of savings that will be held in money market accounts. For different savers the relevant

alternatives could include treasury bills and notes, certificates of deposit, stocks, and bonds. It is some weighted average of these differences which should appear in the LM equation. If changes in the money supply have (at fixed levels of income) an effect on some interest rates, it must only be through their effect on this difference. But changes in the differences appear to be extremely small, and hard to relate to changes in the real rates of interest that ought to be affecting investment.

In our simple theory of credit markets, when credit is being rationed, the terms of loan contracts may not be as important as credit availability. Economic policies which affect the availability of credit will affect the level of investment, whether real interest rates (either those paid to depositors or charged borrowers) rise, fall, or remain the same.

Even during periods in which credit is not rationed, all of the terms of credit contracts, as well as the interest paid depositors, are important for determining the level of investment and the allocation of investment funds across different projects. When credit is not being rationed, changes in monetary policy will affect the terms at which credit is made available. Adjustments in interest rates charges are only one of the instruments which adjust. Collateral requirements, for instance, also adjust, as does the mix of loans of various types. Thus there is not simple link between the availability or allocation of credit and average interest rates charged even in the absence of rationing, see Stiglitz and Weiss [1987].

It follows, then, that real interest targets are unlikely to be the appropriate basis for the design of monetary policy. Of course, monetary authorities have not traditionally focused on real interest rates, but on nominal interest rates; and since nominal interest rates are highly

correlated with (expected) rates of inflation, focusing on nominal interest rates is much like focusing on inflationary expectations. Because our theory suggests that monetary authorities focus on aggregate demands, it provides a rationale for such policies.<sup>46</sup> For when there is excess demand for goods, too many investment certifications have been issued; one way to reduce aggregate demand is to reduce the demand for investment goods by reducing the availability of credit. Thus, our theory yields results concerning the effects of monetary policy (in periods in which there is credit rationing<sup>47</sup>) which are in accord with the standard theory, but for quite different reasons. At the same time, to the extent that there is a close link between money and credit, and between credit and economic activity, our theories provide a rationale for monetarist positions which

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<sup>46</sup>There are, however, some telling criticisms of using interest rate targets. Interest rates, both real and nominal, reflect both the authorities' own actions, and the impact of the economy on them. Thus, using nominal interest rates may reflect either tighter policy or a more expansionary/inflationary economy, and it may be hard to distinguish the relative strength of the two effects.

Our argument here is simply to suggest that, in our model, it makes sense for the monetary authorities to focus their attention on some indicator of excess demand.

<sup>47</sup>And in which banks are constrained in the amount of credit which they can make available, i.e. there are no free reserves.

Greenwald and Stiglitz (1987) provide an explanation for why, when there are free reserves, monetary policy is likely to be ineffective: increasing the amount of free reserves is unlikely to result in increased availability of credit, and hence in increased investment.

Of course, no single bank will ever be constrained by the quantity of free reserves; so long as it is credit worthy, it can borrow, e.g. via the interbank market. Presumably the interest rates charged on these loans must adjust so that no bank wishes to borrow more.

argue that the central variable of concern is the quantity of money, not the interest rate.<sup>48</sup>

It is perhaps worth noting that France and Portugal, where controls on interest rates paid and charged lead to patterns of responses similar to those described here, have employed credit targets.

#### 11. Some Perspectives on Monetary Policy

Since monetary policy directly affects bank lending, restrictions on credit not only have a disproportionate effect on those who make more extensive use of bank lending--a potentially large distortionary effect of the use of monetary policy as a control mechanism--but also give rise to forces for the use of other credit creation mechanisms and institutions. Earlier episodes of tight credit, for instance, gave rise to a vast expansion in the commercial paper market. Not everyone has equal access to the commercial paper market. But to the extent that large borrowers switch to the commercial paper market and reduce their demand for bank loans, funds are freed for the use of smaller borrowers. There are large fixed costs associated with establishing alternative institutions and institutional arrangements; the advantages of banking institutions as intermediaries may mean that it will not pay for many borrowers to "switch" to alternative institutional arrangements, provided that they believe that the credit restrictions are infrequent and temporary. But if they come to believe that

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<sup>48</sup> If, for instance, for one reason or the other, ordinary relationships between the level of economic activity and the rate of inflation become disturbed, then the quantitative targets associated with the control of money (credit) may be more effective than interest rate targets.

they are frequent and/or long lasting, then their incentives for developing alternative intermediary arrangements, not subject (or less subject) to the control of the monetary authorities, are increased. As a result, credit control can, at best, only be effective if it is used only sparingly.

## Part V

### A General Equilibrium Model of Credit Rationing

The discussion so far has been couched mainly in partial equilibrium terms: we have not constructed a complete model of the economy. Our objective in this section is to show how a simple general equilibrium model with credit rationing can be constructed. We do not present the details of the model, nor do we show how monetary authorities affect the general equilibrium of the economy. Our point here is simply to show that it is, in fact, easy to construct a consistent general equilibrium model with credit rationing.

Again, we turn to a simple life cycle model, now the more standard two period overlapping generations model. Individuals have wealth  $W$ . There are two investment projects, each costing  $B > W$ . The safe project yields a return  $R^S$ , with probability  $p^S$ , zero otherwise; the risky project a return of  $R^R$  with probability  $p^R$ , zero otherwise.<sup>49</sup> For simplicity, assume all individuals are identical, with no collateralizable wealth. (In Stiglitz-Weiss, 1986, we analyzed the case with heterogeneous individuals having different amounts of collateralizable wealth.) There is a critical (real) interest rate  $r^*$ , such that above  $r^*$  individuals invest in the risky

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<sup>49</sup>In general, loan contracts are characterized not only by an interest rate,  $r$ , but also by a collateral requirement. Here, we assume entrepreneurs invest all of their available wealth in the investment enterprise, and hence no collateral is feasible. The more general case where there is both collateralizable and non-collateralizable wealth may be handled similarly.



asset.<sup>50</sup> Banks (lenders) will charge no more than the interest rate  $r^*$ , even if there is an excess demand for credit at  $r^*$ . If all individuals are identical, then a fraction  $\alpha$  of the individuals become entrepreneurs. Under suitable conditions,<sup>51</sup> it can be shown that entrepreneurs will invest all of their wealth. Assuming homothetic indifference curves, the remainder will save a fraction  $s[(1+r^*)p^S]$ . Thus,  $\alpha$  solves

$$\alpha(B - W) = (1 - \alpha)s[(1+r^*)p^S]W$$

Demand for funds          Supply of funds

A credit rationing equilibrium exists for this model, so long as those who become entrepreneurs are better off than those who do not. We let  $U(C_1, C_2)$  be the utility of the individual as a function of his consumption first and second periods, respectively. Recall that entrepreneurs consume nothing the first period. Let  $V$  be the indirect utility function, giving the level of utility as a function of the wealth and interest rate of a non-entrepreneur (who simply takes whatever funds he does not consume and invests it at the safe rate  $r^*$ ). We require that

$$p^S U(0, R^S - (B - W)(1+r^S)) + (1 - p^S)U(0, 0) > V(W, (1+r^*))$$

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<sup>50</sup>  $r^*$  is the interest rate such that the expected return to the firm investing in the safe and the risky asset is the same:

$$p^S U(0, R^S - (1+r)) + (1 - p^S)U(0, 0) = p^R U(0, R^R - (1+r)) + (1 - p^R)U(0, 0),$$

where  $U(\cdot, \cdot)$  is the individual's two period utility function.

<sup>51</sup> The elasticity of substitution between consumption in the two periods in the individual's life has to be sufficiently large, and the returns from investing have to be sufficiently great.

For sufficiently high values of  $R^S$  and sufficiently large elasticities of substitution between consumption in the two dates, there exists a credit rationing equilibrium.

## VI. Concluding Remarks

That there exists a link between money and banking, on the one hand, and the level of economic activity, on the other has long seemed evident, in spite of the well established propositions asserting its neutrality. The question is, why does money have the real effects that it seems to have? What are the links?

We have stressed here the informational role of banks, and the importance of credit. Money creation has affects through credit creation. Monetary disturbances have further affects through the disturbances which they induce in society's accounting system, in the mechanisms by which it is ascertained who is credit worthy, who has the right to the use of currently available resources. In the theory we have developed prices--interest rates--play an important role, but not the simple allocative role ascribed to them by the conventional paradigm. Market equilibrium may be characterized by credit rationing; interest rate movements over the business cycle may be quite different from those depicted in the standard stories; and the equilibrating forces may be weak or virtually absent.

While we have shown that in some instances the predictions of our theory accord with those of the conventional paradigm, there are other aspects in which they differ: interest rate targets may be inappropriate; financial innovations, which increase the speed with which transactions become recorded, may be socially undesirable though privately profitable, and credit rationing may be effective only if used sparingly, and even when effective, it may be highly distortionary.

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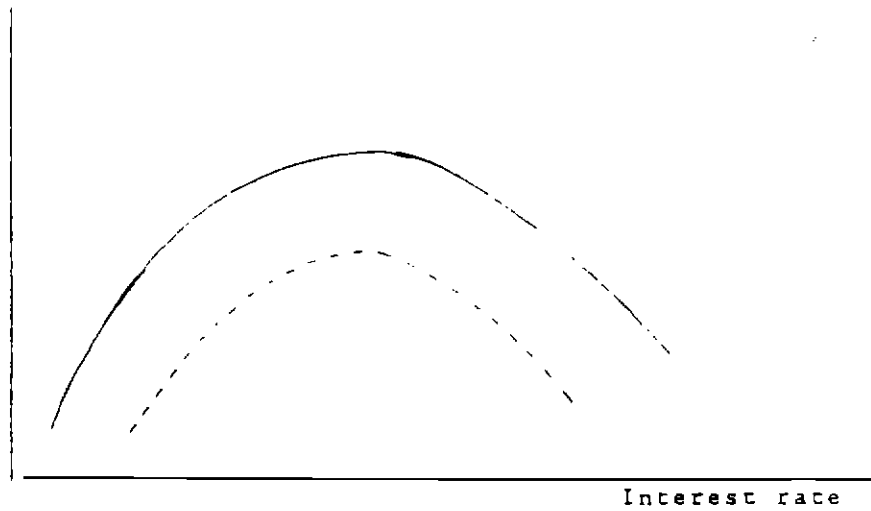
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Expected return to  
bank



The increased uncertainty shifts the expected return curve of the bank down, and some categories of loans get denied access to credit (even if the required return to the bank falls).

Figure 1