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Can a "Credit Crunch" Be Efficient?

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The past year has seen widespread talk about a "credit crunch" in the United States. The views of two groups have dominated in this debate. One group argues we are experiencing a "credit crunch" right now and something needs to be done about it; the other group argues that a "credit crunch" cannot exist without major impediments to the achievement of market equilibrium, that no such major impediments currently exist, and that what is happening now is merely a periodic episode in which bank loans lag behind the business cycle. The implication of this second argument is that the market should be left to take care of itself.

One frustrating aspect of this debate is that people seem to mean somewhat different things when they speak of a "credit crunch." The logic of the various positions would be clearer if each position were developed within the framework of a coherent model of how the credit-intermediation sector of the economy operates. Two such alternative models already exist: a textbook-style model according to which the credit market operates efficiently and a low level of lending activity is presumably a business cycle phenomenon driven by the demand side of the market, and a liquidity-constraint model according to which intermediaries impose nonprice constraints on their customers with consequences that can be inefficient.[1] In this paper, we analyze a third alternative model of financial intermediation in which phenomena qualitatively resembling a "credit crunch" occur but are efficient.

The definition of *efficiency* is key to the differences between our model and the two alternative models of intermediation just mentioned, and we examine it in detail later. First, though, we want to outline the textbook-style and liquidity-constraint models and then to describe our model of efficient financial-intermediation contracts that may involve nonprice rationing in some circumstances.

Three "Credit Crunch" Perspectives

A "Credit Crunch" in Full Swing? . . .

We begin our examination of the prevailing views with the perspective of those who think a "credit crunch" is already in full swing. One person who has repeatedly suggested that a situation of inefficient credit restraint is occurring is the Chairman of the Federal Reserve Board, Alan Greenspan.[2] His remarks to Congress over the last year have made it clear that he believes something akin to a "credit crunch" now exists: "The restraint on credit availability at depository institutions represents a continuing clear risk to the outlook . . . . Banks report that they have been applying more stringent credit standards and have made the price and nonprice terms of business credit less favorable to a wide range of customers. . . . In certain areas . . . the credit retrenchment appears to have gone beyond a point of sensible balance." (See Greenspan 1991b, pp. 305–6 and 1991c, pp. 713–14.)

In his remarks to Congress, Chairman Greenspan (1991c, pp. 713–14) has also identified the attitudes and actions of intermediaries he sees as contributing to this situation of credit restraint:

> In some cases, lender attitudes and actions have been characterized by excessive caution. As a result, there doubtless are creditworthy borrowers that are unable to access credit on reasonable terms . . . . To an extent, the scarcity of some types of loans may reflect the efforts of individual financial institutions to reduce the share of their assets in a particular category, such as commercial mortgages. While a single bank may be able to do this without too much trouble, when the entire industry is trying to make the same balance sheet adjustment, it simply cannot be done without massive untoward effects.

Chairman Greenspan has taken pains to speak of "credit restraint" rather than of a "credit crunch." Nevertheless, in three respects his view coincides with those who would say that a "credit crunch" is now in full swing. First, allegedly a situation currently exists in which those who are creditworthy cannot get credit, or cannot get it at reasonable terms. Second, lenders allegedly exhibit an attitude of excessive caution which may or may not be traceable to regulatory distortion.[3] Third, regardless of whether it is due to lenders' misperceptions or to regulatory distortions, the resulting inability of would-be borrowers to fund their investment projects is allegedly inefficient. The conclusion drawn by those who hold such views is that regulatory changes that would provide incentives for lenders to relax their credit restrictions would ameliorate this inefficiency. Chairman Greenspan (1991a, p. 246) has also drawn the connection to regulation in remarks to Congress: "The Federal Reserve is working with the other bank supervisory and regulatory agencies to ensure that bank examination standards . . . do not artificially encourage or discourage credit extension. The intent of these efforts is to contribute to a climate in which banks make loans to creditworthy borrowers and work constructively with borrowers experiencing financial difficulties, consistent with safe and sound banking practices."

. . . Or Just Business Cycle Fluctuations?

Chairman Greenspan's assessment of the credit situation is not shared by all economists, however. The Shadow Open Market Committee (a group of academic and business economists who regularly report on economic issues) offers a different evaluation of the same current market situation. In a September 1991 press release, it claims that

> the so-called credit crunch was a red herring. The recent drop in business loans neither indicates a shortage of credit nor a refusal by bankers to lend. To the contrary, banks are cutting loan rates in an effort to drum up business. Bank loans (especially bank loans to business) always lag behind the economic cycle.

Silas Keehn (1991, pp. 544, 546), President of the Federal Reserve Bank of Chicago, has offered a similar assessment in the specific context of the Midwest. Like Chairman Greenspan, President Keehn uses the term *credit restraint* to describe the current state of the market. However, while Greenspan's view of the lending market is that "credit retrenchment appears to have gone beyond a point of sensible balance" and may have "massive untoward effects," Keehn considers the situation to be a market adjustment that is beneficial from a long-term perspective:

> What constitutes a credit "crunch," to my way of thinking, is when creditworthy borrowers, those that would normally find it possible to obtain credit even under adverse economic circumstances, cannot obtain financing. This is not currently the case, at least in the Midwest. . . . What currently exists is credit restraint—not a "crunch." . . . To conclude, it is my opinion that the credit restraint that we are experiencing in the Midwest reflects an adjustment in the marketplace, and it is entirely possible that we are coming to the end of this phase. . . . While in the short run the credit restraint that we have been experiencing has been difficult, particularly for those who have been denied credit, in the long term the overall economy will benefit from this significant transition.

Although these comments specifically concern the current situation, they argue in terms that many economists would use to cast doubt on the general concept of a "credit crunch." These economists use two main textbook-style arguments. One is that credit allocation must be viewed in the context of a general theory of the business cycle. Economic models based on rational expectations and competitive market-clearing are appropriate for explaining the business cycle in the United States. Such models do not accord any role to systematic misperceptions in determining allocation, and they imply

that interest rate movements will equilibrate supply and demand without recourse to rationing.

The second textbook-style argument these economists use is that this equilibration process will produce an ex post efficient resource allocation (that is, an allocation which is efficient with respect to the preferences that agents would have if they were fully informed about the state of the economy) unless its operation is distorted by nonmarket forces, and the current supervisory regulation of lenders is not the sort of intervention that would produce such a distortion.

A Caveat: Is Credit Information Public?

If one accepts the thesis that a "credit crunch" sometimes occurs, however, then one must reject at least one of these last two arguments.[4] Indeed, some economists do have doubts about how well these two arguments apply to the credit markets to which consumers and all but the largest business turn for credit. These doubts are based on three considerations.

First, the two textbook-style arguments above refer implicitly to a class of models in which all information held by various economic agents is known to all of the agents (although some information may not be known to anybody). In lending markets, though, important information may be private. For example, the owner of a business may have a fairly certain assessment of its profitability during the coming year but may be unable to document this assessment to a bank.

Second, this privacy of information prevents lending markets from operating in the same impersonal, decentralized way that many other markets operate. In particular, credit allocation often takes place in the context of a long-term relationship between a borrower and a lender. As a result of the informational problem, borrowers who are denied credit from their specific lender may simply be unable to shop around for another lender with any success.[5]

Third, this privacy of information and the resulting bilateral, contractual aspect of credit markets is not represented in the textbook-style characterization of the economy above. Yet the publicity of information is an important, implicit premise in the second textbook-style argument that the market reaches an equilibrium which is efficient. Thus, the presumption that credit markets subject only to prudential regulation will attain efficient outcomes cannot apply to the actual economy.

This third point is supported prima facie by some evidence that credit allocation in the U.S. economy fails to conform to the pattern that the textbook-style theory would predict. The consumption pattern of low-wealth households seems to depart particularly far from the theoretical predictions. Some researchers have found statistical evidence which suggests that these households' marginal propensity to consume is close to unity. Moreover, there are some private information models of lending that can explain this high marginal propensity to consume and that have inefficient equilibria. (See Hayashi 1987.)

So research from the liquidity-constraint perspective seems to provide theoretical and statistical support for Chairman Greenspan's views. That is, there is some statistical evidence against the view that decentralized interest rate competition always clears credit markets, and there are some models in which such a failure of market clearing induces an inefficiency that regulatory or monetary policy could potentially ameliorate. A limitation of these models is that they do not explicitly relate credit allocation to the business cycle, though.

Maybe in Full Swing, But Nevertheless Efficient

The alternative theory we present here can be characterized by comparison with the views just discussed. In common with the textbook-style theory and the liquidity-constraint theory, we envision an economy of maximizing agents who have rational expectations. In common with the liquidity-constraint theory, we suppose that these agents possess private information which means that efficient allocation cannot be achieved in a completely decentralized way. However, an implication of our theory is that the required centralization can be achieved by long-term contracting between agents and intermediaries. Thus our theory implies, contrary to the liquidity-constraint theory, that competition among intermediaries to provide enforceable long-term contracts leads to an efficient allocation.

Our concept of incentive-constrained, ex ante efficiency is different from the efficiency concept to which the textbook-style account of the equilibration process refers, though. Later we will explain in detail this efficiency concept, which is widely used for the welfare analysis of economies with private information. (We will use the term *efficiency* to refer to ex ante efficiency except where we explicitly indicate otherwise.) The allocation we characterize as efficient is not supported by competitive adjustment of interest rates or other prices. In this respect, our theory does not agree with the textbook-style characterization of the economy.

The theory we present here can account for several phenomena that Chairman Greenspan and others seem to have in mind when they suggest that credit restraint has apparently been inefficient. One of these phenomena is a cross-sectional consumption function that exhibits marginal propensity to consume close to unity at low income levels. Another such phenomenon is that the most favorably situated agents in the economy could achieve higher utility from an ex post perspective by making net trades at the interest rate envisioned in the textbook-style theory (that is, at the rate determined by the economy's marginal rate of intertemporal transformation) than from accepting the commodity bundles that the ex ante efficient allocation assigns to them.

In contrast to Chairman Greenspan's apparent view, however, our theory does not support the interpretation of these phenomena as symptoms of economic inefficiency. Our theory predicts that an efficient allocation will result when intermediaries compete freely with one another to offer enforceable long-term contracts. The most direct implication of the theory for policy is that nonmarket restrictions on the enforceability of long-term contracts for financial intermediation are likely to prevent an efficient allocation from being attained. If such restrictions are to be enforced for reasons that lie outside the scope of our model, though, then potentially a role exists for regulatory policy (and conceivably for monetary policy) to mimic the allocative role of unenforceable contingent claims. What we argue below, however, is that the policy recommendations our theory would endorse differ substantially from those derived from either the textbook-style theory or the liquidity-constraint theory.

Two features of our model are especially relevant to the current public discussion of policy. First, nonprice rationing of credit in our model has to do with features of the economic environment that vary over the business cycle. Specifically, as the public discussion envisions, nonprice rationing of the most solvent credit market participants occurs when aggregate investment is depressed.[6] Second, we model the provision of financial intermediation to traders who do not possess a production technology, rather than to firms. In this respect, our model is not fully adequate to address the issue of credit allocation to firms that is the focus of current public discussion. The general points made here are certainly also applicable to credit allocation to firms, though, and we strongly believe that our specific results will have close analogues in a model of intermediation of firms' investment.

A Simple Efficient Exchange Model

Next, we will present a simple model of an economy. This model emphasizes an explicit representation of economic

agents' private information. Because of private information in the model, decentralized trading of debt securities is not an efficient financial arrangement. Rather, the efficient arrangement has features that seem to resemble what some people currently identify as a "credit crunch." One of these features, the nonprice rationing of the most solvent credit market participants, occurs specifically when aggregate investment is at its lowest possible level (which we take to represent a recessionary situation in the model). Since the arrangement that we characterize in the model is efficient, though, we conclude that the observation of nonprice credit rationing during recessions is not necessarily a symptom of inefficiency in the actual economy.

In our model economy, all traders will be identical ex ante, but traders will subsequently acquire private information about their own endowments. We first show an arrangement which includes the provision of explicit insurance that would be efficient in this economy if information were public; however, this arrangement is infeasible because of the privacy of information. Second, we will show that a market for debt securities is feasible despite the privacy of information and that the allocation determined by such a credit market provides a higher level of welfare than traders would receive in autarky. Third, we will show that another allocation can provide an even higher level of welfare than the debt-securities allocation. We interpret this allocation as the outcome of a contract that households can make with a welfare-maximizing intermediary, and later we will describe a notion of competitive profit maximization which entails that intermediaries should behave as though they are maximizing welfare.

Our model depicts an economy in which traders consume goods at two dates and in which they have private information about their endowments at the first of these dates but not at the second. Before describing this model formally, we give two examples of the kind of situation in the actual economy that the model is supposed to reflect. In thinking about the relationship of our formal model to the actual economy, the first consumption date (date 1) in the model should be understood to describe the trader's situation within the horizon of a typical bank loan or other financial contract. The second consumption date (date 2) should be understood to describe the longer-term future.

For example, the owner of a firm may know that the firm currently has a better product than its competitors have and that the firm will be able to exploit this advantage, if investment can be financed. Given that special expertise is needed to recognize which product is the best one, the owner might be unable to document this knowledge convincingly to a banker who lacks this expertise. If technical progress in the industry is rapid enough to allow any firm to leapfrog the current industry leader, then the owner will also not be confident that the firm will still have the best product in the future. That is, the owner may have important private information regarding the firm's short-term prospects, but not regarding its longer-term prospects. A parallel example is that a worker may receive reliable but informal (and hence unverifiable) advice that a promotion and salary increase will soon be announced, but that worker would not have private information regarding the likelihood of further promotions to take place in several years' time. Although these examples cannot be represented literally in our model of an exchange economy, they illustrate the way in which the information structure of the economy is to be interpreted.

The Model

Now we describe the formal model. Consider a world in which there are three dates: 0, 1, and 2. No production or consumption takes place at date 0—we will discuss in a moment what happens at that date. There is one good that can be consumed at date 1 and one good that can be consumed at date 2. Call these *good 1* and *good 2* respectively. (The goods may be identical except for the date when they are available for consumption.) There is a linear technology that can transform an amount x of good 1 into an amount Rx of good 2.

There are many traders (who might also be thought of as households) in the economy. These traders all have identical preferences, but they receive different endowments from one another. Specifically, there are n classes of traders, and for each $i \leq n$ a proportion π_i of traders receives endowment y_i at date 1 and endowment z at date 2. (Note that all traders have the same endowment at date 2, and assume that $y_1 < ... < y_n$.) Assume also that the utility function is of the form $u(c_1,c_2) = w(c_1) + v(c_2)$, where w and v are strictly increasing, strictly concave functions defined on the nonnegative real numbers and differentiable at every positive real number. A trader must consume a nonnegative amount of each of the two goods.

At date 0, a trader (or household) does not yet know what its endowment will be. Since it is just like every other trader at date 0, it assumes that its probability of receiving any endowment level y_i at date 1 is π_i. From the perspective of date 0, a consumption bundle consists of an amount of good 1 and an amount of good 2 contingent on each endowment realization. That is, a consumption bundle will be a vector $\vec{c} = (c_{11},...,c_{1n},c_{21},...,c_{2n})$, where the first subscript indicates the date of consumption and the second subscript indicates the trader's endowment level for which that consumption is enjoyed. The trader desires to maximize expected utility $\bar{u}(\vec{c}) = \sum_{i=1}^{n}\pi_i u(c_{1i},c_{2i})$.

At date 1, each trader will receive its own endowment of good 1 but will be unable to observe the endowments of other traders—nor will traders' endowments of good 1 subsequently be verifiable to other traders at date 2. In what follows, the distinction between communication about endowments and direct verification of endowments is crucial. Assume that each trader can make a public report of its endowment at date 1, but that no one else can verify directly whether this report is truthful. Communication can also occur at date 0. At this date, traders can negotiate binding contracts with one another to share their goods available for consumption at the subsequent dates. By negotiating such consumption-sharing contracts with a large number of its counterparts, a trader can completely diversify the idiosyncratic risk of its own endowment. However, the traders' ability to contract with one another is limited by the impossibility of direct verification just discussed. Traders can make binding contracts to share their consumption on the basis of reports made to one another regarding their endowments, but they have no way to check whether other traders' reports are truthful. Thus, contracts need to be designed in such a way that no one can gain anything from misrepresentation.

Four Allocations

In this exchange economy, one of the primary reasons for trade would be to provide insurance against the randomness in individual endowments. We will consider four allocations in this economy: the endowment, the full-insurance allocation, the ex post efficient allocation resulting from competitive trade of a debt security at date 1, and the ex ante efficient allocation that we will characterize in terms of a contract that traders could make with one another at date 0.[7] These four allocations are depicted in the figure in the box, which shows an economy in which there are two levels, y_1 and y_2, of endowment of good 1.

At date 0, all of the traders would like to pool, invest, and redistribute their resources so that each trader will consume a bundle $\vec{c}$ that solves this problem: maximize $\bar{u}(\vec{c})$ subject

to the constraints of nonnegativity (that is, for all i, $c_{1i} \geq 0$ and $c_{2i} \geq 0$) and aggregate feasibility (that is, $\sum_{i=1}^{n} \pi_i c_{2i} \geq z$ and $\sum_{i=1}^{n} \pi_i [c_{1i} + R^{-1}(c_{2i} - z)] \leq \sum_{i=1}^{n} \pi_i y_i$). Let us consider a special case that $v(\cdot) = R^{-1} w(\cdot)$. It is easy to show that this optimization problem is solved by setting $c_{1i} = c_{2i} = z$ for all i. That is, the solution is essentially to provide full insurance to traders at date 1. When this has been done, nothing is gained by using the intertemporal-transformation technology to convert consumption at date 1 to consumption at date 2.

This full-insurance allocation would be achieved by a contract that requires each trader to report truthfully its endowment and that transfers to each trader the difference between z and its reported endowment. After having become parties to this contract at date 0, though, traders would not report truthfully at date 1. Rather, each trader would claim to have the lowest possible endowment (that is, y_1) in order to get the maximum indemnity from the insurance contract. Traders will prevaricate in this way because the intermediary cannot check their reports directly. Given that the underreporting of endowments will occur, it will not be feasible to make the positive transfers to all traders that are promised in response to their messages.

Instead of an insurance market, now consider a market for debt securities that pays gross interest R between dates 1 and 2. Since R is also the traders' rate of pure time preference, each trader would want to consume equal amounts at the two dates if such a security were traded at date 1. That is, each trader receiving endowment (y_i, z) would consume the bundle $((y_i + R^{-1}z)/(1+R^{-1}), (y_i + R^{-1}z)/(1+R^{-1}))$. That is, each trader is consuming the optimal bundle in its budget set where the price of good 1 is 1 and the price of good 2 is R^{-1}.

This debt-securities equilibrium could also be expressed in terms of net trades. A trader may receive any net trade that has zero value at the price vector $(1, R^{-1})$ and that provides a nonnegative consumption of each good when it is added to the trader's endowment. No trader's choice of net trade would be both feasible for another trader and also strictly preferred by that trader to its own choice, since both net trades have zero value. That is, although traders' information about their endowments is private, traders do not attempt to claim the net trades intended for other traders who have different endowments. Unlike the full-insurance allocation, the debt-securities-equilibrium allocation is *incentive compatible* in the sense that traders do not strategically exploit the privacy of their information.

Generally (that is, unless $y_i = z$ for some wealth level i) each trader strictly prefers its debt-securities-equilibrium consumption bundle to its endowment ex post. Since this is true regardless of the amount of endowment that will be realized, each trader also has this preference ex ante. Although the welfare gains from participation in the debt-securities market are not as large as what would be possible through full insurance if endowment information were public, this arrangement does afford some improvement over autarky.

Economists have devoted much attention to the question of whether households' actual allocations conform to the pattern suggested by the debt-securities-equilibrium allocation.[8] The apparent intent of their work is to draw some welfare conclusion regarding the situation of households in the credit market, using the debt-securities-equilibrium allocation as a benchmark. This benchmark would not be a sensible one if information about households' endowments (or, perhaps more realistically, information about their employment opportunities) were public. In that case, an allocation in which full insurance is provided would be the appropriate benchmark. Given that full insurance is infeasible in the presence of private information and that a debt-securities market is feasible and affords some improvement over autarky, there is a prima facie case that the debt-securities-equilibrium allocation would be an appropriate benchmark if we take seriously the privacy of households' information. That is, the allocation is an appropriate benchmark if it solves the problem of maximizing traders' ex ante expected utility subject to both the technological constraints and the constraint of incentive compatibility in the economy with private information.

Closer inspection reveals, though, that the debt-securities-equilibrium allocation is generally not the solution to this constrained-optimization problem. To see why not, consider the typical case in which each trader consumes a strictly positive amount of good 1 in the debt-securities-equilibrium allocation. We have already argued that each trader strictly prefers its own net trade to that of a trader with any other endowment. By the continuity of the utility function, we could perturb these net trades slightly without violating this strict preference. In particular, we could impose a small tax on the purchase of debt securities and we could redistribute the proceeds from this tax to the issuers of debt securities. If the tax were sufficiently small, incentive compatibility would not be violated. Since traders with large endowments purchase debt securities and traders with small endowments issue debt securities, this tax transfer scheme would in effect provide partial insurance against having a low endowment. Traders want to insure themselves ex ante, so the tax transfer scheme will raise ex ante expected utility without violating technical-feasibility or incentive-compatibility constraints.

The upshot is that, contrary to what economists who study credit markets have often seemed to assume, an allocation which deviates systematically from the debt-securities equilibrium may in fact be superior to the equilibrium from an ex ante perspective. In particular, such a deviation does not necessarily imply that it would be desirable to regulate intermediaries in order to impose the debt-securities equilibrium. In Green and Oh 1991, we formulate and analyze in detail the constrained-optimization problem that we are considering here. We also examine how the efficient allocation can potentially be distinguished from various inefficient liquidity-constrained allocations that have been proposed to explain apparent systematic deviations of households' consumption from the pattern that debt-securities equilibrium would entail.[9]

Competitive Intermediation Via Contracts

We have been discussing what sort of allocation might be arranged by a benevolent social planner who is constrained to treat traders according to their unverifiable (and unfalsifiable) reports of their endowments. In the actual economy, though, credit allocation is the outcome of competition among intermediary firms rather than the outcome of a benevolent planner's decision. Thus, we need to relate the foregoing discussion to a notion of competition among intermediaries.

In a Walrasian economy where all information would be public, the First Welfare Theorem implies that the competitive allocation is one solution of the social planner's problem of Pareto-efficient allocation. Green (1987) has proved a related result regarding one parametric, infinite-horizon version of the economy studied here, and Oh and Green (forthcoming) prove it in exactly the present context. If intermediaries compete with one another to offer incentive-compatible contracts for state-contingent net trades, then the unique contract that will be offered in equilibrium is the contract that maximizes ex ante expected utility subject to the constraints of technical feasibility and incentive compatibility.

Here is the notion of equilibrium to which this result refers. At least two intermediaries offer contracts at date 0. A contract specifies net trades of good 1 and good 2 to be made on the basis of a trader's reported endowment. Thus, a contract can be represented as a vector $\Gamma = (\gamma_{11}, ..., \gamma_{1n}, \gamma_{21}, ..., \gamma_{2n})$,

where γ_{ti} denotes the promised net trade in good t if endowment y_i of good 1 is reported. (The subscript i ranges over n possible income levels.) Note in particular that if a trader gives a truthful report, then $\gamma_{1i} = c_{1i} - y_i$ and $\gamma_{2i} = c_{2i} - z$. A contract must be technically feasible (that is, $\gamma_{1i} \geq -y_i$ and $\gamma_{2i} \geq -z$ for all i and $\sum_{i=1}^{n}\pi_i[\gamma_{1i} + R^{-1}\gamma_{2i}] \leq 0$ and $\sum_{i=1}^{n}\pi_i\gamma_{2i} \geq 0$) and incentive compatible (that is, for all i and j, $u(y_i+\gamma_{1i}, z+\gamma_{2i}) \geq u(y_i+\gamma_{1j}, z+\gamma_{2j})$) and individually rational ex ante (that is, $\sum_{i=1}^{n}\pi_i u(y_i+\gamma_{1i}, z+\gamma_{2i}) \geq \sum_{i=1}^{n}\pi_i u(y_i,z)$). In terms of the numeraire good 1, an intermediary's profit from offering contract Γ is $-\sum_{i=1}^{n}\pi_i[\gamma_{1i} + R^{-1}\gamma_{2i}]$. This profit is the negative of the net value of the goods that the intermediary gives to traders. If traders report truthfully, then nonnegativity of profit is equivalent to a technical feasibility constraint. If we define the state-contingent endowment vector $\vec{\omega} = (y_1,...,y_n,z,...,z)$, then a trader's ex ante expected utility from participating in Γ is $U(\Gamma) = \bar{u}(\vec{\omega}+\Gamma)$.

An intermediary who offers no contract earns zero profit. Suppose that u^+ is the maximum of the utility levels provided by the contracts offered by the competitors of some intermediary. In order to attract traders away from competitors, that intermediary must offer a contract which provides utility level strictly higher than u^+. A way to do this is to design a more *cost-effective contract* than competitors offer, that is, one that provides utility level u^+ at lower cost (and thus higher profit per trader) than the contracts offered by competitors. Then, modify this contract by giving a small part of the cost saving to the traders in a way that does not spoil the incentive-compatibility of the contract. The modified contract will provide a utility level strictly higher than u^+, since it provides this transfer in addition to the net trades that had already provided expected utility u^+.

As this process continues, imagine intermediaries converging to a contract that is as cost effective as possible. At this point, intermediaries must compete with one another by offering transfers to traders out of their own profits. This bids profits down to zero. When an intermediary offers a cost-effective contract Γ^* that yields zero profit, then no one else can bid traders away without having a negative profit.

This informal description of competition among intermediaries suggests the following definition. A contract Γ^* is an *equilibrium contract* if there is no contract Γ satisfying both $U(\Gamma) \geq U(\Gamma^*)$ and $-\sum_{i=1}^{n}\pi_i[\gamma_{1i} + R^{-1}\gamma_{2i}] \geq 0$, with at least one strict inequality.

We want to show that an equilibrium contract is always efficient. Suppose that the equilibrium contract Γ^* were not efficient. Then there would be another feasible contract Γ' that provides strictly higher ex ante expected utility than Γ^* provides. This contract could be modified by taking away a tiny amount from traders in a way that does not spoil incentive compatibility. The resulting contract Γ'' would still provide strictly higher ex ante expected utility than does Γ^* and would yield strictly higher profit than does Γ'. Recall that the technical-feasibility condition $\sum_{i=1}^{n}\pi_i[\gamma'_{1i} + R^{-1}\gamma'_{2i}] \leq 0$ is equivalent to the nonnegativity of profit for Γ', so Γ'' earns strictly positive profit. This contradicts the assumption that Γ^* was an equilibrium contract.

Thus, we have established that intermediaries earn zero profit in equilibrium and that the equilibrium contract is efficient. For more formal versions of this argument, see Green 1987 and Oh and Green, forthcoming. The argument can be modified straightforwardly to show that a profit-maximizing monopolistic intermediary would maximize traders' ex ante expected utility subject to achieving the monopoly profit level. That is, the monopolist would extract rents from traders but would still offer them the same kind of insurance arrangement that the competitive contract provides. (We will appeal to this fact in the Appendix of the paper.)

A noteworthy aspect of this argument is its dependence on the assumption that traders irrevocably bind themselves at date 0 to make contractually specified net trades with the intermediary at dates 1 and 2. Because the efficient contract provides endowment insurance to some extent, traders who receive high endowments must earn less than R, the marginal rate of intertemporal transformation, on the deposit of good 1 that they are required to make with the intermediary. After having learned that their endowments are high, these traders would like to default on the contract and invest their endowments directly in the intertemporal-transformation technology (or renegotiate a contract with an intermediary who will provide the same rate of return as that technology) ex post. Such default is assumed not to be possible in the model economy. In the actual economy, though, long-term contracts for financial intermediation do not seem to be so completely immune from default. This distinction between the actual economy and the model economy will be crucial to the following discussion of financial intermediation.

Numerical Solution of the Model

In this section, we will show that nonprice rationing is a more efficient way than price adjustment to provide insurance in an economy of privately informed traders. We will also show that it is specifically when the nonnegativity constraint on aggregate investment is binding (a situation that is most closely approximated during recessions in the actual economy), rather than in other unforseen contingencies, that nonprice rationing is incident on consumers at the highest endowment level.

Our argument relies heavily on numerical solution of the model presented in the efficient exchange part of this paper. Ideally, we would like to have a genuine time-series model to study the relationship of intermediation to macroeconomic events, but we do not have such a model.[10] Provisionally, then, we study the three-date model (that is, with a contracting date and two consumption dates) that we have specified above. We compare what happens in the model when the nonnegativity constraint on investment (that $\sum_{i=1}^{n}\pi_i c_{2i} \geq z$) is binding to what happens when it is not binding, in order to get a rough idea of how the efficient allocation is affected by recession.[11] We focus here on the investment constraint as a proxy for recession because in the actual economy investment is much more volatile than consumption. Specifically, during recessions investment tends to be heavily reduced in significant sectors of the economy.[12]

Comparing numerical solutions of our three-date model for parameter values where the constraint is binding with solutions for parameter values where it is not binding shows the effects of a binding nonnegativity constraint on investment. A typical solution where the nonnegativity constraint does not bind is shown in Figure 1.[13] There are five levels of endowment of good 1: 1.0, 1.5, 3.0, 4.5, and 5.0. One-fifth of households receive each of these endowments. All households are endowed with 2.5 units of good 2. In the figure, the horizontal axis represents good 1 and the vertical axis represents good 2. The endowments in the economy are represented by the points on the horizontal line. The debt-securities-equilibrium consumption bundles of traders with the five different endowments are shown by points on the diagonal line. (The third point from the top right is not one of these.) The consumption bundles assigned to the corresponding traders by the efficient allocation are the four points on the southeast side of the diagonal line and the second point from the top right on the diagonal line itself. Because these four points do not lie on the wealth-expansion path of traders' demand for the debt security (that is, the diagonal line), the consumption of traders at all but the highest endowment level must be determined in part by nonprice rationing. Note especially that the consump-

tion bundles of traders at the lowest two endowment levels provide virtually the same amount of consumption at date 2, and the difference in date 1 consumption between the two households is virtually the same as the difference between their endowments of good 1. That is, the marginal propensity to consume from date 1 endowment (that is, income) is very close to unity.[14]

As Hayashi (1987) notes, macroeconomists have tended to infer the presence of inefficient "liquidity constraints" from high marginal propensity to consume. Specifically, macroeconomists have also tended to suggest that the households in the actual economy which display high marginal propensity to consume are worse off than they would be if they could trade on a debt-securities market. The results shown in Figure 1 do not support that conclusion, though. Note that traders with the two lowest levels of endowment receive more of good 1 in the efficient allocation than they receive in the debt-securities-market equilibrium allocation, but they receive essentially the same amount of good 2 in both allocations. Clearly, they are receiving some subsidy (from an ex post perspective) in the efficient allocation relative to the debt-securities-market equilibrium allocation. From an ex ante perspective, we would interpret this subsidy to be an insurance indemnity provided through intermediation.

In contrast to other traders in the efficient allocation, the highest endowment traders have a consumption bundle that is on the income-expansion path for the debt-securities market because the efficient allocation specifies that their marginal rate of intertemporal rate of substitution should be equal to the economy's marginal rate of intertemporal transformation. These highest endowment households never face nonprice rationing except when the nonnegativity constraint on aggregate investment is binding at the efficient allocation.

Figure 2 shows an economy just like the previous one, except that all traders are endowed with three units of good 2. At the efficient allocation in this economy, the nonnegativity constraint on investment is binding. The efficient allocation in Figure 2 differs from that in Figure 1 in the important respect that households with the highest endowment level consume substantially less of good 1, but very little more of good 2, in the efficient allocation than they consume in the debt-securities-market equilibrium allocation. From an ex post perspective, these households with high endowment at date 1 are subject to nonprice rationing at date 1.

To summarize, our numerical analysis supports two main results. First, it shows that a cross-sectional pattern of high marginal propensity to consume out of current endowment (that is, income) is consistent with efficient allocation and in fact is consistent with the households that exhibit high marginal propensity to consume being better off than they would be in a debt-securities-market equilibrium. Second, our numerical analysis shows that an allocation can be ex ante efficient despite the nonprice rationing of high-endowment traders that may occur when the investment constraint is binding.

How the Model Relates to an Actual Economy

The research we have presented here concerns ex ante efficient allocations achievable by contracts for financial intermediation in an economy with privately informed agents. Our research supports three main conclusions drawn from the specific model of a private information economy we studied. First, efficient allocations can have features previously thought to indicate the occurrence of inefficient credit rationing. Second, competition in the provision of intermediation contracts will lead to the provision of an efficient contract if long-term contractual obligations are enforceable. Third, if restrictions on the enforceability of long-term contracts exist (as in the actual economy), then some forms of regulatory intervention traditionally criticized by economists may improve welfare by constraining contingent claims to be honored that could not be enforced directly; conversely, to the extent that the efficient long-term contract does characterize the actual allocation of resources, policies formulated with a full-information economy in mind may reduce welfare in the actual economy.

Although the above conclusions are derived from a schematic model, they are relevant to current discussion of actual economic conditions and policy. That is, in the context of our model, the phenomena about which people complain in terms of a "credit crunch" are actually consistent with economic efficiency. Thus, without a specific alternative model in which policy intervention is shown to do some good, there should be no rush to implement presumed policy remedies.

A possible rejoinder to this position would be that actual credit transactions do not have the rich contractual form that our model posits. The intermediaries with which households and relatively small firms deal are banks, S&Ls, and other firms that nominally provide only a limited range of intermediation services: issuing credit and taking savings deposits. Based on what these intermediaries ostensibly do, it is not immediately evident that the contracts they write have the insurance aspect which our theory predicts. Rather, the actual contracts seem to be very closely related to debt securities that are held by the intermediary rather than being traded.

We argue that, despite this superficial appearance, contracts in the actual economy are more contingent de facto than their explicit provisions indicate. We believe that the most important contingencies have to do with macroeconomic recessions. When a severe recession takes place, borrowers in especially hard hit sectors of the economy obtain some reduction in the burden of their debt. Because this relief must be offered by an intermediary which had expected to make zero profit in competitive equilibrium, the intermediary is unable to meet all of its commitments to its customers. In various ways, customers who are relatively lightly affected by the recession tend to be rationed. These lightly affected customers correspond to the high-endowment traders in our model. That is, various apparent breaches of intermediaries' explicit or implicit promises to favorably situated customers during a recession may actually be the empirical counterpart of the nonprice rationing of high-endowment traders that occurs in the efficient allocation depicted in Figure 2.

In the Appendix, we summarize three pieces of historical evidence on the performance of the U.S. financial-intermediation industry during severe recessions. This evidence is fragmentary and impressionistic, but it seems to conform to the pattern we have just described. An important aspect of this evidence is the prominence of legislative and regulatory intervention in forms that, from an ex post perspective, seem inimical to welfare. From an ex ante perspective, though, some such interventions are welfare-enhancing. When nonprice rationing abrogates explicit contractual promises that were made with normal economic conditions in mind, the involvement of the monetary authority or of financial regulators is necessary to facilitate it. The resulting combination of debt relief for the heavily affected customers of the intermediary and nonprice rationing for the lightly affected customers is tantamount to the kind of insurance our theoretical analysis predicts. It is noteworthy that such a combination of debt relief and rationing is what some observers, viewing the current U.S. economic situation from an ex post perspective, are calling a "credit crunch."

Appendix
Three Intermediation Episodes During Severe Recessions

What follows is an exploration of three historical episodes of intermediation during severe recessions that seem to support the theory presented in the preceding paper.

1838

The first of these episodes concerns the activities of the financier Nicholas Biddle during 1838 (McGrane 1924, pp. 193–205). He was clearly one of the dominant bankers in the United States and presumably had considerable market power. Biddle had been the largest shareholder of the Second Bank of the United States, and when its federal charter expired, he obtained a Pennsylvania charter for the bank. This bank apparently had a cost advantage over its competitors in the South and West that presumably conferred close to monopoly power in the cotton-growing regions of the United States.[1] The relevance of this supposition is that a monopolist might well be better able than a competitive intermediary to enforce the efficient long-term contract.[2]

In fact, Biddle did take actions that were tantamount to providing insurance to his bank's customers, particularly to the cotton growers. In 1838, and again in 1839, Biddle and his associates entered the market as go-betweens, taking legal possession of baled cotton from heavily indebted growers who would normally have relied on credit to finance shipment of their crops to England and other markets.[3] By taking these speculative positions, Biddle and his associates did two things. They both transferred their customers' risks to themselves and also undertook the transportation and marketing investment that these customers would not otherwise have been able to finance because they were too heavily indebted to be offered further credit.

In the spring of 1838, Biddle was also resisting pressure for the resumption of specie payment after a suspension of many months. He cited the fact that resumption at that point would have caused difficulties for Southern and Western farmers as one reason for his resistance. Thus, Biddle was offering substantial help to customers to whom he was not contractually obligated, who would have been poor candidates for such help according to normal banking practices, and whose weak financial position as a group was attributable to their being particularly hard hit by a macroeconomic recession that had less serious effects elsewhere in the country.

Let us interpret this episode explicitly in terms of our theory. Nicholas Biddle might have restricted his business with cotton growers to the making of loans on an annual cycle to finance the growing and marketing of the crop. In years when growers experienced difficulty in repaying these loans, he could have forced them to repay these loans despite the hardship (presumably including the sale at auction of plantations which collateralized the loans) that this policy would have entailed for them. Suppose that the annual cost of funding these loans would have been C for Biddle and $C' > C$ for his competitors. Thus, Biddle could have made an annual profit of $C' - C$ from such a straightforward lending business. (That is, he would have charged his competitors' cost of funds as his interest rate. If a competitor were to enter the market, Biddle could have reduced his interest rate below C' and driven the competitor out, although Biddle himself would have continued to break even.)

However, suppose instead that a recession occurred on average every n years, and Biddle were to make and to honor a commitment to his client cotton growers that he would give them an amount M of debt relief. In particular, suppose he agreed to purchase their crops at a favorable price and assume the cost and the risk of marketing them. Suppose also that the growers were willing to pay a premium $P > M/n$ for this commitment, which amounts to an informal or implicit insurance contract.[4] Then Biddle's expected profit in a year would be $(C'-C) + (P-M/n) > C' - C$. That is, he would continue to make the same profit as before on his lending business and he would also conduct an insurance business that would be profitable on average. In years when the informal insurance commitment specified that Biddle should offer debt relief, short-term profit maximization would dictate that he should not honor the commitment. However, if he were to make that decision, his subsequent promises to provide insurance would not be credible, so his annual profit in the future would be reduced to what he could achieve by lending alone. If he faced competition from other intermediaries whose costs were as low as his own, then competition would drive Biddle's annual profit to zero in any event. He would thus have no incentive to override his short-term inclination not to honor his promise of relief. Because of his cost advantage, though, Biddle was assured of an enhanced stream of future profits if he did honor his commitment. That is, Biddle's dominant competitive position made it more profitable for him to offer an efficient long-term contract from which he demanded a stream of rents ex ante than to maximize short-term profits ex post at the expense of his steady customers.

1819–21

A second historical episode, the two-year-long depression following the Panic of 1819, shows the role of public intervention in approximating an efficient-contract allocation when unenforceability of implicit long-term agreements prevents decentralized competition among intermediaries from achieving efficiency (Rothbard 1962). Again, we will first summarize the historical situation and then explain how our theory bears on this evidence.

The 1819–21 depression was marked by a monetary contraction and deflation that greatly increased the burden of nominal debts. In response to this situation, a number of states passed stay laws and minimum assessment laws. In principle, a *stay law* specified only that a period of time had to pass after a debt became due before legal action could be taken to collect it. However, states actually passed laws that made the length of a stay depend on the type of asset that the creditor required for payment. A typical law would provide that a creditor could collect quickly if the creditor were willing to accept bank notes at face value, but that collection proceedings against the borrower would be stayed for a long time if the creditor insisted on being paid in specie (that is, in coin). In many cases, the effect of such a provision would be to induce the creditor to settle for payment in bank notes with a market value substantially below their face value in order to receive any payment at all within a reasonable period of time.

Suppose, for example, that a borrower owed $100 to a creditor. The borrower might offer the creditor payment in notes issued by a bank of dubious soundness whose notes were being traded at half their face value. If the creditor needed funds quickly, this offer would be accepted because otherwise there would be an inordinately long stay in collection of the debt. When the offer of repayment in bank notes was accepted, the borrower would purchase bank notes of face value totaling $100 for $50 in specie and would give them to the creditor who would immediately sell them to someone else for $50 in specie. If the debt had been contracted on the implicit understanding that payment would be made in specie, then this repayment arrangement was tantamount to the creditor providing $50 of debt forgiveness to the borrower in return for quick repayment.

From an ex post perspective, the effect of the stay law appears to have been to abrogate the intended debt contract. From an ex ante perspective, though, both borrower and lender must have recognized that such a law was a likely legislative outcome in the event of a severe recession. Thus when they made their contract, both borrower and lender understood that debt relief would be provided if there were a recession. The cost of this contingency to the creditor was presumably taken into account in setting the interest rate on the loan. From an ex ante perspective, then, negotiating a debt contract in an institutional setting that would generate a stay law if there were a recession (so that the debt contract had an implicit contingency clause) was Pareto superior to negotiating a truly noncontingent debt contract.

The other common way states responded to this depression was by instituting minimum assessment laws. A *minimum assessment law* stated that assets seized in case of default had to be accounted at an assessed value rather than at their market value in determining satisfaction of the debt. These laws tended to specify assessment mechanisms that were heavily biased in favor of the defaulting debtors. Again, the effect of the law was to permit the satisfaction of debts at considerably less than their contractually specified values in market terms.

One might suppose that these legislative interferences with the conduct of credit markets should be explained in terms of inefficient political institutions rather than in terms of efficient economic insti-

tutions. The obvious political explanation would be that the depression created a powerful constituency of debtors who lobbied successfully for relief. Two considerations cast doubt on such an explanation, though. The first consideration is the demographic composition of support for debtor relief. The debtors themselves were presumably a fairly small proportion of the population. An important class of these debtors, those who had earlier purchased federal land on credit, included both small Western farmers and wealthy speculators from Eastern cities. These debtors were not concentrated in any particular state or group of states; thus, they did not constitute a powerful coalition by themselves within any state. Indeed, Rothbard (1962) emphasizes that the debates over debtor relief generally cut across established political coalitions.

The second consideration against a political inefficiency explanation of debtor-relief legislation is that such legislation was already on the books in some states before 1819, and similar legislation was passed subsequently in the Panic of 1837 (McGrane 1924, p. 137). So although a debtors' lobby would have been only occasionally and temporarily influential (that is, during recessions), debtor-relief legislation seems to have been an established response to recession in the aftermath of deflation. It is more difficult to accept inefficient political equilibrium as an explanation of such a systematic policy than it would be as an explanation of a onetime rent-seeking experiment imposed by a minority coalition on an unprepared or unsuspecting majority.

Our theory provides a more satisfactory explanation of the kinds of debt relief that were legislatively enacted after the Panic of 1819 than does the explanation of politically inefficient rent seeking alone. The transfers to which the various legislative measures led are qualitatively similar to the ex ante efficient allocation in our model. Agents in the economy held portfolios containing varying amounts of nominally denominated assets and liabilities. An intermediary would not necessarily be fully informed about how much of an agent's portfolio was exposed to price-level risk. For example, holdings of bonds issued by governments or by railroad and canal companies and debt owed directly to the federal government through purchase of public land on credit would be nominal assets and liabilities respectively which would not be contracted through a bank. Nor would such portfolio positions be strictly a function of a person's wealth or other attributes directly observable by a bank. For example, a wealthy person might either be a large holder of canal bonds (and hence a beneficiary of deflation, if the canal in question remained solvent) or a speculator in the purchase on credit of public lands (and hence a victim of deflation). That is, the extent to which a person was a beneficiary or a victim of deflation is the kind of private information with which our theory is concerned.

We have characterized the efficient allocation as one in which the victims of deflation would be subsidized (for example, by being allowed to repay their debts in depreciated assets which would be accepted by the intermediary at full face value) while the beneficiaries would be assessed the cost of this subsidy. However, if any competitive intermediary were to attempt to implement this allocation with respect to its customers, the beneficiaries of deflation would refuse to pay their assessments. In the absence of public intervention, they could succeed in doing so because the intermediary was bound to treat them generously by contracts that did not contain contingencies for the event of severe deflation that had come about. Moreover, to the extent that the efficient allocation would require the beneficiaries of deflation to accept a lower-than-market rate of return on additions to their savings, they could simply refuse to deposit new savings with an intermediary that required these terms. Their business could be bid away by a competing intermediary, or they could simply invest their savings in nonintermediated assets.

That is, intermediaries in the actual economy could not implement the efficient allocation because they were in continual competition (with one another and with providers of nonintermediated assets) for their customers' business. This form of competition contrasts sharply with the form of competition assumed in our theory, which is ex ante competition to be in a binding, long-term contractual relationship. However, some of the benefits of ex ante competition can be obtained by ex post political intervention such as occurred during and after the Panic of 1819. This intervention forced intermediaries to make the subsidies required by efficiency, with the cost of these subsidies being borne either by the stockholders of the bank or (if the amount of the subsidy was sufficiently large or the bank was thinly capitalized) by its noteholders and depositors.

The allocation resulting from political intervention presumably fell short of fully achieving efficiency in three respects. First, stay laws and minimum assessment laws could probably only achieve a rough approximation of the efficient levels of subsidy to various persons. Second, the class consisting of stockholders, noteholders, and depositors of a bank probably coincided only roughly with the class of persons from whom it would have been efficient to collect the value of subsidies in order that the intermediary would make nonnegative profits. Third, implementation of subsidies by political intervention arguably has large costs (which are the main focus of textbook-style economic theory criticisms of such intervention) in terms of resource allocation ex post. Nevertheless, if (for either good or bad reasons) long-term contracts for intermediation relationships are made unenforceable in a legal system, then such recourse to ex post political intervention at times of severe economic dislocation may possibly implement the closest feasible approximation to the efficient allocation.

1980

The third historical episode we want to consider in support of our theory is a recent one: the imposition of selective credit controls by the Carter administration in 1980. At that time, unanticipated sharp increases in the price of petroleum and in the value of the dollar relative to foreign currencies had recently exacerbated problems in the agricultural and industrial sectors of the economy. The inflation rate was also high relative to its levels in recent history, and the administration had committed itself to reducing this rate quickly and substantially. To the extent that borrowers had expected to repay nominally fixed debts in an inflated currency, then, the cessation of inflation would raise their real indebtedness above its anticipated level. There were three reasons why this would be a problem for farmers and owners of small businesses that were dependent on intermediated credit. First, deflation would combine with changes in the price of oil and the exchange rate to lower their current profits. Second, this additional negative shock might force some heavily indebted borrowers to default and might make other borrowers ineligible to be extended further credit. Third, because market forces might not cause nominal interest rates to fall until after inflation were demonstrably under control (since nominal interest rates reflect subjectively anticipated rates of inflation and market participants might be skeptical of the seriousness or efficacy of the administration's plans to lower inflation), these borrowers might have to take out new loans that would have a very high real interest rate, assuming that inflation were successfully brought under control.

If the administration were attempting to adapt credit arrangements to the contingency of a tight-money policy conducted during a recession, then our analysis suggests that it should attempt to mitigate the incidence of these three effects on farm and small business borrowers. Moreover, our analysis suggests that the burden of its policy should fall most heavily on classes of credit market participant that were relatively lightly affected by the macroeconomic shocks that were affecting the borrowers so seriously. A prime example of such a lightly affected class of credit market participants were firms and workers in the urban service sector. Because these people were involved predominantly in domestic trade, the high exchange value of the dollar did not affect them as heavily as it affected exporters. Also, petroleum was a less significant input to production in this sector than it was in heavy industry or in agriculture (because of agriculture's reliance on petrochemical fertilizers).

As part of its monetary policy, the administration put into effect a set of selective credit controls. Prominent among these was a special reserve requirement on consumer installment credit. This reserve requirement could have been structured in a way that would have forced some states to relax usury law ceilings that were binding on such lending, but the opportunity to structure the requirement in that way was not taken. Credit for automobile and housing purchases—two hard-hit industries in the recession—was exempted from selective controls.[5]

Once again, the Carter administration's policy can be understood as an outcome either of an inefficient political process or of an attempt to approximate an ex ante efficient contract in a contingency for which explicit contractual provisions had not been made in the market. Schreft (1990) explains clearly why the policy of selective

credit constraint was inefficient from an ex post perspective. The fact that firms and unions in the automobile and construction industries are powerful lobbies certainly helps to account for the special treatment of those two industries. It is not necessary to choose between those two explanations of the policy, though. Selective credit controls may have been a reasonable attempt to approximate contingencies of an ex ante efficient contract, even though they did not constitute a perfect approximation. Therefore, political agents would find it easier to succeed in advocating such a policy than an egregiously inefficient one.

The selective credit controls imposed in 1980 can indeed be viewed as approximating contingencies of an ex ante efficient contract. To a considerable extent, consumer installment credit (for example, credit card usage) is a convenient means of payment rather than a significant part of households' strategies for the intertemporal allocation of their wealth. Since consumer installment credit was functioning this way, the special reserve requirement against this form of credit was an inducement to banks to constrain the liquidity of their customers who would otherwise draw on their credit. Had the requirement been structured in a way that would have mitigated state usury law constraints, part of its effect would have been achieved through price rationing rather than through the nonprice rationing that we have shown should occur. In the case of credit for automobile purchases and housing construction, the affected forms of credit to consumers were economically equivalent to the direct provision of financing to producers in industries that were clearly intended to be beneficiaries of the policy. Thus, the exemption of these transactions can be viewed as an implementable (albeit imperfect) way of targeting the controls as tightly as possible.

Conclusion

The three episodes considered here typify a pattern of legislative or regulatory interference in credit markets that clearly departs from laissez-faire treatment of a market for debt securities. We have argued that such interference might be consistent with an attempt ex post to approximate an ex ante efficient contract when an unforeseen contingency arises. A common feature of the examples discussed here is that legislative or regulatory intervention has occurred during severe recessions or depressions. We believe that the political system may be particularly prone to generating such outcomes during macroeconomic recessions. The results presented earlier in the paper explain this pattern in the following sense. When contracts that would govern long-term intermediation relationships are not completely enforceable (as in the actual economy), then the equilibrium of decentralized competition among intermediaries may closely resemble equilibrium in debt-securities markets. Legislative or regulatory intervention can have the effect of partially substituting for long-term contractual promises (which cannot always be enforced in the actual economy) in moving the economy towards the ex ante efficient allocation. This perspective on political intervention may help to explain why, although intervention has occurred many times in the history of the U.S. economy and has been recognized as being inefficient from an ex post perspective, there has been relatively little enthusiasm for systematic reforms that would limit its future scope.

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[1]Throughout the paper we will use the terms *textbook-style* and *liquidity-constraint* to refer to these two models, which we will describe in more detail below. Hayashi (1987) also has a discussion that makes clear the logical structure of these two theories. We adopt the *liquidity-constraint* terminology only because it has been used by Hayashi and by other proponents and expositors of the second theory.

[2]Note, however, that Greenspan (1991a, p. 245) has minimized the risk of this situation for the conduct of monetary policy.

[3]Chairman Greenspan's quoted remarks do not address explicitly the issue of possible regulatory distortion, but there seems to have been supervisory concern about the imbalance of lenders' portfolios—specifically, about the degree of exposure to the commercial real estate industry. Richard F. Syron (1991, p. 542), President of the Federal Reserve Bank of Boston, has stated to Congress that "there may have been a shift in regulatory sentiment about some New England institutions that, while understandable or even appropriate on a case-by-case basis, may have been perverse for the economy as a whole." President Bush and several officials of the executive branch have made statements blaming overzealous bank supervision for causing a "credit crunch." (See Cope and Atkinson 1991, Murray and Duke 1990.)

[4]Chairman Greenspan (1991c) could be understood as rejecting either of these two arguments. If his references to "inappropriate caution" and to the absence of "sensible balance" express reservations about imputing rational expectations to lenders he would certainly reject the first; and if he concurs with President Syron's (1991, p. 542) worry (fn. 3) that recent supervisory attitudes or practices may have been inappropriate, he would certainly reject the second of these textbook-style arguments.

[5]President Syron (1991, p. 540) of the Federal Reserve Bank of Boston has recently drawn attention to the costliness of switching intermediaries, but both he and President Keehn (1991, p. 544) of the Federal Reserve Bank of Chicago have noted that substantial amounts of such switching may quickly occur despite these costs.

[6]Researchers such as Gale and Hellwig (1985), Williamson (1986, 1987), and Boyd and Smith (1991) have formulated other models in which nonprice credit rationing is as efficient as our model, but neither these models nor the liquidity-constraint models relate the occurrence of such rationing to the magnitudes of macroeconomic aggregates.

[7]In Green and Oh 1991, we have referred to this allocation as the *efficient-contract allocation.*

[8]Hayashi 1987 provides a survey of theoretic and econometric work in this area.

[9]Whether the data on households' consumption patterns reflect such a deviation continues to be debated. See Christiano, Eichenbaum, and Marshall 1990; Runkle 1991; Keane and Runkle 1991; and Falk and Lee 1990.

[10]The formulation of, and solution method for, such a model have been developed in Oh 1991, and the time-series analysis that we envision here is currently in progress.

[11]Binding consumption constraints for low-income traders can also result in efficient-contract allocations that involve nonprice rationing.

[12]Alternatively, binding nonnegativity constraints for consumption of low-endowment traders might be taken to characterize recession. The implications would be qualitatively the same as those we discuss here.

[13]This solution is for an economy in which traders have additively separable, constant-relative-risk-aversion utility $x^{-1/2}$ with a discount factor of 0.96 and a marginal rate of intertemporal transformation $R = 1.04$. The solution is obtained by converting the optimization problem defining the efficient contract to an equivalent constrained optimization problem (described in Oh and Green, forthcoming), solving the Lagrangian for this problem, and verifying that the constraint qualification condition holds at the solution.

[14]Our schematic model is not calibrated to parameters of the actual economy. Examples with different parameters display widely varying levels of the marginal propensity to consume.

[1]Dewey (1910, p. 200) writes that "the bank adopted a policy of supplementing banking facilities in those sections where there was weakness. Biddle admitted that large amounts of the capital were given to those sections where there was a deficiency, because the production of the great staples seemed to require the most assistance in order to get them into the market. As Catterall [another economic historian] points out, one result of the branch system was the supplying of loans to the South and West at a cheaper rate than could have been possible without them."

[2]A monopolist has incentive to maintain a reputation for keeping its own long-term commitments and for dealing severely with customers who renege on their long-term commitments. Reputation effects are likely to be weak in a competitive market with many intermediaries, and defaulting customers in such a market may be able to recontract with new intermediaries and thus avoid reprisal for their default.

[3]It is not clear from McGrane 1924 whether Biddle's United States Bank accepted the cotton in settlement of accounts or whether Biddle himself became heavily involved in the cotton market. In view of Biddle's direct and close control of the bank, the distinction between these possibilities is immaterial to the point that we are making here.

[4]Dewey (1910, p. 244) notes that branches of the Bank of the United States had previously come to the aid of cotton growers in 1831–32. This evidence strengthens the case that Biddle's subsequent policy was consistent with an ongoing insurance relationship. Moreover, one factor in the difficulties of 1831–32 was a cholera outbreak. Whether the labor force of a particular producer had been lightly or heavily affected by cholera typifies the kind of information that might not be directly verifiable by a lender. In this respect, our model fits the earlier episode better than it fits the episode that we have chosen to recount. (It does so on the grounds that the lender's response is better documented.)

[5]Schreft (1990) documents these measures, but she interprets them rather differently than we do here.

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Graphing the Theory

An easy way to understand how the four allocations discussed in the text illustrate our theory is to see them depicted graphically. The figure in this box does just that.

The first of these four allocations is the *endowment*. Half of the traders in the economy receive 1.5 units of the good at date 1, and the other half receive 3.5 units. All traders receive 2 units of the good at date 2. Thus, there are two endowment points, $(y_1, z) = (1.5, 2.0)$ and $(y_2, z) = (3.5, 2.0)$. In the figure, we label these points as W_1 and W_2 respectively.

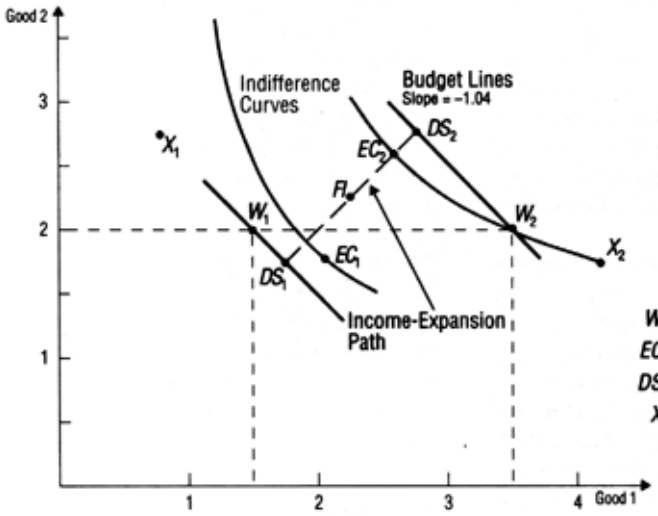
We assume that 1 unit of the good at date 1 can be transformed to 1.04 units of the good at date 2. In the textbook-style theory, then, each trader (or household) will have a budget line that passes through its endowment point and has slope −1.04. These budget lines are depicted by the straight lines in the figure. The competitive gross interest rate is the price of date-1 consumption in terms of date-2 consumption, and this competitive price must equal the marginal rate of intertemporal transformation 1.04. At this price, there is an income-expansion path depicted by the diagonal dashed line in the figure. (The path will be a ray from the origin, as depicted here, if traders have homothetic preferences; however, this feature is not assumed or implied by our theory.) The consumption points for traders in the second allocation, the *debt-securities equilibrium*, are the points where the traders' budget lines intersect this income-expansion path. These debt-securities consumption points are labeled DS_1 and DS_2 in the figure.

The consumption bundles that traders with the two endowment levels are assigned by the efficient contract are labeled as EC_1 and EC_2 in the figure. This *efficient-contract allocation* is the third allocation in the theory. Note that EC_2 is also on the income-expansion path. We argue later in the paper that this is the typical situation—that high-endowment traders seem to be optimizing at the competitive interest rate after a lump-sum subtraction from their endowments—whenever aggregate investment is positive.

Through each of the efficient-contract allocation points, we have drawn the indifference curve of the trader that receives the corresponding consumption bundle. Note that the net trades of traders with endowments W_1 and W_2 are $EC_1 - W_1$ and $EC_2 - W_2$ respectively. If a trader with endowment W_1 were to claim to have endowment W_2 and were to be given the net trade intended for the other type of trader, then the trader in question would consume $X_1 = W_1 + (EC_2 - W_2)$. This point X_1 is below the indifference curve through EC_1, so misrepresentation is not in the trader's interest. That is, the efficient-contract allocation is incentive compatible for traders whose endowment is W_1. Analogously, a trader with endowment W_2 would consume bundle $X_2 = W_2 + (EC_1 - W_1)$ as a consequence of misrepresenting its endowment. This consumption bundle is on the same indifference curve as is the trader's intended consumption bundle EC_2, so the trader does not gain from misrepresentation. Again, the efficient allocation is incentive compatible for traders with this endowment.

If the allocation were not constrained by incentive compatibility, then traders would choose ex ante to have a fourth allocation, the *full-insurance allocation FI*. In this allocation, all households consume identical bundles. Whether a trader receives a high or low endowment has no effect on what the trader consumes.

Efficient-Contract Allocation



$W_{1\&2}$ Endowment Points
$EC_{1\&2}$ Efficient-Contract Points
$DS_{1\&2}$ Debt-Securities Points
$X_{1\&2}$ Traders Misrepresenting Endowments
FI Full-Insurance Point

Figures 1 and 2

Two Types of Investment Constraint

Figure 1 **Nonbinding**

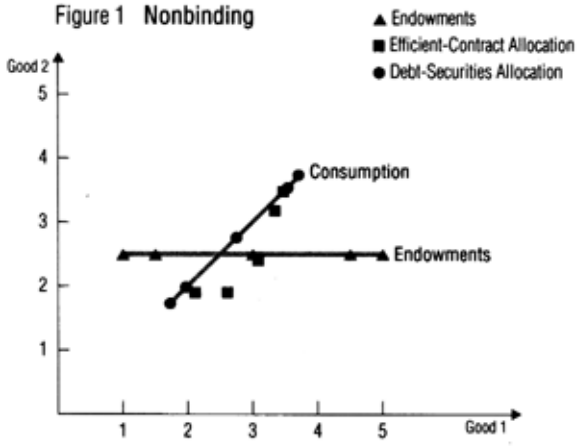


Figure 2 **Binding**