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and Small Business Finance

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THE INTERAGENCY TASK FORCE ON SMALL BUSINESS FINANCE

Board of Governors of the Federal Reserve System
Federal Deposit Insurance Corporation
Office of the Comptroller of the Currency
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Small Business Administration
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CREDIT RATIONING AND SMALL BUSINESS FINANCE

The case for governmental support of small business rests heavily on alleged financing difficulties linked to idiosyncrasies of the money and capital markets. Thus, commercial banks and other lenders allegedly exclude certain potential borrowers categorically by allocating credit according to non-price considerations. In periods of tight money, the "fringe of unsatisfied demand" is enlarged and the burden of adjustment is borne unduly by the relatively high risk borrower, i.e., small business, in large part. Testifying before Congress, Paul Samuelson (1952) explained that

...if you change the terms of Government bonds -- and that is all you can do to an individual bank by open market operations, for you have no other control, over him -- what he will do is not post a sign outside his doors saying "I am going to raise my interest charges." But, on the contrary, for a while at least, he might hold the same interest charges, but he is going to be more choosy in that margin of to whom he makes the loan. In other words, he rations out credit.

In summarizing the Federal Reserve System's (1958) study of small business finance, George Garvey observed that

[e]vidence presented...suggests that banks, and, possibly, certain other lenders, tend to have an effective ceiling on interest rates despite risk differentials and probably, below-legal maximums. These lenders tend to avoid raising their interest rates to the point where they would cover the more unusual varieties of risks. They may feel that businesses who cannot borrow under the prevailing conventional rates must be outside the zone of acceptable risks, or that not enough borrowers would be available to support a specialized type of financing, designed with unique protections to cope with the extra risk.
The high cost of lending to small concerns, the reluctance of most financial institutions to assume losses (even when they are averaged out by higher than normal earnings on nondefaulted loans), and such other elements as the managerial supervision involved in small business lending, taken together, seem to have resulted in some degree of imperfection in the financial mechanism. (p. 15).

Fifteen years later, in a study based on data from the Federal Reserve System's Quarterly Survey of Changes in Bank Lending Practices, Duane Harris (1974) observed that "[o]ur results confirm the existence of nonprice credit rationing by banks." Furthermore,

[credit rationing may have its greatest impact through the differential effects it sets in motion. We have seen that changes in loan term stringency were not applied equally to all customers. On the average, banks discriminated against new and nonlocal borrowers and, generally, against borrowers with the weakest customer relationship. (p. 239).

Despite such findings and impressive, if not incontrovertible, evidence based on casual empiricism, the very existence of credit rationing and hence its impact on small business remains in doubt. Part of this doubt arises from definitional ambiguity surrounding the credit rationing phenomenon. Probably more important, however, is the implacable question of why the lender should refuse to quote an appropriately high interest rate to a high risk borrower rather than categorically deny credit. Similarly, if the lender's cost of funds increases, should it not increase its own interest charges rather than expand the fringe of unsatisfied borrowers? These questions recur precisely because satisfactory explanations have not been forthcoming and
without such explanations the rationality and hence existence of credit rationing remains open to question.

This paper describes the behavior of credit markets, particularly as related to small business. Hence, the first section discusses inflexibility of interest rates which we view as a precondition for the existence of credit rationing. Section II describes a dynamic model of credit rationing which is predicated on interest rate rigidity. The model provides an understanding of the roles of customer heterogeneity, demand uncertainty, the dynamic nature of credit rationing, and the role of intermediation technology. Section III discusses small business attributes that tend to inhibit access to credit. The special feature of this treatment is its presentation within the framework of the credit rationing model. Also discussed are recent changes in banking practices and credit market conditions stemming from inflation. In particular, we explain how inflation induces banks toward more matched balance sheets, variable rate lending, and more stringent credit standards.

Two Types of Interest Rate Rigidity

Without interest rate rigidity, small businesses and other potential borrowers might confront high interest rates; but credit would be available. Yet availability, and its differential impact on potential borrowers of varying size, remain the most acrimonious themes in discussions of credit markets (e.g., see Case (1971) and Garvin (1971).

Credit markets differ from most goods markets in that attributes of the buyer or borrower affect the perceived profitability of sales or
loans. Indeed, the centrality of customer heterogeneity may well be the hallmark of financial intermediation, as distinct from other forms of intermediation such as commerce. Since each customer is unique—the uniqueness is usually modeled in terms of default risk characteristics but other customer attributes may be equally important—completely flexible interest rates should imply that the lender charges a distinct interest rate for each loan made. Thus, one form of potential interest rate rigidity arises from the possibility that lenders have fewer interest rates than customers. The limiting case, of course, is where the lender offers only one interest rate to all potential borrowers, as is common in the case of trade credit. Mortgage rates quoted by thrift institutions approximate trade credit in their cross-sectional invariance and commercial banks' apparent reluctance to lend at rates much higher than 3 or 4 percent above prime suggests similar rigidity (see Boltz and Campbell (1978)). Grouping of dissimilar customers into classes within which all are offered the same interest rate almost inevitably leads to excess demand and non-price credit rationing (see Jaffee and Modigliani (1969)). This is a form of equilibrium rationing rooted in customer heterogeneity (see Hodgman (1960, 1963) and Freimer and Gordon (1965)). Garvey's reference to lenders who "...avoid raising their interest rates to the point where they would cover the more unusual varieties of risk" can be interpreted as a reference to cross-sectional rigidity and the implied equilibrium form of rationing.
In contrast, Samuelson's suggestion that "...for a while at least..." the lender may not adjust interest charges to a change in costs refers to a dynamic adjustment problem. Price adjustment costs lead to an ephemeral form of non-price rationing the durability of which will depend on the magnitude of these costs relative to the cost of adjusting other lending terms. However, even if interest rate adjustment costs are small and interest rate changes are effected expeditiously, the allocation process may commonly display symptoms of disequilibrium rationing if credit markets are subject to frequent external shocks.

Sources of Price Rigidity: Collateral

A commonly cited source of cross-sectional rigidity is collateral based (see Jaffee and Modigliani (1969)). Consider a borrower who will undertake a specific project given that a loan of specified size is obtained. The project, which ultimately secures the loan, generates an uncertain cash flow. Increasing the interest rate on the loan has two distinct effects. First, it will monotonically increase the lender's return, provided the loan is fully repaid. Second, it will monotonically increase the probability that the loan will not be fully repaid. Thus, increases in the interest rate at low levels will raise the expected return on the loan as the increase in the payoff can be expected to dominate the effect of the increased probability of default. However, beyond some rate of interest, further increases in the loan rate can be expected to reduce the expected return as the effect of increased probability of default eventually outweighs the increases in the
conditional payoff. Ultimately, the project's uncertain cash flow sustains the debt and since the cash flow is independent of the interest rate charged, the probability of receiving the full contractual return must ultimately fall with increases in the contractual rate of interest. The expected return on the loan can therefore be expected to first rise with increases in the contractual interest rate, but it must ultimately decline. Details of the relationship between expected return and the contractual interest rate will ultimately depend on the probability distribution of cash flows associated with the project.

Thus, the cash flow associated with the project securing a loan establishes a finite ceiling on the optimal contractual interest rate where the expected return on the loan is a maximum. It will never pay for the lender to increase the contractual interest rate beyond that point; if for any reason the "appropriate" contractual rate for a potential borrower should exceed that maximum contractual rate, we can expect the lender to refuse credit.

**Adverse Selection and Incentive Effects.** Stiglitz and Weiss (1980) offer two alternative explanations for a ceiling on the maximum contractual loan rate. First, as a lender's contractual interest rate--presumably uniform across potential borrowers due to the lender's inability to discern individual default characteristics--is increased, riskier potential borrowers are drawn into the loan applicant pool and less risky applicants are driven out. Deterioration of the applicant pool is manifested in riskier assets. A maximum expected rate of return
is obtained at some finite contractual interest rate and increases in the contractual rate beyond that point result in declines in the expected rate of return for the lender. As in the previous case, the maximum contractual rate gives rise to the possibility of excess demand which must be dissipated using non-price discriminants.

Stiglitz and Weiss' second explanation for a contractual interest rate ceiling relates to the borrower's choice of projects. In situations with imperfect monitoring and control, the borrower may react to a higher interest rate by undertaking riskier projects. The result is again a positive relationship between the probability of default and the contractual rate of interest and a non-monotonic relationship between the risk adjusted expected rate of return on lending and the nominal or contractual rate of interest.

Information Costs. Jaffee and Russell (1979) provide a similar rationale for cross-sectional interest rate rigidities. They begin by recognizing that the potential borrowers' unique attributes are not always readily discernible by the lender. In general, the lender will need to incur costs to obtain (produce) information regarding the relevant attributes of potential borrowers. The presence of information costs inevitably leads the lender to an equilibrium with less than complete information.

Optimization of information production—unfettered by law, public regulation or social stigma—will have a number of likely entailments. First, inexpensive proxies, such as applicant's race or location of
collateral (neighborhood), may prove to be efficient (in both the statistical and economic senses) predictors of default. In the absence of social pressures this discovery can be expected to foster redlining, racial and sexual discrimination. Second, because information is incomplete, lenders will inevitably fail to distinguish among disparate potential borrowers. It will not be cost-effective to explore customer attributes beyond some point. Customers with moderate attribute differences will therefore be grouped together and each group will be offered a single interest rate, or not offered a loan. Excess demand will almost certainly result along with the necessity for non-price allocation rules.¹

Dynamic Rigidity. The phenomena discussed thus far provide bases for equilibrium rationing. Unexplained is the type of price rigidity described by Samuelson, i.e., gradual interest rate adjustment to altered market conditions. During adjustment periods, while interest rates are moving toward a higher equilibrium, quoted rates will spur excess demand. Partial or gradual adjustment processes have been widely applied in both theoretical and empirical studies of asset selection and are usually based on some sort of transaction cost argument. That is, rapid portfolio rebalancing and interest rate adjustment is somehow retarded by

¹ Still other explanations for equilibrium credit rationing have been offered by Fried and Howitt (1980) and Cukierman (1978). The former view the credit decision in the context of optimal risk-sharing between lender and borrower. The latter describes credit allocation as one component of a package of linked services intermediaries will sell to customers.
an adjustment cost. However, discussions of this dynamic rigidity seem to be most commonly grounded in an empirical appeal. Thus, before the adoption of formula prime rates, reference to the stickiness of prime was common. With the advent of a more volatile prime rate, deteriorating bank profits in periods of credit stringency continue to be explained in terms of a time consuming adjustment of prime to market rates of interest. The same argument is used to explain increasing bank profits when market interest rates recede in the early stages of recession and banks deliberately retard their downward adjustment of prime rates. Interpretation of temporal variations in the prime rate is a subtle problem not likely to yield to casual empiricism. Indeed, the very meaning of prime has changed in the recent more volatile milieu. Previously understood as a minimum interest rate charged by commercial banks, more recent experience indicates substantial lending by money center banks at interest rates considerably below prime.

Apparent temporal invariance of trade credit terms is still another ostensible illustration of dynamic interest rate rigidity. Indeed, trade credit may be the most compelling available example now that the prime rate has become more volatile and less well-defined. Mortgage pricing by thrift institutions also illustrates an apparent rigidity, but it would appear to be more cross-sectional than temporal in nature. Thrift institutions seem to offer a narrow range of publicly stated interest rates--usually expressed as functions of the loan to property value ratio--to potential borrowers at any given time, but mortgage rates seem to be as temporally flexible as the prime rate.
Interest Rate Rigidity. We are left with an assortment of arguments and appeals to fact to support the notion that in equilibrium, faced with disparate potential borrowers, lenders will not offer a market clearing distribution of interest rates. Consequent excess demand will need to be dissipated using non-price discriminants resulting in the categorical denial of credit to certain potential borrowers. This phenomenon is referred to as equilibrium rationing. In addition, some, including Samuelson and Jaffee-Modigliani, have argued that interest rate adjustments are costly, giving rise to a second dynamic or disequilibrium form of rationing.

The collateral, adverse selection and incentive effect arguments are related in that they posit a functional relationship between the contractual or nominal interest rate and the probability of loan default. This relationship, based on loan applicant heterogeneity, means that risk-adjusted expected rates of return will increase with contractual rates at low levels, but will fall with contractual rates at sufficiently high contractual interest rates. In the case of collateral and incentive effects, individual project cash flows are at issue whereas in the case of adverse selection, properties of the applicant pool--a collective potential cash flow generator--is the focus.

What appears to be non-price rationing from the vantage point of nominal or contractual interest rates--a borrower willing to pay in excess of the prevailing interest rate is denied credit--is indeed price rationing in terms of risk-adjusted expected rates of return. Projects
or collection of potential borrowers that offer the lender real returns lower than the acceptable minimum are rejected. Interest rate rigidity and the attendant non-price rationing arises from the lack of correspondence between contractual interest rates and expected rates of return—in turn, this lack of correspondence is rooted in the impact of customer heterogeneity on lender profitability.

We are ultimately left with information costs or some functional relation between the contractual interest rate and customer attributes as the basis for understanding cross-sectional interest rate rigidity and apart from efforts such as Jaffee-Russell (1976) and Stiglitz-Weiss (1980), this phenomenon remains to be adequately modeled. Temporal price rigidity has still less support in theory and seems to be grounded largely on appeals to casual empiricism. In the following section, we shall examine the process of credit rationing and its relation to alternate financial intermediation technologies, i.e., asset-transformation and brokering. We assume a rigid contractual interest rate at the outset in order to facilitate analysis of the links between types of financial intermediation and the extent of credit rationing. Thus our focus is on the how of credit rationing rather than the why.

II. The Credit Decision

In this section, we provide a framework for analyzing the lender's credit policy incorporating several elements. Both the quantity and the quality of loan demand are assumed to be uncertain. Thus, each potential
borrower is imbued with unique attributes and the number of such borrowers is not known, a priori. Recognizing the applicants' unique attributes (default characteristics) results in the rationing of less desirable clientele (those with unacceptably high default risk). The lending firm facing a rising marginal cost of loanable funds will need to fix the quantity of loans if it fixes the contractual interest rate. The necessity to choose both an interest rate and quantity raises the possibility of excess demand, irrespective of customer characteristics. In addition, we show how rationing will depend on lender attributes, especially the lender's chosen technology of financial intermediation.

As in the case of an inventory producer, the lender can borrow funds in advance to be loaned as applicants arrive. Alternatively, the lender can borrow funds only as demand is realized, as in the case of a custom producer. In the former situation, the lender functions as an asset-transformer, accepting the exposure of a mismatched balance sheet, due to possible insufficient loan demand. In addition, the asset-transformer sustains opportunity costs if loan demand exceeds the funds inventory. If however, the asset-transformer can accurately predict loan demand, he is rewarded with reduced borrowing cost. That is, by borrowing en masse, the asset-transformer obtains a reduced interest rate because of certainty provided to the funds supplier and

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2 A third intermediation technology, representing an intermediate case, is suggested by the intermediary that purchases a loan commitment. This commitment lender pays a fixed fee to ensure the availability of a fixed sum of funds at some pre-established and often constant marginal cost.
assorted fixed costs in transacting. As a broker, the lender operates without risk of excess demand (supply). The broker avoids exposure by borrowing funds only as needed. The lending firm obviously adapts its credit policy according to the type of financial intermediation it chooses to engage in.

In the following discussion, we assume a fixed contractual rate and seek to explain how rationing is conditioned by alternate financial intermediation technologies. Our model assumes credit applicants arrive randomly over a fixed time horizon, and while each loan is for a unit amount, the total number of applicants as well as their default characteristics are unknown a priori. As each potential borrower arrives, the lender considers the applicant's default risk, the planning horizon, and the amount of loans already granted. The lender then decides to accommodate or deny the applicant taking into account the effect of past decision, the immediate profitability of the current decision, and its impact on future decisions in the face of uncertainty as to the magnitude and composition of future loan demand. The importance of whether the lender functions as an asset-transformer or as a broker is evident here. In the former case, the lender has already purchased the loanable funds and the cost of overestimating demand is obviously greater than in the case of the broker. Thus, while stochastic

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3 The broker in our model is not without exposure since all loans involve default risk. However, as the intermediary's funds inventory shrinks toward zero, exposure to risk of over-supply diminishes and it consequently evolves toward the pure broker.
demand with rising marginal cost of funds leads to the possibility of excess demand, it will also affect the credit decision on each individual applicant.

The Model

In this subsection, we describe a model of the lending decision process. "Borrower Attributes and Uncertain Demand" explains the uncertainties in the demand function and the lender's decisions. "Intermediation Technology and the Cost of Funds" characterizes the lender technology, and "A Dynamic Programming Formulation" presents a dynamic programming formulation of the lender's decision problem. "Lender Technology, the Interest Rate, and Loanable Funds" provides added interpretation of the model. A more detailed exposition of the model is available in Deshmukh, Greenbaum and Kanatas (1980a).

Borrower Attributes and Uncertain Demand. Consider a lender who extends credit for a fixed term at an interest rate, r, to randomly arriving loan applicants over a fixed planning period [0, T]. We assume loan applicants arrive according to a Poisson process and that the random rate of arrival is influenced by the prevailing loan interest rate. For simplicity, each loan applicant requests a unit of credit, say, one dollar, so that the uncertainty in the quantity of loans demanded can be expressed in terms of the number and the temporal pattern of individual applicant arrivals.

In addition to the demand uncertainty, there is also uncertainty about the profitability of each potential loan due to the unique attributes of each applicant. Specifically, let $\theta$ denote the probability
that a particular customer will default on both principal and interest, so that the expected revenue from lending one dollar to a customer with the default characteristic $\theta$ is $((1-\theta)(1+r))$, which may be interpreted as the risk-adjusted return.

Without these uncertainties, the lender would know that exactly $N$ applicants will arrive in $[0, T]$ with known default characteristics $\theta_1, \ldots, \theta_N$. With a fixed interest rate, $r$, the lender could rank applicants in increasing order of default probability and satisfy the demand of the best $L(<N)$ customers, i.e., those for whom $(1-\theta)(1+r)$ exceeds the lender's marginal cost of borrowing. The $N$ minus $L$ riskiest customers would be rationed. With demand uncertainty, however, the lender's problem becomes considerably more complicated. At the time of applicant arrival, the lender should consider not only the immediate profitability of each potential loan, but also the successive loan decisions that will need to be made in the face of uncertainty about the number and quality of subsequent applicants.

More specifically, let $L_t$ denote the number of loans made through time $t$. If a new applicant arrives at $t$, the lender considers the default characteristic $\theta$ (which determines the expected loan revenue $(1-\theta)(1+r)$), takes into account $L_t$ (which may affect the marginal cost of borrowing to satisfy current and future demand) and the remaining time $(T-t)$ until the end of the planning horizon (during which any additional lending must be done under given credit market conditions). On the basis of this information, the lender decides to either satisfy the customer's
loan request or to reject the request in anticipation of better subsequent applicants. The accept decision is denoted as \( d=1 \) and the reject decision by \( d=0 \). Thus, after the decision at time \( t \), the total loans outstanding becomes \( (L_t + d) \) and remain at this level until the random arrival and optimal decision on the next customer. The process continues until the end of the planning horizon at time \( t = T \). Thus, the cumulative loan process evolves stochastically as illustrated in Figure 1 where arrival times, default rates and lender's decisions are shown on the horizontal axis and cumulative loans are shown on the vertical axis.

Customer \( i \) who arrives at time \( t_i \) and is denied a loan (i.e., \( d_t = 0 \)) on the basis of his default characteristic \( \theta_i \) is said to be rationed. On the other hand, if the asset-transformer's inventory of loanable funds, \( L \), is exhausted by some (random) time \( T \), then the arrivals between \( T \) and \( T \) will be denied credit irrespective of their default characteristics. The optimal rationing policy will depend upon the lender's chosen technology of intermediation which determines the lender's cost of funds, as described in the following subsection.

**Intermediation Technology and the Cost of Funds.** Profitability of a loan policy demands on both borrower and lender characteristics. Just as the borrower attribute, \( \theta \), defines a customer, the relevant lender characteristic is reflected in the cost of making a loan. The broker reduces search, information and other transactions costs involved in joining potential lenders and borrowers with complementary needs or tastes. This intermediation technology leads to a matched balance
Figure 1

The Cumulative Lending Process

The graph shows the cumulative lending process over time, denoted as $L_t$, with time points at $t_1, t_2, t_3, t_4, t_5, t_6, t_7, T$. The labels for the variables $\theta_{t_i}$ and $d_{t_i}$ are shown as a series of 1s and 0s, indicating the status or presence of each variable at the respective time points.
sheet. However, the intermediary engaged in qualitative asset-transformation deliberately mismatches its balance sheet and sustains a consequent risk. We call this latter type of intermediary an asset-transformer (see Niehans and Hewson (1976) and Niehans (1978)).

These differences in risk exposure of the two types of intermediaries are formulated here in terms of their cost of funds functions.

The broker, or custom producer, borrows loanable funds only as demand is realized according to a cost function $C_B(\cdot)$. In this way, the intermediary avoids any exposure associated with a loanable funds inventory. Thus, if an applicant arrives at time $t$, with $L_t$ loans outstanding, then the intermediary's marginal borrowing cost will be

$$[C_B(L_{t+1}) - C_B(L_t)].$$

As usual, we assume that $C_B(L_t)$ is convex and increasing in $L_t$.

The asset-transformer, or inventory producer, borrows a prespecified quantity of funds, $\bar{L}$, in advance of realizing any demand according to a cost function $C_A(\cdot)$ that is also increasing and convex in $L$. Loans are then made over $[0, T]$ as applicants arrive and are accepted until $L_t = \bar{L}$. Since the asset-transformer borrows $\bar{L}$ en masse at the outset,

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4 The broker in our model is hedged to the extent that he never borrows funds in advance of realizing demand. In the case of a pure broker, there would be no exposure at all and the emission of indirect claims would be superfluous.

5 Mismatching may be in terms of term-to-maturity, numeraire, divisibility, or some other attributes and the associated exposure may be in terms of interest rate risk, foreign exchange risk, oversupply or some other risk.
it reduces the uncertainty of its supplier and minimizes any fixed
borrowing (transaction) costs. We therefore assume that total and
marginal costs of borrowing are lower for the asset-transformer than the
broker, i.e.,

\[ C_A(L) \leq C_B(L) \quad \text{and} \quad C_A(L+1) - C_A(L) \leq C_B(L+1) - C_B(L), \quad \text{for all} \quad L \leq \bar{L}. \]

Having chosen \( \bar{L} \) prior to customer arrivals, the asset-transformer's
borrowing cost will not later affect its lending decisions. The broker,
however, incurs no borrowing cost in advance of realizing demand
(customer arrivals), but its cost of funds affects loan decisions and
increases with each loan approval. The asset-transformer bears the risk
of oversupply and incurs only a fixed cost \( C_A(\bar{L}) \). The custom producer
has no risk of oversupply and no fixed borrowing cost, but sustains a
rising marginal borrowing cost with each loan approval. The expected
profit maximization problem for the two types of lenders is formulated in
"A Dynamic Programming Formulation."

A Dynamic Programming Formulation. Since intermediaries are
distinguished exclusively in terms of their cost functions, their profit
maximization problem is similar and can be characterized without
identifying subscripts. We assume that there is no discounting and that
the lender's borrowing cost (including principal) denoted by \( C(L_t) \) is
sustained at the end of the planning horizon. For the sake of
comparability, we assume that \( L_t \leq \bar{L} \). Fixing \( \bar{L} \) is an analytical
simplification. A more general formulation would treat the choice of
as well as the intermediation technology as part of the lender's optimization problem (see Deshmukh, Greenbaum and Kanatas (1980b).

By a rationing policy, we mean a decision rule \( \delta \) that specifies a decision on each loan applicant on the basis of information available at the time of applicant arrival. If an applicant with default characteristic \( \theta \) arrives at time \( t \) and if the cumulative loans at that time is \( L_t = L \), then \( \delta(t,L,\theta) = 1 \) corresponds to an accept decision while \( \delta(t,L,\theta) = 0 \) means that the customer is rationed. Let \( V_\delta(t,L,\theta) \) denote the total expected profit under policy \( \delta \), given that a customer with default characteristic \( \theta \) has arrived at time \( t \) and that \( L \) is the cumulative lending done up to that time. Consider the decision on the first applicant. Integrating over the entire time interval \([0, T]\) and over all possible default characteristics \([0, 1]\), we have the total expected profit under policy \( \delta \),

\[
\Pi_\delta = \int_0^T \int_0^1 V_\delta(s,0,\theta)f(\theta)\lambda(r)e^{-\lambda(r)s}d\theta ds - C(0)e^{-\lambda(r)T}
\]

where \( s \) is the random time of arrival of the first applicant, \( \theta \) is the first applicant's default characteristic (with density \( f(\theta) \)) and the second term on the RHS represents the borrowing cost if no applicants arrive during the entire time interval (which has probability \( e^{-\lambda(r)T} \)).

The lender's objective is to determine an optimal credit policy \( \delta^* \) for the first applicant that will maximize \( \Pi_\delta \) for all possible values of \( s \) and \( \theta \). This is equivalent to maximizing \( V_\delta(t,L,\theta) \), which is the expected profit during the time interval \((s,T)\), given that the first applicant arrives at time \( s \) with characteristic \( \theta \). More generally, the lender wishes to determine an optimal policy \( \delta^* \) that will maximize \( V_\delta(t,L,\theta) \) for all \( t, L \) and \( \theta \).
With the arrival of an applicant, the expected revenue from the loan will be \((1-\theta)(1+r)\) if the lender grants the credit \((d=1)\) or zero if the loan application is rejected \((d=0)\). Regardless, cumulative loans are \((L+d)\) after the decision and the lender then waits a random time interval until the next applicant arrives. The optimal decision should maximize current return, \(d[(1-\theta)(1+r)]\), plus the expected future profit \(E[V(t+s, L+d, 0)]\), from the next customer onwards. Denoting the latter term by \(U(t,L+d)\), the lender's total maximum expected profit from the current customer onwards must satisfy \(V(t,L,\theta) = \max \{ [(1-\theta)(1+r)]+U(t,L+1), U(t,L) \}\) for all \(t, L,\) and \(\theta\). That is, the lender must decide if expected profits are greater if the present application is rejected and \(V(t,L,\theta) = U(t,L)\), or if it is accepted and \(V(t,L,\theta) = (1-\theta)(1+r) + U(t,L+1)\). Therefore, it is optimal to accommodate the current applicant (i.e., \(\delta^*(t,L,\theta)=1\)) if and only if \([(1-\theta)(1+r)] + U(t,L+1) > U(t,L)\).

Otherwise, the applicant should be rationed (i.e., \(\delta^*(t,L,\theta)=0\)). Note that \([U(t,L) - U(t,L+1)]\) is the expected marginal cost of accepting the current applicant in terms of foregone future opportunities due to higher borrowing costs (for the broker) or paucity of funds to service potentially better future applicants. Thus, the above inequality is the usual profit maximizing condition with the marginal cost function complicated as a result of uncertainties and intertemporal considerations.

Equivalently, we can solve for \(\theta\) and express the optimal rationing policy \(\delta^*\) in terms of a critical level of default risk

\[
\theta^*(t,L) = \left\{ \frac{(1+r) - [U(t,L) - U(t,L+1)]}{(1+r)} \right\} / (1+r), \quad t, L \geq 0.
\]

Thus the optimal policy provides credit if and only if the applicant's
default rate, \( \theta \), is less than or equal to \( \theta^*(t,L) \) which is the maximum acceptable default rate given that \( L \) loans have been made by time \( t \).

Expected long-run profits decrease in the current applicant's default rate \( \frac{\partial V(t,L,\theta)}{\partial \theta} \leq 0 \). Similarly, the closer the end of the planning horizon, the less is the value of optimally made loans, \( \frac{\partial V(t,L,\theta)}{\partial t} < 0 \), and \( \frac{\partial U(t,L)}{\partial t} < 0 \), since fewer customer arrivals and decision opportunities remain. In addition, since the marginal cost of borrowing is nonnegative and nondecreasing, committing fewer funds to loans by time \( t \) improves the benefit of future decisions and improves optimal expected profits from \( t \) onwards; however, this marginal advantage is less pronounced for lower values of \( L \),

\[
0 < V(t,L-1,\theta) - V(t,1,\theta) < V(t,L,\theta) - V(t,L+1,\theta).
\]

Moreover, the marginal advantage of reduced lending diminishes as the end of the planning period approaches,

\[
\frac{\partial}{\partial t} [V(t,L,\theta) - V(t,L+1,\theta)] \leq 0,
\]

and

\[
\frac{\partial}{\partial t} [U(t,L) - U(t,L+1)] \leq 0.
\]

Thus, although it is better to have more time left for future arrivals (and decision opportunities) and less funds committed, there are diminishing returns to committing fewer funds and the value of uncommitted funds diminishes with time. Hence, for any given quantity of loans, the lender will be more selective in evaluating earlier arriving
loan applicants and less selective with later applications. Irrespective of intermediation technology, the lender's optimal schedule of maximum default rates, $\theta^*(t,L)$, grows more lenient with time and for smaller amounts of loans already contracted. For proofs, see Deshmukh, Greenbaum, and Kanatas (1980a).

Lender Technology, the Interest Rate, and Loanable Funds. In Deshmukh, Greenbaum and Kanatas (1980a), we show that the broker will adopt a more stringent credit policy and will tend to ration more than the asset-transformer. In particular, we show that for all $t \in [0, T]$ and $L=0,1,2,...L-1$,

$$[U^A(t,L) - U^A(t,L+1)] \leq [U^B(t,L) - U^B(t,L+1)],$$

$$[V^A(t,L,\theta) - V^A(t,L+1,\theta)] \leq [V^B(t,L,\theta) - V^B(t,L+1,\theta)],$$

and

$$\theta^B(t,L) \leq \theta^A(t,L).$$

where A and B denote asset-transformer and broker, mnemonically. These inequalities indicate that the marginal expected opportunity cost of committing more funds is always lower for the asset-transformer than for the broker. Consequently, the asset-transformer will be less selective in its credit policy and by definition will ration less.

Having borrowed $L$ at the outset, the asset-transformer recognizes that only a limited demand can be accommodated. Facing homogeneous applicants, the lender would merely satisfy the first $L$. However, with heterogeneous customers, the lender evaluates each applicant in light of
potentially superior future opportunities, taking into account the remaining time and the loanable funds still available. Hence, less profitable or higher risk applicants will be rationed.

Since the broker does not borrow in anticipation of loan demand, deficient demand is not a problem. However, the broker is not necessarily more likely to ration a given applicant than is the asset-transformer. Consider an applicant with default risk $\theta$, arriving at time $t$, with $L$ loans already made. Since $\theta^B(t,L) < \theta^A(t,L)$, we know that the broker will be more selective in his credit policy than the asset-transformer. However, since the latter follows a less selective policy, all else the same, more loans are expected to have been granted by the asset-transformer at any given time. Therefore, the loan applicant arriving at time $t$ may be more likely to be rationed by the asset-transformer than by the broker. That is, if $L^A_t > L^B_t$ at time $t$, then we may have $\theta^B(t,L^B_t) > \theta^A(t,L^A_t)$ implying that the asset-transformer will be more selective at time $t$. However, since any new customer will be more likely to be rationed by the asset-transformer only if the latter has already made more loans than the broker, aggregate rationing is always less for the asset-transformer. Thus, the lower (zero) marginal cost of borrowing of the asset-transformer leads the latter to ration less than the broker.

For the asset-transformer, an increase in $\bar{L}$ will tend to decrease rationing. If the volume of loans outstanding at time $t$ is the same, then a greater $\bar{L}$ will induce the lender to be less selective because
However, if the lender has followed this less selective credit policy from the outset, then the loans granted by time $t$ would most likely exceed those attained with a lower $\bar{L}$. Thus, an applicant arriving at time $t$ may face a higher probability of being rationed even though the lender initially chose a greater $\bar{L}$. Thus, the lender’s optimal credit policy at time $t$ actually may be more selective with a larger $\bar{L}$, i.e., $\bar{A}^*(t, L_2) < \bar{A}^*(t, L_1)$ with $L_2 > L_1$ and $\bar{L}_2 > \bar{L}_1$. However, since this is possible only if the loans already made by time $t$ are greater, the aggregate amount of rationing must decrease as $\bar{L}$ is increased.

A greater $\bar{L}$ obviously means a lower chance of exhausting the supply of loanable funds, all else the same. However, since there is a cost to over-supply, the lender will tend to pursue a less selective credit policy and may exhaust his supply of funds earlier. Thus, the effect of $\bar{L}$ on the probability of confronting a "stockout" (insufficient funds) is ambiguous. As long as $\bar{L}$ is finite, there will be some probability of exhausting the funds inventory. The somewhat surprising result is that increasing $\bar{L}$ will not necessarily decrease the probability of realizing this possibility because the lender adapts by relaxing credit standards and reducing rationing. The higher $\bar{L}$ could ultimately result in the earlier exhaustion of funds. One might imagine the asset-transformer behaving as if all applicants were identified, in which case all would be accommodated until $\bar{L}$ loans were made. However, as indicated earlier, the lender can always do better by using the available information about
individual loan applicants. A change in $L$ will then lead to a change in credit standards with an indefinite effect on the probability of exhausting the available funds.

The effect of a change in the contractual loan rate, $r$, is similar for both types of lenders. A lower interest rate leads to more expected customer arrivals during any time interval $[t, T]$, and to a more selective credit policy on any given customer $(t, L, \theta)$. However, while rationing is expected to increase, the greater expected number of applicants will tend to increase the chance of prematurely exhausting the loanable funds.

Now, consider the riskiness of the applicant pool. A potential borrower with characteristic $\theta$, arriving at time $t$, when $L$ loans have already been made will appear more profitable (or less unprofitable) among a pool of riskier applicants than in one of lower risk; he will thus face a lower probability of being rationed. Thus, the lender does not consider the riskiness of the applicant in isolation, but rather relative to other potential borrowers. The lender's total expected profit would decrease as the applicant pool becomes riskier.

Finally, although we have taken the lender's intermediation technology as given, the choice of technology should be made endogenously on the basis of the distribution of demand and the lender's cost of funds. With certain demand, all lenders would choose to be asset-transformers because of the cost of funds advantage. However, with uncertain demand, an asset-transformer may be able to improve his expected profits by switching to a broker technology. We would expect to observe an
increasing tendency toward the broker technology as the uncertainty of demand increases since dispersion of demand increases the probability of experiencing excess demand (supply). In Deshmukh, Greenbaum and Kanatas (1980b), we show that increasing loan demand uncertainty, in the form of a mean-preserving spread of the loan interest rate distribution, does indeed increase the tendency for the intermediary to choose the broker mode of production. Thus, volatile interest rates induce financial intermediaries to move towards closer balance sheet matching--i.e., towards the broker technology, and consequently towards greater credit rationing.

III. Small Business Attributes and Credit Markets

We have provided a framework for analyzing credit rationing in which individual customer attributes and lender technologies play central roles. "Asset Valuation," "Short-Term Financial Management," and "Equity Financing" discusses selected attributes of small business that tend to place them among high 8 loan applicants. In "Credit Markets" we shall address recent developments in credit markets that have tended to exacerbate the financial difficulties of small business.

Asset Valuation. In our model, the 8 describing each loan applicant was assumed to be known by the lender. That is, all information regarding 8 is costlessly available to all lenders. However, lenders do not generally know 8 with certainty, but rather have access to information that aids in estimating 8. Moreover, such information is not
obtained costlessly and hence knowledge regarding \( \theta \) is always incomplete. Under such circumstances, high variance of \( \theta \) should predispose lenders to reject loan applicants as readily as would high expected values. A high variance of \( \theta \) for small business would be anticipated if information regarding small business is relatively costly since less information would then be collected (produced) under optimal conditions.

Although financial statements are a primary source of information on potential borrowers, two considerations tend to reduce their usefulness among small business. First, the importance of the "key person" tends to vary inversely with the size of a business and this human capital asset is not recorded in financial statements. Second, the tax system provides incentives to businesses and individuals to minimize their tax liabilities. The result may reduce the informational content of business financial statements thereby increasing the variance of \( \theta \). Although largely unsubstantiated, it appears this distorting impact may be especially important in the case of small business. The remainder of this subsection analyzes these two facets of small business.

Owner/manager of small business often represent significant assets of their firms because of their willingness to accept low wages, i.e., relative to their marginal revenue products. Discussions of this phenomenon are often couched in terms of the difficulty of replacing small business managers. However, there are two strands to the argument. Ultimately, the manager is a net asset if his wage is exceeded
by his marginal revenue product. This gap, which establishes the return stream on the human capital embodied in the owner/manager, may or may not be readily replaceable. The question turns on whether the return stream is ultimately attributable to an employee idiosyncrasy or an idiosyncrasy of small business. If the former, the return system may be difficult to replace and would accordingly be heavily discounted. If the return stream results from a special attribute of the business it may be readily replaceable and therefore receive a low discount rate.

Small businesses convey special benefits as an employer. One such benefit relates to the ability of small business to make (un)employment more divisible. When business is slack, the small business owner/manager normally will be offered partial employment rather than being summarily "laid-off." Assuming risk-aversion, the owner/manager would be willing to accept a lower wage in exchange for this reduced employment variance. A second benefit stems from the tax-sheltering capability of small business, including opportunities for transforming ordinary income into capital gains and taxable ordinary income into nontaxable income. Clearly, such benefits should induce owner/managers to accept a reduced wage, but they have little to do with the replaceability of management. Reasonably efficient labor markets would presumably produce many willing to accept reduced wages in exchange for such benefits.

On the other hand, the owner/manager's willingness to accept a low wage may be attributable to personal attributes; the return stream is then more uncertain and the appropriate discount rate applicable to the
human capital asset rises. Such would be the case when the wage gap is based on some specialized skill of the owner/manager or—what amounts to the same thing—a low opportunity cost. In such cases, the firm's human capital asset may be difficult to replace. However, this is not true for the human capital arising from the tax-shelter or partial employment argument. The return stream is less exposed in those cases precisely because the human capital element is readily replaceable.

Replaceable or not, the owner/manager's marginal revenue product often exceeds his wage rate and when properly capitalized this disparity becomes a substantial component of the firm's net worth. Accounting conventions ignore this asset presumably because the thinness of human capital markets complicates the valuation problem. In addition, the lack of appropriability of the asset limits its value to the firm's creditors. Human capital serves poorly as collateral for the same reason that it widens the gap between the value of the firm as a going enterprise and as a collection of marketable assets. Hence, the recorded net worth of small businesses will tend to be biased toward understatement and inefficient as an estimator of the firm's market value. Hence both the expected value and variance of θ for small business can be expected to increase.

Let us now return to the tax considerations for they further obscure the financial records of small business. So long as the ordinary income tax rate exceeds the capital gains tax rate, the small business owner/manager will be encouraged to save through the business, i.e.,
forego dividends. This tax avoidance vehicle is limited, however, for most businesses since the IRS taxes extraordinary corporate savings as if they were paid in dividends. In any case, corporate saving tends to strengthen the firm's financial statements. The most interesting case is the conversion of taxable ordinary income into nontaxable income. This transformation embraces a wide array of activities ranging from the clearly legal to the blatantly illegal. To the extent that business earnings are understated by such practices, the integrity of financial statements is jeopardized. The expected value of $\theta$ may or may not be reduced depending upon whether the firm's debts are personally guaranteed by owners. If personally guaranteed, the expected value of $\theta$ should increase, but without such guarantees, a reduction can be expected. In either case, the variance of $\theta$ should rise.

These arguments suggest that the substitution of a value-added tax (VAT) for an income tax might significantly affect small business. It would eliminate a tacit subsidy and might improve small business' access to credit. A VAT that would raise the same revenue as current income taxes would likely imply a higher effective tax rate on small businesses. However, by reducing the noise and bias in financial statements, the VAT might also reduce borrowing costs of small businesses. However, if the tax increase is sufficiently large, the

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6 A special attraction of commercial bank stock is its treatment as an exception in this regard. Presumably in order to discourage failures banks are allowed to retain as much of their earnings as they wish without penalty from the IRS.
increasingly accurate financial statements may indicate a deteriorated financial condition and the firm's borrowing cost might rise.

Short-Term Financial Management. Small business tends to encounter relatively acute short-term financing problems which tend to increase their riskiness as potential borrowers. These difficulties seem to be especially pronounced in the area of trade credit and are usually explained in terms of factor indivisibilities. That is, the owner/manager in a non-financial business is commonly motivated by a special skill in operations or marketing. Finance is typically viewed as a necessary concomitant but is an afterthought and size often limits the business' ability to staff the function with specialists.

Beyond these standard reasons, the small business has an additional disadvantage in the management of trade credit that helps to explain the superior collection experience of larger non-financial firms and financial institutions such as factors. The threats of small business, directed at recalcitrant customers, are both less punitive and less credible than those emanating from larger businesses or financial institutions. Short of costly legal action, the creditor's primary weapon is the threat of terminating supply. Assuming the threat is credible, the cost of sustaining the sanction would vary inversely with the size of the business making the threat since the customer's supply alternatives are likely to vary inversely with the size of any given supplier. Moreover, large businesses often have the added advantage of supplying an array of related goods and the supply of these can be
withheld as well. Thus, the debtor contemplating default can be expected to attach a higher cost to loss of supply from a large firm than from a smaller firm. Similarly, a financial institution that serves numerous firms in a given industry is likely to be able to withhold supply on behalf of all its clients. Hence, it can apply more restrictive sanctions against abusive trade credit users. The superior collection record of factors and larger firms is quite probably attributable to more skillful and objective front-end risk assessment resulting from specialization. However, it is also due to the punitive content of their threats and their credibility.

The relatively weak credibility of threats emanating from small business is rooted in the importance of any given customer to the firm. The more dependent the firm is on any individual customer, the greater the risks the firm should be willing to sustain in an effort to retain the customer. This risk manifests itself in terms of both deferrals of threats and deferrals of the implementation of threats. These problems of small business encourage the use of credit rating bureaus (both as a threat and as a source of information) and professional collectors such as factors.

In periods of volatile interest rates and credit stringency, the trade credit problems of smaller businesses tend to become magnified into more general liquidity problems. That is, weak credit assessment, monitoring and collection lead to ballooning of receivables. What was a simpler problem of poor quality receivables in a placid economic
environment deteriorates into a more serious liquidity problem in periods of tight credit. The upshot is once again a relatively high \( \theta \) which translates into a high probability of being confronted with credit rationing.

**Equity Financing.** Four commonly cited considerations allegedly inhibit small business' access to equity markets. First, owner/managers are often reluctant to jeopardize managerial control of their firms. Second, the control premium that the capital market often attaches to a larger block of stock may be jeopardized. Third, the sale of equity often necessitates disclosure of proprietary information. Finally, fixed costs in underwriting equity translate into high average costs for the small business.

To the extent that these considerations increase the cost of equity financing by small businesses, they will indirectly elevate \( \theta \). The higher cost of equity constrains the value of the collateral supporting debt and thereby contributes to the likelihood that the firm will be rationed in debt markets.

**Credit Markets**

The inflation of the past decade has altered commercial banks' lending practices with important implications for small business. Inflation reduced the real return of financial claims with fixed nominal

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7 Bank borrowing is often said to be preferred to public sale of debt because the bank protects business secrets that might require disclosure in the process of public sale of debt.
returns, diverted real resources to financial management, and reduced the
public's willingness to hold the conventional claims emitted by
commercial banks. Facing the choice of introducing new funding
instruments or passing into obsolescence, commercial banks discovered
liability management, a euphemism for high and volatile cost funding.
Liability management should be understood as an adaptive response to
increasingly constraining interest rate ceilings, with inflation
progressively tightening the constraint.

Having embraced liability management with the enthusiasm of a
Hobson's choice, commercial banks found their maturity mismatching
between assets and liabilities beyond acceptable bounds. The shortening
of liability maturities translated into acceptable exposure, especially
in light of increasingly volatile interest rates. Banks responded by
eschewing fixed rate loans and loan commitments. These longer-term
assets and commitments to purchase longer-term assets were replaced by
variable rate loans (prime-plus and LIBOR-plus) and commitments with two
implications for small business. First, banks' movement toward this
broker mode of intermediation meant increased credit rationing. Second,
interest rate risk previously absorbed by or dissipated within the
banking sector was now shifted to the borrower. In addition, inflation
increased the demand for credit further exacerbating the problem of
credit rationing. Let us briefly consider each of these effects.

Credit Rationing: The Supply Side. Using the model presented in
Section II, subsection "The Model," we found that brokers could be
expected to adopt stricter credit policies than asset-transformers and that these policies would mean greater credit rationing. In a related paper (Deshmukh, Greenbaum and Kanatas (1980b)), we have shown that an optimally chosen intermediation technology will depend on the dispersion of the loan demand distribution, defined in terms of interest rate volatility, and that increasing volatility induces the asset-transformer to move toward the broker's technology. The introduction of variable rate loans and loan commitments can be interpreted as a movement toward maturity matching in response to the shortened maturities of bank liabilities resulting from inflation, interest rate ceilings and legal reserve requirements. But our analysis predicts that the equilibrium degree of balance sheet matching should exceed that observed before the onset of inflation and the introduction of liability management, i.e., the banking system should have moved toward the broker technology with attendant increased credit rationing of small business.

Moreover, this conclusion appeals intuitively. If the increased level of nominal interest rates had not forced banks to alter their liability offerings, the increased volatility of nominal interest rates would nevertheless have brought into question the prevailing degree of mismatching. Thus, if banks saw interest rates as permanently more volatile, they would have confronted choices of accepting a higher probability of insolvency, augmenting net worth, hedging in forward markets, or hedging internally by more closely matching their assets and liabilities. The last alternative was likely to be employed to some
degree in light of the nascent state of development of the relevant forward markets and the high cost of net worth augmentation, especially in terms of greatest need.

Credit Risk and Interest Rate Exposure. Our second point is that the introduction of variable rate loans and loan commitments shifted risk to the small business and thereby increased the prospect of default on loans to small business. Fixed rate loans provided a natural hedge for non-financial businesses with substantial plant and equipment and goods inventories. The substitution of variable rate loans meant that banks achieved more nearly matched balance sheets by increasing the maturity mismatching in the balance sheets of their customers. Hence reduced interest rate exposure among banks meant increased interest rate exposure among bank borrowers implying an increase in \( \Theta \) among the increasingly mismatched bank customers. The deterioration in the loan applicant pool operates as a countervailing force offsetting the risk reduction achieved by closer maturity matching among banks. The banks could therefore, be expected to alter their credit policies, devoting greater resources to monitoring--another manifestation of inflation waste--and perhaps placing greater emphasis on secured lending.

The case of the loan commitment is even clearer. Availability of fixed rate loan commitments permitted small businesses to hedge against variations in both their default (credit) risk premium and the market (prime) interest rate. Substitution of prime-plus commitments for fixed rate commitments eliminates the opportunity to hedge variations in
prime. Instead, the commitment provides the more limited protection against variation in the mark-up which is insurance against deterioration in the firm's credit rating. Since the commitment guarantees availability of funds at prime-plus, it can be viewed as also insuring against changes in the bank's credit policy that might exclude the commitment owner (i.e., the critical $p$ will not be reduced to exclude the commitment owner). The retreat by banks from fixed rate commitments means added risk is transferred to the small business sector.  

The emergence of financial futures markets at about the time that commercial banks withdrew from the market for fixed rate commitments was not a mere coincidence. Financial futures are imperfect substitutes for loan commitments in that they provide an opportunity to hedge market interest rate variations, but provide no insurance against lack of credit availability owing to either credit risk deterioration or changes in lender standards.  

In fact, the variable rate loan commitment together with the futures hedge provides a risk abatement opportunity approximating that offered by the fixed rate loan commitment. The principal difference is in the distinction between the option and the

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8 For a detailed discussion of bank loan commitments as put options, see Thakor, Hong and Greenbaum (1980).

9 Although prime rate futures contracts are not traded—nor are they likely to be given the mechanics of prime rate determination—Treasury Bill, Note an Bond contracts are available along with two GNMA contracts. Furthermore, these markets are growing rapidly and new CD and Euro-dollar contracts await the approval of the Commodities Futures Trading Commission.
futures contract. Whereas the former provides a nonexercise alternative and therefore a truncated distribution of returns, the futures contract is a commitment to deliver or take delivery and therefore provides a less valuable symmetrical distribution of returns.

Nevertheless, small businesses might well use financial futures to fill the void created by banks' retreat from the fixed rate commitment market. Alternatively, banks might themselves use interest rate futures to re-enter the fixed rate commitment market. The financial futures market is presently in a very early stage in its development and despite its rapid growth very few small businesses or small banks currently use the market (see Treasury-Fed Study (1979)). Public regulation and lack of familiarity with a new technical vocabulary--financial futures were first traded in 1975--are important in explaining the deliberate pace at which end-users have entered the financial futures market. Margin requirements and the singular "marking to the market" represent more basic and formidable barriers to the use of the futures market. 10

Inflation, Credit Demand and Credit Rationing. Finally, our model of credit rationing suggests yet another deleterious impact on small business resulting from inflation. We have already described a supply-side effect whereby inflation that induces interest rate volatility will lead intermediaries away from asset-transformation and

10 The margin problem suggests that commercial banks may yet use financial futures to hedge some of the risk associated with re-entering the fixed rate commitment market. Alternatively, the exchanges may develop options contracts for debt instruments.
toward the broker's mode of production with an attendant increase in credit rationing. Hence, small business should experience decreased access to credit markets. In addition, a demand-side phenomenon leads to the same result—increased credit rationing on the basis of customer attributes. If interest payments are tax deductible, increased inflation reduces the real, after-tax cost of borrowing, provided the inflation is impounded in the nominal interest rate. Effectively, the inflation makes part of the principal as well as the interest tax deductible. Thus, rising inflation rates should lead to increased demand for credit—increasing probabilistic rates of loan applicant arrivals in our model—provided the interest rate in the loan demand function is interpreted appropriately. The increased demand for credit will increase the amount of credit rationing, *ceteris paribus*, further disadvantaging small businesses having higher default risk probabilities.

IV. Conclusion

This paper has discussed three disparate but related facets of small business finance. First, we examined explanations for interest rate rigidity, a precondition for credit rationing. We drew a distinction between contractual and risk-adjusted interest rates and observed that rigidity in the former is consistent with flexibility of the latter. Customer heterogeneity combined with costly information appear to be the firmest foundations for interest rate rigidities and equilibrium credit rationing.
After reviewing explanations for interest rate rigidity, we presented a model of the credit rationing process in which the composition and magnitude of loan demand are uncertain and lender decisions are made sequentially. Individual borrower attributes and intermediation technologies are modelled explicitly. We were able to conclude that in general brokers will tend to be more selective in their credit policies than asset-transformers. In a related paper (Deshmukh, Greenbaum and Kanatas (1980b)), we showed that an optimally chosen lender technology will depend on the dispersion of loan demand and that increased dispersion in terms of a mean preserving spread of the interest rate distribution will induce asset-transformers to shift towards the broker's technology. Combining the results of these two papers permits us to conclude that if inflation increases interest rate volatility, it will also lead to increased credit rationing.

The third part of our paper presents a discussion of selected small business attributes—especially as they relate to asset-valuation, short-term financial management and equity financing. We related these widely recognized features of small business to borrowing problems as framed in the context of our credit rationing model. On the basis of our discussion of asset valuation problems, we conjecture that the substitution of a value-added tax for the present income tax might increase the availability of credit to small business. However, this advantage could quite possibly come at the cost of a higher tax burden. We proceeded to discuss recent changes in commercial banking practices,
particularly as they related to fixed and variable rate lending and forward market credit hedges. These phenomena are again interpreted in the context of our model and partly suggested by the model and its antecedents.

We found that inflation has induced increased credit rationing in two ways. First, concomitant increased interest rate volatility has induced financial intermediaries to shift away from asset-transformation and toward the broker mode of operation. This shift in intermediation technology results in increased credit rationing. This supply-side phenomenon is complemented by a demand side effect. If interest payments are tax deductible and nominal interest rates impound inflation expectations, rising inflation should lead to reduced after-tax real cost of borrowing. With an appropriate interpretation of the interest rate in our loan demand function, we obtain an inverse relationship between the inflation rate and the quantity of credit demanded—the probabilistic loan applicant arrival rate in our model. The increased demand for credit associated with inflation leads to increased credit rationing and probably reduced access to credit markets by small business. In addition, increased maturity matching by banks has led to a shifting of interest rate risk to small business increasing the default (credit) risk on loans to small business. The deterioration in the quality of the loan applicant pool suggests that banks should be altering credit policies in order to ensure their risk abatement efforts in closer maturity matching. Such credit policy changes might plausibly include greater
resource commitments to monitoring loans and perhaps also greater emphasis on secured lending. These changes might further disadvantage small business in gaining access to credit markets. We proceeded to briefly consider a financial innovation, the emergence of the financial futures market, through which small business may learn to shift at least some of the increased risk rooted in inflation.
References


References - contd.


