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Credit Markets: A Theory of Indirect Lending**

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INFORMATION COSTS AND THE ORGANIZATION OF CREDIT MARKETS: A THEORY OF INDIRECT LENDING

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This paper explains indirect lending as a strategy for reducing a bank's cost of screening borrowers. Commercial banks appear to "ration" credit by rejecting some direct loan applicants, although they accept higher-risk borrowers who apply for loans indirectly through retailers. However, the more thorough credit check on direct loans causes applicants to sort themselves according to risk. Indirect applicants signal their higher risk through their choice of financing. Since banks gather more accurate information on direct applicants, the two types of contracts should differ in predictable ways. These implications are tested with Federal Reserve data on 5,000 automobile loans.

1. INTRODUCTION

"INSTANT CREDIT! NO CREDIT CHECK!" Such advertisements are common in many areas. The existence of such lenders contradicts the stereotype of lenders as cautious decision makers who run detailed credit checks on applicants. It also raises an interesting question: since the promise not to run a credit check would seemingly attract higher-risk applicants, wouldn't this raise the value of information about each applicant and prompt the wealth maximizing lender to conduct *more* sorting? This paper demonstrates that the answer to this question is no, when a reputation for "easy credit" is being used as a sorting device. Although we have never identified a situation in which lenders make loans with literally no information about the borrower, reliance on a less radical version of this strategy is far more common in consumer lending than is generally recognized.

The contracts that commercial banks negotiate when making loans for durable goods are characterized by a rather curious dichotomy. Commercial banks that offer "direct" loans for goods such as automobiles and appliances require their applicants to submit to a credit check. Some applicants are rejected after this check, instead of receiving loans at higher, risk-adjusted rates. However, these same banks hold in their portfolios a sizeable volume of consumer loans made by retail automobile and appliance dealers.¹ These "indirect loans" are made at the point of sale to borrowers the bank never sees. After devoting resources to carefully screen their direct applicants and rejecting some high-risk customers, why would banks purchase loans made outside the bank by retail dealers who may or may not have screened their applicants as rigorously?

The observation that banks reject applicants instead of raising the interest rate has been labeled "credit rationing". Over the last decade economists have offered a variety of explanations for why the practice exists. Some attribute it to market segmentation created when lenders specialize in servicing specific risk categories.²

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¹ For example, commercial banks have held over half of all the automobile installment credit (dollar value) extended over the last twenty-five years, in either direct or indirect form. In each of the years from 1963 to 1980 the amount of indirect (dealer made-bank held) paper exceeded the amount of direct loans. See Weber [1984].

² The issue of whether consumer lenders specialize in specific risk classes has been central to studies of consumer credit availability. For a discussion of segmentation by risk, as well as empirical evidence, see Boczar [1978].

More recent explanations have focused on the costs of screening applicants. In an influential paper Stiglitz and Weiss [1981] argue that when banks are unable to distinguish between borrowers according to inherent risk, adverse selection dictates that raising the interest rate can reduce the bank's expected return on its portfolio. Thus, banks turn away some borrowers who would have been willing to pay a higher rate.³

To our knowledge, the widespread practice of indirect lending has not been incorporated into previous models of credit rationing, nor have researchers examined the more fundamental question of why consumer durable lending is arranged in this way. Banking trade journals commonly refer to indirect lending as a means of expanding a bank's customer base, a marketing tool for reaching new borrowers.⁴ This rationale is vague and not particularly helpful for understanding why a bank would choose this method of gaining customers over other marketing tools, or even what kind of customers the bank might be after.

This paper offers a theory to explain why banks lend indirectly. Borrowers are encouraged to reveal their knowledge of their own inherent risk through the process of choosing where to apply for a loan. This reduces the sorting burden on the bank. An important implication of the theory is that at least some of the observed segmentation in lending for consumer durables (and alleged instances of credit rationing) is an illusion, intentionally created by the bank to reduce the screening costs associated with lending across risk categories.

The value of self-selection schemes for producing information is rapidly being recognized and incorporated into economic models. The original self-selection models formulated a decade ago were used to explain hiring practices in labor markets. Job applicants could be induced to reveal information about their productivity through their choice of where to apply for jobs. Similarly, in the context of credit markets, loan applicants are induced to reveal information about their default risk through their choice of where to apply for loans.

Although the general self-selection concept is now well known, its applications are many and varied, and can have surprisingly different implications depending upon the contract being explained. Smith [1987] has provided a recent example related to credit markets. She employs a self-selection model similar to the one in this paper to explain a supplier's decision to offer wholesale trade credit to buyers of intermediate goods. In both her model and ours, information about default risk is revealed through the borrower's choice of financing. However, the objectives of the decision makers who use the revealed information are different in the two models, creating some interesting contrasts which we shall address below.

Section II outlines the conditions that we assume characterize the lending market and describes how a bank could reduce its screening costs by persuading applicants to self-select. The theory explains why lenders incur costly credit checks for some of their borrowers but not for others. It also explains why the customers who are checked are those who appear to be least likely to default. Section III demonstrates that a bank can implement this type of self-selection/testing mechanism by lending indirectly through retail dealers. The theory implies differences between direct and indirect borrowers, as well as in the structure and performance of their respective loan contracts held in bank portfolios and the subsequent default rates. In section IV we use data from

³ In a recent survey article, Stiglitz [1987] refers to credit rationing as a prime example of the way in which quality depends on price in markets. He also notes that relatively little empirical evidence has been brought to bear on the subject, either to test the various credit rationing models or to better define the observation of credit rationing itself. Although our paper does not attempt to "test" any particular credit-rationing model, it does suggest a lending strategy which reduces the information costs that lead to adverse selection. In other words, indirect lending reduces the frequency with which credit rationing would be observed for consumer durables

⁴ For example, consider the following passage from Conlan [1983, p. 34]: "(The indirect loan) is still the entry to all kinds of other business. We get the indirect loan. We pursue the new individual customer for checking and saving accounts. We try to become their bank when they need a student loan, a vacation loan, a boat loan, a second mortgage loan, a personal computer loan or anything else.

a Federal Reserve survey of member banks to test these implications and the accuracy of our "sorting" rationale for indirect lending.

Section V offers concluding remarks.

II. BORROWER SCREENING AND SELF SELECTION

A lender's nominal expected return on a loan is a function of the contract interest rate and the likelihood of repayment. The banking literature has traditionally assumed that lenders adjust contracts to customers of marginally higher risk by increasing the contract interest rate. Although this understates the bank's options in adjusting loan contracts (since other contract margins also influence the probability of default), for simplicity we will begin by assuming that the interest rate is the sole adjustment margin. This assumption is relaxed in subsequent sections.

The inclusion of a risk premium in the contract interest rate is contingent, of course, on the bank's ability to determine the relative riskiness of borrowers at the time the loan is made.⁵ We assume that a wealth-maximizing lender makes the decision to grant a consumer loan in two steps. The first step involves collection of the information about borrowers necessary to sort them into appropriate risk categories. The second step consists of negotiating the contract terms, contingent on information gathered in step one.

The process of sorting borrowers, even into as few as two risk categories, requires that the lender gather information on all applicants. However, the lender need not conduct all the sorting. Low-risk borrowers have an incentive to distinguish themselves from more risky applicants in order to obtain lower interest rates. If applicants have better ex ante information than the bank, it is possible for the lender to reduce its total costs of screening by asking applicants to declare their information, that is, to self select into the appropriate risk category.

Of course, since the lowest interest rates attach to loans of least risk, all borrowers have some incentive to declare themselves to be low risk. A bank must do some screening of its own to verify an applicant's declarations. One method of deterring misrepresentation is to announce that a test (credit check) will be administered to all those applicants who claim to be low risk. Applicants receive the lower rate only after the bank verifies their claim.

Readers familiar with self-selection models applied to labor markets at this point will recognize the similarity of those theories to our characterization of credit markets. The existence of equilibria in self-selection/testing models has been well established in the labor market literature. One such model by Guasch and Weiss [1980] is particularly useful for illustrating our theory. They assume that job applicants can formulate estimates of their own productivity based on information that employers cannot costlessly observe. One strategy available to employers to reduce the cost of screening applicants is to administer a test which reveals information about true productivity. Based on the results of the test, workers are paid wages equal to their revealed marginal products. Alternatively, a firm could choose not to test applicants, and pay workers a wage equal to the average product of those not tested. Testing firms could charge applicants a testing fee such that only those with higher estimates of their own productivity would choose to apply. In this model, Guasch and Weiss derive a market equilibrium in which some firms test and others do not.

⁵ The assumption that banks could not distinguish between borrowers was the driving force behind the Stiglitz and Weiss [1981] model of credit rationing. In their model, the problem of adverse selection dictated that the bank would refuse to lend at interest rates above some critical level, generating non-price rationing despite the presence of excess demand at the posted rate.

Our theory of self-selection in credit markets parallels the Guasch and Weiss model. It is based on the following assumptions.

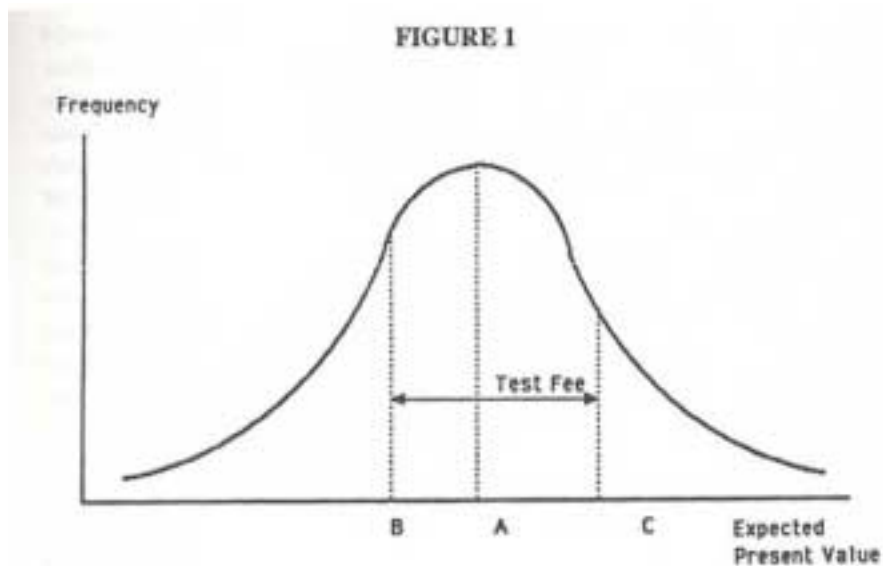
1. The consumer credit market consists of borrowers and lenders, each of whom wishes to maximize their expected present value of the loan contract.
2. The population of borrowers is heterogeneous with respect to probability of default.
3. No potential borrower knows with certainty whether or not he/she will default. However, there exist certain observable characteristics which determine *probability* of default. Each borrower possesses information on these characteristics and can determine the probability of his/her own default.
4. Lenders know the relationship between certain observable borrower characteristics and probability of default. They also know the distribution of these characteristics across the borrower population. However, prior to testing they cannot observe the characteristics for any particular borrower and cannot determine his/her default probability.
5. There exists a test (credit check) which can be administered at a constant, non-zero cost. The test reveals to the lender those borrower characteristics from which a default probability can be determined.
6. For at least some borrowers the value of the information revealed by the test (in terms of revealing a relatively lower probability of default) is greater than the cost of the test.

Figure 1 illustrates the logic of credit market self-selection. The horizontal axis measures the *expected present value (EPV)* of a loan of given size and duration, at some risk-free rate of interest. For example, the promise to pay \$100 one year from today with perfect certainty at 10 percent interest has an EPV of \$90.90. This point is measured at the extreme right with decreasing EPV (due to higher probability of default) as you move to the left. The frequency of borrowers at each level of EPV is measured on the vertical axis. For simplicity assume a normal distribution of borrowers with respect to probability of default and that this distribution is known to the lender.

By assumption, if the lender does no screening, borrowers are indistinguishable at the time the loan is made. Therefore, the contract interest rate would be the same for all borrowers and equal to the risk-free rate of interest plus a risk premium reflecting the *average* default probability for the borrower population. The resulting loans would have an EPV as illustrated by point A in Figure 1.

Now, suppose the lender implements a self-selection mechanism by offering borrowers a choice of application procedures. For clarity, imagine the borrower choosing between two application desks. At the first desk, the borrower undergoes no credit check and receives a standardized contract with a risk premium equal to the average of those untested (see Figure 1, point B). Alternatively, if the borrower believes his risk is lower than average, he can apply at the second desk where the bank administers a test (credit check) designed to reveal the borrower's observable characteristics. This information allows it to determine where each borrower falls in the population distribution. Those applying at this desk pay the risk-free rate plus a risk premium reflecting their own propensity to default. In other words, their contract contains an interest rate tailored to their particular borrower characteristics. The credit check becomes a necessary condition for obtaining a below-average interest rate.

If there is no cost to taking the test, wealth maximization implies that only those applicants who expect to reveal themselves to be lower than average risk will take the test. However, under these conditions the limiting case derives in which only one individual at the extreme left of the distribution will choose not to test. As individuals in the right hand portion of the distribution take the test, the average risk of the untested portion



will rise, prompting an increasing number of applicants to distinguish themselves as better than average risks.⁶ Obviously, for the scheme to reduce the bank's screening costs at all, individuals applying at the testing desk must be forced to bear some extra cost relative to the first desk where no credit check is conducted.

The bank could charge a testing fee. Any fee greater than zero would induce some self selection because potential borrowers would only choose to be tested at the second desk if their EPV is above the average by an amount equal to or greater than the test fee. In Figure 1, BC is the measure of one possible test fee. Given this fee, our theory implies that only individuals with EPV greater than C will test. Those below C will not. The average EPV of the untested will be B.

The number of applicants who self select to the non-testing desk rises with the testing fee. Higher-risk borrowers have no incentive to submit to the credit check since they would pay a higher interest rate that reflects their true probability of default, plus the application fee. The knowledge that an applicant considers himself higher risk is implicitly (and more cheaply) conveyed when the individual self selects to the first loan desk for the loan at the average rate.⁷ As Guasch and Weiss have shown under analogous assumptions, this produces a

⁶ This is, of course, the classic "lemons" problem characterized by Akerlof [1970].

⁷ The G-W model differs from our assumptions regarding credit markets in two ways. They construct their model so that workers either pass or fail a productivity test, as opposed to our model in which borrowers undergoing a credit check reveal to the bank their true probability of default and are offered an interest rate reflecting their revealed risk. Note also that in the G-W model firms may either test or not test, but the model does not consider the possibility of doing both (via two application desks). Consequently, a testing firm must have some method of preventing workers who have been revealed to have below average marginal products from leaving and applying at firms paying an average wage. If this occurs, the self-selection incentive is reduced since the penalty for false declaration (the lower than average wage) is eliminated. For this reason, employers in the G-W model are assumed to know the employment history of workers. Consequently, if a worker previously employed at a testing firm applies at a non-testing firm he reveals himself to be a worker of lower-than-average productivity. Otherwise, he would never have left the former employer for another paying only an average wage. The non-testing employer would reject such an applicant.

In our model, both strategies are employed at the same firm. If the test is perfect, false declaration never pays, since there is no possibility of gaining a lower rate than deserved. The explicit testing fee charged to borrowers ensures that self-selection will occur, since some borrowers will not find it worthwhile to be tested. However, if the test is subject to some error, possible gains to high-risk applicant derive from applying for lower-risk loans. To reinforce the incentives to self select, some additional assumptions are necessary to enforce the penalty for misdeclaration. These assumptions are discussed in the following sections, when testing error is allowed.

credit market equilibrium characterized by two types of borrowers, those who choose to be tested and those who do not.

Do lenders actually employ a "two-desk" strategy to lend across risk categories? In the following section we interpret indirect lending as just such a mechanism for prompting borrowers to sort themselves according to risk.

III. DIRECT VS. INDIRECT LENDING

Lending Through a Dealer

Instead of locating both application desks together, assume the bank moves the no-testing loan desk out to the retail dealership. Acting now as an agent of the bank, the dealer makes loans at a rate reflecting the average risk of those who choose not to apply directly at the bank.⁸ What would be the advantage of implementing the two-desk strategy in this way?

In the course of loaning to consumers for durable goods a bank not only incurs the costs of collecting information about applicants, but it also incurs costs of locating potential borrowers. Borrowers incur a cost associated with identifying a lender and negotiating the loan agreement. These costs increase with the physical distance between the retail dealership and the bank. An agent of the bank placed at the point of sale reduces these transaction costs. Consequently, indirect lending allows the bank to save on the costs of both contacting and screening borrowers.

The credibility of our rationale for indirect lending depends, in part, upon how closely typical indirect lending relationships match the conditions specified by the model. Several apparent discrepancies require some additional explanation. First, the bank's lending strategy in section II was characterized for simplicity as test vs. not test, an all-or-nothing approach. However, the logic of the self-selection process makes it clear that the real issue is how much screening is conducted. So long as higher-risk borrowers are screened less than low-risk borrowers, the bank saves by promoting borrower self selection. We assume that in putting an application desk at the dealership, the bank expects the dealer/agent to conduct some screening of borrowers, but less than would be done for the bank's direct loans.

This raises another question. Even casual experience with retail dealers confirms that they typically require their customers purchasing on credit to complete an application form that is similar if not identical to the

⁸ We assume that there exists a demand for durable good credit, and that buyers value the convenience of point-of-sale financing. By providing the opportunity for buyers to obtain credit while shopping for the good, the retail dealer lowers the buyer's transaction costs. However, since many dealer-made loans are held by dealers themselves there may be other reasons why dealers offer to finance the purchase of their goods. One interesting explanation is contained in Laband and Maloney [1988]. They suggest that sellers offer to hold their own loans as a pledge to the buyer that product defects will be corrected. Since buyers can legally default on loans if the product fails to perform, the seller stands to lose if the customer is not satisfied. Sellers that advertise this willingness to hold the risk are making a pledge of good faith that serves the same purpose as a more formal product warranty. assume the dealer provides the credit approval service as an agent of the bank solely for this purpose. It is important to note that we are not offering a theory of seller financing, that is, the dealer's decision to hold its own loans. Our focus is on the loans that are ultimately held by banks. For simplicity, we assume that dealers have chosen to specialize in retailing, just as banks have chosen to specialize in lending as opposed to selling cars.

However, since many dealer-made loans are held by dealers themselves there may be other reasons why dealers offer to finance the purchase of their goods. One interesting explanation is contained in Laband and Maloney [1988]. They suggest that sellers offer to hold their own loans as a pledge to the buyer that product defects will be corrected. Since buyers can legally default on loans if the product fails to perform, the seller stands to lose if the customer is not satisfied. Sellers that advertise this willingness to hold the risk are making a pledge of good faith that serves the same purpose as a more formal product warranty.

forms used at the bank. If the same information is collected at the dealership that is collected by the bank, where is the source of the savings?

The answer lies in a more careful consideration of what is involved in a credit check. The lender not only solicits information from the applicant but must also verify the accuracy of the information. Although neither task is costless, it is relatively cheaper for the borrower to respond to a question than it is for the lender to verify the response. Because verification is more expensive than initial collection, it provides the bank with a greater source of potential savings. Consequently, a bank could reduce its cost of screening borrowers by contracting with a dealer to collect information on the same set of items but to allocate fewer resources to verify the information.

Next, consider the issue of the testing fee. The model clearly shows there must be some additional cost imposed on direct applicants who desire low interest rates to produce borrower self sorting. Otherwise, all but the riskiest borrowers would apply directly at the bank in order to be screened, and the bank saves nothing. Although some lenders do charge explicitly for the credit check on consumer durable loan applications, most do not. Nevertheless, there are still costs to applying directly at the bank which serve the same function as an explicit fee by lowering the borrower's net gains to being tested. Moreover, the bank can influence the magnitude of these costs to some degree, thereby exercising some control over the resulting number of direct loan applicants.

First, note that giving customers the option of borrowing at the dealership raises the relative cost of applying at the bank. The borrower virtually always visits the dealer in the course of buying the good, but borrowing from the bank involves an extra trip as well as time spent filling out forms for the credit check. Physical separation of the desks raises the cost of direct borrowing.⁹

In addition, if the bank wants to raise the cost of applying for a direct loan even further, it can reject all applicants revealed to have a probability of default greater than some critical level. This is in contrast to the assumption in section II that the bank would lend to those individuals at rates reflecting the higher risk revealed through the test.¹⁰ Those who fail the test would have to incur additional costs of re-applying for a loan elsewhere, as well as the costs many people incur when told they are unacceptable. Consequently, a policy of rejecting higher-risk applicants, as opposed to lending to them directly at higher rates, further encourages self-selection. An explicit application fee is not necessary.¹¹

The bank promotes self-sorting by developing a reputation for stringent acceptance standards. Over time, customers discover that dealerships offer loans at higher average rates but with greater probability of acceptance. The higher cost of applying for a direct loan encourages higher-risk applicants to seek financing at the dealership, where they can arrange the credit contract.¹² The bank intensively screens only its own applicants, now fewer in number because of self-selection.

⁹ The use of physical distance will raise the application fee (cost) more for relatively high-income borrowers. However, income is only one of many variables affecting a borrower's risk. Therefore, we would not expect low-risk borrowers to prefer dealer loans unless the contracts were the same.

¹⁰ The critical passing level in the credit check could be set to generate the same group who chose to be tested under the previous assumptions.

¹¹ These results still hold if we relax the assumption of perfect accuracy of the credit check. The possibility of a high-risk applicant slipping through the credit check and receiving a direct loan does raise the expected gains to applying at the bank. However, the positive costs of applying still ensure self-selection will occur. Testing error alters only the characteristics of the marginal applicant.

¹² As is the case in any screening process, if borrowers learn the criteria the bank uses to assess risk, they have an incentive (subject to the cost) to signal the bank that they are low risk through manipulation of their attributes. For discussion of the signaling value of certain terms of consumer loan contracts see Chiang and Finkelstein [1982]. For example, a borrower's willingness and ability to make

The advantage to using two physically separate locations to encourage self-selection is that, for at least part of its portfolio, the bank (and its borrowers) benefits from the savings associated with point-of-sale financing. This raises an interesting question. If transaction costs are reduced by moving one desk to the point of sale, why don't we observe both desks at the dealership? The answer is that, although point-of-sale financing reduces the costs of contacting borrowers, it potentially increases still another category of costs, relative to lending exclusively at the bank.

When a lender hires an agent to take loan applications it is costly to construct and enforce a contract to ensure the agent's incentives are consistent with the lenders. As with all principal-agent relationships, to deter shirking in the collection of accurate information about borrowers the bank must monitor the agent's performance. If the agent is also a retail dealer, the value of monitoring is even greater, since the dealer has an incentive to make the borrower appear less risky in order to obtain the financing necessary to close the sale. Consequently, accurate screening is more expensive for the bank to produce through the dealership than for its own direct borrowers.¹³

This principal-agent problem is reduced if the bank is lending indirectly in order to exploit the potential for borrower self-sorting. The bank steers the low-risk applicants who will undergo a more intensive credit check directly to the bank itself, where accurate screening is more cheaply produced. Because the indirect borrower's choice of lender itself conveys information, a detailed credit check at the dealership is less valuable than would be the case for a direct applicant. As the bank's agent, the dealer is contracted to do less screening, and lends to higher-risk applicants at a higher average interest rate.¹⁴

To summarize, when a bank lends indirectly in the manner described, it not only reduces the cost of screening applicants (by having two desks) and the cost of contacting borrowers (by putting one desk at the dealership) but it also diminishes the principal-agent problem associated with dealer lending (by leaving the low-risk/testing desk at the bank).

Contract Tailoring vs. Standardization

The theory described above predicts that the information the bank obtains (through a dealer/agent) for its indirect borrowers will be less reliable than the information about its own direct borrowers. From this several implications follow, which provide a means of testing the validity of our theory.

Consider how information derived from the credit check can be used in negotiating the loan contract. The traditional view that banks use the interest rate to adjust for borrower risk understates the choices available

a larger down payment can be interpreted as signaling greater propensity to save. Although we do not explicitly consider these methods of signaling in this paper, they also encourage borrowers to sort themselves, and may operate within the larger direct-indirect self-selection mechanism.

¹³ The problem of monitoring an agent's performance is not unique to the decision to lend indirectly. Within any bank, the loan officer in charge of lending decisions is typically a salaried employee, not the owner/residual claimant. This employee's performance must also be monitored. However, we assume that the marginal cost of monitoring a lending agent increases with the distance between the agent and the bank owner/residual claimant. In addition, since the loan officer is not also attempting to sell a durable good, this removes the incentive to distort information on the application to make the borrower look more credit worthy.

¹⁴ Another possibility for handling the problem of dealer shirking is the use of recourse arrangements, which provide for the dealer to retain some of the risk of borrower default. We discuss this in more detail in section IV. For now, note that the cost to the bank of relying on a recourse agreement to police dealer behavior is the sacrificed gains from risk bearing which it would otherwise collect. These gains revert to the dealer in direct proportion to the amount of risk retained. Our explanation of indirect lending suggests that banks can reduce the shirking problem without resorting to recourse arrangements and the consequent reduction of its share of income from the finance charge.

to the bank for adjusting loan contracts. The bank can influence the expected return on any given loan by adjusting the contract at a variety of margins. Each of the contract characteristics, including collateral requirements, down payment, term and creditor remedies, affects the borrower's incentive to repay or the bank's ability to recover the debt in the event of default.¹⁵ The ability to costlessly tailor a loan contract to reflect individual borrower risk increases the gains to both borrowers and lenders from the loans.¹⁶ The "risk premium" that generates differences in interest rates across loans reflects only the differences in residual risk that were not adjusted away through manipulation of the other loan terms.

If positive screening costs limit the amount of information collected, borrower risk will no longer be assessed perfectly. Lenders would necessarily group borrowers into discrete categories based on similar attributes. As less screening is conducted, the measured variance in characteristics across borrowers declines, although the true variance in borrowers remains unchanged.

As the assessment of any individual's risk becomes subject to greater error, the gains from adjusting the contractual provisions to fit each borrower are smaller, since there is now the possibility that the adjustment will not have the intended effect. Broader risk categories make the borrower's response to changes at any contract margin less predictable, and the gains from contract tailoring smaller. If we further assume that the process of tailoring contracts itself is costly, it follows that as screening costs rise, loan contracts will become more standardized.¹⁷

In our theory of indirect lending, the bank's collection of information to verify self-proclaimed, low-risk borrowers allows it to tailor the contract to each individual. Since dealer's are not expected to conduct as thorough a credit check on indirect borrowers, the information obtained on their applications is less reliable (less valuable) than that obtained for direct borrowers. Less tailoring of contracts to borrowers would be conducted, relative to direct loans. Despite the appearance of greater gains from constraining high-risk borrowers, the theory suggests indirect loan contracts would be the more standardized across recipients.¹⁸

¹⁵ If the costs of writing and negotiating contracts are zero, the wealth-maximizing lender will adjust all terms of the contract, including the interest rate, across loans so that the expected net returns on the last dollar loaned are equal across all borrowers. For an example of stochastic models of the event of loan default in which loan terms such as collateral requirements are adjusted to influence expected return see Barro [1976].

¹⁶ When borrowers are indistinguishable within categories, the interest rate charged will reflect the average risk of borrowers in each category. In this sense, loans in each category are average priced, but with different (though unknown) individual probabilities of default. Average pricing loans reduces the total volume of lending, as well as the total gains from lending. Tailoring loan contracts to individual borrowers increases the net gains from lending in a manner analogous to the way price discrimination leads to greater exchange relative to average pricing across customers.

¹⁷ This point becomes obvious considering that in the limit, with no information, contracts are necessarily standardized, since everyone looks the same.

¹⁸ As noted in the introduction, this paper is not the first to proclaim that information about default risk is revealed when borrowers decide where to apply for a loan. Smith [1987] bases her analysis of why wholesalers extend trade credit on the same principle. We want to emphasize that it is not the revelation that a lender can obtain such information that makes either of these papers unique. The interesting aspect of the papers, particularly when contrasted with each other, is how the lenders make use of the default information. Despite the apparent similarity, the two models are quite different with respect to how the lender gains from coaxing borrowers to reveal their inherent risk and the way the respective markets are organized in order to capture the gains. One reason, of course, is that the two papers address different types of credit. Smith considers credit at the wholesale level between two parties with the expectation of continuous future dealings. Our paper considers bank credit extended at the retail level for consumer durables. This difference leads to the different sources of gain from inducing the borrower to signal, and different implications for the lender's screening behavior. For example, the lender extending trade credit in Smith's paper will monitor the behavior of a high-risk borrower/customer more carefully, (and after the loan is made) than for a low-risk borrower/customer. In contrast, we argue that a commercial bank will allocate fewer resources to verify the reported characteristics of a high-risk borrower, (before the loan is made), than for a revealed low-risk borrower.

Before turning to the empirical tests of the theory a summary of implications is useful. We hypothesize that banks do not treat indirect lending as a simple extension of their direct lending policies. They use indirect lending as part of a strategy that exploits the potential of borrowers to sort themselves according to risk. This implies that, relative to direct loans, the loans the bank obtains indirectly will be characterized by

- 1) borrowers with characteristics associated with greater risk
- 2) a higher rate of default
- 3) higher interest rates
- 4) more standardization of contract terms (less variance in contract terms related to borrower characteristics)

IV. EMPIRICAL EVIDENCE

Evidence from previous research supports the contention that borrowers do self-select based on perceived differences in credit availability between banks and dealerships. In 1979, the National Science Foundation sponsored a survey of credit practices of 3,000 consumers. It revealed that banks have a reputation for more stringent acceptance standards and lower interest rates, relative to dealers offering credit. Also, there appears to be a division of borrowers between banks and dealerships based on the relative importance members of each group place on these two factors. However, the survey contained no information on the risk characteristics of borrowers in each group, and no details of their credit contracts.¹⁹ To determine whether banks exploit the self-sorting potential requires a comparison of direct and indirect loan contracts and borrowers.

We obtained such data from a Federal Reserve Survey of member banks. The data were collected for the period 1967-1971 from thirty banks in five major metropolitan areas. The survey was designed to gather information on the "quality" of consumer installment credit, with respect to purpose, terms, borrower characteristics, and the bank's experience with the loans. Banks were asked to report detailed information at each of these margins for 100 percent of loans charged off (loans written off of the books due to default) during the period and a randomly selected sample of 10 percent of their paid-off loans. Data on over 40,000 consumer installment loans (non-mortgage) were available for analysis. For purposes of our tests we selected loans for new autos.²⁰

Bank-held automobile loans fall into three mutually exclusive groups: direct loans, indirect loans made by dealers with recourse provisions, and indirect loans without recourse provisions. A recourse agreement defines which party, the bank or the dealer, is liable for the debt if the borrower defaults on the loan. An indirect loan with recourse allows the bank to collect from the auto dealer some or all of the outstanding balance on a defaulted loan. It may also provide for a sharing of collection expenses. Non-recourse loans contain no provision for sharing the default burden—a bank that accepts a dealer's loans under such an arrangement holds all of the risk.

This data set offers an advantage over more recent data on automobile loans, given the nature of the theory to be tested. Federal Holder-in-Due Course trade regulations passed in the mid-1970s affected the holding of risk on indirect loans, prompting greater use of recourse arrangements in indirect lending.²¹ However, a comparison of characteristics between direct loans and indirect, non-recourse loans provides the strongest test

¹⁹ For further discussion see Peterson and Black [1982].

²⁰ We selected loans within a single category of durable goods in order to hold constant other factors which might influence the contract. Car loans were chosen due to the abundance of data in the survey.

²¹ For a discussion of how these regulations affected the relationship between dealers and borrowers see Chatfield and Umbeck [1985].

of our theory.²² Consequently, we drew our data from a period during which the bank could choose among recourse arrangements without the additional influence of these regulations.

Each of the following tests compares characteristics of direct loans to those of indirect, non-recourse loans. Due to the large amount of available data, a random sample of auto loans was selected for analysis, weighted to reflect the difference between paid-off and defaulted loans in the original survey. Implications were tested at each of the following margins.

Borrower Characteristics

If the bank lends indirectly as a way of lowering the costs of lending to higher-risk borrowers, direct bank borrowers should be, on average, less risky. More precisely, in a comparison of borrower characteristics at each of the margins typically used by lenders as proxies in assessing risk, direct borrowers should exhibit less risk than indirect borrowers. Table I displays borrower attributes, along with their mean values, for both the direct and indirect samples. The data for the borrower attributes come directly from information given by the borrower at either the bank or the dealership during the original application process.

TOTAL PAYMENTS equals the sum of the borrower's monthly payments on installment debt, including mortgage payments but excluding the car loan. TOTAL INCOME refers to the borrower's total monthly income. BAD CREDIT REPORT is a dummy variable which equals one if the bank either received a poor reference from a rating bureau or had negative reports from local merchants. YOUNG BORROWER is a dummy variable which equals one if the borrower was under twenty-five years of age. Two variables reflect the stability and wealth of the borrower. YEARS AT ADDRESS refers to the number of years the borrower has lived at his/her current address. OWN HOME equals one if the borrower owns his/her own home, as opposed to renting.

We conducted a t-test for difference in means on each of the borrower characteristics listed in Table 1. Of the eight variables in this group, the direct and indirect mean values are significantly different (at the .01 level) on seven of them, indicating a fundamental difference in personal risk attributes of borrowers. Only the credit reference variable fails to differ significantly between the two loan sources.

Of the seven variables with significant differences, six possess mean values in the direct sample that are consistent with the prediction of more stringent bank lending standards (lower-risk borrowers). These bank borrowers, on average, were older, more often were married, had higher incomes, had lived at their current address longer, and were more frequently home owners, relative to indirect borrowers.²³

The results of this test suggest that banks do not implement the same lending policy on their indirect loans as they do on direct loans. This is consistent with our theory and refutes the argument that banks only lend indirectly to reach low-risk borrowers who have not shopped at the bank for credit.

²² A fundamental part of our theory is that banks will voluntarily choose not to screen indirect loans as extensively as their own direct loans. However, if a bank accepts indirect loans with recourse provisions, it may choose to screen less simply because it now bears less risk, independent of the theory to be tested. Consequently, we selected for comparison the class of indirect loans for which the bank has the greatest incentive to screen applicants, those for which it bears full risk of default just as it does on its own direct loans.

²³ Only TOTAL PAYMENTS failed to differ as we might predict (lower on the bank sample). Given the higher observed incidence of home ownership for direct borrowers the higher mean value of TOTAL PAYMENT in the direct sample is not surprising, since mortgage payments typically exceed rental payments. However, the ratio of TOTAL PAYMENTS to TOTAL INCOME is lower for the direct sample than the indirect sample, as predicted.

TABLE I
Variables and Sample Means

Variable	Mean	Std. Dev.	Mean	Std. Dev.	t Test for Mean Difference
Borrower Characteristics	160.25	102.78	167.16	86.99	2.80
TOTAL PAYMENTS					
TOTAL INCOME	779.48	356.25	851.27	344.19	8.14
BAD CREDIT REPORT	.05	.21	.05	.21	0.02
YOUNG BORROWER (under 25)	.83		.38	.38	3.13
MALEBORROWER	.47	.50	.89	.31	6.68
MARRIED	.39	.49	.62	.48	12.11
OWN HOME	1.09	3.13	.48	.50	7.33
YEARS AT ADDRESS	.83	.38	2.44	4.31	15.40
Contract Margins	12.96	3.12	12.53	3.88	5.13
INTEREST RATE					
LOAN SIZE	2467.82	1201.15	1969.45	1346.01	16.03
LENGTH OF LOAN(months)	33.18	9.85	27.36	12.02	22.15
PERCENT	.19	.15	.19	.19	1.64
DOWNPAYMENT					
COSIGNER	.03	.18	.04	.21	2.48
UNSECURED LOAN	.04	.20	.10	.30	10.42
Sample Size					

^aThis t-test considers the direct loan mean minus the indirect loan mean.
Reported t-values are absolute values.

Interest Rate and Default Rate

Our theory predicts that indirect loans would exhibit a higher average default rate, reflecting the higher riskiness of borrowers as well as less compensating adjustment of loan terms to reduce risk. The higher default rate should be accompanied by a higher average interest rate. The sample data reveal that indirect loans had a default rate of 4.1 percent. Direct loans had a default rate of 1.5 percent. This was significant at the .01 level in a t-test for mean differences. The average interest rate of 12.53 percent on direct loans was significantly (at the .01 level) lower than the average indirect interest rate of 12.96 percent. Both results are consistent with the theory.

Standardization of Contract Terms

The theory implies that banks acquire more detailed information on direct borrowers. Consequently, these borrowers receive contracts with terms that are tailored to compensate for the individual's inherent risk.

In contrast, less reliable information is collected about indirect borrowers. Their contracts should be more standardized, with loan terms that vary less with borrower attributes. We offer a simple test of the variability of contract terms across the two types of loans and two more powerful tests of whether contract terms are related to borrower characteristics as predicted.

Variance of Contract Terms Across Loans. A direct implication of our theory is that the contract terms on indirect loans should be more standardized (characterized by less variance) than the terms on direct loans. This implication can be examined using a two-sample test for variance equality across the terms of the loan contract. The null hypothesis in each case is that the variance for each of the six contract terms is equal across the two types of loans. The alternative hypothesis is that the variance on contract terms for indirect loans is less than the variance on these terms for direct loans. A standard variance-ratio test for each of the six contract terms leads to rejection of the null hypothesis in favor of the alternative in each of the six cases at the .01 level of significance.

Risk Premium in the Interest Rate. The banking literature has traditionally treated the contract interest rate as the primary margin for risk adjustment. Our theory recognizes that banks will adjust at all contract margins, the interest rate being only one. It also implies a higher interest rate on indirect loans, but one that reflects the higher average risk associated with these borrowers as a group. Direct loans will exhibit lower average interest rates, but since these (and other contract terms) are tailored to borrowers, relatively more of the existing variance in interest rates across contracts should be related to individual borrower characteristics.

To test this prediction, the variable INTEREST RATE, defined as the contract interest rate (in percentage terms) which the borrower has agreed to pay, was regressed on the set of other contract and borrower variables. Separate equations were estimated for the direct and indirect samples. If our theory is correct, the borrower characteristics and remaining contract terms should explain more of the variance in INTEREST RATE in the direct loan regression, relative to the indirect regression.

The set of other contract variables includes LOAN SIZE, which is the actual amount borrowed, in dollars. LENGTH OF LOAN refers to the length of the loan, measured in months. PERCENT DOWNPAYMENT is equal to the down payment as a percentage of the purchase price. UNSECURED LOAN, a dummy variable for collateral, equals one if the borrower obtains the auto loan without collateral. COSIGNER equals one if the primary borrower had someone (other than spouse) co-sign the loan.

Table II summarizes the results of the two regressions. First, note that in the direct loan regression all but two of the thirteen independent variables explaining INTEREST RATE are significant at the .05 level for a two-tail test. The two exceptions are TOTAL PAYMENTS and MALE BORROWER. In addition nine of the eleven significant variables have a sign consistent with traditional lender adjustments. For example, the regression coefficients suggest younger borrowers pay a higher rate, borrowers who own their own home pay lower rates, and interest rates fall as down payment on the auto rises. The two exceptions with signs opposite of that expected are LENGTH OF LOAN and LOAN SIZE.

Next, consider the regression for the indirect sample. Note that for the exact same set of variables the adjusted R² is less than half that for the direct sample. Only five variables are significant at the .05 level in this

equation. More importantly, only one of the borrower attributes, TOTAL PAYMENTS, is significantly related to the interest rate. This is an important piece of evidence, consistent with our theory. The indirect regression suggests that dealers do almost no significant adjustment of the interest rate as a function of borrower attributes, at least those attributes that appear on the application.²⁴

It is interesting that although INTEREST RATE does not vary with borrower characteristics in the indirect sample, it does seem to vary with contract terms. This suggests that indirect lenders offer a menu of contracts with rates that adjust to the various contract variables affecting risk but not borrower characteristics. This sort of menu is relatively inexpensive to establish in advance, without requiring the more costly screening of borrowers to determine risk.²⁵

Default as a Function of Borrower Attributes. If the costs of collecting information and adjusting the contract were zero, the bank could adjust any or all contract terms to inherent borrower risk to alter the probability of default. Any residual risk that the bank detected from the borrower's application, but chose not to offset by adjustment of other contract provisions, will be accounted for through a higher contract interest rate, so that the expected return across all loans is equal. If the bank adjusts in this manner, actual (ex post) defaults would be random with respect to all observable borrower and contract characteristics.

Conversely, assume that the bank granted loans to individuals randomly selected from the population of all consumers (helicopter loans). No information is collected on inherent borrower risk and no adjustments are made to contract terms. Observed defaults on such loans would not be random. They would occur with the same frequency as suggested by the true population risk parameters.²⁶

Of course, all of the loans in our sample fall somewhere in the middle of the spectrum described above. However, bank direct loans should be closer to the random default end of the spectrum than are indirect loans, because banks have already adjusted the contract with the superior information obtained through direct borrower screening. Thus, one would expect more of the variation in default frequency to be related to application and contract variables on indirect loans than on direct loans.

To test this hypothesis we estimated two probit equations for the probability of default, one each for the direct and indirect samples, of the following form:

$$I = a + b_1X_1 + b_2X_2$$

where I is the probit index, X_1 , is the vector of borrower characteristics and X_2 is the vector of contract characteristics. Table III summarizes the results of the estimation.

²⁴ It is important to recall that banks can use all contract margins to adjust the loan to borrower risk. Variance in the interest rate across loans reflects only the residual risk left after these other adjustments are made. This makes the current test even more powerful, since, even after the bank adjusts the other margins of its direct loans, the residual adjustments of the interest rate to the borrower still exceed those made on the indirect loans.

²⁵ For example, it is common on automobile loans today for lenders to advertise a series of interest rates that increase with the loan term (thirty-six, forty-eight, sixty months), or that decline with down payment.

²⁶ In fact, this would be the only way to verify the validity of bank credit scoring models, which assign a certain value to various borrower attributes as they affect overall risk of default. Determining the impact of characteristics like age, income, occupation, etc., on default risk is always biased because there is always some adjustment on any bank loan, particularly in the accept/reject decision. Moreover, as this paper argues, bank applicants do not constitute a random sample of the population of potential borrowers.

TABLE II
Interest Rate Regressions

Variable	Indirect Loans		Direct Loans	
	Coeff.	t	Coeff	t
Constant	15.89		15.47	
Contract Terms	-.0029	17.40	-.0015	10.30
LOAN SIZE				
LENGTH OF LOAN (months)	1.098	5.63	-.906	4.20
PERCENT DOWNPAYMENT	-.308	4.92	-.522	8.35
COSIGNER	-.001	1.41	-.009	3.02
UNSECURED LOAN	.028	2.83	.034	2.19
Borrower Characteristics	-.513	4.30	.100	1.37
TOTAL PAYMENTS				
TOTAL INCOME	.078	.75	-.170	2.37
BAD CREDIT REPORT	.039	1.76	.012	1.99
YOUNG BORROWER	-.036	1,33	.027	2.85
MALE BORROWER	-.179	1.03	-.001	.89
MARRIED	-.043	1.61	-.023	1.91
OWN HOME	-.047	1.59	-.011	2.73
YEARS AT ADDRESS	-.086	1.73	-.124	4.21
	R ₂ =.141		R ₂ =.297	
	Adj R ₂ = .139		Adj. R ₂ = .293	
	F = 71.34		F = 71.98	

The difference between the two estimated equations is dramatic at every margin of comparison. In the indirect loan equation all variables but two are significantly related to the likelihood of default. The signs on every variable are consistent with the default relationships described in the banking literature and implicit in bank credit scoring models. In contrast, only two variables in the direct loan equation are significant, YOUNG BORROWER and PERCENT DOWNPAYMENT, both with a sign consistent with traditionally assumed relationships. The other eleven variables are not significant. The chi-square test (using the log likelihood test statistic) on the direct loan equation does not reject the null hypothesis that all coefficients in the equation are zero. Apparently, default in the direct sample is largely random with respect to the contract and borrower variables on which the bank collected data. The opposite is true for indirect loans. Once again, this is consistent with our theory.

V. CONCLUSIONS

Wealth maximizers will attempt to minimize the negative impact of information costs on the volume of exchange. From this principle, this paper has derived a theory to explain contract formation and the organization of firms that lend for consumer durables. The theory implies that commercial banks use indirect lending for consumer durables to reduce the costs of lending across risk categories. The bank's reputation for rejecting all but the lowest risk direct loan applicants encourages higher-risk borrowers to self-select to dealerships. Banks then agree to accept dealer-made, indirect loans, for which less screening is required since information is revealed by the borrower's choice of where to apply. At the same time both bank and borrower gain from the convenience of point-of-sale financing on part of the bank's portfolio. This strategy minimizes the costs of expanding the bank's customer base.

TABLE III
Probit Equations for Probability of Default^a

Variable	Indirect Loans		Direct Loans	
	Coeff.	t	Coeff.	t
Constant	-2.951		-2.7703	
Contract Margins				
INTEREST RATE	.0577	2.88	.0489	1.44
LOAN SIZE	.0003	2.31	.0001	.79
LENGTH OF LOAN	-.0023	2.01	.0043	.73
% DOWNPAYMENT	-.8973	4.10	-.9136	2.12
COSIGNER	-.0194	2.03	-.1307	1.31
UNSECURED LOAN	.6902	2.44	.4329	.77
Borrower Characteristics				
TOTAL PAYMENTS	.0017	3.13	.0024	.19
TOTAL INCOME	-.0001	1.97	-.0003	1.17
BAD CREDIT REPORT	1.9801	1.81	1.8828	1.61
YOUNG BORROWER (under 25)	.3676	2.95	.5693	3.02
MARRIED	-.9787	1.83	-.9751	1.55
OWN HOME	-.0271	2.19	-.0012	1.41
YEARS AT ADDRESS	-.0491	4.11	-.0041	1.27
-2 log likelihood		193.67		21.92
test statistic (degrees of freedom)		(13)		(13)
Number in sample		5664		2229

^aThe absolute values of the asymptotic t-statistics appear after the estimated coefficients. The log likelihood test statistic is distributed chi-square in large samples. This statistic tests the null hypothesis that all coefficients except the constant are zero.

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