

The background of the entire page is a grayscale photograph of a modern university building. The building features a prominent glass facade with vertical window columns. In the foreground, there is a paved courtyard with several concrete benches and young trees. The overall scene is bright and clear.

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Relationships and Rationing in Consumer Loans: Evi-
dence from the Nineties

by

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Relationships and Rationing in Consumer Loans: Evidence from the Nineties

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Abstract

Using a national survey data where the event of individual households being refused loans (credit rationed) by financial institutions -- as well as the specific loans for which they were turned down -- is observed directly, this study investigates both the role of relationships on credit rationing in the nineties and the *differential* role of relationships across credit rationing in various consumer loan types, like mortgage loans, auto loans, installment loans, credit card loans, and lines of credit. We find that even though relationship variables continue to be very important determinants of credit rationing in the consumer loan market in the nineties, their relative impact may have, in fact, declined compared to the eighties. We also find that relationships appear to be most important in decreasing the probability of rationing in mortgage loans, and play a relatively less important role in the rationing of car loans and installment loans. Credit cards and Lines of credit appear to be immune from relationship effects. Our work highlights the uniqueness of relationships in secured consumer loans like mortgage loans and its difference with secured loans in small business lending.

1. Introduction

We investigate the *differential* role of relationships in the rationing of major consumer loans. Ideally, every individual with a positive net present value project should be able to borrow money at her appropriate rate of interest. Stiglitz and Weiss (1981), however, show how the problem of asymmetric information between a borrower and a potential lender could impede the flow of credit to an otherwise qualified borrower.¹ Subsequent researchers have argued that lenders could overcome the informational asymmetry by producing information about the borrower through the building and sustenance of a relationship and using such information in credit approval/rejection decisions, thereby lowering the cost of capital for the lender.

While the early work on relationships focused primarily on borrowing by large and small businesses,² a recent study by Chakravarty and Scott (1999), using the 1989 version of the Survey of Consumer Finances (SCF) data,³ is among the first to empirically document how relationships between individual households and their creditors affect the probability of being credit rationed. The uniqueness of the SCF data lies in its extraordinary detailed household-level information, including the fact that the credit-constrained borrowers are directly observable, thereby allowing the authors to draw an explicit connection between credit rationing and borrower characteristics vis-à-vis the borrowers' personal relationships with their banks.

Unfortunately, the 1989 version of the SCF data set is restrictive in that it does not ask the respondents to identify the specific loan-type for which they got rationed. This leads

¹ In practice, too, we see examples of families who are often shut out of the loan market. Examples abound of white neighborhoods receiving proportionately more mortgages than their black counterparts; far fewer blacks applying for mortgages than comparable white families but getting rejected far more frequently and that minorities being discriminated against in the home mortgage market (see, for example, Munnell et al. (1996)).

² See, for example, James (1987), Lummer and McConnell (1989), Hoshi, Kashyap and Scharfstein (1991), Slovin, Sushka and Poloncheck (1993), Petersen and Rajan (1994), Billett, Flannery and Garfinkel (1995), Berger and Udell (1995), Blackwell and Winters (1997), and Cole (1998)).

³ The Federal Reserve System conducts surveys, underlying the data, every three years over a cross section of approximately 4000 households in the United States. The sample is chosen to represent the wealth, financial (including loan-related), demographic and related characteristics of the U.S. population as a whole.

Chakravarty and Scott to examine the probability of being rationed on consumer loans overall. But the various loans taken out by individuals or families over their lives, such as mortgage loans, auto loans, personal lines of credit, loans through credit cards and personal lines of credit, all have distinct characteristics related to loan amount, duration, repayment, collateral and interest rate considerations. It is therefore reasonable to expect that the role of relationships will also be distinct across such loans as well.⁴ We use the most recent version of the SCF data to investigate the differential role of relationships across credit rationing in the five consumer loans discussed above.

Additionally, a lot has changed in the intervening dozen years or so since 1988 -- when the data set used by Chakravarty and Scott was compiled -- both from the standpoint of the relative usage of various types of consumer loans and in the banking industry itself. Thus, over the decade of the nineties, new car loans made by auto finance companies grew about 69%; mortgage loan originations rose an astonishing 343%; the market share of credit cards, as a fraction of the total dollar volume of consumer payments in the U.S., increased by about 10%, while consumers' outstanding revolving credit (through the use of credit cards) grew over 600%. Over the past five years itself, the total amount owed by U.S. consumers on credit cards, car loans, and other installment loans has grown by about 50 percent, to more than \$1.2 trillion.⁵

Strong earnings during the 1990s have also enabled banks and thrifts to build their capital to the highest levels in more than 50 years. The website bankinfo.com reports that, as a percentage of total assets, banks' equity capital rose from 6.45% at the end of 1990 to 8.33% at the end of 1997. During that time, thrifts' average equity ratio climbed from 5.36% to 8.71%. Many institutions used this capital to fund acquisitions, contributing to the ongoing consolidation in the banking and thrift industries. Bank mergers also resulted in a larger share of industry assets being held by a smaller number of organizations. While 41 banking companies held 25% of total domestic deposits in 1984, only 11 companies accounted for the 25% share at the end of 1997. Finally, institutional, regulatory and market changes during the nineties altered the way in which households think about and plan for their finances; new

⁴ The extant literature in small business lending has shown (see, for example, Berger and Udell (1995)) that relationship duration is more important for the determination of rates and collateral requirements of lines of credit but less important for mortgage loans.

⁵ These numbers have been compiled from various sources including the U.S. News and World Report, the Federal Reserve Board's G.19 Report and statistics from the Mortgage Banker's Association.

means of trading stocks emerged; automobile dealers added less expensive models to the vehicles available for leasing; lenders became increasingly willing to accept mortgages with very low down payments and many banks faced increased regulatory pressure to provide equitable access to credit (Canner, Passmore and Laderman (1999)).

In light of the above, this paper also takes a critical look at the (possibly) continuing significance of relationships in credit rationing in the consumer loan market in the nineties, using both the 1998 and 1995 version of the SCF data set. While the 1995 version of the data reflects borrower characteristics nationally over the first half of the decade, the 1998 data set does so for the latter half of the decade, and is ideal for our purposes.⁶

We find that even though relationships continue to be significant in lowering the probability of being rationed out of consumer loans in the nineties, its relative impact on the credit approval/denial process may have, in fact, declined relative to the eighties. We also find that, among the various consumer loans, relationships appear to be most important in decreasing the probability of rationing in mortgage loans, and relatively less important for auto loans and installment loans. Credit cards and Lines of credit appear to be immune from relationship effects.

These results, especially those related to mortgage loans and lines of credit, are distinct from those reported by Berger and Udell (1995) in the context of small business lending. Specifically, these authors find that mortgage loan rates (used to proxy for credit rationing) show little or no dependence on relationship effects while rates related to lines of credit, do. Our results, in the consumer loan market, perhaps underscore the symbolic importance placed on mortgage and auto loans by families⁷, not seen in equivalent small business loans where they may be deemed just another secured loan. Additionally, credit cards and personal lines of credit allow families to borrow within their credit limit without transaction costs including all

⁶ Unfortunately, the surveys, in the various years, do not include the same set of households. It is, therefore, impossible to track a given borrower over the years.

⁷ A website on American Social Trends characterizes home buying, for example, in the following way: *"People buy a house for many reasons. Although shelter and a secure centre for family life are perhaps the major reasons, economic reasons are also important. A house can be an investment or even, in some circumstances, a liability. For most Americans a house is certainly their greatest financial commitment and their most important asset. A house can also have a symbolic role in our society. Where you live and the house you live in can be used to indicate to the world your social position and values."*

the time and effort involved in obtaining bank loans. To the extent that some families are using credit cards as a source of convenient credit, they are willing to incur the considerably high interest rates rather than take the time and effort to obtain a conventional bank loan at a lower rate. We would therefore expect families with little or no relationships with banks to use credit cards as sources of credit. Our findings support this notion. Overall, our results serve to highlight the uniqueness of consumer loans.

As banking institutions have become larger through mergers and consolidations, the loan granting (or rejecting) decisions are increasingly being made in corporate headquarters hundreds of miles away from the physical location of the borrower and her assets. Consequently, there has been increasing concern that *relationships* between banks and borrowers may be on the wane. Our finding of declining significance of relationship variables in the nineties supports this growing concern. However, there is evidence that the wealth building potential afforded by banking relationships, especially for certain segments of the population, is beginning to be acknowledged (see, for example, Hogarth and O'Donnell (1999)).

The rest of the paper is organized as follows. Section 2 provides a description of the SCF data including a discussion of how missing observations are handled and how credit constrained families are identified. Section 3 provides the underlying theory while section 4 compares across rationed and non-rationed families in the data. Section 5 provides details of multivariate analyses on the role of relationships on credit rationing. Section 6 investigates the differential role of relationships in the rationing of various consumer loans. Section 7 concludes. The appendix contains details of how computations of means and standard errors related to variables of interest and estimated regression coefficients are performed in the paper with multiple imputation data.

2. Data Description

The SCF is a triennial survey of U.S. families sponsored by the Board of Governors of the Federal Reserve System with the cooperation of the U.S. Department of Treasury. The term "family" used here is comparable to the U.S. Census Bureau's definition of "household" which includes the possibility of a family of one individual. The survey is designed to provide detailed information on U.S. families as of the time of interview for data collection. Because only minor changes have been made in the wording of the questionnaire since 1989, the

underlying measurements are highly comparable over time.

To ensure that the survey picks up attributes both broadly distributed in the population as well as those concentrated in a relatively small part of the population, the SCF employs a dual-frame sample design consisting of both a standard geographically based random sample and a special oversampling of relatively wealthy families. This design too has been unchanged since 1989. Through this sampling process, the 1998 SCF represents 102.6 million families within the United States. Other details about the 1998 SCF data collection process, including summary statistics on the data itself, is provided in Kennickell et al. (2000).

2.1 *Multiple imputations*

Missing or incomplete information is common to all survey data and SCF is no exception. Data can be missing because respondents are unable or unwilling to provide information, or due to errors in data recording and processing which make data unusable. Missing information raises issues of both efficiency and bias in the data. Nonresponse to selected survey questions implies less efficient estimates due to the reduced size of the usable dataset. Also, the usable data itself are subject to possible bias because non-respondents are often systematically different from respondents.

There are several ways of dealing with nonresponse or missing data. They could be simply eliminated from the sample but would result in less efficient estimates due to reduced sample size and would assume no nonresponse bias. Missing values could also be replaced by the sample mean value of the respective variable. This too would assume no nonresponse bias, but could distort correlations among variables and would understate the variance of the underlying variables because all missing values would be replaced with the sample mean.

The way SCF deals with missing data is through multiple imputations whereby stochastic multivariate methods are used to replace each missing value with multiple values generated to simulate the sampling distribution of the missing values. The goal of the imputation process is to obtain the best possible estimates of the true but unobserved values of the missing data. As more imputed values are generated, the approximation to the true sampling distribution improves. SCF uses the multiple imputation technique to compile five complete data sets referred to as “implicates”.

The relevant question is how to use the information from all five implicates to generate the best point estimates and estimates of variance for variables and estimated regression

coefficients of interest.⁸ Specifically, the best point estimate of a variable of interest is the average of the point estimates derived independently from each of the five imputates. The best estimate of variance is the average of the variance estimates derived independently from each of the five imputates (“within” imputation variance) plus an estimate of the “between” imputation variance, with an adjustment factor for using a finite number of imputations. The “between” imputation variance is the sum of the squared deviations of the point estimates in each imputate from the overall average point estimate divided by the number of imputates minus 1. Further details on the formulae involving multiple imputations, used for the computations to follow, are provided in Montalto and Sung (1996).

2.2 *Identifying the credit constrained families*

The SCF data is uniquely suited to the study of credit rationing because the credit-rationed households are identified directly. We define a credit-rationed household as one who answered in the affirmative to the question: “In the past five years has a particular lender or creditor turned down any request that you (and your spouse) made for credit or have you been unable to get as much credit as you applied for?” Now, some consumers may not have applied for credit because they assumed that, if they did, they would be turned down. These discouraged borrowers are households who reported in the affirmative to the question: “Was there any time in the past five years that you (or your spouse) thought of applying for credit at a particular place but changed your mind because you thought you might be turned down?” Jappelli (1990) and Cox and Jappelli (1993), in the context of the 1983 SCF data, argue for the inclusion of the discouraged borrowers to the credit-constrained group by pointing out that omitting this group of consumers may lead to biased estimates of the probability that consumers are credit constrained, since the self-selection of applicants may induce intermediaries to adopt screening rules that differ from those that would prevail if the discouraged borrowers were to apply too. Accordingly, we too add these discouraged borrowers to the group of credit-rationed households. Finally, we exclude from the group of credit-rationed families those who reapplied for credit and received the desired amount. In the final analysis, we have 801 families who were credit-rationed and 1,932 families who received

⁸ Interestingly, all existing studies we are aware of use only the first imputate to perform statistical and econometric analyses and draw inferences therefrom (see, for example, Black and Morgan (1998)). Unfortunately, this could lead to misstating the standard errors of the underlying variable or estimated coefficient of interest, resulting in erroneous conclusions.

credit.

The 1998 SCF data also permits us to investigate the differential role of relationships on various consumer loans that was not possible with the 1989 SCF data used by Chakravarty and Scott (1999). Specifically, the 1998 data asks: “What type of credit did you apply for?” Based on the responses and on the frequency distribution thereof, we classify families into those who applied for mortgage loans, vehicle loans, other installment loans, credit cards and lines of credit.⁹ Details of the sample distribution across these various loan categories are provided later.

3. Theory

3.1 *Relationship factors affecting credit rationing*

The basic intuition provided by Stiglitz and Weiss (1981) is that the informational asymmetry between borrower and lender originates from moral hazard and adverse selection effects, causing lenders to refuse loans to some among an observationally identical population of potential borrowers. It is, therefore, argued that through the observation of certain variables related to the interaction over time between a potential borrower and a lender, the latter is better able to make a determination about a potential borrower’s ability to repay the loan. Consistent with Petersen and Rajan (1994), we label these interaction terms, *relationships*.

Our choice of relationship variables is guided by the extant literature related to small business and individual borrowers (see, for example, Petersen and Rajan (1994) and Chakravarty and Scott (1999)). These are, respectively, LENGTH, defined as the duration (in years) of the family's oldest loan account with the potential lending institution; ACTIVITY, defined as the total number of asset accounts and loans with a family's potential lending financial institution; and NOFININ, defined as the number of financial institutions that a family has association with – either through asset accounts or through loans.¹⁰

⁹ It is noteworthy that the survey did attempt to collect information on loans besides the ones we investigate here. But their frequencies are insufficient to do a meaningful economic analysis. These are: store account (14 obs), Equity loan (11 obs), business/investment loan (11 obs), personal loan (17 obs), consolidation loan (13 obs), student loan (1 obs) and home improvement loan (5 obs).

¹⁰ Cole (1998) discusses the notion of pre-existing relationships between a borrower and a potential lender and argues that such relationships generate useful information in ascertaining a firm’s creditworthiness. A proxy for such a pre-existing relationship is provided by the various asset accounts

3.2 *Other factors affecting credit rationing*

Berger and Udell (1995) and Cole (1998) have argued about the importance of accounting for the potentially confounding effect of firm age, which previous studies have shown to be highly correlated with the relationship-length variable discussed above. Additionally, Diamond (1991) argues the age of a firm should influence whether it receives credit simply because a firm in business for a longer period of time has generated enough reputational capital though its ability to survive the critical start-up period. We, therefore, include AGE, defined as the age of the head of the household, as a public information proxy.

We also control for borrower riskiness with the traditional borrower-specific measures of riskiness that includes size, leverage and creditworthiness. We proxy size with the natural logarithm of total family assets (LASSETS) and the natural logarithm of total family income (LINCOME). We proxy for leverage by the natural logarithm of total family liability (LLIABILITIES). We proxy for borrower creditworthiness with three variables: BADHISTORY, a dummy variable taking the value 1 if the individual (or any member of the household), over the previous year, had problems in making existing loan payments and zero otherwise; WELFARE, a dummy variable taking the value 1 if the household received public assistance over the preceding year and zero otherwise; and, CUREMP, a variable measuring the number of years that the head of the household had worked in his current employment.¹¹

Finally, we include three demographic variables. MARRIED is a dummy variable taking the value 1 if the head of the household was married and zero otherwise; WHITE is a dummy variable taking the value 1 if the head of the household is of Caucasian origin and zero otherwise; and HHLSIZE is a variable measuring household size.

that a family could maintain with a potential lender. They could be important if it turns out that the type of information that a lender obtains from monitoring a checking/savings account is likely to be different from the information obtained by monitoring an individual's individual retirement or Keogh account. Accordingly, Chakravarty and Scott (1999) use variables capturing whether a family has checking, savings, trust/annuity/managed investment account, brokerage account or an IRA/Keogh account with the potential lender. But since these dummy variables have no explanatory power in the Chakravarty and Scott regressions using the 1989 SCF data, we omit them here in favor of parsimony.

¹¹ We do not use variables capturing the type of lending institution best describing the lender. While Cole (1998) includes a dummy variable to specifically identify if a lending institution is a commercial bank, Chakravarty and Scott (1999) in the context of the SCF data find them lacking in explanatory power.

4. Comparing Across Credit Rationed and Non-Rationed Families

Table 1 presents univariate statistics (means and standard deviations) for the variables introduced in section 3 across the credit-rationed and non-rationed families. Column 2 presents results for the non-rationed families, column 3 presents results for the rationed families. Column 4 provides results of a t-test of equality of means across the rationed and non-rationed families. As discussed in section 2.2, all results are adjusted across all five imputations of the data.

There appear to be significant differences in the characteristics of families who obtained credit and those who were rationed. Not surprisingly, the non-rationed families have a significantly longer relationship (LENGTH) with their potential lenders (12.6 years versus 7.2 years) and have a significantly greater number of activities (ACTIVITY) with their potential lenders (2.7 versus 2.1). Also, the number of financial institutions that a non-rationed family has association with (NOFININ) is greater (2.8 versus 2.5) and is consistent with Cole (1998) in the context of small business borrowers.

Among the financial variables measuring borrower characteristics, the total assets (ASSETS) and total annual income (INCOME) are both significantly greater for the non-rationed families (\$436,663 and \$71,048, respectively) relative to rationed families (\$178,926 and \$42,499, respectively). Interestingly, these numbers are significantly higher than those reported by Chakravarty and Scott (1999), applicable to rationed and non-rationed families in the mid to late eighties, and perhaps reflect the impact of a decade long prosperity in the nineties. The non-rationed families also exhibit higher liabilities (LIABILITIES) than the rationed sample (\$74,349 versus \$52,702), and the difference is significant at the 0.01 level.

Finally, the credit-rationed families are mostly unmarried, non-white, younger, more likely to have had credit-related problems, more likely to have been on welfare, and have a relatively shorter tenure at their current employment, compared to their non-rationed counterparts.

Table 2 provides a detailed comparison among the rationed families classified by the type of loan that they got rationed for. Recall that Chakravarty and Scott (1999) are unable to provide this kind of analysis on the rationed families because the 1989 SCF data set used by them did not contain this information. Overall, our sample contains 107 families that were

refused a mortgage loan, 161 families that were refused an auto loan, 76 families that were refused an installment loan, 324 families that were refused a credit card and 61 families that were refused a line of credit.

Table 2 indicates that relationship and other borrower characteristics are statistically significant across loan types, as demonstrated by the significant F-statistics across most variables corresponding to a null hypothesis of equality of means across the various loan types. Specifically, among relationship variables, LENGTH and NOFININ are significantly different across the rationed for the various types of credit considered. For example, those rationed from an auto loan (line of credit) have the shortest (longest) average length of relationship with their potential lender at 5.1 (9.9) years. Those turned down for an auto loan (credit card) have the smallest (largest) average activity with their main bank at 1.7 (2.3). This may suggest that credit cards are less relationship sensitive than auto loans.

Among borrower characteristics, those families rationed for an auto loan are the youngest (average AGE equals 36.5) while those families rationed for either a mortgage loan or a line of credit are in their forties with the families rationed for other loans falling in between. This evidence implies that families look more actively for a car (house) when relatively young (older).

Examination of the INCOME variable reveals that families rationed from auto loans and installment loans have statistically similar average income of \$36,614 and \$35,845, respectively, and are among the lowest in our sample of credit-rationed families, while those rationed for a mortgage loan are at the highest average income at \$49,778. The variable, ASSETS, reveals that the average range varies from \$87,916 corresponding to the families refused an auto loan to \$257,212 associated with those refused a mortgage loan. The variable, LIABILITIES, indicates that families refused an automobile (mortgage) loan have the lowest (highest) average at \$41,330 (\$75,323). Those families rationed from other loans have liabilities averaging between \$46,992 and \$54,335.

BADHISTORY averages 0.29 for families denied a credit card and 0.45 for families denied an auto loan. In comparison, those denied a mortgage loan have a mean BADHISTORY of 0.38. Thus, a relatively higher proportion of families denied an auto loan or even a mortgage loan have past credit problems compared to those denied a credit card. Perhaps, banks are less comfortable handing out secured loans than they are in providing unsecured loans (even at

high rates). The variable CUREMP also shows a significant variation across families rationed for the different loans, varying between 4 (7.3) years for those rationed for an auto (mortgage) loans. It appears that banks may have a significantly higher threshold for granting mortgage loans than they have for granting auto loans even though both are secured loans.

Finally, among demographic variables, those rationed for mortgage loans and line of credit are more likely to be married while those rationed for auto loans, other installment loans and denied a credit card, are more likely to be single.

In sum, we find significant differences in relationship, financial and demographic characteristics across families rationed for the various types of consumer loans studied here. This would suggest that rules of engagement between borrower and lender are also likely to be different across these loan types. This distinction argues for investigating the differential role of relationships across loans, a significant design improvement over Chakravarty and Scott (1999), and a central goal of the current paper.

5. Role of Relationships in Determining the Probability of Being Credit Rationed

5.1 *The empirical model*

We employ a general multinomial logistic (or logit) regression framework to perform our analysis appropriate when the dependent variable takes on multiple discrete, but unordered, values. Multinomial logit models are derived from the random utility function given by

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

where V_{ij} is a non-stochastic utility function and ε_{ij} is a random utility component and assuming that error disturbances are assumed to have type I extreme value distribution with distribution function $\exp(-\exp(\varepsilon_{ij}))$. The event of selecting alternative j by individual i can be expressed as

$$U_{ij} > \max_{k \in C_i, k \neq j} U_{ik}.$$

Using properties of the type I extreme value distribution, the simple multinomial logit model can be expressed as

$$\begin{aligned}
P(y_i = j) &= P\left[X'_{ij}\beta + \varepsilon_{ij} \geq \max_{k \in N} (X'_{ik}\beta + \varepsilon_{ik})\right] \\
&= \frac{\exp(X'_i\beta_j)}{\sum_{k=0}^N (X'_i\beta_k)} \quad \text{for } j = 0, \dots, N
\end{aligned} \tag{2}$$

We use the above framework to do our analyses. Thus, initially we allow j to be a binary realization depending on whether a family got a loan or was rationed. Specifically, we let $y_i = 1$ for a rationed household and $y_i = 0$ otherwise. Subsequently, we expand the scope of our analysis by allowing y_i to take multiple (unordered) discrete values $y_i = 1, \dots, N$ depending on which loan-type the family got rationed for and $y_i = 0$ still denoting a family receiving its loan and X_i representing the independent variables given by

$$X_i = \alpha_0 + \alpha_1(\text{Relationship Variables}) + \alpha_2(\text{Borrower Characteristics}) + \varepsilon_i \tag{3}$$

The system of equations given by (1)-(3) is estimated with our sample. Note that when $N=1$, we obtain the usual binary logistic regression model.

5.2 Estimating the binary logistic regression

We begin by estimating the coefficients of the binary logistic regression, using the 1998 SCF data, with the probability of being credit-rationed (1 if yes and 0 if no) as the dependent variable. The results are presented in column 2 of Table 3. The independent variables proxy for bank-borrower relationship and borrower characteristics including demographics as discussed before. The p-values, corresponding to a two-tailed test of parameter significance, are in parentheses under the respective parameter estimates. Note that the estimated coefficients, their standard errors, the resultant t-statistics and the corresponding p-values of significance are adjusted across the five imputations of the data. Since logit regressions are non-linear estimation processes, the marginal effect of an independent variable is not readily apparent from the parameter estimates, as in standard OLS estimations. We therefore provide, in column (3), the corresponding marginal effects of a change of 1 unit of the dependent variable on the probability of being rationed, while holding all other explanatory variables at their respective sample averages.

To account for the fact that the value of the information (both public and private) generated in later periods is likely to be distinct from that generated in the earlier periods, the marginal effects of the corresponding variables are unlikely to be constant over time. We, therefore, replace the linear specification of the three information-related independent variables

with their natural logarithms (i.e., AGE is replaced by LAGE, ACTIVITY is replaced by LACTIVITY and LENGTH is replaced by LLENGTH).¹² We also replace the financial variables, INCOME, ASSETS and LIABILITIES, by their natural logarithms. These transformations significantly improve the explanatory power of the model, including the statistical significance of the individual variables. We, therefore, use the logarithmic form of these variables in subsequent specifications.

Column (2) shows that the estimated binary logit model has a pseudo R-square of 0.26 and indicates reasonably good explanatory power. Among relationship variables, LENGTH, ACTIVITY and AGE are all negative and significant at the 0.01 level. Column (3) shows that an increase by 1 year in relationship length decreases the probability of being rationed by 0.24%. Similarly, an increase in activities with the bank by one unit decreases the probability of being rationed by 1.24%. An increase in the age of the household head by 1 year decreases the probability of being rationed by 0.39%. The remaining relationship variable, NOFININ, is not statistically significant.

Among the financial variables, ASSETS is negative and significant (at the 0.01 level) while LIABILITIES is positive and significant (at the 0.05 level). Column (3) shows that for each \$1000 increase in assets, the probability of being rationed declines by 0.006%, while a \$1,000 increase in liabilities increases the probability of being rationed by 0.008%.

Among variables measuring borrower creditworthiness, BADHISTORY is positive and significant at the 0.01 level while CUREMP is negative and significant at the 0.10 level. From column (3) we see that an extra instance of a bad credit record in the recent past increases the probability of being rationed by about 28%; an extra year of service at current employment decreases the probability of rationing by about 0.19%.

Finally, among demographic variables, MARRIED is negative and significant at the 0.01 level and HHLSIZE is positive and significant at the 0.01 level. The marginal effects column indicates that getting married decreases the probability of being rationed by 5.78% while an increase in the size of the family by one unit increase the probability of being rationed by 1.94%.

To investigate if the effect of relationships and other borrower-related characteristics on

¹² Specifically, we replace LENGTH by $\log(1+LENGTH)$ and ACTIVITY by $\log(1+ACTIVITY)$ to account for the fact that some families may have a zero length of relationship and zero activities with their potential lender.

the probability of being credit rationed has remained constant over the decade, we estimate the same empirical model using the 1995 SCF data. The results are presented in column (4) of Table 3 with the corresponding marginal effects in column (5). The results indicate that the impact of relationship variables on credit rationing is about the same in both years while the impact of AGE (the public information proxy) is somewhat greater in 1998. The financial variables like INCOME, ASSETS and LIABILITIES appear to show similar impact in both years. The borrower creditworthiness proxy, BADHISTORY, appears to have a significantly greater impact on credit rationing in the 1998 data. Further, the race variable, WHITE, which is statistically insignificant in the 1998 data, is negative and highly significant in the 1995 data. This could imply that, over time, race has been replaced by other factors in determining credit rationing of individual borrowers.

We further compare our results with those reported in Chakravarty and Scott (1999) (Table 2, p. 534). The magnitude of the coefficient estimates pertaining to the relationship variables in our data appear to be significantly smaller than those reported in Chakravarty and Scott while the effect of AGE is significantly greater. The impact of the proxy for borrower creditworthiness, BADHISTORY, is also significantly greater (almost double) in our (1998 and 1995 SCF) data. A possible conclusion from the above is that lenders are putting increasingly less weight on relationships, and putting more weight on public information and past credit indiscretions in their credit granting/rationing decisions. The relative magnitudes of the coefficient estimates should, however, be interpreted with caution.

In sum, it appears that relationship variables continue to be very important predictors of credit rationing in the consumer loan market in the nineties but their relative impact appears to have declined over time (relative to the mid-to-late eighties). This would be consistent with large banks of the nineties making loan decisions in corporate headquarters far removed from their clients, with little scope for relationship building.

6. Differential Role of Relationships Across Consumer Loans

Given that the various loans taken out by individuals, such as mortgage loans, auto loans, personal lines of credit, loans through credit cards and personal lines of credit, all have distinct characteristics related to loan amount, duration, repayment, collateral and interest rate considerations, it is reasonable to expect that the role of relationships will also be distinct across

such loans as well. Thus, for example, mortgage and auto loans are both secured loans distinguished primarily on loan amount and duration. Installment loans can be either secured or unsecured loans of relatively smaller amounts (and shorter duration) written against an underlying asset (when secured) and paid back in equal monthly installments, while personal lines of credit are usually unsecured revolving lines of credit. When secured by the underlying asset, installment loans are similar to auto loans, while personal lines of credit and credit cards share similar features with regard to the credit portion. Not surprisingly, loan rates associated with lines of credit are only slightly below credit card borrowing rates. Additionally, some loans might be preferred over others by specific individuals depending on their relative risk aversion and their beliefs about future uncertainties in borrowing rates. For example, installment loans and personal lines of credit can serve as (imperfect) substitutes, depending on an individual (or family's) frequency of borrowing needs and on their beliefs about the uncertainty of future loan rates. Additionally, an examination of the magnitudes of successful loans in each loan class reveals a wide variation in magnitudes. Thus, for example, the average outstanding mortgage loan is worth \$162,460; the average outstanding auto loan is worth \$41,285; the average outstanding installment loan is worth \$60,671; average outstanding balance on a credit card is worth \$2,236 and the average outstanding balance on a line of credit is given by \$280. All this would also argue for a differential role of relationships in the rationing of the various consumer loans, which we investigate here.

To do so, we extend the scope of our binary logit model from the previous section by allowing the dependent rationing variable to take on (unordered) values of 1- 5 depending on whether a family was denied a mortgage loan, automobile loan, other installation loan, credit card, and line of credit, respectively, and zero (considered the reference group) if a family had not been refused any loan it had applied for in the previous five years. We then use a multinomial logistic estimation procedure to analyze the role of relationships on being rationed for any one of the five popular consumer loans. Table 4 provides the results of the multinomial logit estimation with the corresponding p-values of parameter significance under the respective estimates. As discussed before, the reported parameter estimates, as well as their tests of significance, are adjusted for all five imputations of the SCF data. The pseudo R-square of 0.25 implies a reasonably good fit of the model given the survey nature of the data.

Panel A of Table 4 indicates that, in terms of magnitude, LENGTH plays the most

significant role in mortgage loans, followed by installment loans and then by automobile loans. In each of these cases, LEGNTH is statistically significant at 0.10 level or better. Relationship length appears to play no role in the rationing of credit cards and line of credit. The other relationship variable, ACTIVITY, plays a significant role only in the rationing of auto loans and somewhat less so in the rationing of mortgage loans. Overall, relationship variables appear to play the most significant role in the rationing of mortgage and automobile loans, and a relatively less significant role in the rationing of installment loans. Relationship appears to play no role on the rationing of credit cards and lines of credit.

The remaining independent variables, in Table 4 panel A, display a wide range of explanatory power to predict rationing across loan types. For example, variables like AGE (the public information proxy) appears to play no significant role in mortgage lending while having a negative and significant effect in the rationing of auto loans, credit cards and installment loans. Borrower financial/creditworthiness and demographic variables, like ASSETS, BADHISTORY and HHLSIZE are usually important in explaining rationing across the board and do not distinguish across loan types, while other financial variables, like LIABILITIES, have a marginally significant positive role in explaining rationing in auto loans only. Also, CUREMP has a negative and significant role in explaining rationing in auto loans and credit cards, while MARRIED is associated with a lower probability of being rationed for an auto loan or to receive a credit card.

In panel B of Table 4, we seek to examine if the estimated coefficients (in Table 4A) corresponding to the three relationship variables, LENGTH, ACTIVITY, NOFININ, and the public information proxy, AGE, are each statistically distinct across the five distinct loan types a family can be rationed from. Accordingly, we provide p-values of pair-wise t-tests (across the five loan types) of the estimated coefficients of each of the four variables.¹³ Overall, these tests confirm that relationship variables play a statistically distinct role across the five consumer

¹³ Thus, for example, in the cell denoted by (Mortgage Loan, Car Loan), we have four p-values given by 0.0170, 0.0044, 0.9835 and 0.0348. These imply that the estimated coefficient of LENGTH (in Table 4A) corresponding to being rationed for a mortgage loan, given by -0.18876 , and that corresponding to being rationed for an auto loan, given by -0.39560 , are distinct from each other at the 0.0170 level (or 1.7%). Similarly, the estimated coefficient of ACTIVITY corresponding to being rationed for a mortgage loan, given by -0.70254 , and that corresponding to being rationed for an auto loan, given by -0.64426 , are distinct from each other at the 0.0044 level (or 0.44%). The remaining numbers in the cell follow similarly as do the remaining cells.

loans considered in the paper. Specifically, relationship variables associated with rationing in mortgage and car loans appear most distinct relative to rationing in all other loans. This is followed closely by installment loans. The estimated relationship coefficients across those rationed from credit cards and lines of credit are not statistically distinct, consistent with their lack of statistical significance, individually, in the multinomial regression. The coefficient on AGE is statistically distinct in eight out of ten pairwise comparisons.

As a robustness check on our results, we replicate the multinomial logit regression estimation with the 1995 SCF data to investigate the relationship between conclusions arrived at with data gathered in the latter part of the decade and those gathered at the beginning of the decade. As with the binary logit results (in Table 3), we find (not reported, but available on request) similar results to those reported in Table 4.

In related work, Berger and Udell (1995) show that relationship duration is important for determining rates and collateral requirements on small business lines of credit but is less important for mortgage and equipment loans. They argue that mortgage loans are transaction driven and have specific collateral written against the loan, which can be repossessed in the event of default. In contrast, lines of credit are more often relationship driven because they can be used as working capital, which cannot be easily repossessed. Contrarily, in the context of loans by individuals, we see that mortgage loans, auto loans and installment loans are the three consumer loans for which relationships are important. Interestingly, based on the average outstanding loan sizes presented above, these very loans are the three largest, in precisely that order. It is possible that the importance of relationship in consumer loans is driven more by loan size and less by whether they are collateralized, as in the case of small business loans. Furthermore, the relative importance of relationships in secured consumer loans like mortgage and, to a lesser extent, auto loans, compared to secured small business loans is, perhaps, also driven by the symbolism and the importance that these items enjoy in an individual's (or family's) life. Unlike a small business, it does not appear as these loans represent just another transaction driven collateralized loan. The personal dimension of secured loans among individuals, and the role of relationships in receiving these loans, has not been shown by extant research.

In sum, relationships appear to be most important in decreasing the probability of

rationing in mortgage loans, and relatively less important for auto loans and installment loans. Credit cards and Lines of credit appear to be immune from relationship effects.

7. Conclusion

While an extensive literature exists on the role of relationships in lowering the probability of credit rationing among large firms and small businesses, a significantly smaller literature, spearheaded by Chakravarty and Scott (1999), exists on the role of relationships in credit rationing for consumer loans. Unfortunately, the latter research is performed with data collected in the late eighties and applicable only to consumers in the mid to late eighties. The data are also restrictive in the kind of information they provide on the nature of loans for which individuals were rationed. To the extent that the role of relationships are distinct, depending on the specific type of consumer loan considered, Chakravarty and Scott are unable to provide any answers on the subject.

Additionally, in the dozen or more years that have passed since the time the data used in the Chakravarty and Scott study was collected, the U.S. credit landscape has undergone a sea change - including an explosion in consumer loans, restructuring in the banking industry including the process by which loan granting (or rejecting) decisions are made and how households themselves think about their personal finances. All this raises new questions about the continuing role of relationships (if any) on consumer loans.

Thus, the current study uses both the 1995 and the 1998 (most recent) version of the SCF data to (1) study the overarching role of relationships in the nineties and (2) to examine the *differential* role of relationships across credit rationing in various consumer loan types, like mortgage loans, auto loans, installment loans, credit card loans, and lines of credit.

We find that although relationship variables continue to be very important determinants of credit rationing in the consumer loan market in the nineties, their relative impact may have, in fact, declined relative to the eighties. This is consistent with the big banks of the nineties, making loan decisions in locations far removed from their customers. We also find that, among the various consumer loans, relationships appear to be most important in decreasing the probability of rationing in mortgage loans, and relatively less important for auto loans and installment loans. Credit cards and Lines of credit appear to be immune from relationship effects. Our work also highlights the uniqueness of consumer loans vis-à-vis similar small

business loans.

References

- Berger, A.N., and Udell, G.F. 1995. Relationship lending and lines of credit in small firm finance. *Journal of Business* 68: 351-382.
- Billett, M., Flannery, M., and Garfinkel, J. 1995. The effect of lender identity on a borrowing firm's equity return. *Journal of Finance* 68: 351-382.
- Black, S.E., and Morgan, D.P. 1998, Risk and the democratization of credit cards, working paper, Federal Reserve Bank of New York.
- Blackwell, D., and Winters, D.B. 1997. Banking relationships and the effect of monitoring on loan pricing. *Journal of Financial Research* 20: 275-289.
- Chakravarty, S., and Scott, J.S. 1999. Relationship and rationing in consumer loans, *Journal of Business*, 72, 523-544.
- Canner, G.B., Passmore, W., and Laderman, E. 1999. The role of specialized lenders in extending mortgages to lower income and minority households, *Federal Reserve Bulletin*, 85, 709-723.
- Cole, R.A. 1998. The importance of relationships to the availability of credit. *Journal of Banking and Finance* 22: 959-977.
- Cox, D., and Jappelli, T. 1993. Credit rationing and private transfers: Evidence from survey data. *The Review of Economics and Statistics* 72: 445-454.
- Diamond, D. 1991. Monitoring and reputation: the choice between bank loans and directly placed debt. *Journal of Political Economy* 99: 688-721.
- Hogarth, J.M., and O'Donnell, K. H., 1999, Banking relationships of lower income families and the government trend toward electronic payment, *Federal Reserve Bulletin*, July, 459-473.
- Hoshi, T., Kashyap, T., and Scharfstein, D. 1991. Corporate structure, liquidity and investment: evidence from Japanese industrial groups. *Quarterly Journal of Economics* 106: 33-60.
- James, C. 1987. Some evidence on the uniqueness of bank loans. *Journal of Financial Economics* 19: 217-235.
- Jappelli, T. 1990. Who is credit constrained in the U.S. Economy? *The Quarterly Journal of Economics* 105 (February 1990): 219-234.
- Kennickell, A.B., Starr-McCluer, M., Surette, B. J., 2000, Recent changes in U.S. family finances: Results from the 1998 Survey of Consumer Finances, *Federal Reserve Bulletin*, 86 (January 2000), 1-29.

- Lummer, S., and McConnell, J. 1989. Further evidence on the bank lending process and the capital market response to bank loan agreements. *Journal of Financial Economics* 25: 99-122.
- Montalto, C., and J. Sung, 1996, Multiple imputation in the 1992 Survey of Consumer Finances, *Financial Counseling and Planning*, 7, 133-146.
- Munnell, A. H., Browne, L. E., McEneaney, J, and Tootell, G. 1996. Mortgage lending in Boston: Interpreting the HMDA data. *American Economic Review* 86: 25-53.
- Petersen, M. A., and Rajan, R. G. 1994. The benefits of lending relationships: Evidence from small business data. *Journal of Finance* 49: 3-37.
- Slovin, M. B., Sushka, M. E., and Poloncheck, J. A. 1993. The value of bank durability: Borrowers as bank stakeholders. *Journal of Finance* 48: 247-266.
- Stiglitz, J., and Weiss, A. 1981. Credit rationing in markets with imperfect information. *American Economic Review* 71: 393-410.

TABLE 1. Sample Means and Standard Deviations of Relevant Variables

The data is the 1998 version of the Survey of Consumer Finances (SCF). All variables are defined in the text. The means appear first with the standard errors in parenthesis. Column 4 presents the results of t-tests for differences in the means of the rationed and non-rationed households

| Variables (1) | Non-rationed Households (2) | Rationed Households (3) | t-test (4) |
|-------------------------------------|--------------------------------|----------------------------|---------------|
| Relationship variables: | | | |
| LENGTH | 12.6 (11.5) | 7.2 (7.6) | 13.4* |
| ACTIVITY | 2.7 (1.7) | 2.1 (1.6) | 8.7* |
| NOFININ | 2.8 (1.8) | 2.5 (1.8) | 5.3* |
| Borrower characteristics: | | | |
| AGE | 46.3 (13.8) | 38.7 (11.8) | 14.3 |
| INCOME | 71,048 (312,579) | 42,499 (76,400) | 2.7* |
| ASSETS | 436,663 (1.99E6) | 178,926 (1.14E6) | 3.7* |
| LIABILITIES | 74,349 (134,945) | 52,702 (90,223) | 4.4* |
| BADHISTORY (0,1) | 0.10 (.31) | 0.37 (0.48) | -17.3* |
| WELFARE (0,1) | 0.03 (.16) | 0.07 (0.26) | -5.5* |
| CUREMP | 8.4 (9.4) | 5.4 (7.3) | 8.4* |
| COM (0,1) | 0.65 (0.48) | 0.62 (0.49) | 1.2 |
| Demographic characteristics: | | | |
| MARRIED (0,1) | 0.70 (0.46) | 0.59 (0.49) | 6.1* |
| WHITE (0,1) | 0.84 (0.36) | 0.74 (0.44) | 6.7* |
| HHLSIZE | 2.8 (1.4) | 2.9 (1.6) | -3.0* |
| No. of observations | 1,932 | 801 | |

* The difference in the means of the six groups is significant at the .01 level.

** The difference in the means of the six groups is significant at the .05 level.

*** The difference in the means of the six groups is significant at the .10 level.

TABLE 2. Sample Means and Standard Deviation of Relevant Variables of Rationed Families Classified by Types of Loans Rationed For

The data is the 1998 version of the Survey of Consumer Finances (SCF). All variables are defined in the text. The means appear first with the standard errors in parenthesis. Column 7 presents the results of an F-test of equality of means of each variable related to households rationed from five specific consumer loans.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------------------------|---|-------------------------------------|--|---------------------------------------|--|---------|-----|
| | Households Rationed from Mortgage Loans | Households Rationed from Auto Loans | Households Rationed from Installment Loans | Households Rationed from Credit Cards | Households Rationed from Lines of Credit | F-value | |
| Relationship variables: | | | | | | | |
| LENGTH | 8.3 (8.3) | 5.1 (5.6) | 6.6 (8.0) | 7.8 (8.0) | 9.9 (8.9) | 6.1* | |
| ACTIVITY | 2.1 (1.9) | 1.7 (1.1) | 2.1 (1.5) | 2.3 (1.6) | 2.1 (1.5) | 4.3* | |
| NOFININ | 2.7 (2.0) | 2.5 (1.7) | 2.2 (1.6) | 2.4 (1.7) | 2.6 (1.8) | 1.4 | |
| Borrower characteristics: | | | | | | | |
| AGE | 41.4 (10.9) | 36.5 (10.3) | 38.5 (13.0) | 38.3 (12.3) | 43.4 (13.2) | 5.2* | |
| INCOME | 49,777.5 (136,562.2) | 36,614.1 (27,775.1) | 35,845.2 (28,650.5) | 41,719.3 (52,643.4) | 44,870.3 (47,363.8) | 0.83 | |
| ASSETS | 257,212 (1,124,438.5) | 87,916.2 (307,536.7) | 131,794.3 (590,089.1) | 192,763.3 (1,111,205.8) | 250,950.7 (914,516.8) | 0.76 | |
| LIABILITIES | 75,322.8 (99,418.0) | 41,329.6 (77,116.9) | 46,991.7 (80,272.3) | 51,179.6 (98,208.5) | 54,334.9 (92,333.1) | 2.3*** | |
| BADHISTORY (0,1) | 0.38 (0.49) | 0.45 (0.50) | 0.41 (0.49) | 0.29 (0.45) | 0.42 (0.49) | 3.8* | |
| WELFARE (0,1) | 0.06 (0.24) | 0.07 (0.26) | 0.08 (0.28) | 0.08 (0.27) | 0.06 (0.23) | 0.24 | |
| CUREMP | 7.2 (8.8) | 4.0 (5.8) | 5.7 (7.6) | 5.1 (7.3) | 5.0 (7.7) | 3.6* | |
| COM (0,1) | 0.64 (0.48) | 0.61 (0.49) | 0.55 (0.50) | 0.64 (0.48) | 0.69 (0.46) | 0.89 | |
| Demographic characteristics: | | | | | | | |
| MARRIED (0,1) | 0.73 (0.45) | 0.57 (0.50) | 0.59 (0.49) | 0.52 (0.50) | 0.67 (0.47) | 3.9* | |
| WHITE (0,1) | 0.73 (0.44) | 0.77 (0.42) | 0.77 (0.42) | 0.72 (0.45) | 0.75 (0.43) | 0.46 | |
| HHL SIZE | 3.2 (1.6) | 3.0 (1.5) | 3.0 (2.1) | 2.8 (1.5) | 2.7 (1.4) | 1.7 | |
| No. of observations | 107 | 161 | 76 | 324 | 61 | | |

* indicates that the difference in the means of the six groups is significant at the .01 level.

** indicates that the difference in the means of the six groups is significant at the .05 level.

*** indicates that the difference in the means of the six groups is significant at the .10 level.

TABLE 3 Results of Logistic Regressions and Predicted Changes in the Probability of Credit-Rationing

The dependent variable in the logistic regressions is the probability of being credit-rationed. The independent variables are defined in the text. The results are for 2,733 families (in 1998) and for 2,769 families (in 1995) who either received credit or were turned down. Columns (2) and (4) present the results of (binary) logistic regressions for the 1998 and 1995 versions of the SCF data, respectively. The *P*-values of a two-tailed test of parameter significance are provided in parentheses under the respective estimates. Columns (3) and (5) present the marginal effects of the respective variables -- computed holding all other variables at their respective sample averages -- for 1998 and 1995 data, respectively. All coefficient estimates significant at the 0.10 level or higher are shaded.

| Variables (1) | 1998 (2) | Marginal Effects (3) | 1995 (4) | Marginal Effects (5) |
|------------------------------------|----------------------|-------------------------|---------------------|-------------------------|
| INTERCEPT | 5.87234 (0.0001) | | 5.6374 (0.0001) | |
| Relationship variables: | | | | |
| LENGTH | -0.19506 (0.0006) | -0.0024 | -0.1715 (0.0017) | -0.0021 |
| ACTIVITY | -0.24996 (0.0159) | -0.0124 | -0.2806 (0.0125) | -0.0184 |
| NOFININ | 0.0155 (0.5932) | 0.0025 | 0.00871 (0.7752) | 0.0013 |
| Borrower characteristics: | | | | |
| AGE | -1.1191 (0.0001) | -0.0039 | -0.9700 (0.0001) | -0.0033 |
| INCOME | -0.0654 (0.4871) | -0.00011 | -0.0837 (0.2667) | -0.00023 |
| ASSETS | -0.15096 (0.0001) | -0.00006 | -0.1092 (0.0012) | -0.00005 |
| LIABILITIES | 0.0368 (0.0315) | 0.00008 | 0.0113 (0.5240) | 0.00003 |
| BADHISTORY (0,1) | 1.36016 (0.0001) | 0.2780 | 0.9759 (0.0001) | 0.1870 |
| WELFARE (0,1) | -0.32232 (0.1682) | -0.0470 | 0.2468 (0.2058) | 0.0405 |
| CUREMP | -0.01128 (0.0577) | -0.0019 | -0.0174 (0.0073) | -0.0270 |
| COM (0,1) | 0.1582 (0.1266) | 0.0233 | -0.0995 (0.3011) | -0.0154 |
| Demographic characteristics | | | | |
| MARRIED (0,1) | -0.3353 (0.0041) | -0.0578 | -0.1315 (0.2730) | -0.0205 |
| WHITE (0,1) | -0.1576 (0.1739) | -0.0268 | -0.5061 (0.0001) | -0.0859 |
| HHLsize | 0.12296 (0.0007) | 0.0194 | 0.0532 (0.1563) | 0.0089 |
| Pseudo R ² | 0.26 | | 0.22 | |

TABLE 4. Results of Estimating the Multinomial Logit Model on the Probability of Credit-Rationing in the Five Distinct Loans.

The underlying data is the 1998 SCF. The dependent variable in the multinomial logit model is the probability of being credit-rationed in any of the five different loans. The independent variables are defined in the text. The results are for 2,661 who either received credit or were turned down from five different loans. The *P*-values of a two-tailed test of parameter significance are provided in parentheses under the respective estimates. All coefficient estimates significant at the 0.10 level or higher are shaded.

Panel A: Regression Estimates

| Variables (1) | Mortgage Loan (2) | Auto Loan (3) | Installment Loan (4) | Credit Card (5) | Line of Credit (6) |
|-------------------------------------|-------------------------|---------------------|----------------------------|---------------------|-----------------------|
| INTERCEPT | 0.04016 (0.962) | 5.19002 (0.000) | 3.61382 (0.057) | 6.41834 (0.000) | -0.72128 (0.958) |
| Relationship variables: | | | | | |
| LENGTH | -0.18876 (0.088) | -0.39560 (0.000) | -0.2204 (0.097) | -0.07712 (0.307) | -0.029114 (0.964) |
| ACTIVITY | -0.70254 (0.001) | -0.64426 (0.002) | -0.29494 (0.241) | 0.11904 (0.585) | -0.3497 (0.151) |
| NOFININ | 0.017492 (0.614) | 0.07768 (0.131) | 0.0090 (0.978) | 0.011818 (0.924) | 0.04716 (0.367) |
| Borrower characteristics: | | | | | |
| AGE | -0.49416 (0.204) | -1.42768 (0.000) | -0.97656 (.018) | -1.41294 (0.000) | -0.087192 (0.724) |
| INCOME | 0.020118 (0.818) | -0.0249 (0.926) | -0.05398 (0.748) | -0.12426 (0.326) | -0.12374 (0.458) |
| ASSETS | -0.13706 (0.100) | -0.17422 (0.000) | -0.21864 (0.002) | -0.1306 (0.003) | -0.12238 (0.231) |
| LIABILITIES | 0.08772 (0.129) | 0.04698 (0.097) | 0.00621 (0.880) | 0.008412 (0.480) | 0.04298 (0.683) |
| BADHISTORY (0,1) | 1.39886 (0.000) | 1.71528 (0.000) | 1.52008 (0.000) | 1.0672 (0.000) | 1.7275 (0.000) |
| WELFARE (0,1) | -0.32026 (0.471) | -0.64914 (0.061) | -0.41282 (0.373) | -0.01052 (0.948) | -0.15222 (0.725) |
| CUREMP | 0.006188 (0.718) | -0.03268 (0.019) | 0.00026 (0.934) | -0.01592 (0.067) | -0.02014 (0.300) |
| COM (0,1) | 0.07032 (0.739) | 0.22264 (0.281) | -0.13268 (0.555) | 0.21208 (0.112) | 0.38834 (0.186) |
| Demographic characteristics: | | | | | |
| MARRIED (0,1) | -0.031794 (0.916) | -0.4897 (0.018) | -0.12544 (0.610) | -0.53336 (0.001) | 0.29966 (0.486) |
| WHITE (0,1) | -0.26342 (0.255) | 0.33058 (0.120) | 0.18374 (0.527) | -0.29616 (0.056) | -0.17386 (0.521) |
| HHLSIZE | 0.1928 (0.009) | 0.19192 (0.002) | 0.1487 (0.081) | 0.09166 (0.056) | -0.06474 (0.629) |
| Pseudo R ² = 0.25 | | | | | |

Table 4 continued

Panel B: Are the Estimated Relationship Coefficients Across the Five Loan Types in Panel A Distinct From Each Other?

Here we examine if the estimated coefficients (in Table 4A) corresponding to the three relationship variables, LENGTH, ACTIVITY, NOFININ, and the public information proxy, AGE, are each statistically distinct across the five distinct loan types a family has been rationed from. Accordingly, we provide p-values of pair-wise t-tests (across the five loan types a family can be rationed from) of the estimated coefficients of each of the four variables. All pairwise tests significant at 0.10 level (or better) are shaded.

| | Relationship Variables | Rationed from Car loan | Rationed from Installment Loan | Rationed from Credit Card | Rationed from Line of Credit |
|--------------------------------|------------------------|------------------------|--------------------------------|---------------------------|------------------------------|
| Rationed from Mortgage Loan | LENGTH | 0.0170 | 0.0043 | 0.0184 | 0.0548 |
| | ACTIVITY | 0.0044 | 0.0469 | 0.0776 | 0.0445 |
| | NOFININ | 0.9835 | 0.9900 | 0.9953 | 0.9848 |
| | AGE | 0.0348 | 0.0788 | 0.0431 | 0.6810 |
| Rationed from Car Loan | LENGTH | | 0.0149 | 0.0263 | 0.0487 |
| | ACTIVITY | | 0.0401 | 0.0899 | 0.0376 |
| | NOFININ | | 0.9772 | 0.9844 | 0.9925 |
| | AGE | | 0.0871 | 0.9392 | 0.0691 |
| Rationed from Installment Loan | LENGTH | | | 0.0233 | 0.0484 |
| | ACTIVITY | | | 0.2025 | 0.0118 |
| | NOFININ | | | 0.9963 | 0.9761 |
| | AGE | | | 0.0522 | 0.0487 |
| Rationed from Credit Card | LENGTH | | | | 0.1841 |
| | ACTIVITY | | | | 0.2083 |
| | NOFININ | | | | 0.9824 |
| | AGE | | | | 0.0322 |

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